RIVERS

Asset Management Plan

November 2018

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Executive Summary

The Purpose of the Plan

This asset management plan outlines how the Council proposes to manage, maintain and upgrade its flood control and land drainage services over the period from 2018–2028, and summarises the information available to Council during preparation of the Long Term Plan (LTP).

Strategic Priorities over the next 10 Years

Ensure the existing levels of service are being met.

The focus until 2020 is on ensuring existing assets are maintained or upgraded to a level where they will perform to expectations in response to heavy rainfall events. The principle is to have assets that are 'ready to go.' This aligns well with the national mandatory 'state of readiness' performance measure determined by the Department of Internal Affairs and incorporated into the LTP.

The strength and size of the stopbanks are sufficient to contain the design flows, and the pumps are in good condition. Improvements to the Ōpaoa stopbanks are a priority (with $800,000 budgeted for this work to be progressively undertaken over the next 14 years).

Work will continue on the remaining heavy overhauls of the pump station network (2018-21)

Changes to the existing flood protection and land drainage systems to adapt to climate change.
A plan to be completed over the next five years which will enable the Council to continue to deliver the existing levels of service from 2020–2050.

A climate change allowance is already built into current stormwater planning model. Flow projections for Picton rivers were more recently reviewed following the very large Waitohi and Waikawa River floods in 2004.

A comprehensive assessment of the core Wairau flood protection and drainage scheme was last undertaken in 1994. The upcoming review will consider the predicted effects of climate change in Marlborough, as well as update the past 25 years of flow data.

The programme will involve extensive technical work on what climate change means for Blenheim and Picton's river systems, so that we can review the hydrological designs required to meet the existing levels of service (eg; flood protection in a 1:50 or 1:100 year event).

The Council will share the findings of the technical work with the community and encourage discussion on the options for adapting to sea level rise, changes in groundwater levels and the predicted changes in rainfall patterns. The aim is to identify acceptable solutions to serve the community over the next 30–40 years whilst ensuring the solutions are financially viable.

The Council recognises the need for flexibility when planning for climate change as outlined in the December 2017 guidance for local government - 'Coastal Hazards and Climate Change. The Council's adaptive planning strategy is likely to include the monitoring of agreed triggers (or indicators) which provide early signals that a change in approach is required.

These could include:

- increasing cost and/or complexity of maintaining pumping systems
- the number of damaging or disruptive floods over a specific time period.

Once the assessment of flood risks has been updated, and the willingness of the community to pay for new flood protection works is understood, an updated Wairau flood protection and drainage plan will be developed for the years 2020–2050.

This plan for the Wairau floodplain is likely to include modest changes to existing systems such as more pumping to overcome the impacts of rising sea levels on the current gravity-based drainage system.

Review of the existing levels of service.
In approximately five years' time the Council will carry out a review of the existing levels of service related to flood protection and land drainage, as the last formal review of the levels of service was in 1994.

Existing Levels of Service

A number of different systems make up the Council's river and drainage assets, and they have different levels of service. In summary:

- Wairau floodplain major rivers and stopbanked floodways — contain a 1:100 year flood event
- Wairau tributaries (not stopbanked) — keep the river channels clear of trees and debris
- Wither Hills soil conservation works — limit sediment discharge to watercourses and provide for public recreation through implementation of the Wither Hills Farm Management Plan
- Wairau land drainage — provide a drainage outfall for all properties greater than 1 hectare within the defined drainage areas, and ensure ponding on land does not occur for more than three days
- Blenheim, Riverlands, Picton and Renwick urban stormwater disposal channels — contain stormwater run-off from a 1:50 year flood event
- Gibsons Creek rewatering — supply water for the Southern Valleys Irrigation Scheme (SVIS) and provide a continuous flow to the sea in the Ruakanakana (Gibsons Creek)/Ōpaoa system without flooding riparian land (therefore maximising groundwater recharge of the Wairau aquifer)
- Council river control (floodway) reserve land — manage this land in a way that optimises its flood protection role while providing for public recreation, ecological/amenity planting, and commercial use where feasible
- Sounds watercourses — sufficient stormwater capacity to contain a 1:50 year flood event.

Lifecycle Management Plan — Key Issues

This plan provides for progress on a number of issues identified over the last couple of years that need to be addressed in this plan. These issues are summarised as follows:

Maintenance

Heavy maintenance requirements

Stopbanks require very limited maintenance work over the first 20 to 40 years following their construction. However, once every 50 years they need a heavy maintenance overhaul to keep ahead of natural wear and tear processes. This equates to heavy maintenance of 2–3 km of stopbanks each year to maintain the network in perpetuity.

An ongoing programme of stopbank inspections are required by both maintenance crews (to address immediate maintenance issues) and asset engineers (to maintain an overview of the condition of the assets and to prioritise their maintenance).

Asset Improvements

Taylor Dam upgrades to meet new Dam Safety Regulations

The Taylor flood detention dam is a very important part of the flood protection system that protects Blenheim. The dam is now close to 50 years old and generally in very good order. Dam safety regulations now require dams like the Taylor to be regularly inspected and assessed for safety.

The recent comprehensive safety review was completed earlier this year and has identified a number of

matters for Council to attend to including a minor capacity upgrade to the auxiliary spillway, installation of additional drainage and crest level monitoring points and resealing of the main outlet culvert joints. This work is underway.

Similar refurbishment work is also required to the Ruakanakana Creek (Gibsons Creek) Waihopai intakes.

Completing agreed improvements to the Lower Wairau drainage network

The approved plan from the 2015-2025 Long Term Plan (LTP) is on track but will extend into the 2018-2028 LTP.

Blenheim stormwater outfall upgrades

Ongoing development of Blenheim including infill housing and expansion into the recently rezoned areas to the north and west requires upgrades of the stormwater system, including the outfall channels and pump stations.

Work continues on the design and construction of upgrades for the Redwood Street catchment (Town Branch drain and Redwood Street and Abattoir pumping), Blenheim north rezone area (Caseys Creek and pump station) and Blenheim west (Murphys Creek capacity and environmental issues). Budget provision has been included for new/upgraded pump stations and channel upgrades.

Completing the Lower Ōpaoa stopbank upgrades

A regular system of monitoring, maintaining and inspecting infrastructure is carried out. The gradings used in the condition assessments are: perfect (1), minor maintenance required (2), significant maintenance required (3), major overhaul required (4) and high risk of failure (5).

The Council needs to address all the 4s and 5s, then work on the 3s. A good system has 80-90% of the assets in the 1 and 2 categories. There shouldn't be any 4s and 5s unless the Council is prepared to carry the risk.

That's why $800,000 has been budgeted for repairs to the Ōpaoa stopbank — which has sections rated as 4s and 5s, to be addressed over the next 14 years, and will require land acquisitions involving eight landowners.

Creation/Acquisition/Augmentation

Pukaka Quarry Extension

The Council owned Pukaka Quarry is a key source of rock rip-rap for river protection works on the Wairau River and tributaries. The quarry also supplies a variety of aggregates to the contracting market as a by-product of the rock production.

The rock resource within the existing land boundary is now limited and a further 3.5 ha of land will be required if the quarry is going to continue for a further 50 years. Discussions with the adjacent landowner are continuing.

No specific capital budget is provided for in this plan. However the Pukaka Quarry is self-funding and capital requirements for any extension are proposed to be serviced from operating revenue.

Expansion/Extension of Levels of Service to New Areas

Minor boundary reviews to clarify the extent of the area for which Council provides flood protection services (such as channel clearing) will be carried out, and will be linked to rating classifications.

Risk Management

The key way to recover from flood damage is through investment in the Emergency Events Fund and in insurance. The Council is also in a very good position to borrow additional money if required, due to its low debt levels.

A risk profile has been developed for rivers and land drainage, which includes the strategies in place to manage the identified risks. In summary, the higher level risks are: ecological impacts; failure of infrastructure including stopbanks, floodgates and pumps; inadequate flood carrying capacity of rivers, drains and culverts; inadequate access for maintenance of streams and drains; management and accessibility of flood hazard information; and retention and recruitment of staff.

Financial Summary

Capital expenditure costs over the next 10 years are:

- Wairau floodplain rivers: $17,811,000
- Drainage: $11,119,000
- Sounds watercourses: $223,000.

Operational expenditure over the next 10 years are:

- Wairau floodplain drainage: $14,872,000
- Rivers outside the Wairau floodplain: $3,012,000.

Asset Management Practices

Senior members of the Rivers and Land Drainage team assess the highest priority actions to be undertaken when planning the operational and capital expenditure programmes.

Over time, rivers and land drainage asset information will be transferred to the Council's Asset Management Information System (AMIS). However, progress on shifting over to this system is dependent on staff resources being available to carry out this work.

Plan Improvement and Monitoring

Over the 2015–2018 period the focus has been on improving the existing assets to ensure they are 'ready to go' in an emergency event.

Planned improvements over the 2018-2021period are listed on the following page.

Planned improvements	Progress
The next asset valuation of stopbank rates should reflect the true cost of replacement, and enable insurance to reflect that true cost.	The next asset valuation will occur in 2019.
Implementation of the asset information system (AMIS) for rivers and land drainage assets.	Progress will be subject to budget being approved for staff resourcing to carry out this work.

Chapter 1: Introduction

1.1 Purpose of the Plan

This plan describes the flood control and drainage services provided by Council, the assets used to provide these services, and how the Council proposes to achieve the levels of service over the next 10 years. It contains details supporting the Council's proposed Long Term Plan (LTP).

Most of the assets discussed in this plan are permanent, so it's important to plan how the assets will be managed over a long timeframe. The key future challenge to be addressed is the effects of climate change on flood risk management and land drainage services.

The appendices provide more in-depth information for the management of the assets.

1.2 Asset Management Goals

The primary goal of the Rivers and Drainage Department is to manage flood hazards and drainage, particularly in the more developed areas of Marlborough. However, marginally different management strategies and objectives have developed for different drainage areas for the following reasons:

- the history of flood events experienced in different catchments
- differences in the population and property at risk of flooding/drainage
- the development of drainage improvements over time and
- the historical aims and objectives of previous administrations within the region.

The current management objectives and the required actions for achieving them are summarised in Appendix 1.

1.3 Rivers and Drainage Assets

Table 1-1 Summary of Rivers and Land Drainage Assets

Asset	Length /Quantity
Stopbanks, training banks, the Taylor Dam, and other minor dams which in total comprise of 4.8 million cubic metres of earthworks.	180 km
Large rock rip rap for river bank erosion protection purposes.	585,000 m^3
Trees (willows, poplars etc) for riverbank erosion protection purposes.	55 hectares
Excavated minor watercourses for agricultural drainage and urban stormwater disposal purposes.	160 km
Major river diversions.	4
Pumping stations for agricultural drainage purposes.	19
Pumping stations for urban stormwater disposal purposes.	11
Culverts under stopbanks etc of various sizes and lengths, usually floodgated.	290
Control gates or weirs.	20
Floodway land.	3,000 hectares

Council's river and drainage assets are grouped as systems throughout this plan, as outlined below.

The Wairau River floodplain major rivers and stopbanked floodways
The Wairau River is the most engineered river course in New Zealand. It is the primary focus of Council's river control and drainage activity as it provides flood protection services for 20,000 hectares of fertile land around Blenheim, Renwick, Spring Creek & Grovetown. Works have been carried out to control the Wairau River since soon after European settlement nearly 150 years ago, and the need to maintain, monitor and upgrade river control works is ongoing.

The Wairau tributaries (not stopbanked)
The Wairau tributaries traverse the remaining 4,000 km² of the Wairau catchment outside of the main Wairau floodplain and include the Omaka, Fairhall, and Taylor rivers. Approximately 120 km of these river and stream channels are regularly kept clear of obstructions to river flows such as vegetation and sediment build up. The area includes the main Wairau River channel upstream of the Waihopai River confluence to the Wye River confluence. The management of this area is currently under review as land use adjacent to the river has changed significantly in recent time as high value viticulture moves further west up the valley.

Wither Hills soil conservation works
Tree planting, re-vegetation, stock control and water course flow controls are carried out to lessen erosion from the 1,030 ha of erodible hills immediately south of Blenheim. This reduces the risk of sediment creating an obstacle to flood flows. Another benefit of this activity is improved water quality as a result of less sediment entering waterways.

Wairau land drainage
Land drainage services are actively provided for 8,000 ha of the low lying Wairau floodplain. Eighteen pumping stations are used to transport this water to sea via 150 km of minor watercourses.

Blenheim, Riverlands and Renwick urban stormwater disposal channels
The piped urban stormwater system is discharged into 25km of minor watercourses running through the urban areas. The Rivers and Drainage Department maintains the watercourses and 10 terminal pumping stations which lifts the run-off into the main river/drainage system.

Ruakanakana Creek (Ruakanakana Creek (rewatering
The Ruakanakana Creek (Gibsons Creek) was originally part of the braided watercourse network of the Wairau River. It became dry as the result of early engineering works to train the course of the main river. In response to public demand for improved ground-water re-charge and to provide water for increasing agricultural and domestic consumption the creek was re-watered in 1960. A further in-take was created in 1993. The Ruakanakana Creek (Gibsons Creek) is now the essential source of water for the Southern Valleys Irrigation Scheme. The department maintains two river intakes and 25 km of small channels.

Council river control (floodway) reserve land
The Council owns 3,500 hectares of flood prone land to ensure that this land is not used for activities which increase the community's vulnerability to flooding. Much of this land is used for ecological and amenity planting, public recreation or for commercial purposes such as forestry.

Sounds watercourses
The Council manages 3 km of waterways in Picton and Waikawa to reduce flood risk within the town

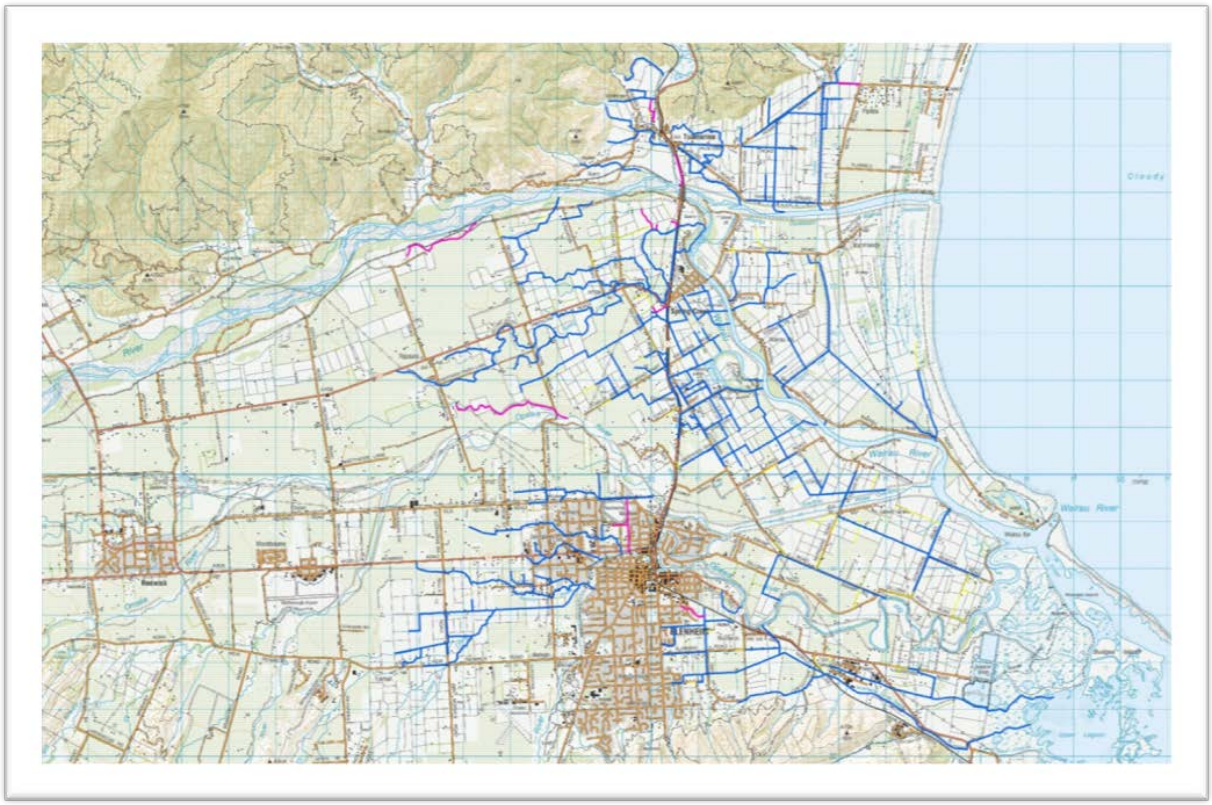


Figure 1-1 Lower Wairau Drainage Channels

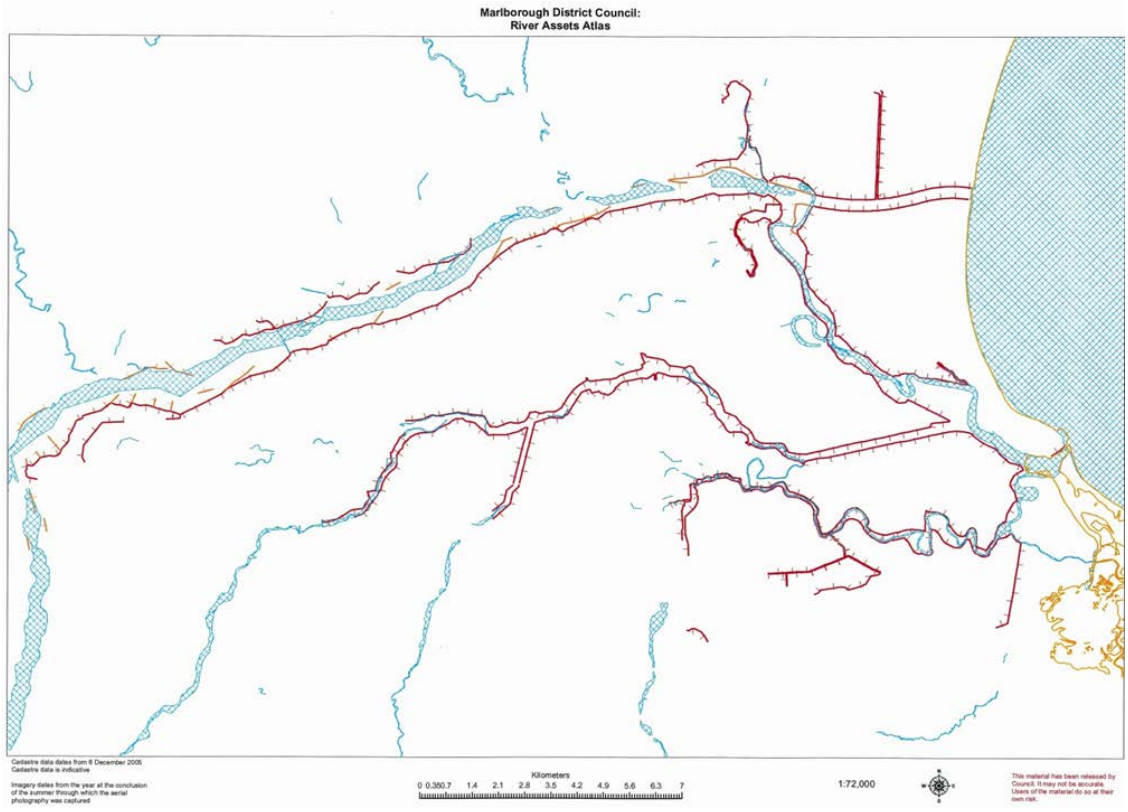


Figure 1-2 Stopbank and River Protection Structures on the Wairau Plain

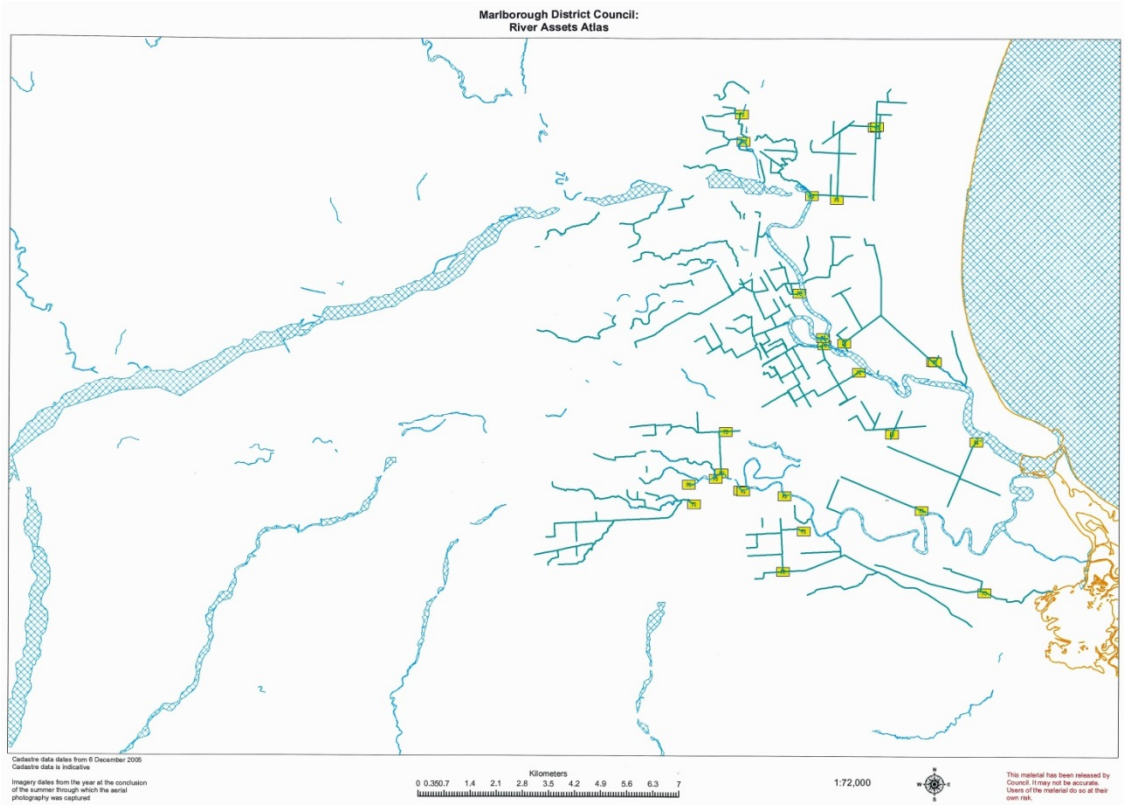


Figure 1-3 Urban and Rural Land Drainage Channels

1.4 Key Stakeholders

Each of the systems listed above has its own community of people who directly benefit from the land drainage or improved security from river floodwaters. Other specific stakeholder groups are:

- Ngāti Rārua, Te Ātiawa and Rangitāne o Wairau
- Heritage New Zealand (involved in archaeological work particularly in the nationally important areas of early iwi occupation around the Wairau Bar)
- communities with an interest in a specific area such as Murphys Creek
- the Department of Conservation (riparian management as well as bird and fish habitats)
- Fish and Game (the larger rivers, especially the Wairau River and Spring Creek)
- Network utility providers/suppliers seeking protection to utility services including roading, sewer and watermains, fibre optic cables and the electricity network where lines cross or are located alongside rivers
- environmental groups
- rural landowners in areas which are flood prone, subject to drainage issues, or affected by land access or acquisition requirements
- residents affected by flooding and flood risk management provisions related to the Waitohi River in Picton
- gravel extraction contractors who need to comply with the Council's gravel extraction policies
- the Council executive which is responsible for flood protection (and the consequences of failure) as well as for environmental outcomes.

1.5 Stakeholder Consultation

Council's decisions related to flood protection, and the associated levels of service, are informed by feedback on the Long Term Plan consultation documents and annual plans in the intervening years.

In the case where work is required in specific areas, letters are sent to affected landowners inviting their feedback on the proposed approach. Staff also engage directly with landowners from early on in the process.

For significant changes to policy or major individual projects the Council seeks to establish an advisory group of local stakeholders. Information is exchanged with advisory group members and issues and alternatives are explored. There are often conflicting demands from different stakeholders or unrealistic expectations which need to be managed to an acceptable compromise.

In the case of works affecting Murphys Creek, an external facilitator was appointed by the Council to assist in a collaborative decision making process. Over the course of 18 months nine alternative options were established and presented to the consultative group for consideration. Agreement in principle has been reached on a pathway forward, and that agreed approach will be reflected in an upcoming resource consent application.

1.6 Council's Vision & Outcomes

The role of Council within the wider Marlborough community will vary over time and be influenced by the complexion of national and international politics, prevailing economic conditions and levels of social development. The Council's Vison and Mission Statements seek to clarify the purpose, aims and values of the Council at this time.

1.6.1 Vision and Mission

The vision statement is an aspirational description of what an organisation would like to achieve in the mid-term or long term. It serves as a clear guide for choosing current and future courses of action.

Vision

"Marlborough is a globally-connected district of smart, progressive, high-value enterprises, known for our economic efficiency, quality lifestyle and wellbeing, caring community, desirable location and healthy natural environment."

Mission

"We invest in Marlborough's future, our people, quality lifestyle and outstanding natural environment."

The vision, mission statements and community outcomes are reviewed and updated from time to time to ensure they are clear and fit for purpose. Amendments are consulted on and published in the Long Term Plan, with the latest amendments made in 2018.

The Council's vision and mission are interpreted into a number of community outcome statements which describe the sort of community Marlborough could become as a result of actions taken now and into the future.

1.6.2 Community Outcomes

These community outcomes are based on the Smart and Connected framework, and are supported by specific actions or goals for each outcome.

The flood protection and land drainage activities contribute to the achievement of the following community outcomes.

Governance *— Marlborough has a strong community that is passionate about participating, connecting with and helping shape our future. Our Council listens to its communities and strives for best practice governance to support their aspirations. We value our strong partnership with tangata whenua iwi.*

The up-coming community engagement processes on options for adapting to climate change will provide opportunities for people to participate in decision making and to help shape the community's future.

Environment *— Marlborough's communities are the guardians of our unique place. Our landscape, water, air, natural features and biodiversity are managed, protected, enhanced and valued as the cornerstone to our quality of life.*

Reducing the ecological impacts of flood protection and drainage activities and supporting riparian planting projects will contribute to Marlborough's unique landscape, natural features and biodiversity.

Economy *— Marlborough's economy supports the aspirations of our community. It is underpinned by strategic, thoughtful and sustainable use of resources which provides opportunities for business innovation and quality employment.*

Flood protection and land drainage activities enhance pastoral and viticulture land uses in flood prone and low lying areas. This activity also protects Marlborough's urban centres from significant flood damage.

Living *— Marlborough's enviable community facilities, infrastructure, landscapes and climate enables our community to thrive. Life in Marlborough is safe and healthy.*

Flood protection activities support the outcome of a safe community, and enabling recreation along riparian margins provides recreation options to support a healthy community.

The Council have developed a number of strategies to help deliver services that will contribute to the community outcomes

1.7 Strategic Context

1.7.1 Smart and Connected Strategy

The 'Smart and Connected' Strategy was originally adopted to help promote the economic development of the region but this has now extended across all Council activities.

The strategy emphasises an integrated approach that maximises the skills and resources of the region and how they interrelate with the national and international context. It has been built on the framework of the Community Outcomes - as shown in Figure 1-4.

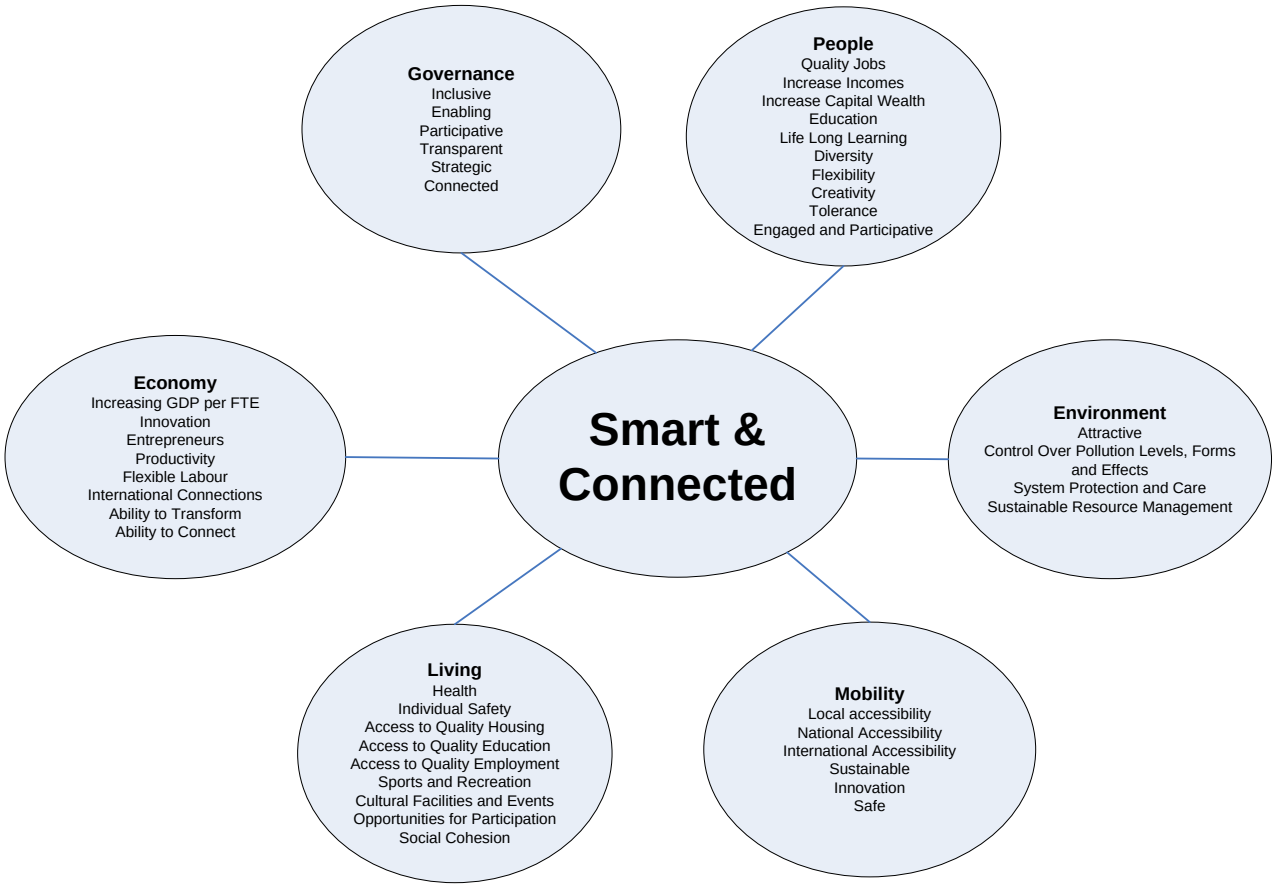


Figure 1-4 The Smart + Connected Strategy

1.7.2 30 Year Infrastructure Strategy

This asset management plan complements, and contributes to, the Marlborough Infrastructure Strategy 2018 which looks at infrastructure challenges over a 30 year planning horizon.

The key challenges facing our region's entire infrastructure include:

- the need to maintain infrastructure and replace it when it which has reached the end of its useful life
- changes to legislative requirements
- climate change predictions
- preparation for a major earthquake.

Specific issues related to rivers and land drainage are:

- higher expectations related to flood protection and environmental outcomes
- managing the impact of coastal storm waves and sea level rise on drainage
- potential impacts of climate change on flood flows.
- managing urban growth
- affordability of improving and maintaining flood and drainage infrastructure for a changing
- settlement pattern and demographic changes

1.7.3 Blenheim Stormwater Strategy

The stormwater strategy has integrated and aligned thought, investment and action around Blenheim's total stormwater infrastructure. This includes our urban piped infrastructure and rural drains and rivers (as one system).

The stormwater strategy:

- identifies stormwater quality and quantity issues in Blenheim and the solutions to address them
- prioritises the required actions to address the issues
- provides the mayor and councillors with clear information on the investment requirements for stormwater management.

The stormwater strategy identifies a number of different stormwater management areas (SMAs), and recognises the need to develop an environmental management plan for each of these areas.

The catchment stormwater management plans will provide valuable information for Rivers and Land Drainage staff - stormwater run-off quantities, the capacity of the receiving watercourses, water quality issues and any resource consent requirements. They will also provide the wider context for Council decision making.

The implementation of the strategy is guided by the Stormwater Action Group (SAG.) The Rivers & Land Drainage department and the Services department are the core participants of the SAG with contributions from Regional Planning, Asset Management and Environment Science and Monitoring. The SAG has the important role of coordinating the interface between urban stormwater and the receiving rivers.

1.7.4 Growing Marlborough – urban growth strategy

A regional urban growth strategy[1] was developed through 2011–13 following thorough consultation and analysis of future growth patterns. The Assets & Services (A&S) Department was fully involved in the evolution of the strategy to ensure urban growth pockets could be protected from flooding.

It was recognised that the main areas of growth would be on the peripheries of Blenheim. Land to the north and west of the town was identified as suitable for urban development and zoned accordingly. The areas identified are on generally flat land with a gentle slope from west to east. Natural drainage is mainly from ephemeral streams that feed creeks that flow through the main township. The stormwater design for the growth pockets must be closely coordinated with the Rivers & Drainage Department to ensure there is adequate capacity in the receiving waters

The A&S Department works with developers from the outset to form an agreed service plan to ensure new infrastructure is designed and installed to meet the long term growth projections. Council coordinates the collection of development levies to ensure developers are reimbursed for installing additional capacity to meet future demand.

1.7.5 Financial Strategy

The Financial Strategy sets out Council's plans to finance its activities over the next 10 years while achieving a balanced budget. Strategies to achieve this include:

- setting a cap on rates increases of the Local Government Cost Index + 2%
- setting a debt cap of $140 million
- setting an annual capital expenditure limit of $60 million.

Council also has a funding hierarchy for capital expenditure which is designed to reduce the impact on rates. In summary the hierarchy of funding sources is:

- development contributions
- depreciation reserves
- other reserves (including the Infrastructure Upgrade Reserve and the Forestry and Land Development Reserve)

[1] Growing Marlborough – A Strategy For The Future (March 2013)

- Emergency Events Reserve to replace/repair infrastructure damaged in emergency events
- rates-funded debt.

1.7.6 Marlborough Environment Plan (Proposed)

The regional environment plan is prepared under the auspices of the Resource Management Act to provide a local context and rules for environmental planning. A long-term review of the existing plans – the Wairau-Awatere Resource Management Plan (WARMP) and the Marlborough Sounds Resource Management Plan (MSRMP) is drawing to a conclusion with the publication of the Proposed Marlborough Environment Plan (MEP).

The provisions for managing natural hazards in the MEP are the principle framework under which the Rivers and Drainage activity operate.

Flood hazard mapping identifies where building and development should be avoided. Compliance with the rules prevents building in these areas and therefore will avoid the need for new flood protection works in flood prone areas.

The main river floodways are identified and have their own zoning which protects them from inappropriate uses. The primary use of this land is for flood protection. Farming may be a permitted use of the land but restrictions and a clear understanding of the risks is required.

The MEP enables Council's in-stream flood protection works to be carried out as a permitted activity within the floodway zones. Instream works such as gravel extraction or vegetation removal beyond the designated floodway zones require resource consent permission.

The existing WARMP and MSRMP allow Council to undertake in-stream maintenance within the designated major floodways, drainage channels and minor water courses as a 'permitted activity'. The Proposed MEP has omitted the minor watercourses. This exclusion will be inhibitive to the routine maintenance of the water courses and a review is being sought

Since the Christchurch earthquakes new residential zoning has been confined to the western areas of Blenheim, which aren't vulnerable to liquefaction or to the drainage issues in Blenheim's low-lying eastern areas.

1.7.7 Long Term Plan 2018 - 2028

The Long Term Plan (LTP) is the Council's 10-year planning document. It sets out the Council's broad strategic direction and priorities. It also includes community outcomes and the activities the Council will undertake to support those outcomes.

The Local Government Act 2002 states that flood protection is one of the five core activities which the Council must address in its Long Term Plan. This includes:

- the reasons for the flood protection and control works to be carried out
- any significant negative effects of these activities
- the intended levels of service to be provided for the next 10 years
- funding impacts for the next 10 years
- the amount of capital expenditure the Council has budgeted to meet additional demand for the activity, improve levels of service and replace existing assets.

The Council's commitment to financial prudence while maintaining assets is reflected in the Rivers and Land Drainage budgets in the Long Term Plan 2018–2028. This budget prioritises funding to improve the condition of the Ōpaoa stopbanks due to the risks associated with delaying this work.

The annual work programme also needs to reflect the amount of work which can be progressed with the staff and resources available.

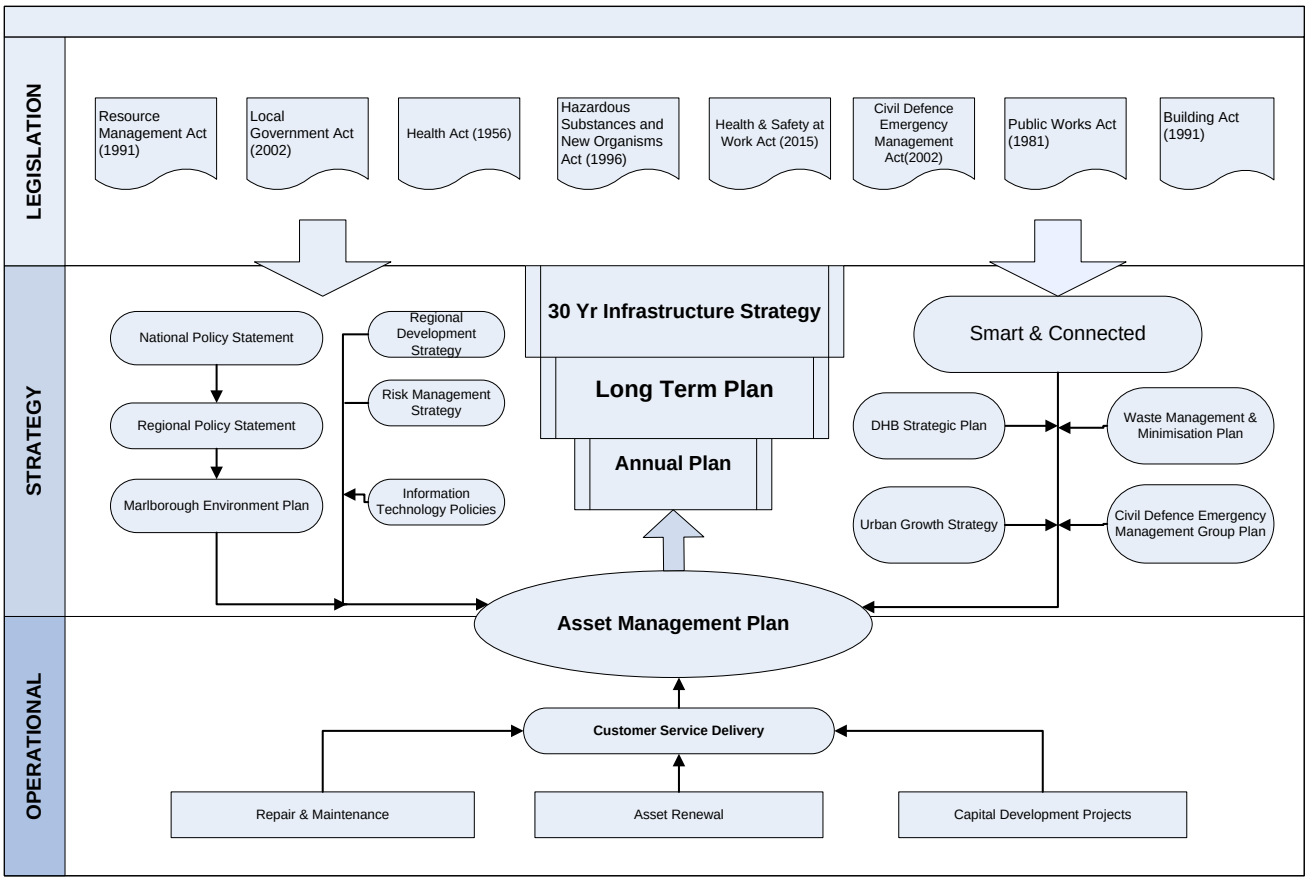


Figure 1-5 Council's Strategic Planning Framework

1.7.8 Rivers & Drainage Asset Management Plan

The role of the Rivers and Land Drainage asset management plan in Council planning is shown in Figure 1-5 Council's Strategic Planning Framework. The asset management plan provides a link between the strategic objectives of the Council, long term planning, and the day to day functioning of the operational activities. Over recent years the issues involved in river control and drainage have become more complex due to changes in both public expectations and legislation related to flood protection and freshwater environments. These changes are reflected in the documents outlined below

1.8 Relevant Legislation

Marlborough District Council is empowered to carry out public river control and drainage mitigation measures under the following legislation.

- The Land Drainage Act 1908 includes provisions related to construction and maintenance of drains and watercourses (although nothing is this Act can detract from the Resource Management Act 1991).

- The Soil Conservation and Rivers Control Act 1941 provisions enable purchase of land under the Public Works Act as well as leases and land improvement agreements related to soil conservation reserves.

- The Local Government Act 2002 requires local authorities to take a sustainable development approach, taking into account the current and future needs of communities for good quality local infrastructure, and the efficient and effective delivery of services. Section 11A of this Act states that a local authority must have particular regard to the contribution core services make to their communities.

- The Local Government (Rating) Act 2002 enables the Council to set different flood protection rates for different geographic areas and land uses, reflecting the different levels of benefit ratepayers receive from the Council's flood protection activities.

The following legislation and national policy statements influences the manner in which any river works and measures are carried out.

- Resource Management Act 1991 — both the preservation of the natural character of rivers and their margins, and the management of significant risks from natural hazards, are identified as matters of national importance in section 6 of this Act.

- Section 13 of the Act does not permit the disturbance of river beds, removal of vegetation from the bed of a river, and damaging or disturbing the habitats of animals in, on or under the bed of a river unless this is specifically provided for in a national environmental standard, a rule in a regional plan or in a resource consent.

Damming and diverting a waterbody is controlled under section 14. This means resource consents are required for these activities unless they are specifically provided for in a national environmental standard or a rule in a regional plan.

Through the resource consent process the Council can set minimum ground levels and floor levels for areas which are at risk of flooding in a 1:50 year event.

- **Reserves Act 1977** — this Act enables the Council to apply specific conditions and restrictions on the use of land which is classified as a reserve. This ensures the reserve can be managed in a way that is compatible with the Council's primary purpose for owning that land (such as management of flood risk).

- **Building Act 2004** — section 71 of this Act requires the Council to consider natural hazards (including flooding) in relation to building consent applications, and the Building Code requires buildings to be constructed in a way that avoids impacts to that building in a 1:50 year flood event. This can be achieved via protection works (as occurs in Blenheim) or through flood hazard provisions in the Proposed Marlborough Environment Plan (MEP), which enable the Council to specify minimum floor levels and/or the location of a building on a site.

  The Building Act and the Building (Dam Safety) Regulations (2008) provide the principle framework for managing the safety of the Taylor Dam

- **National Policy Statement for Freshwater Management 2014 (NPSFM)** — Objective C1 of the NPSFM is the most significant for flood management activities. *(To improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water, land, associated ecosystems and the coastal environment.)*

- Each regional council, including Marlborough District Council, is required to put in place a progressive implementation programme outlining how it will implement the NPSFM. This needs to be fully completed by December 2025.

- The relevant policies in the New Zealand Coastal Policy Statement 2010 are Policy 11 (to protect indigenous biological diversity in the coastal environment), Policy 13 (to preserve the natural character of the coastal environment, which includes the natural movement of water and sediment), and Policy 14 (restoration of the natural character of the coastal environment).

- The purpose of the Health and Safety at Work Act 2015 is to protect workers and other persons against harm to their health, safety and welfare by eliminating or minimising risks arising from work. Under this Act the Council is responsible for the safety of staff, contractors and the public who have access to sites where work is being undertaken.

Health and safety is entrenched in the Council's approach to flood protection works. Health and safety implications are the first consideration at the beginning of every new job.

Public safety is managed by excluding access to work areas through temporary fencing, signage, rerouting pedestrians during earthworks and temporary closure of pieces of track.

Staff safety is also of paramount importance when monitoring large flood events.

1.9 Resource consents and codes of practice

Most maintenance works on the Rivers and Drainage assets are "permitted activities' under the WARMP and MSRMP and resource consent is not specifically required. Separate resource consent approval is sought for major capital projects however.

A limited number of resource consents exist for specific rivers and drainage works, including:

- Wairau diversion of water into Ruakanakana Creek (Gibsons Creek) (2003)
- Use of aquatic herbicides (2009)
- Wairau River flow split bank (2010)

The Code of Practice for Subdivision and Land Development (June 2008) is particularly relevant to the design of stormwater infrastructure but is also relevant to river control and drainage activities.

1.9.1 Significant negative effects

As noted in section 1.6.6 of this Plan, the Local Government Act 2002 requires the Council to identify the possible negative effects associated with the provision, or the inadequate provision, of flood protection and land drainage services.

Area of Impact	**Negative Effects**
The safety of communities	Potential impacts of inadequate flood protection include: human fatalities, stock losses, and interruptions to lifelines such as water and wastewater services and transport networks.
Minimising property damage	Potential impacts of inadequate flood protection and land drainage include crop losses (including grapes), and damage to buildings and infrastructure.
New development	Planning decisions not to invest in flood protection and drainage services in additional flood-prone and low lying areas places some constraints on urban development opportunities and land values.
Minimising adverse environmental effects	Flood protection measures can damage freshwater ecosystems through physical loss of habitats, barriers to fish passage, use of herbicide, and impacts on water quality including sedimentation, nutrients and metals, hydrocarbons and other contaminants from urban stormwater run-off.
Cultural and environmental values	Modification of natural watercourses for flood protection or drainage purposes can impact on the cultural and environmental values of iwi and other members of the community. Disturbance of river beds and banks has the potential to affect historic and waahi tapu sites.

1.10 Organisational Structure

The Assets and Services department is responsible for the Council's flood protection and land drainage services. These services are delivered through a combination of internal and external contract resources.

The internal resources include seven engineering staff. All physical works are carried out under contract.

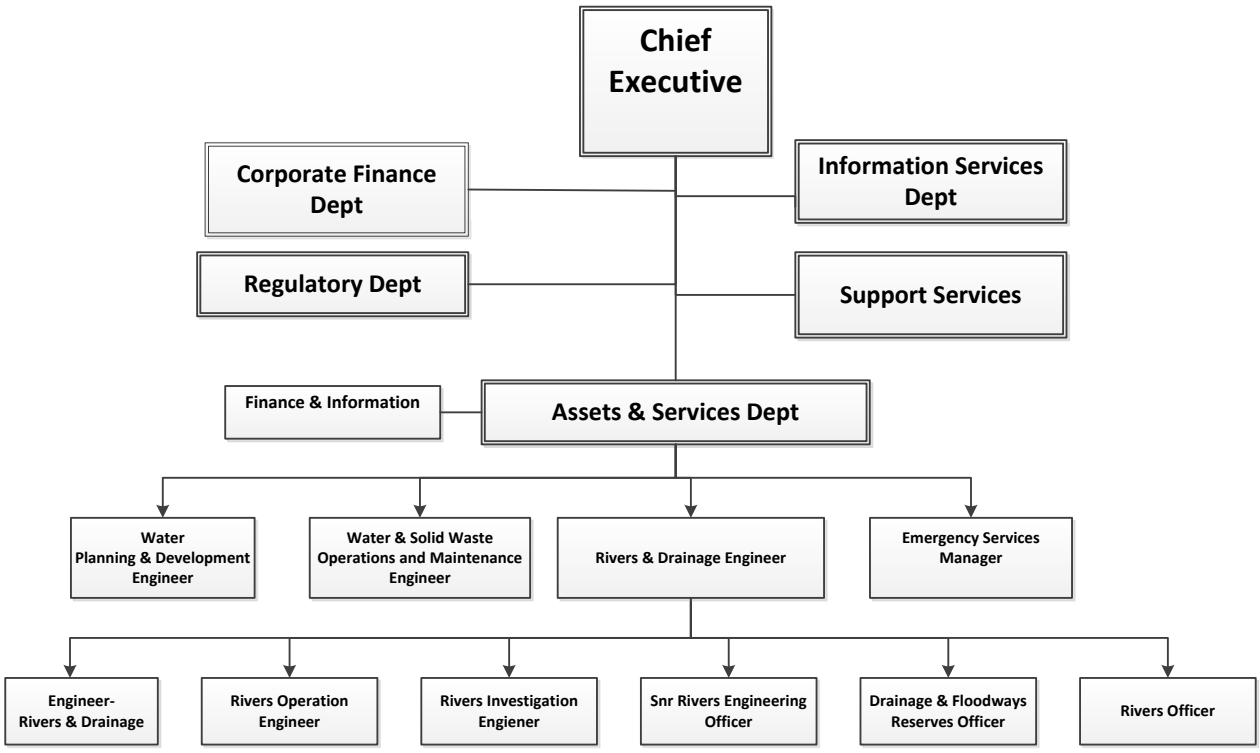


Figure 1-6 Rivers and Land Drainage Department Staff Structure

1.11 Asset Management Planning Maturity

Generally the Rivers and Drainage Department seeks to achieve a solid core standard of asset management. Intermediate and advanced asset management tools and techniques are deployed where they add demonstrable value to the decision making process. The maturity of asset management within Marlborough District Council is dependent upon a number factors — skills available; size, complexity and value of the infrastructure; the value and criticality of the land and community facilities the infrastructure protects; experience and culture of staff and corporate policy to risk management.

The department benefits from the knowledge and experience of a stable and highly skilled workforce. The depth and breadth of experience across the workforce helps to reduce risks associated with reliance on individual personnel. However, undocumented knowledge should not be relied upon. High quality data and empirical analysis is essential for effective decision making and forward planning. Specialist consultants are employed to provide services that add value such as dynamic hydraulic modelling, structural design, geo-technical investigations, etc.

A relatively small unitary council such as Marlborough is also able to learn from the experience of larger regional councils around the country that have significantly greater resources and for specialist river management. The work being done by Environment Waikato on the design of

pump stations to avoid eel mortality and the Bay of Plenty Regional Council's approach to sea level rise adaptation.

1.12 Plan Framework

Chapter 1 — Introduction: this section provides the strategic context for the plan, including a description of the assets, stakeholders and Council's approaches to consultation with them, as well as how flood protection and land drainage activities relate to the Council's strategic goals and legislation.

Chapter 2 — Levels of Service: the agreed levels of service for each system are described, followed by an assessment of whether or not these levels of service are being achieved. Current and proposed performance targets are also identified.

Chapter 3 — Future Demand: factors which could place additional demands on flood protection and land drainage services are considered, as well as Council's proposed responses to these demands.

Chapter 4 — Lifecycle Management Plan: this section outlines Council's regular maintenance commitments, as well as the key issues related to maintenance, asset improvements, augmentation, extension of levels of service and the disposal of assets.

Chapter 5 — Risks and Assumptions: this section includes a summary of the higher level risks associated with the Council's rivers and land drainage responsibilities, as well as the strategies in place to manage these risks. Assumptions which are specific to flood protection and land drainage assets relate to the location of new development, viticulture and climate change.

Chapter 6 — Financial Summary: the forecast capital and operational expenditure over the next 10 years is listed, and details are provided on how this work is funded by ratepayers in different geographic areas.

Chapter 7 — Asset Management Practices: outlines the Council's approach to decision making, data management and the upcoming implementation of an asset management information system.

Chapter 8 — Plan Improvement and Monitoring: improved maintenance is the current focus, with further improvements planned to valuations and to data management.

Appendices — these provide more indepth information for the management of the assets and are primarily for use by Assets & Services staff.

Chapter 2: Levels of Service

2.1 Introduction

The Councils Rivers and Land Drainage department undertake two major activities and several subsidiary activities

- 'Flood Control' works are those that prevent damage from large sudden inundation from the major rivers.
- 'Drainage' is the steady longer term removal of water from sodden ground or ponded areas to reduce groundwater levels so as to enable productive use of the land to occur.

There is a degree of overlap between 'flood control' and 'drainage' assets on low lying land requiring drainage. Drains and natural watercourses that are specifically excavated to drain otherwise swampy land will also reduce the flood level in storm events, especially where there is good channel capacity and outfall capacity to the main river systems.

The subsidiary activities include

- Soil conservation on the Wither Hills – helps to reduce sedimentation of downstream waterways
- Stormwater/Land Drainage interface management
- Ruakanakana Creek (Gibsons Creek) Re-watering
- Floodway Reserve Land Management

The drivers behind determining the appropriate levels of service for river control and land drainage are

- legislative requirements,
- customer expectations,
- historical decisions,
- risk management,
- affordability and
- preserving environmental values.

The relative balance of these parameters is changing. The long history of flood control and drainage on the lower Wairau floodplain initially had an emphasis on risk management and affordability. Historical decisions made by the Wairau floodplain community 100 years ago are still fundamental to the level of service council has to provide.

More recently the ratepayers (customers) are expecting that Council will provide a high standard of flood control and drainage throughout Marlborough and this is being enshrined to some degree in legislation. The Building Act 2004 and Resource Management Act 1991 have tighter requirements regarding managing flood hazard to buildings and subdivision than earlier regulatory legislation. There are also tighter conditions on ecological and other environmental values of watercourse management.

These factors are of particular relevance in the Sounds area, an area with less history of flooding problems.

Since 2010 significant flood events have occurred in most of the region's rivers and streams including the Rai/Te Hoiere/Pelorus/Wakamarina catchments, outer Sounds Catchments, in the wider Picton/Waikawa/Koromiko area, Wither Hills and Southern valleys and the main Wairau River and lower Wairau floodplain.

The ratepayers desire for an increased level of service is usually only expressed following a major flood event. Generally existing flood systems coped well but all the flood events required

post flood examination and reporting to Council. No major changes to existing service levels have followed from these flood debriefs.

2.2 The Murphys Creek Case Study

The Rivers and Drainage department along with the Services Department were the major contributory partners in the development of the Blenheim Stormwater Strategy.

The Council has sought community involvement and acceptance throughout development of the strategy and the early stages of its implementation. Public consultation and collaboration in decision making has been an evolving process. Resolution of conflicting views on stormwater and urban drainage issues around Murphys Creek has been an exemplary exercise in this evolving process.

Murphys Creek is a spring fed creek that drains through a northern suburb of Blenheim and into the Taylor River just north of the town centre. The creek is maintained by the Rivers department. The creek also receives drainage from the adjacent land through private and Council's stormwater pipes. The surface water flows have increased over the years as a result of housing infill and a decrease in permeable surfaces for rainwater soakage. Flow characteristics in the creek are also influenced by weed growth in the watercourse.

Commercial development and rezoning of land in the headwaters of the catchment was the catalyst for a collaborative decision making process relating to Murphys Creek. A resource consent application was approved to permit the stormwater from a large retail park to be discharged into upper Murphys Creek. The pipe was installed in 2012 with additional capacity to allow for future urban development on the north-west periphery. The potential consequences of the additional flow from a large commercial site provoked considerable concern amongst the downstream residents.

Murphys Creek has high amenity value to local residents and particularly property owners adjacent to the watercourse. The spring fed creek is generally considered to be high quality water and is valued for its aesthetic and ecological value. Whilst this would appear to be self-evident there has been little supportive long term scientific data regarding the chemical and biological quality of the stream.

The Murphys Creek stakeholders were well organised in their opposition to the upstream developments. Their concerns centred on an increased risk of flooding due to the additional flows and the potential damage to water quality and the ecosystem from the stormwater collected from a commercial/urban area.

Council has responded by helping to facilitate an investigation into the stakeholders' concerns. An independent facilitator was appointed to conduct a structured decision making process into the issues and options. Five stakeholder workshops were organised.

Detailed hydraulic modelling of the relationship between the flows in the creek and Taylor River have been undertaken. Flood levels along the course of the creek have been projected from the mathematical models for a range of different storm scenarios. A permanent water quality monitoring station has been established on the creek. The data has been supplemented by routine manual sampling. An analysis of 'first flush' rainwater run-off has also been undertaken to check the effects of surface water draining to the creek after a prolonged dry spell. The data is being made available to an independent consultant to analyse and report to the stakeholder group.

Ten alternative solutions to the stakeholders' concerns emerged from the workshops. Each option was evaluated by the stakeholder group on set criteria — stream bed, aesthetic value, water quality, bank stability, ecosystem health, mauri, economic impact, cost and recreation. At the end of the fifth workshop one solution predominated (Option G) with a reasonable consensus agreement between the stakeholders.

Councillors attended many of the workshops and a proposal was prepared for the Assets & Services Committee to consider.

It is likely this approach will be a model community consultative process for other Stormwater Management Areas in the Blenheim strategy, and subsequent strategies.

2.3 Strategic overview and priorities

The Council's Rivers and Land Drainage service ensure human safety, protects property and contributes to economic development.

The strategic priorities over the next 10 years are as follows.

1. Ensure the infrastructure is sufficient to meet the existing levels of service. Works already identified include: complete the overhaul of the pumped drainage network (over the next three years) and complete the upgrades to the Ōpaoa stopbanks (over the next 14 years).

2. Plan for climate change

    - Upgrades required to the existing flood protection and land drainage systems to adapt to climate change so the Council can continue to deliver the existing levels of service from 2020–2050.

    - Engage in public consultation to review the existing levels of service in view of the climate change forecasts to ensure they meet the community expectation and can be maintained within the projected budget.

2.4 Levels of service for each system

River management across the region has evolved over many years under a number of different administrative bodies. Separate levels of service have developed for each of the drainage systems that reflect the priorities and goals of the population and land within the catchment areas. The following table provides brief details of the levels of service for each of the service areas. More background information and detailed management objectives are in Appendix 3.

Table 2-1 Levels of Service and recent performance assessment

The Wairau floodplain major rivers and stopbanked floodways		
Level of Service	**Assessment**	**Performance/Comments**
A floodway capacity for flood sizes up to a 1 in 100 year return period for the Wairau River and the associated major floodplain rivers.	Approximately 4km of stopbank on the Lower Ōpaoa require upgrade to meet the 1 in 100 year and modern design standards	Not achieved – capital project to commence 2018/19
	Future capability of this system, in the light of climate change and customer expectation will be assessed through the major hydrological review	Review to commence 2019/20
The Wairau Tributaries (not stopbanked)		
The river channels are kept clear of trees and debris.	Routine and post-flood inspection	Achieved
Lower Wairau Flood Plain Land Drainage		
Extend the land drainage channel scheme to provide a separate connection point for individual holdings greater than 1 hectare.	Project commenced in 2015 and progressing	Not achieved - due for completion in 2018/19
Clear those watercourses/drainage channels of impeding weeds up to twice a year.	Routine twice yearly inspection and maintenance contract.	Achieved
Clear silt build up in drains, usually requiring excavation at approximately seven year intervals.	Routine twice yearly inspection and maintenance contract.	Achieved
Maintain floodgated outlets to the major rivers so that backflow is minimised in times of river flood or high tide.	Routine and pre-flood inspection. Monitor during flood conditions.	Achieved
Supplement gravity drainage with pumping stations so the maximum ponding period is equal to or less than three days for a rainfall event of 1 in 10 year ARI. This generally requires pumping stations to have the capacity to remove 15 mm rainfall in 24 hours.	25 rural pump stations annually inspected and maintained	Achieved
Carry out aquatic weed removal in an ecologically sensitive manner with methodologies specifically targeted to each watercourse.	Currently achieved but the use of aquatic herbicides is under consideration during the Proposed Marlborough Environment Plan re-drafting	Achieved
Manage the riparian margins of selected channels in an aesthetic and ecologically sensitive manner.		Achieved

Level of Service	Assessment	Performance/Comments
Urban Drainage and Stormwater Interface Management		
The channel network and pumping stations cope with a 1 in 50 year return period flood event	The Redwood/Town branch system is under capacity, with network upgrades and a pump station to be progressed. An initial $10M project approved Phase 1 Phase 2. Phase 3 Land acquisition Detailed design access and public consultation	 Completed in 2018 Contract tendered in 2018 Completed In progress
	Murphys Creek – upgrade Main Street Pump Station capacity to maintain LoS following increased stormwater from new growth pockets	Detailed design programmed
	Caseys Creek – upgrade channel and pump station for increased stormwater from growth pockets north of Old Renwick Road.	Contract let. Commence summer 2018/19
Sounds Watercourses		
Waitohi Stream/Kent Street catchment1 in 50 year ARI flood protection	Culvert upgrade delayed to coincide with railyard upgrade. Interim flood hazard protection through rules in Proposed Marlborough Environment Plan	Not achieved.
Waikawa River	Removal of accumulated silt from river mouth	Not achieved
Wither Hills soil conservation		
Little or no sediment is deposited in watercourses at the base of the Wither Hills.	Establish and maintain grass, trees and other vegetation to prevent soil erosion.	Achieved

Level of Service	Assessment	Performance/Comments
Gibsons Creek Re-watering		
Supply the requirements of the Southern Valleys Irrigation Scheme.	Supply maintained within resource consents constraints.	Achieved
Provide continuous flow in the Ruakanakana Creek (Ruakanakana Creek)/Ōpaoa system without flooding riparian land	Supply maintained within resource consents constraints.	Achieved
Council Floodway Reserve Land Management		
The space required for flood control works is not compromised.	Continuous liaison with landowners. Small annual budget for land purchase	Achieved
Provide and maintain access to Council floodway land for public recreation.		Achieved
At least 20 hectares of land is planted and maintained in ecological/amenity vegetation.		Achieved
Other floodway land is utilised for economic gain by forestry and/or leasing.		Achieved
Riparian access for maintenance of drains and small watercourses is not compromised.	Landowner and stakeholder relationship management	Achieved
The space required for flood control works is not compromised.		Achieved

2.5 Gap Analysis

Wairau Land Drainage - The Council has committed to increase the existing network of drains in the Lower Wairau by approximately 5.4%. The project has emerged as land has been sub-divided and higher value grapes are planted on traditional pastoral land. Every property greater than 1 hectare will have a direct connection to a council drain. The **smaller** blocks will not be reliant on maintenance of drains neighbouring property. Good progress is being made on this project which will be completed in the 2018/19.

Lower Ōpaoa Stopbanks - An extensive survey of existing stopbanks revealed around 4kms of older, first generation, stopbank around the Lower Ōpaoa did not meet the current design standards. A programme to upgrade these banks has been initiated. Slow progress is anticipated as residential development on the adjacent land will make access and construction difficult.

Redwood Street/Town Branch Drain Upgrade - Ongoing stormwater flooding problems in the low-lying areas of south Blenheim were investigated. A major hydraulic modelling project was commissioned. The resulting report identified a number of problems from urban infill and a legacy of under-sized infrastructure. The consultant's report proposed nine different remedial options. Following critical review by Council engineering staff one of which was recommended to Council as it provides the most cost-effective solution and the capital expenditure could be phased over a number of years. Council accepted the recommendation and provided an initial budget of $10M to commence the works.

Blenheim Urban Development.- Zoned development land to the north-west of Blenheim will require upgrades to the waterways receiving the additional run-off – Fulton Creek, Murphys Creek, Caseys Creek, Camerons Creek. Works are being planned and designed ahead of development and the funding model through development contributions has been updated accordingly.

Waitohi Culverts - Upgrades to the culverts have been deferred to be re-programmed to align with the anticipated Picton railyard redevelopment.

Maintenance Management - No significant change in pumping or outfall capacity standards is proposed but a more rigorous asset maintenance/renewal programme is required to make sure the existing pumping equipment works reliably and to design capacity. Mobile pumping units were used to manage excessive demand following ex-cyclone Gita in February 2018.

Ecological standards - There is a continuing demand for Council to maintain high ecological standards in relation to its flood protection and land drainage activities. River management policy for operation and maintenance and capital investment projects must meet the communities' environment al expectations

This is particularly the case regarding Spring Creek and its tributaries due to the trout fishery and eel habitat. There is also a demand to maintain and enhance remaining riparian ecological habitats including whitebait spawning areas and bird nesting habitat.

The use of aquatic herbicides to control weed growth is currently being reviewed during the development of the proposed Marlborough Environment Plan. Evidence of environmental damage through the use of chemical herbicides is being compared with alternative methods such as mechanical weed-cutting and the subsequent increase sediment disturbance and damage to the riverbank habitat during plant access for waste removal.

The community's environmental expectations need to be built into all the work undertaken by the Council's Rivers team, whether it be maintenance, capital improvement works or policy development.

Forestry - Forest harvesting causes a large amount of loose debris (slash) around the timber processing sites that can remain unstable for up to 5 years after the harvest. Major storms during this period can result in debris from logging sites blocking river channels and damming

the water flow. Subsequent dam collapses cause flow surges, diversions from the normal river course and large debris flows. This can be very damaging and dangerous to down-stream populations and infrastructure as it is very unpredictable and can be unprecedented.

Council's Environmental Protection Officers monitor and control the logging sites. Section 330 of the Resource Management Act (emergency works and power to take preventive or remedial action) enables the Council to take immediate action to resolve these situations rather than waiting for a resource consent to be approved. The Rivers and Drainage department work in collaboration with the Regulatory Department to prevent disruption to downstream flow paths during flood events

2.6 Current Levels of Service Performance

Satisfaction Survey Results

The residents' satisfaction survey is conducted each year. A telephone poll of approximately 600 residents is undertaken around June/July. Participants are asked to rate the Council's performance in providing the service. The measure is subjective and can be heavily affected by recent storm activity or publicity on a particular topic. However as a general indicator of public opinion it is an important reference. The survey scores achieved between 2011 and 2017 are shown in Figure 2-1

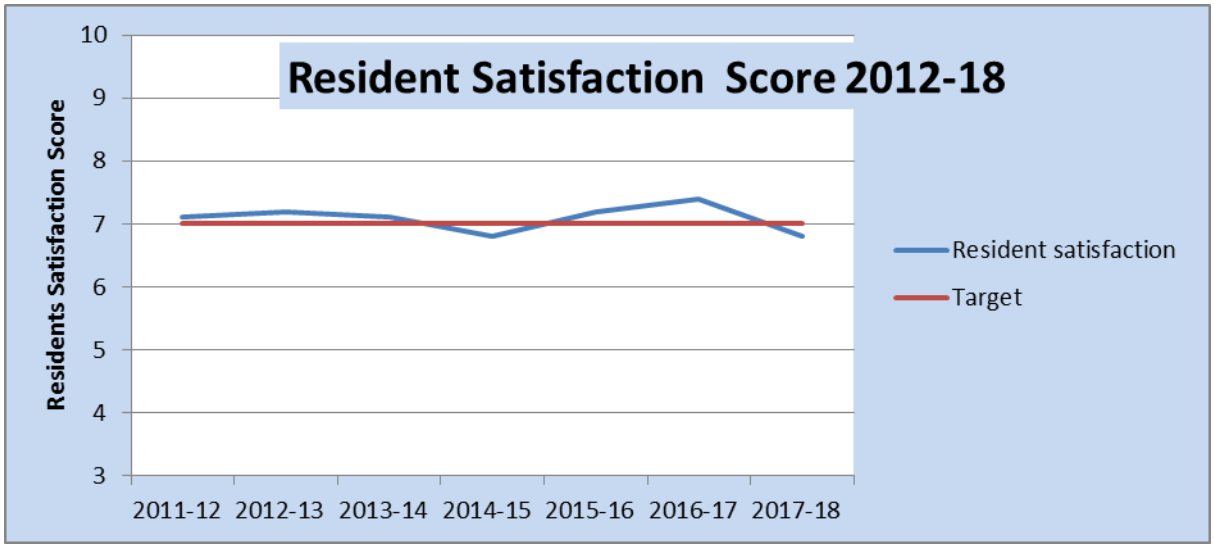


Figure 2-1 Recent history of the residents satisfaction with the Rivers and Land Drainage Activity

Figure 2-2 shows the distribution of scores in the 2017/18 survey for different geographical areas. Many of the areas with poor lower scores do not receive the Council flood protection service. A wet winter and heavy rainfall during the survey period had cause localised flooding to some rural areas and may have caused the adverse perception of the service.

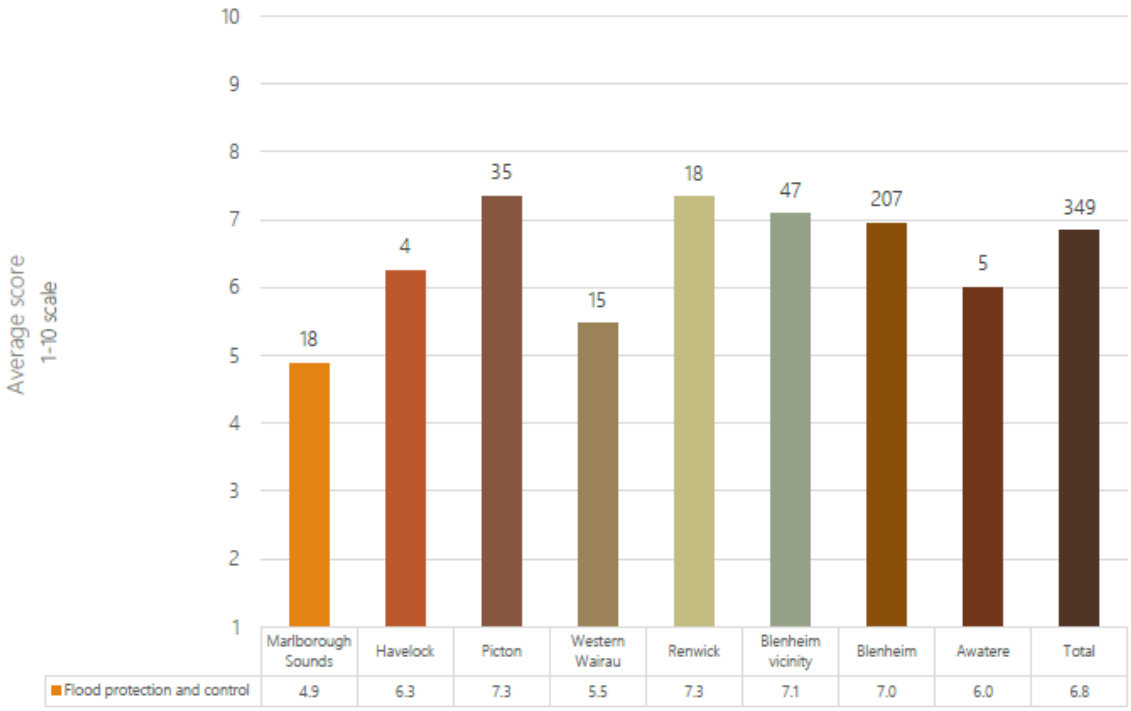


Figure 2-2 Resident Satisfaction Scores 2018

2.7 Future Levels of Service

In preparation for the 2018-28 LTP the levels of service were reviewed by departmental staff. A number of factors were taken into consideration

- the acceptable performance recognised in the customer satisfaction survey,
- a staff review of customer service requests/complaints
- the significant existing work-load (see Gap Analysis above) and
- the uncertainty of climate change

In August 2017 a Levels of Service workshop was held with all councillors and for discussion on current and future targets. It was proposed to councillors that the levels of service for the Rivers and Drainage department remain unchanged.

The proposed levels of service and targets were published to the community through the LTP consultation process. The public were encouraged to comment on the proposals through formal submission. All submissions were reviewed and council hearings received verbal submissions. Following the consultation and careful consideration the service levels and performance targets shown in Table 2-2 were adopted by the Council.

Table 2-2 Proposed Levels of Service 2018-28

Levels of Service 2018-28: Flood Protection and Control Works

Performance Targets (for the financial year)

Level of Service	Indicator	Baseline	2018-19	2019-20	2020-21	2021-28
Provide an overall level of service that meets or exceeds residents' expectations.	Resident satisfaction with this service as measured by survey, where 10 = "service delivered extremely well".	7.0	7.0	7.0	7.0	7.0
Wairau River scheme - system and adequacy These major flood protection and control works are maintained, repaired and renewed to the standards defined in Rivers and Drainage Asset Management Plan (AMP)	% of floodway and tributary network inspected annually for condition and maintenance requirements.	95%	95%	95%	95%	95%
	% of programmed maintenance and renewal works identified in the AMP 'practically'[2] completed.	100%	100%	100%	100%	100%
	% of capital improvement works in the AMP achieved.	80%	80%	80%	80%	80%
	Timeliness of providing a report to the Assets and Services Committee on the damage to the floodway network and potential problem areas following significant flood events (generally exceeding a 1:2 year return).	<2 months post event	<2 months post event	<2 months post event	<2 months post event	<2 months post event
Wairau Plains Effective drainage provided to the lower Wairau plains.	% of drain network inspected at least annually for condition and maintenance requirements.	100%	100%	100%	100%	100%
	% of drains weed sprayed each year.	90%	90%	90%	90%	90%
	% of drains mechanically cleared each year.	4%	4%	4%	4%	4%
Picton Floodways Monitor, maintain and upgrade key Picton floodways (Waitohi and Waikawa Rivers) to provide for a 1 in 50 year return period flood event.	% of floodway network inspected annually for condition and maintenance requirements.	100%	100%	100%	100%	100%
	% of programmed maintenance and renewal works identified in the AMP 'practically'[5] completed.	100%	100%	100%	100%	100%
Blenheim Urban Upgrade and maintain key Blenheim stormwater outfalls.[3]	% of programmed maintenance and renewal works identified in the AMP 'practically' completed.	100%	100%	100%	100%	100%
	% of capital improvement works in the AMP achieved.	80%	80%	80%	80%	80%
Sound flood hazard advice provided.	Number of liability consequences for Council arising from incorrect advice provided on flood hazards as part of the Resource Consent, Building Consent, PIMs and LIMs processes.	<5	<5	<5	<5	<5

[2] NZS 3910:2003 defines practical completion as when the contract works or any separable portion are complete except for minor omissions and minor defects.

[3] Channels and pump stations, including the Town Branch Caseys, Fulton and Murphys Creeks to provide for a 1 in 50 year return period storm event runoff including both infill and greenfield development.

Chapter 3: Future Demand

3.1 Demand Drivers

Future demand for flood protection and land drainage services is influenced by:

- climate change – rainfall patterns and sea-level rise
- urban development – intensification and extension to the existing urban areas
- changes in rural land use - higher value crops and changes to run-off characteristics
- public expectation of the service
- changes to legislation

3.2 Demand Forecasts

3.2.1 Climate change in Marlborough

Forecasts of climate change are the long term variation in global weather patterns. The regional consequences have been increasingly incorporated into the planning and design of long-life infrastructure as its influence has become more apparent.

The Ministry for the Environment has published advice on their website (updated December 2017) on the likely impacts of climate change in Marlborough. The information is included in Appendix 5.

Council is seeking expert advice on impacts across Marlborough. However, it is likely that Northern Wairau, Marlborough Sounds and Picton will experience more frequent storms with a greater intensity of rainfall. Changes in the rainfall pattern in the ranges around the upper Wairau basin will have a major impact on the flows in the lower reaches of the river.

Areas south of Blenheim are likely to be drier so it's likely there will be increased demand for irrigation in the southern valleys. Changes to rainfall patterns in Blenheim are the Taylor River catchment is not yet known.

Sea level rise is likely to have the significant impact on river flows and land drainage. Rising sea-level will alter the flow characteristics of the channels and inhibit the capacity of rivers and drains to discharge.

The consequences of high flow levels and higher sea levels need to be evaluated through hydraulic modelling. The Lower Wairau River was extensively analysed in 1992 which has provided a solid base for design for many years however the influencing factors need to be updated to ensure future projections are accurately modelled. A major hydrological review of the Lower Wairau basin is planned for 2019/20.

The Picton drainage catchments were analysed and flood models updated in 2005 following intensive flooding in the area. This remains adequate for flood design planning.

3.2.2 Population Growth Trends

Previous analysis of the four Census counts between 1991 and 2006 coincided with a period of rapid economic growth in the Marlborough region. Overall population growth in the region was around 1.5% per annum although there were some significant local variations. For example, the population of Waikawa more than doubled in this period whilst the usual resident population of Seddon decreased by 13%.

In 2014 a reassessment of population projections was undertaken and presented to the Council's Assets & Services Committee. The report recognised several trends in global population demographics that are contrary to historical growth patterns. These trends are likely to have significant implications for national and regional planning assumptions.

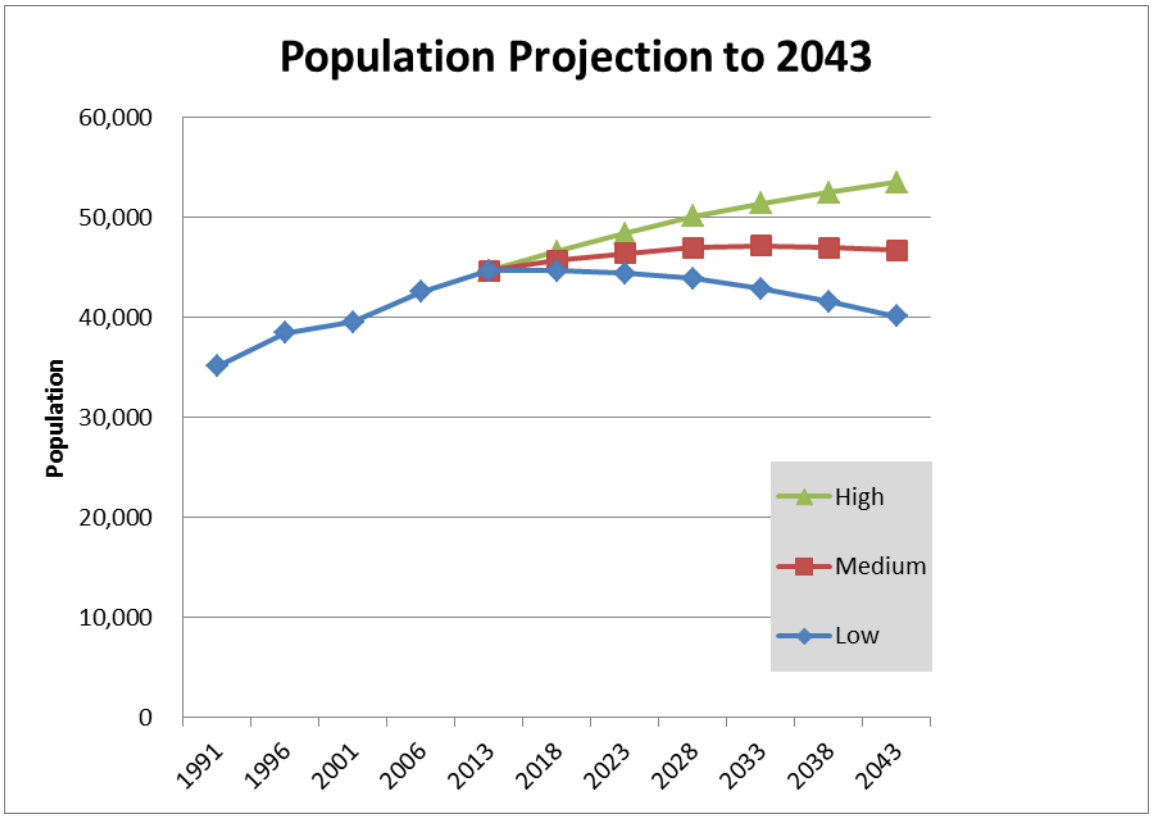


Figure 3-1 Population Projections to 2043

3.2.2.1 *Marlborough Population Growth*

There are two major trends in the demographics of developed countries that are unprecedented — a slow down in population growth and an increase in the age of the population.

Within a generation most developed countries (including New Zealand) as well as many developing countries will be experiencing negative population growth. Figure 3-1 shows the population projection for Marlborough based on the data collected in the 2013 census by Statistics NZ. In addition the Council commissioned two reports from the National Institute of Demographic and Economic Analysis (University of Waikato). The Institute's report provided further detailed analysis and population projections for the region. This 2012 report used local economic data supplied by Infometrics to inform their conclusions.

Population predictions — Both Statistics NZ and the Institute of Demographic and Economic Analysis report provided projections on high, medium and low growth scenarios. The trends are broadly similar. The Institute generally projected lower growth over a narrower time period than the Statistic NZ projections but this is within the overall range of the Census projections. The Institute's report looked at the whole of Marlborough rather than the individual settlements, and projected further into the future. The conclusion for all three projection scenarios (low, medium and high) was that the population will continue to grow for some time, then slow down and eventually decline. The timing of the population peak varied from as early as 2017 for the low projection to as late as 2061 for the high projection.

The release of the 2013 usual resident population statistics show the actual population for Blenheim to be very similar to the medium projection previously published by Statistics NZ. The Census showed some of the smaller settlements to have grown at a slower rate than was previously projected. These statistics fit with the national pattern of slowing growth in rural areas and more people moving to the more urban areas. However, local economic opportunities can strongly influence regions or individual townships, bucking the national trends.

Over the next 35 years there will be a slowing down of population growth, followed by a period of no growth and eventual negative growth.

Regional variation — The changes in population are not occurring uniformly through the region or uniformly across all settlements. Generally the smaller rural settlements are experiencing a more rapid slow-down in growth than the urban populations. However, there is also a shift in the "centre of gravity" of the Blenheim–Renwick and the Picton–Waikawa urban areas. Renwick and Waikawa have experienced considerable increases in population whilst central Blenheim and Picton have seen less growth or a decline in population.

The main urban growth areas are the greenfield sites on the periphery of existing urban areas. Urban growth pockets have been identified to the north and west of Blenheim's existing town centre and these areas have been zoned for urban residential development.

Household sizes — The number of inhabitants per dwelling is also falling. This means the demand for housing will decline at a slower rate than the fall in population. With Marlborough's age distribution this could indicate there will be fewer wage earners per household, which has consequences for the future affordability of water services.

3.2.2.2 Ageing Population

The proportion of the total population over 65 years old will increase significantly. The baby boom that followed the conclusion of World War Two continued into the 1960s. However subsequent generations had unprecedented access to effective birth control and a different attitude to family size. Other social factors such as opportunities for women in the workplace and greater financial security in old age have also been influential. As a result the average size of families has been dropping steadily.

Improving life expectancy for the baby boomers and continued trends of smaller family sizes by the following generations will ensure the proportion of older people in the population will increase significantly over the next 30 years. Currently the proportion of the Marlborough population over 65 is around 23%, which is marginally above the national average. By 2043 this is projected to increase to 34%. The proportion of the population of working age will decrease from 64% to 50%. Taking into account a considerable number of people of working age may not be working, significantly less than half of the total population will be wage earners.

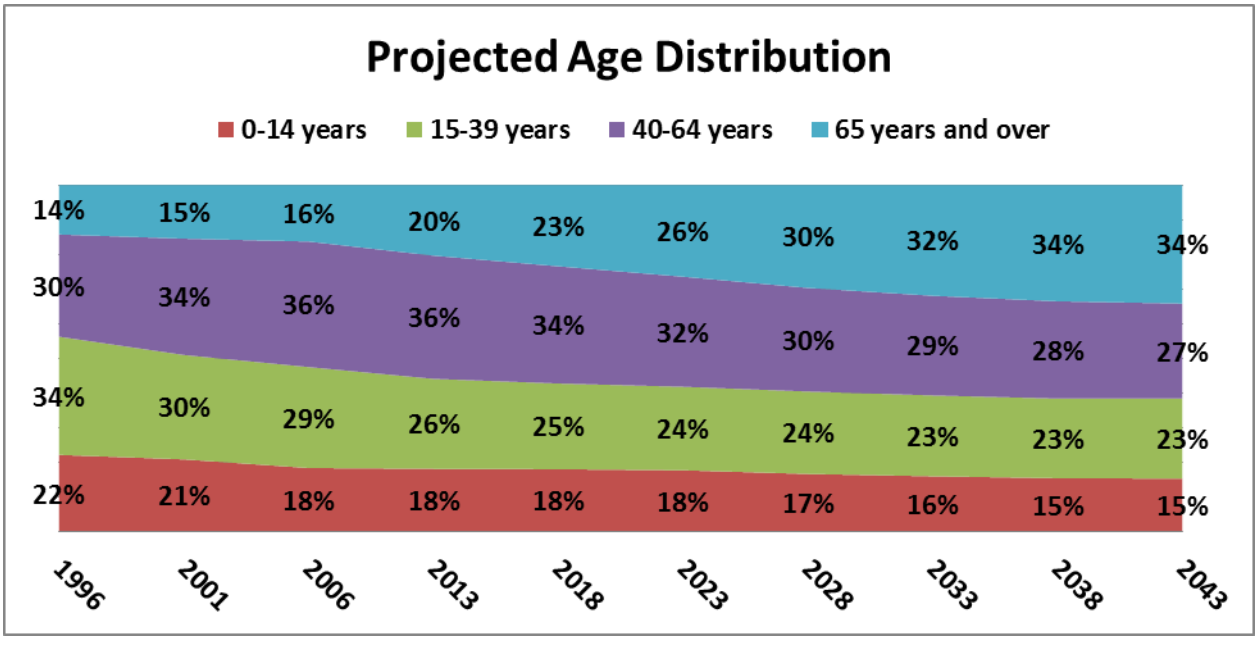


Figure 3-2 Marlborough Population Projected Age Distribution

At a high level there are two consequences for Council infrastructure that need to be highlighted.

1. Councils can no longer simply design infrastructure for significant growth secure in the knowledge that at some time in the future the capacity will be required.

2. A greater portion of the population will be on fixed incomes so people will have a limited capacity to handle increased costs.

3.2.2.3 Marlborough Urban Growth Strategy

In 2009 the Council embarked on a major project to develop a comprehensive urban growth strategy for the Marlborough region. Population projections were based on the previous Census which estimated growth over the next 25 years of approximately 9,300 additional residents across the region. The opportunity for infill housing and urban densification within the existing settlements was taken into consideration. Household and section sizes were also analysed and trends were projected into the future.

The data was used to inform a major consultative process with the public, other expert stakeholders and Council staff. The quantity of land required was estimated and areas with potential to be developed into urban growth pockets identified. Wholly new settlement hubs were considered unlikely and future growth was assumed to occur on the periphery of existing settlement nodes. All areas of the region were considered for their growth potential and capacity to provide for future growth. Growth will be mostly required on the periphery of Blenheim. Eight growth pockets were identified and zoned for residential development. (see Figure 3-3**Error! Reference source not found.**)

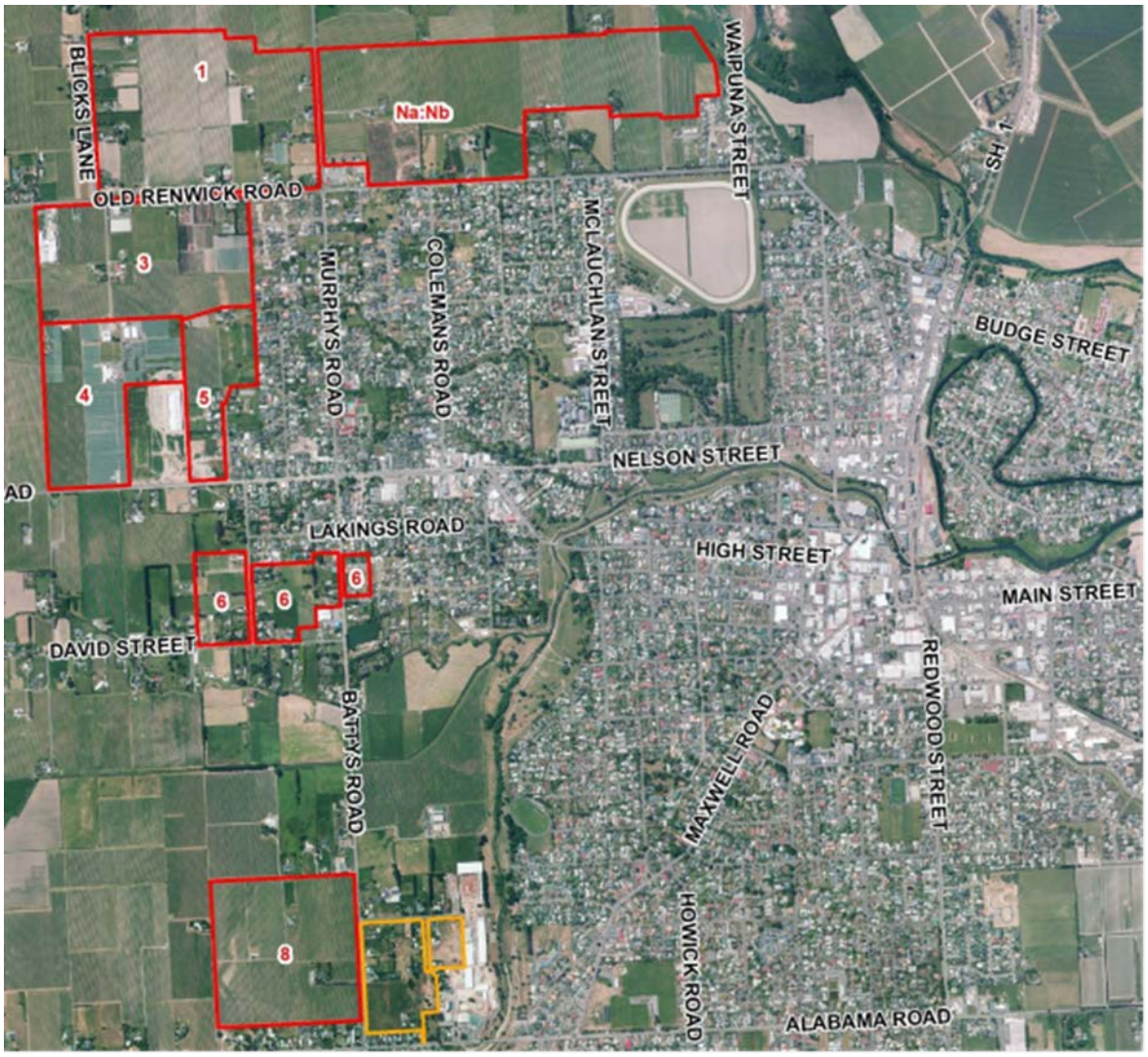


Figure 3-3 Blenheim Urban Growth Pockets

The Rivers & Drainage section were fully involved in the consultation process from the out-set. Their knowledge and experience of land drainage issues were an important factor in evaluating the suitability of perspective development zones. Land parcels with minor drainage issues were considered along with an estimation of improvement costs and residual risks. Many of these were later excluded, particularly to the east of Blenheim as they were also vulnerable to liquefaction.

The Marlborough Urban Growth Strategy was adopted in 2013. During the strategy development many potential growth pockets were considered on a broad range of factors. Input from the Rivers and Drainage department at this stage was able to advise on the land drainage and flood risks. Areas where the risks could not be managed were excluded from the final zoning proposals.

3.2.2.4 Blenheim Urban Growth

Stormwater flows from the existing Blenheim urban areas have been extensively analysed. The capacity to accommodate additional flow from in-fill sub-division and major growth pocket development has been estimated. Resource Consent applications are considered and conditions imposed where capacity is limited.

The Stormwater Action Group has overseen the early design of the northern growth pockets (Na-Nb and Pocket 1). The process involves estimating the additional stormwater flows that will result from sub-division of the land under a number of storm event scenarios. This is compared with the surplus capacity of the downstream drainage channels. Stormwater flow management techniques are considered before downstream capital upgrades. The permeability of the land has been assessed and drainage swales and flood attenuation land has been incorporated into the design of the sub-divisions.

Agreed service plans were prepared and accepted by the developers of the recent Omaka Landings development to the south-west. Similar plans are being developed for the growth pockets to the north-west of Blenheim. The plans have been established through close collaboration of the Stormwater Action Group and land developers

The Stormwater Action Group has overseen the early design of the northern growth pockets (Na-Nb and Pocket 1). Maximum allowable discharge rates from the new sub-divisions have been calculated. The stormwater designs have achieved the flow rates by maximising ground soakage, splitting the flow between different catchments and incorporating flow detention ponds into the design of the sub-division. The remaining flow is accommodated in new stormwater infrastructure and upgrade to Rivers & Drainage assets

Blenheim drainage is generally from west to east via existing streams such as Caseys Creek., Murphys Creek., Fultons Creek and Yelverton Creek. The stormwater from the identified growth pockets will discharge to these watercourses and the careful design will be require to ensure there are no adverse downstream consequences.

The maximum flow capacity of Caseys Creek immediately north of Old Renwick Road will be increased from around 1.5 cumecs to around 2.4 cumecs. The channel will be widened and lined with rip-rap/reno mattress. All culverts below property driveways and the outlet from the pump station will be increased to a minimum size of 1800mm. The first phase of approximately 750 metres is programmed for the summer of 2019. The outlet of the pump station and downstream through Lansdowne Park is programmed for 2020. The project cost is estimated at $4.7M

The outcome of the collaborative decision making process for the Murphys Creek resulted in a similar combination of stormwater upgrades and River asset upgrades. The preferred option (Option G) allowed for a discharge to the upper Murphys Creek equivalent to the undeveloped discharge rate and a new stormwater main to be installed in Middle Renwick Road/ Boyce Street at an estimated cost of $2.5M. Rivers department will upgrade pump station at the High Street Bridge with a second gravity outfall, new pumps and an improved collection basin. The estimated cost is $100,000

3.2.2.5 The costs of growth

The capital costs of the scheme have been calculated and included in the re-assessment of the Development Contributions policy that was included in the 2018-28 LTP.

Recent population projections cast some doubt as to when that investment would be recouped from development contributions and the increased rating base. The sequence of development and the timing of design and installation of infrastructure will require constant monitoring. Simultaneous development of all sites identified for development would result in a significant capital investment. The Council has not specified a preferred sequence for development, but the full costs of developing in a non-logical progression will be borne by the developer. The Stormwater Action Group will continue to monitor progress to ensure there is adequate design and supervision of the prerequisite infrastructure.

3.2.2.6 Stormwater Quality

The designers of new sub-divisions are required to incorporate structures into the stormwater drainage design that will provide treatment to avoid contaminant entering the receiving waters. These measures help to meet the demand for improved river water quality defined in the National Policy Statement for Freshwater Management. Further details are included in the Stormwater Asset Management Plan

3.2.3 Land-use change

Viticulture

Viticulture land use has expanded rapidly in Marlborough, from around 2,000 hectares in 2000 to approximately 23,000 hectares in 2010. The land dedicated to grape production is forecast to increase to 29,000 hectares by 2019/20. Council continues a close liaison with the industry to identify the areas of land for development

The Council is committed to ensuring the existing areas where land drainage services are provided continue to work well. However as the demand for grapes increases landowners will be seeking to expand into increasingly marginal areas. Much of the lower Wairau Plain would be a natural swamp without human drainage intervention and grapes vines require free-draining soils. Enquiries for the provision of additional drainage are therefore anticipated.

To significantly increase the drainage area is likely to require increased investment in infrastructure. An agreement on the funding mechanism would be required with landowners. There are no major extensions to the drainage areas planned at this time.

There are a number of bores and pumps that help to lower the water table and assist with land drainage. Increasing the pumping rate may increase the area of land drained but may have unwanted consequences for other groundwater abstractions, the behaviour of natural springs, the local environment or may encourage salt-water intrusion into the aquifer in areas close to the sea. For these reasons it is unlikely that Council will pursue this option.

Increasing demand for viticulture land is likely to prompt further proposals to plant grapes on private land within key Wairau Floodplain floodways (especially the Ōpaoa, Wairau and Taylor River floodways.) Invoking statutory powers to control private land-use can be time consuming and incur legal expense. There is a small annual capital budget for the purchase of floodway land where the existing private land use is not consistent with floodway management requirements.

Council provides only a limited flood protection service to land adjacent to the Wairau River upstream of the Waihopai confluence (mainly in-stream vegetation control.) Vine planting has extended west along the Wairau Valley and onto the lower river terraces. Landowners are aware of the risk of flooding to the lower terraces during extreme rainfall events but extending stop bank protection to this area is not a viable option at this time

3.3 Demand Management Plan/Strategies

There are two options to meet increased demand for river drainage and flood protection:

- building new asset infrastructure or upgrading existing assets to meet the demand.
- implementing demand management strategies that removes or reduces demand and/or

In a period of uncertainty of population and economic growth the first priority is to manage the demand and avoid capital and on-going revenue costs of new infrastructure.

The objective of demand management is to actively seek to modify customer demands for services in order to:

- optimise utilisation/performance of existing assets
- reduce or defer the need for new assets
- meet the organisation's strategic objectives (including social and environment objectives)
- deliver a more sustainable service.

3.3.1 Planning for Growth

The methodology for infrastructure planning most commonly adopted by the Assets & Services engineers is to use the medium growth scenario for population projections. The census data is analysed at mesh-block level and population estimates assigned to the drainage catchment boundaries. Adjustments can be made depending on the growth characteristics of individual mesh-blocks and local knowledge.

When planning services with a long lead time, the anticipated increase in demand needs to factor in a margin of error. A 'just in time' approach is prudent both from the point of view of capital expenditure and the uncertainty of projections and assumptions. In contrast, from a financial planning perspective, it is prudent to anticipate a slower growth in the rateable property base and income from development contributions, with a subsequent delay in cash flow returning to the Council.

Many of the flood protection and land drainage assets have a planned life in excess of 80 years. Stop banks can be maintained in perpetuity. As a large proportion of the total assets costs occur in the initial construction phase, it would be expensive to underestimate the long term demand and be forced to upsize assets. Thus the tactic employed is to err on the high side for such long life components, use the medium scenario for the design of shorter life components, and for all assets build 'just in time' to meet demand.

Viticulture/rural land development
Changes in demand for land drainage and flood protection associated with the intensification of rural land use, primarily through the development of more viticulture, will be considered during the levels of service review (proposed to occur in five years' time.).

The land west of the Waihopai confluence with the Wairau River has undergone extensive viticultural development in recent years. The options may include additional stopbanks, drainage channels with flood-gated outfalls, gravel extraction, floodway management. A funding strategy with the beneficiaries will need to be agreed in advance.

Climate change
There remains a degree of uncertainty on the impact of climate change on local and national weather patterns.

New infrastructure and asset upgrades are designed and built based on engineering estimates of the maximum probable demand. Mathematical models are built so that various weather conditions can be evaluated. The duration and intensity of different storm events can be modelled as well as different patterns of run-off and the preceding conditions of the rivers and

land. Engineering designs for long-life infrastructure are conservative. They are built to meet the extreme conditions with an additional factor of safety. Recent designs have included a further factor for the uncertainty of climate change

A climate change allowance is included in current Blenheim stormwater planning. The relationship between storm rainfall and river flows is constantly monitored and models calibrated. The Picton rivers were recently reviewed following the very large Waitohi and Waikawa River floods in 2004.

Increased flood carrying capacity may be required in future, as well as more pumping of water to overcome the effects of sea level rise on the effectiveness of gravity-based drainage.

In 2019/20 a major project is planned to update the hydrological model for the Lower Wairau and re-draft the Wairau River Floodway Management Plan 1993. A complete re-assessment of the river flow patterns using the latest data on the cross-section of the channels, floodway and stopbanks; drainage pattern from the adjacent land and current land-use; up to date surveys using LIDAR and other data, estuary conditions and the latest projections on future weather patterns. At the conclusion of the project the Council will have a good understanding of the adequacy of the existing flood protection system and an outline of any upgrades that maybe required to meet future demand. The analysis will be used to inform a major public consultation process with landowners and other stake-holders. Different scenarios can be presented to the interested parties and actions discussed as well as the options and alternative methods of funding.

The project will form the basis for a long-term strategy for the Lower Wairau River. A subsequent flood plain management plan will identify the works required to meet the strategic objectives.

Subdivision of rural land

The Wairau Awatere Resource Management Plan and the Marlborough Sounds Resource Management Plan have been updated in rules in the Proposed Marlborough Environment Plan. The knowledge of historical flood patterns is good and is used to manage resource consent proposals. Consent applications can be declined or conditions imposed to ensure the flood risk is managed appropriately.

Implications of technological change

Most pump stations are not currently fitted with telemetry and require electro-mechanical level sensors for activation. Telemetry will enhance both monitoring and flood control measures. Improved monitoring will allow flood models to be calibrated to provide better forecasts and warnings during an event.

New pump stations and major upgrades will include the ability to remotely control and electronic management of the gates in future. The Gibsons Creek inlet will be retro-fitted with telemetry to assist with future control of the flow in the creek.

Projects		**Works required**	**Cost**	**Date**
Climate Change		Major review of the Wairau River Floodway Management Plan(1993)		Start 2019
Urban Growth	Caseys Creek	Upgrade river course and pump station	$4.7M	Summer 2019
Urban Growth	Murphys Creek	Upgrade Main Street outfall pump station	$100k	
Urban Growth	Yelverton Creek	TBD – based on developer demand		
Urban Growth	Fultons Creek	TBD – based on developer demand		
Rural Land use change	River Terraces u/s Waihopai confluence	TBD – will require significant rate review for funding		
Rural Land use change	Various	Floodway land purchase	$200/ pa	Ongoing

Chapter 4: Lifecycle Management Plan

4.1 Background Information

The lifecycle management plan aims to deliver the best value for money while also providing the agreed levels of service. This involves anticipating and managing risks on an ongoing basis.

Maintenance of our permanent assets is the key asset management focus. The purpose of a maintenance strategy is to effectively manage:

- **Risk of failure** -The risk associated with failure of critical assets
- **Levels of service** – Consistently achieve the current or agreed level of service
- **Economic efficiency** – ensure assets are operated efficiently
- **Extend the life of the asset component**
- **Legislative compliance**.

Appendix 1 provides background information on our approach to river control asset management.

More detailed information about the assets and management objectives for each system is provided in Appendix 2.

4.1.1 Operations and maintenance programme

The annual maintenance programme includes provision for:

- Standard monitoring maintenance works necessary to ensure that the assets are
- operational at all times. Such works include monitoring inspections, audits and
- surveys, removal of blockages from outlet channels and floodgate flaps, weed
- spray and lubrication of mechanical components.
- Planned maintenance works which are undertaken on a cyclic basis, or through
- the annual condition survey, crest level surveys, cross section surveys and
- structures audit reports. Prioritisation is based on the risks of failure.
- Unplanned maintenance which is urgent maintenance work identified during
- routine inspections, or through customer feedback. These are investigated and
- assessed, and if the risks of failure warrant it, works are added to the current
- annual maintenance programme.

4.2 General Monitoring and Maintenance Activities

4.2.1 Stopbank Maintenance

Stopbanks normally require limited maintenance work over the first 20 to 40 years following their construction. The maintenance requirement will increase as the banks age and a major overhaul will be required at around 50 years. In order to maintain the 180km of stopbanks, in perpetuity, the Council is required to carry out around 2–3 km of heavy maintenance on of stopbanks each year.

An ongoing programme of stopbank inspections is required by both asset engineers to maintain an overview of the condition of the assets and to prioritise their maintenance and maintenance crews to address immediate maintenance issues.

Other common maintenance activities are

- Weed & vegetation control
- Floodway reserve management
- Bank protection repair & maintenance
- Pump station maintenance

- Gravel extraction management -river channels are constantly surveyed and monitored to assess the accretion of gravel. The Council manages the commercial extraction of gravel where it is permitted under the Environment Plan and where accumulation of sediment is inhibiting the flow characteristics of the river. Careful management is required as excessive removal can cause the river flow to be re-channelled and under-mine the river banks.

The following is a table of the scheduled maintenance activities undertaken by the department (or contractors working on their behalf):

Table 4-1 Schedule of Routine Maintenance Activity

Item/Activity	Description	Frequency
River floodways		
General overview	Oversight and general inspection of floodway.	1 year
Bank erosion	Assess where undesirable bank erosion may be occurring, and the need for strengthening.	1 year or after significant flood events
Rock rip-rap condition	Rock rip-rap being undermined, scrub and trees growing in rock and needing removal.	1 year
Bank protection tree condition.	Health of willow and poplar trees, need for lopping and layering trees, fences kept stock-proof.	1 year
Channel fairway clearance	Active channel is kept clear of growing or stranded trees.	1 year
Stopbank condition	Stopbank surface is maintained with good coverage of grass and scrub, and trees are removed. Rabbit holes, stock damage and vehicle damage are repaired.	1 year
Berm condition	Berms are kept clear of scrub and trees where water way capacity is needed; berms are kept vegetated by trees where there is a need to prevent surface erosion.	1 year
Gravel/sediment extraction		
Undesirable gravel bar build up.	Oversight and general inspection of reach.	1 year
Gravel extraction by permit	Ensuring gravel is extracted in the right place and in the right amounts.	Before and during extraction
Riverbed survey	Assessing degree of build up or lowering of riverbeds.	3 to 15 years depending on river
Flood inspections		
Integrity during floods	Assess if stopbank is likely to fail and the need to advise police of public evacuation procedures.	During floods.
Aerial photography during flood	Obtaining record of flow patterns and flood spread.	During large floods

Item/Activity	Description	Frequency
Post flood damage inspection	Assess damage to river control assets.	As flood waters recede after large floods
Hydraulic review Reassess hydraulic performance of floodway	Reassess the capability of river channels to carry the design flow, especially where a riverbed is changing or the design flood changes.	10 to 15 years, or after major flood depending on river
Hydrologic review Reassessment of design flood size	As more hydrologic information comes to hand, especially after a very large flood.	15 to 20 years, or after a very large flood, depending on the river
Specialist structures (eg Waihopai control gates)	Inspection and report.	1 to 10 years
Drainage channels Channel weed removal Channel siltation Bank stabilisation and other channel maintenance	 Spring and autumn weed spray. Machine excavation. Oversight and general inspection of drain. Provision for new, and maintenance of existing, rip-rap as required for drain edge or road stabilisation.	 6 months 8 years 1 year
Drainage channel riparian management Ensure adequate maintenance access is preserved	Requiring land owners to remove problem trees; removing self-seed scrub etc.	1 year
Gravity outfalls (150 mm-300 mm) Minor floodgates Annual inspection Miscellaneous maintenance	 Regular operational check (high risk gates) Oversight and inspection. Miscellaneous minor repairs to stopbanks/culverts/fences/gabion baskets.	 Prior to floods 1 year 2 years
Major floodgates (450 mm - 1200 mm) Normal inspection Annual inspection Desilting Miscellaneous maintenance Ancillary replacement	 Regular operational check (high risk gates). Condition/settlement check and repair. Sediment removal around floodgates. Floodgate chains/bolts etc. Flapgates/winches/retaining walls/timber.	 Prior to floods 1 year 3 years 3 years 20 years

Item/Activity	Description	Frequency
Pump stations		
Normal inspection	Regular operational check, motors, floodgates, check screens.	Weekly
Operational during floods	Operational and screen clearing.	During floods
Electrical inspection	Full pump station electrical check.	3 months
Mechanical maintenance	Repair/replace seals, bearings, minor electrical, repaint buildings, steelwork.	5 years
Pump recondition	Replace bell mouth, shaft, deflector casing, build up and balance impellors. Refurbish weed screens. (Retain access to mobile back up pump for use during both emergency events and when existing pumps are out of action due to reconditioning.)	10 years
Major maintenance	Replace weed screens, switchboards, control equipment.	20 years
Control gates and equipment		
Structural	Inspection and reporting.	1 year
Mechanical service	Bolt replacement, sand blasting, repainting, deck replacement/refurbishment, thrust bearing overhaul.	5 years

4.2.2 Procurement of Maintenance Services

Currently the maintenance of river drainage and flood defence assets is separated into five contracts

- earthworks
- a strategic labour team responsible for signs, spraying and other maintenance activities
- specialist electric maintenance of pumps and control gates
- scheduled mechanical maintenance
- mowing and general stopbank maintenance.

Maintenance contracts are let for a period of three years with options to renew up to a maximum of seven years if the performance of the contractor is satisfactory.

Contracts are renewed through competitive tender. Tenders are assessed on pre-defined weighted attributes – including the contractor's health & safety record, experience of similar works, staff capabilities availability to respond to flood events and price.

4.3 Asset Upgrade Plan

4.3.1 Taylor Dam (and spillway) upgrades to meet new Dam Safety Regulations

The Taylor flood detention dam is a very important part of the flood protection system that protects Blenheim. The dam is now close to 50 years old and generally in very good order. Dam safety regulations now require dams like the Taylor to be regularly inspected and assessed for safety.

The recent comprehensive safety review was completed in 2018 and has identified a number of matters for Council to attend to including a minor capacity upgrade to the auxiliary spillway,

installation of additional drainage and crest level monitoring points, and resealing of the main outlet culvert joints. This work is underway.

4.3.2 Ruakanakana Creek (Ruakanakana Creek) Intake

Refurbishment work is required to the Waihopai intake and is programmed for 2019/20.

4.3.3 The Lower Wairau drainage network

The improvement plan approved in the 2015-2025 LTP to provide separate connection for all properties greater than 1Ha is on track. The programme will increase the managed drainage network by an additional 15.3kms and will extend into the 2018-2028 LTP.

4.3.4 Blenheim stormwater outfall upgrades

The improvement of stormwater outfall infrastructure has been incorporated into upgrades associated with the recently rezoned areas to the north and west. Upgrades to Caseys Creek and Murphys Creek are discussed in Chapter 3

4.3.5 Redwood St/ Town Branch Drain Improvement Plan

The major project to improve the Redwood Street/ Town Branch Drain catchment has commenced. The first phase to install 300 metres of concrete channel at the head of the Town Branch Drain, rear of Easthaven Place was completed in early 2018 at an approximate cost of $800k.

A contract has been prepared for phase 2. To upgrade the culvert beneath Redwood Street from the head of Town Branch Drain, connect to the Muller Road stormwater drain and the construction of a temporary storm overflow between the Redwood Street storm main and the Town Branch Drain network. Work is due to commence in late 2018 pending a compliant contract tender.

Work has also commenced on the downstream phase of the plan with the acquisition of a parcel of land at Snowdens Basin to provide a flood detention area. Peak flows will be diverted to the basin and a new pump station will be constructed to drain it once the peak flows have subsided. The overall plan has been allocated a budget of $10M dollars. Early negotiation with landowners has begun but an application for resource consent, detailed design and land access along the existing drain will need to be completed for construction work to start in 2020/21

4.3.6 The Lower Ōpaoa stopbank upgrades

A budget of $800,000 has been allocated for the upgrade of stopbanks on the Lower Ōpaoa that are currently assessed as Condition Grade 4 or 5. The work will require land acquisition and access agreements as private developments have occurred in close proximity to the banks. The work is scheduled over the next 10 years to be completed as soon as possible but smoothing the expenditure profile.

4.4 Asset Creation and Acquisition

4.4.1 Pukaka Quarry Extension

The Council owned Pukaka Quarry is a key source of rock rip-rap for river protection works on the Wairau River and tributaries. The quarry also supplies a variety of aggregates to the contracting market as a by-product of the rock production.

The rock resource within the existing land boundary is now limited and a further 4.5ha of land will be required if the quarry is going to continue for a further 50 years. Discussions with the adjacent landowner are continuing

However the Pukaka Quarry is self-funding and capital requirements for any extension are proposed to be serviced from operating revenue. No specific capital budget is provided for in this plan.

4.4.2 Expansion of Service to New Areas

As discussed in Chapter 2 land-use changes may create a demand for an expansion to the current service area. Minor boundary reviews to clarify the extent of the area for which Council provides flood protection services will be carried out. Additional assets or maintenance will be funded through a revision of the current rating classifications and boundary changes.

4.5 Asset Condition

A regular system of monitoring, maintaining and inspecting infrastructure is carried out. Asset condition is graded on a standard grading system such as the NZWWA Infrastructure Asset Grading Guidelines. The gradings used in the condition assessments are:

1. Very good,
2. Good - minor maintenance required
3. Moderate - significant maintenance required
4. Poor - major overhaul required
5. Very poor -high risk of failure

The Council objective is to ensure 80–90% of the assets are in the Condition Grade 1 and 2. Of the remaining assets those in Condition Grade 4 and 5 are to be attended to as a matter of urgency followed by upgrades to assets in CG 3 if resources permit. A good system has. There shouldn't be any CG.4s and CG.5s unless the Council is prepared to carry the risk.

Asset condition data is currently held in a series of well-established records. It is planned to merge and standardise the existing records into the corporate asset management information system (AMIS) – see Improvement Plan. This will also assist in inspection scheduling, monitoring and reporting on condition.

4.6 Asset Renewals

The major part of the asset base, in terms of volume and value, are the stopbanks, earthwork and rock protection which are maintained in perpetuity and are not subject to renewal. There is around $200M of non-depreciated assets. As a rule of thumb the maintenance cycle is approximately 50 years and the cost of maintenance over that period is around 50% of the replacement cost. Therefore the maintenance budget needs to be around $2M per annum to maintain the non-depreciated assets

The main renewable assets are the renewable components of the Taylor Dam, the pump stations and miscellaneous components such as floodgates, outfall structures, penstocks, etc. In 2018 the replacement value of these assets was valued at $14M and the depreciated value estimated at $7.7M (see Appendix 4.) In line with Council policy, depreciation is fully funded.

The Rivers Operations Engineer is primarily responsible for maintenance and upgrade of the pump stations and mechanical assets associated with urban drainage. Currently asset information is held on files and spreadsheets within the corporate document management system. These records are well maintained and a good source to inform the renewals programme.

Data will be extracted from the records and entered into the asset management information system (AMIS) when it is introduced (see Chapter 7 & 8). The AMIS will permit ready analysis of the condition and performance of the assets as-well as linkage to maintenance history and costs.

Wherever possible pump station and other asset renewals are incorporated into works with other drivers- growth and/or level of service. For example, the upgrade of pump stations at Lansdown Park and High Street associated with Blenheim urban growth pockets will permit the replacement of ageing components. Identification of the separate drivers within the budget is important however to ensure correct funding allocation (see 7.8 Residual Risk Management). Similarly the upgrade to the Town Branch Drain will renew a number of culverts and part of the existing drainage channel.

4.7 Disposal of Assets

Most of the flood protection and drainage assets have no remaining financial value at the end of their life. Stopbank earth is recycled into new stopbanks. Plant and equipment is de-commissioned and either returned to stock for spares, sold or scrapped. Concrete structures are demolished and disposed of as clean-fill.

Land which is no longer required for flood protection purposes has ongoing value for other uses. Disposal of land is uncommon as generally the requirement for flood protection is increasing and access needs to be maintained for the remaining assets. Any surplus land identified is formally considered for disposal by Council.

A small amount of forestry in floodway reserve can be harvested for timber but is generally of too small scale to return significant revenue

4.8 Asset Valuations

As part of its statutory obligations, Marlborough District Council is required to determine the replacement cost (ORC – Optimised Replacement Cost) of its assets, the current depreciated value (ODRC) and the annual decline in service potential (DISP).

The total asset value for the Rivers & Land Drainage Activity as at 30 June 2018 is $214.9 million. Details of the 2018 valuation are shown in Appendix 4.

As previously noted, 97% of the Rivers and Drainage assets are maintained in perpetuity. Depreciation is therefore calculated on the remaining 3% to finance the replacement. Accurate valuations are important for insurance purposes but less significant for renewal financing than some other Council activities such as roading and water/wastewater.

An accurate assessment of condition and life expectancy of the assets is important for the valuation process. Generally the life expectancies recommended by IPWEA/NAMS are considered satisfactory. In exceptional circumstances these have been adjusted if justified by on-site assessment.

The replaceable assets at the Taylor Dam are regularly inspected and assessed for condition and their remaining life is estimated.

Table 4-2 Asset Life Expectancy

Asset type	Life Expectancy
Pump Stations	
- Mechanical	60
- Electrical	35
- Civil/Structure	100
Stopbanks	In perpetuity
Groynes	In perpetuity
Rock Armouring	In perpetuity
Taylor Dam Assets	Individually assessed

A list of the pump stations, their residual life and valuation details are shown in Table 4-3 below

Data quality is generally considered to be good – see Table 7-1

The valuation will increase significantly in 2018 to around $200M as the contract construction rates for stopbank renewal would appear to have been under-estimated in the past. Contract rates recently received during the earthquake damage repair and reconstruction would suggest a price of around $25 per linear metre for the stopbank earthworks. A rate of around $12/m had previously been used in calculations. Following the Christchurch earthquake sequence and the damage to State Highway 1 following the Kaikōura earthquake there has been a heavy demand on the heavy civil engineering industry. There is also a local shortage of good quality construction rock and materials. It is believed the current increases are not a temporary peak in prices and therefore it is appropriate to raise the rates. However the rates will applied to all stopbanks over a number of years to avoid a 'shock' increase and ensure prices have stabilised.

Details of the asset valuation are provided in Appendix 4.

Table 4-3 Pump Station Details

SUMMARY SCHEDULE							
Pumping Station Location				**Valuation**			
	Mechanical Residual Life	**Electrical Residual Life**	**Civil Residual Life**	**Replacement Value**	**Depreciated Replacement Cost**	**Depreciation to Date**	**Annual Depreciation**
Tuamarina - Pembers area	2018	2018	2018				
Parkes Bros	42	2	52	$ 241,718	$ 121,930	$ 119,788	$ 3,103
Tuamarina Lagoon	43	7	52	$ 251,685	$ 132,470	$ 119,215	$ 3,121
Pembers Road	1	1	39	$ 287,705	$ 85,634	$ 202,070	$ 3,509
Thomas Rd	12	1	52	$ 303,336	$ 127,107	$ 176,229	$ 3,804
Pukaka Pondage	14	1	54	$ 237,414	$ 111,366	$ 126,048	$ 2,794
Blind Creek	23	1	79	$ 217,740	$ 147,940	$ 69,800	$ 2,651
Tuamarina Village	36	11	62	$ 34,548	$ 19,004	$ 15,544	$ 547
				$ 1,574,144	**$ 745,450**	**$ 828,694**	**$ 19,529**
Spring Creek & Township							
Watsons Road	26	1	66	$ 337,770	$ 186,969	$ 150,801	$ 4,435
				$ 337,770	**$ 186,969**	**$ 150,801**	**$ 4,435**
Wairau Pa - Marshlands							
Rouses Drain	43	18	47	$ 321,459	$ 167,538	$ 153,921	$ 4,173
- Electrical Additions 2017		34					
Roberts Drain	43	18	50	$ 294,614	$ 161,108	$ 133,505	$ 3,632
Roberts D electrical upg		28		$ 16,843	$ 13,474	$ 3,369	$ 481
-Electrical Additions 2017		24					
Chaytors Drain	3	1	43	$ 291,895	$ 96,412	$ 195,484	$ 3,595
- Structural Addition 2017			99				
-Electrical Additions 2017		34					
				$ 924,811	**$ 438,532**	**$ 486,278**	**$ 11,881**
Grovetown district							
Grovetown Lagoon No 1	3	1	43	$ 395,424	$ 117,411	$ 278,013	$ 5,376
- Electrical Additions	60						
Grovetown Lagoon No 2	40	15	80	$ 416,945	$ 298,821	$ 118,124	$ 5,906
				$ 812,369	**$ 416,232**	**$ 396,137**	**$ 11,282**

SUMMARY SCHEDULE							
Pumping Station Location				**Valuation**			
	Mechanical Residual Life	**Electrical Residual Life**	**Civil Residual Life**	**Replacement Value**	**Depreciated Replacement Cost**	**Depreciation to Date**	**Annual Depreciation**
Lower Wairau area							
Woolley & Jones	13	27	54	$ 309,339	$ 152,988	$ 156,351	$ 4,060
Lower Wairau	27	1	39	$ 272,980	$ 129,165	$ 143,815	$ 4,273
				$ 582,319	**$ 282,153**	**$ 300,167**	**$ 8,334**
Blenheim urban							
Alabama Rd							
- 1963 struct'			45	$ 183,497	$ 82,574	$ 100,923	$ 1,835
- 2011 upgrade	53	28	93	$ 286,572	$ 251,568	$ 35,004	$ 5,001
- power supply/datran/comm	0	28	93	$ 84,953	$ 69,435	$ 15,518	$ 2,217
Town Branch	25	1	65	$ 409,922	$ 230,821	$ 179,101	$ 5,143
- 900mm outfall to Ōpaoa River			65	$ 726,036	$ 471,923	$ 254,113	$ 7,260
- Electrical Addition 2018		35					
Main Street			1	$ 187,348	$ 3,122	$ 184,226	#DIV/0!
-2018 Additions	30	35	100				
Caseys	12	1	52	$ 299,372	$ 128,109	$ 171,263	$ 3,726
Waterlea Creek	3	23	82	$ 417,398	$ 233,458	$ 183,940	$ 5,480
Waterlea Crk Nelson St outfall		29	94	$ 82,351	$ 75,862	$ 6,488	$ 1,081
Redwood Street	26	32	5	$ 305,896	$ 79,661	$ 226,235	$ 5,588
High Street	27	32	5	$ 304,295	$ 79,620	$ 224,675	$ 5,542
Andrew Street	48	8	46	$ 280,219	$ 140,210	$ 140,009	$ 3,348
Monroe Street	33	8	45	$ 307,752	$ 138,153	$ 169,599	$ 3,965
Boyce Street	34	9	74	$ 345,133	$ 232,583	$ 112,550	$ 4,329
				$ 4,220,743	**$ 2,217,099**	**$ 2,003,644**	**#DIV/0!**
Riverlands							
Riverlands Industrial	47	22	87	$ 424,987	$ 350,578	$ 74,409	$ 5,724
Riverlands Telemetry		30		$ 22,982	$ 19,699	$ 3,283	$ 657
Wineworks (incl telemetry)	57	32	97	$ 316,039	$ 303,181	$ 12,858	$ 4,286
- inlet pond			77	$ 176,171	$ 169,564	$ 6,606	$ 2,202
Dillons Point							

SUMMARY SCHEDULE							
Pumping Station Location				**Valuation**			
	Mechanical Residual Life	**Electrical Residual Life**	**Civil Residual Life**	**Replacement Value**	**Depreciated Replacement Cost**	**Depreciation to Date**	**Annual Depreciation**
Swamp Road	39	14	60	$ 327,794	$ 195,126	$ 132,668	$ 3,906
Dillons Pt	6	1	41	$ 367,553	$ 157,831	$ 209,722	$ 11,261
- Structural Addition			44				
- Electrical Addition		35					
Total pumping station value				**$ 9,595,473**	**$ 5,009,671**	**$ 4,585,802**	**#DIV/0!**

Chapter 5: Risks and Assumptions

5.1 Risk Management

The Council's approach to risk management is outlined in the MDC Risk Management Strategy and Tools[4]. The strategy was initially developed by the Risk Management Steering Committee in 2001 in accordance with the AS/NZS 4360 Risk Management standard and later updated to ISO 3100 (2009).

The aim of the strategy is *to identify, assess, and manage risks in a consistent and demonstrable way.*

Our strategy is to:

- *introduce tools and internal assistance that enables sections to complete a risk analysis relevant to their operation*
- *ensure our decision making is consistent and demonstrable*
- *develop a 'risk aware' culture that encourages everyone to identify risks and associated opportunities*
- *promote and foster communication and risk monitoring throughout the organisation.*

This framework will be managed by the Risk Manager and supported by the executive management team.

The Council employs a Risk Manager who promotes a positive risk aware culture and assists senior staff across all Council departments to develop and review risk profiles in accordance with the Council's Risk Management Policy.

5.1.1 Objectives of Risk Management

The objectives of risk management for rivers and land drainage services are to:

- safeguard community health and wellbeing
- maintain a core business activity and customer service
- safeguard continued economic activity
- protect the natural environment
- provide the most cost effective service
- protect the asset value
- protect inter-generational equity
- fulfil legal obligations.

Restoring flood protection has been identified as a top priority after a significant event, along with other basic (lifeline) services. Repair and rebuilding of core infrastructure is the second priority.

[4] Risk Management Strategy and Tools. V3.2 (Dec 2011) MDC

5.2 Risks

The risks associated with all of the Council's activities may be considered under a number of broad categories.

Legal	Events which may lead to criminal or civil proceedings taken against the Council.
Political	Events that prevent or restrict Council from leading the community and making prudent decisions on behalf of the community.
Economic	Events that cause a financial loss to the Council or cause loss or reduced profitability to commercial enterprise.
Environmental	Events which damage natural and man-made environments, resources and/or ecosystems.
Service Delivery	Events which cause an interruption of service, or result in a standard significantly below the levels of service agreed with the community.
Community Health	Events that may cause harm to the health and welfare of residents or visitors to the region.
Human Resources	Events that adversely affect the people who are directly or indirectly employed by the Council.
Financial	Events that cause unplanned financial loss or prolonged financial inefficiencies for Council or within the community.
Information Management	Events which cause damage or disruption to the information systems and infrastructure supporting Council activities.
Reputation	Events that may damage the reputation, image or public confidence in the competence of the Council to perform its core duties.

Risk is frequently defined as the product of the *likelihood* of an event occurring and the severity of the *consequences* that result. It is possible for an event or situation related to the flood protection and land drainage assets to affect the Council and community across several of the categories listed above. For example a severe flood event related to stopbank failure could result in loss of life and property damage, affect the economic prosperity of the region due to disruptions to business continuity, lead to legal prosecutions and damage the reputation of the Council.

5.2.1 Risk Assessment in Rivers and Land Drainage

Under the guidance of the Council's Risk Manager and the Senior River Management Engineer the hazards associated with the Rivers & land Drainage activity are systematically evaluated.

The separate schemes are analyzed through the major constituent parts: stopbanks, river channels, drainage channels, floodway reserve land, culverts, pipes, pump stations & pumps and flood-gates. General management practices are also analysed.

The hazards are risk assessed on the standard Likelihood/Consequence matrix to establish a risk profile. The 'controls' for each risk are considered and assessed. The 'controls' are the plans, operational procedures, systems and regulations that can be implemented to mitigate either the likelihood or consequence of any given risk. Once the preferred controls have been identified, an action plan is prepared to implement the controls and ensure their efficacy. Finally, an assessment of the residual risk is made and either accepted or laid-off through insurance. High risks that cannot be readily mitigated are recognised and included in long term planning considerations.

The risk profile is reviewed and updated on an annual basis. New and modified infrastructure is included in the review and lessons from recent events are used to inform the assessments. Hazards are reassessed in the light of any new information or research.

5.2.2 Mitigation Measures

All the Rivers and Land Drainage infrastructure is subject to a number of 'risk treatments' to help mitigate the impacts of the hazard. Risk treatments can be applied through either:

- capital improvements — building new infrastructure to mitigate the risk, and/or
- operational treatments — implementing systems for the day-to-day operation of the rivers and drainage assets.

Capital improvements can be more readily incorporated into new or replaced infrastructure. Good design practice is to build in redundancy through duplication of assets, providing alternative drainage routes, safe overflows, emergency flood storage or through the provision of emergency standby facilities.

Operational treatments can include installing controls that are 'fail-safe', automated monitoring and control systems, rigorous Standard Operating Procedures, regular proactive maintenance and good alerting/response procedures for system malfunction.

In response to the recent earthquake sequence and the maximum Probable Loss calculation the size of the Disaster Recovery Reserves will be increased from $12 million to $15 million by 2028. A contingency plan has been prepared to immediately inspect the stopbanks to the east of Blenheim as the area is prone to liquefaction and lateral slip. Repairs in the order of $2M were required following the Kaikōura earthquake in November 2016. Urgent repairs maybe required to maintain the safety of the community.

Implications of technological change Telemetry will enhance both monitoring and flood control measures. For example, the Council is future proofing the design of the control gates to enable the addition of remote monitoring and operation of the gates in future. The return of 'live' information on the river flows during storm events is vital for the management of the response and can help to reduce risk to life and property, damage and subsequent restoration.

5.2.3 Emergency Response Planning

The risk assessment process and the consideration of existing and future controls for residual risks provide a convenient framework for emergency response planning. For example power failure is a significant risk to the drainage pump stations. The consideration of the risk treatments (including backup network connections, emergency generators, deployment of mobile generators and additional storage) provides the basis for an emergency response plan.

The risk management process is included in the preparation and review of Standard Operating Procedures used by operational staff. Emergency Management Plans have been developed for both sites (such as the Lower Wairau floodway) and specific events that may affect multiple sites (such as earthquakes, tsunami and floods).

The Assets and Services Department has a well prepared emergency response plan. In a major event an Incident Management team is mobilised and establishes a response centre in the Council offices. Rivers and Drainage engineers, water services staff and Council expert hydrologists are mobilised to the response centre.

Available resources from Council staff and contractors are determined and staff rosters are prepared for long duration events. In major emergencies a staff member is deployed to the CDEM Emergency Management Operations Centre to liaise with CDEM Controllers and to act as the Lifelines Utility Co-ordinator.

A supply of emergency standby equipment is regularly tested and is ready to be deployed at short notice.

Existing service contracts include clauses for the provision of emergency services. There is a pre-determined communications plan to ensure communications are maintained during periods of possible disruption.

In recent years the emergency response plans have been regularly exercised through actual emergency events — including earthquakes in 2013 and 2016 and local and regional flood events. Each event is subjected to a post-event evaluation at which the strengths and weaknesses are discussed and the emergency plans adjusted.

5.2.4 Engineering Lifelines

Assets & Services staff (including an engineer from the Rivers and Land Drainage department are active participants in the Marlborough Engineering Lifelines Group, which has been chaired by the MDC Asset Management Engineer since its inception in 2008.

The Engineering Lifelines Group facilitates the exchange of information and planning with utilities such as Marlborough Lines and Marlborough Roads. The inter-dependencies between the Lifeline agencies are explored and plans are evolved within the CDEM 4R framework — Reduction, Readiness, Response and Recovery.

An annual action plan is prepared and agreed with all members. The Lifeline agencies also participate in civil defence exercises to test their response capabilities and to prepare for major events.

In 2016 the Lifelines agencies contributed to the update of the Marlborough Civil Defence Emergency Management (CDEM) plan[5]. The development of the plan included two regional risk assessment workshops. The workshops involved a thorough evaluation of the hazards in the region. A detailed risk assessment and prioritisation process was undertaken. The flood hazard data is critical information for risk assessment of current and future infrastructure Participation in the workshops provided insight into the relative risks and informed the discussion on the risk mitigation strategies required based on the information from the Rivers department.

The Rivers and Land Drainage department regularly remind Lifelines agencies of the flood inundation mapping and any updates. They provided key input to the critical node/Hotspot mapping exercise.

In 2015 the department initiated the tsunami inundation mapping project through NIWA. The maps were introduced to the Lifelines agencies and used as a data source for an inter-dependability exercise for utilities in the inundation zones.

Flooding and tsunami inundation information has also been used in business continuity planning workshops with local schools and NGOs.

5.2.5 Critical Assets

Critical assets are those which, if they failed, would likely cause a serious risk to human life, major economic loss or severe environmental damage.

Criticality 1

- All stopbanks
- Taylor Dam
- Waitohi Culverts

Criticality 2

- All other assets and infrastructure are regarded as Criticality 2 as failure of these assets can cause significant local risks and losses.

[5] Marlborough Civil Defence Emergency Management Plan 2017-22 (MDC)

Critical 1 assets are subject to a high standard of regular inspection and maintenance, pre-flood checks, continuous monitoring during flood events and specialist survey from time to time.

The Taylor Dam is regularly inspected as the Potential Impact Classification is High. Eight separate engineering assessments were carried out on the dam between 2008 and 2014. Possible impacts were analysed for floods between 1 in 100 year ARI and 1 in 12,000 year ARI. A Comprehensive Safety Review and a report on options to upgrade the spillway have recently been completed.

Flood inundation modelling has been completed for the lower Wairau Plain. Flood flow paths in the event of stopbank failure have been mapped. Whilst there are a number of points where the river breakout would be particularly dangerous. The behaviour of the river in extreme flood conditions is less predictable. The proximity of habitation, transport routes and high value crops along the length of the Lower Wairau is such that the full length of stopbank is considered critical.

The following table summarises the high level risks associated with the Council's Rivers and Land Drainage responsibilities, and the strategies in place to manage these risks.

Table 5-1 Risk Management Tactics

Risks	**Management strategies**
Ecological damage during drain and river channel maintenance	Abide by resource consents Operate within the constraints of the Proposed Marlborough Environment Plan Stakeholder consultation and education.
Pump failure	Routine scheduled inspection & maintenance. Emergency stand-by plant and engineered redundancy Electronic monitoring & telemetry communication (6 of 30 sites) Note: Further electronic monitoring and warning system planned
Privately installed structures - under-sized culverts, privately installed drains and other inadequate/impeding structures. Drains filled-in	Enforce preventative measures in the Proposed MEP Maintain relationships and education of landowners Liaison with internal departments, e.g. Science and Monitoring, Compliance, etc Liaison with Strategic Planning Group
Access to drains for maintenance	Relationships built up with landowners Landowner agreements for new work Easements for new subdivisions Enforce statutory powers
Private structures and/or trees preventing access	Proposed Marlborough Environment Plan policies and rules

Risks	Management strategies
	Engagement and education of landowners
Failed floodgate	Annual maintenance programme Pre-flood check Monitoring during flood
Inadequate assessment of flood potential	Accurate and timely data collection from flow monitoring stations Knowledgeable and experienced emergency response staff
Hydraulic performance of river channels less than expected	Staff monitoring during event to calibrate computer models developed Remedial excavation
Stopbanks failure: - slumping - piping	High standards of design & construction, Routine maintenance and inspection programme. Post flood/earthquake inspection
Stopbanks failure: - erosion - landowner damage - rabbit or stock damage	High standards of design & construction, Routine maintenance and inspection programme.
Inadequate knowledge of stormwater discharges to urban streams.	Direct liaison between Services and Rivers sections regarding future planning through the Stormwater Action Group Investigations for new work (ongoing) Use of consultants as required
Council does not have adequate access for maintenance of streams	Access incorporated in subdivision development Legislative controls Maintenance free design Property owner negotiation Consider land purchase where needed Easements for new subdivisions
Correct information available to potential land developers Rivers section information not getting into RIs (Related Information), LIMs (Land Information Memoranda) and	'Related Information' provides advice on minimum floor levels and the location of building platforms for new building work in flood hazard areas, as well as flood risk information in relation to new subdivisions, to the resource consents and building consents teams. Specialist flood risk information is also added to LIMs

Risks	Management strategies
Building Control reports Flood hazard information not transmitted accurately Flood hazard information not in readily accessible form (staff members' personal knowledge, inadequate records) Inadequate Council flood hazard information Information not being properly incorporated into resource consent applications River section advice not given proper consideration by planning officers Lack of suitable flood hazard information for some resource consent applications results in development in flood-prone area	where necessary. Computer GIS flood hazard atlas, capturing corporate knowledge Standardised internal process — interfacing LIMs/RIs, Building Control and Rivers staff Standardised internal process including circulation of consent applications Good relationships with Resource Management Officers (RMOs) Rivers staff alert consent officer that applicant needs to provide more detailed analysis
Major storm event Public not advised of degree of flooding emergency in a timely manner	MDC website Media management "Phone out" warning system "Phone in" warning system Flood Response Manual Flood watch system on MDC website
Emergency procedures (e.g. deliberate stopbank breach) do not have Council approval/not clearly established	Emergency action approval — Management/Council
Rainfall and river flow information not available Computer systems transmitting information are faulty	Support the monitoring and maintenance programme by Environmental Science and Monitoring group (hydrologists) IT back up for system
Lost, unavailable or inaccurate record of assets' design and performance standards, historic records	Archiving filing, scanning into the electronic filing system (TRIM) Professional engineering culture and standards for recording new and existing asset data - as-builts, site records, etc Capture and retention of appropriate data

Risks	Management strategies
	Adoption of the asset management information system
Inadequate staffing — skills, numbers, retention and recruitment	Remuneration, working conditions and employee benefits Prioritising work
Not meeting legislative requirements — resource consents, building consents (e.g. dams)	Use of suitably skilled consultants where required Specialist in-house adviser Adequate and accessible records In-house training/induction
In breach of resource consent conditions Potential prosecution/compliance issues	Adequately trained staff Contractor selection, supervision and audit
Not having contractors for maintenance work	Implementation of longer term strategic contracts Relationship building
Loss of corporate knowledge due to excessive use of consultants/contractors	Decisions on staff structure Retain local technical knowledge in-house
Asset repair costs after flood/earthquake disaster are not covered	Self-insurance/emergency fund Insurance (LAPP) Government Disaster Policy

5.3 Residual Risk Management

The Council's strategy to cover the costs of potential losses is to use a combination of the following:

- Commercial/LAPP insurance,
- government emergency funding,
- cash reserves and
- deferred capital expenditure.

5.3.1 Insurance

Council mitigates residual risk through insurance. The Council's Risk Manager, with the assistance of an independent broker, considers all of Council's liabilities. The residual risk is mitigated through a combination of commercial insurance, insurance through the Local Authority Protection Programme (LAPP), and self-insurance.

LAPP is a not-for-profit co-operative established by local authorities to provide mutual insurance for underground assets and other specialist structures that are difficult to insure through the

main insurance market. The Council insures water, wastewater and stormwater reticulation, wastewater wet-wells and flood protection structures through LAPP.

Following the Canterbury earthquakes sequence there were heavy demands on the LAPP funds. Councils were required to make an additional contribution to boost the reserve funds. LAPP introduced a $3M excess on claims and a combined cap of $125M. Subsequently a number of councils have moved away from LAPP and sought cover through the commercial insurance sector which has now developed policies for council infrastructure.

The Council revised its insurance policy following the Christchurch earthquakes and now the Council has accepted higher excess on damage to many assets and self-insures through emergency reserves.

5.3.2 Government Emergency Fund

Central government has provided indemnity for 60% of the value of post-disaster recovery costs on the condition that the local authority has made reasonable provision for the remaining 40%. However, the Government is currently reviewing this commitment.

In 2016 the Council employed AON/Tonkin & Taylor to undertake a Maximum Probable Loss assessment of water, wastewater, stormwater, roading and flood protection infrastructure. The study modelled two scenarios — a 1:500 year and a 1:1000 year earthquake event centred in the Marlborough region. The outcome of the study was a maximum probable loss prediction of $349M and $485M respectively. This was a significant increase on the previous estimate.

5.3.3 Financial Reserves

The department regularly contributes to a Flood Damage Reserve. Monies accumulate and are used to fund repairs and recovery from flood events assessed as between 2 year and 20 year ARI.

5.3.4 Deferred Capital Expenditure

In the event of a very large flood or earthquake the Council has assumed that the normal capital investment programme will be delayed or suspended during the recovery. The capital funds will be reallocated to the repair works. Re-financing the capital projects will be dependent on the size and extent of the damage experienced.

5.4 Assumptions

When making projections into the future and planning the provision of services there are a number of assumptions that are made There are key assumptions for the whole of Council activities (see Appendix 6: LTP Assumptions) These are also published in the LTP and include the level of uncertainty, risk and financial impact for all Council activities.. There are assumptions common to the main infrastructural assets and some that are specific to the Rivers and Drainage section. These are shown in Table 5-2

Table 5-2 Assumptions related to Rivers and Land Drainage

Risks & Assumptions	Discussion	Responses	Confidence in Assumption	Risk
Financial assumptions All expenditure has been stated at 2017 values and inflated through the Local Government Price Index (LGPI).	The LGPI is typically 1 or 2 percentage points above CPI. The LGPI includes a bundle of prices representative of all Council costs that may not represent the cost increases in wastewater materials and contract rates.	Many costs are subject to fluctuations in international markets out of the control of the Council. The A&S Department uses the best information practically available and seeks Council approval with updated estimates as the projects progress.	Medium	Low
Accuracy of capital project cost estimates The capital project cost estimates are sufficiently accurate to determine the required funding level.	Under-estimation of project out-turn costs will cause a problem in delivery of projects within the agreed budget. Delays or refinancing may result. Over-estimation of the capital projects may incur additional financing costs.	Outline costs are prepared during the feasibility stage. Detailed construction costs are peer-reviewed prior to contract tender and returned tenders are compared with the engineers' estimates. Project constructions are closely supervised to avoid delays or additional costs.	Low	Low
Emergency funding The level of funding available to the Council will be adequate to cover asset rehabilitation following an emergency event.	Funding requirements and sources are regularly reviewed and updated. The Council has employed consultants to undertake a Maximum Probable Loss assessment and advice on risk management strategies.	Funding sources include use of reserves, central government relief, commercial and cooperative insurance (LAPP). Once other sources of funding have been exhausted capital projects will be deferred and money reassigned.	Low	High

Risks & Assumptions	Discussion	Responses	Confidence in Assumption	Risk
Impacts of climate change There remains some uncertainty on the extent and timing of climate change impacts in the region.	The Council follows the recommendations of the Ministry for the Environment and research and advice from international organisations.	Infrastructure is designed for the worst case projections but only constructed 'as and when' necessary. This approach maintains the maximum flexibility and defers investment.	Medium	Medium
Changes in legislation and national policy	The risk of major change is high due to the changing nature of the Government and political focus.	The Council takes all opportunities to engage with central government and local government representation — LGNZ, SOLGM, Water New Zealand, etc to help anticipate future policy development.	Medium	Medium
Growth forecasts The region will grow as forecast in line with current projections.	The capital expenditure programme is based on the medium to high growth forecast. Migration is likely to have a greater influence on growth as birth rates decline. Migration will respond more rapidly to changes in the economic prosperity of the region than natural growth.	Continue to monitor population statistics and influencing factors. Ensure the design of long life assets can accommodate the higher growth projection, and assets with a shorter life can be readily upgraded as necessary.	Medium	Low
Demographic projections The age profile of the population will increase significantly.	An older population will see an increase in the proportion of ratepayers on a fixed income and a decreasing ability to respond to cost increases. An older population will have a different lifestyle and will change demand for services.	Ensure infrastructure is flexible and appropriately sized. Manage operational and capital costs and seek cost efficiencies.	Low	Low

Risks & Assumptions	Discussion	Responses	Confidence in Assumption	Risk
Timing of capital projects Capital projects will be undertaken when planned.	The risk to the programme timing of capital projects is high due to factors such as delays in the approval of resource consents, public consultation and land purchase.	The Council tries to mitigate these issues by undertaking the consultation, investigation and design phases sufficiently in advance of the construction phase. Budgets are prepared for the best case scenario but delays can result in additional costs from under-utilised funding.	Medium	Low
Resource consents The approval of resource consent applications and the imposed consent conditions have been reasonably anticipated.	There is a high risk that a resource consent application will have restrictive conditions that will delay or incur costs of construction or operation of new infrastructure.	Thorough public consultation, early engagement with the regulatory authorities, and completion of Environmental Assessments help to manage the risks.	High	High
Asset data knowledge The Council has adequate knowledge of the assets and their condition so that the asset management plan will allow the Council to meet the proposed levels of service.	Increased frequency of asset failure will affect the capacity to meet levels of service without increased maintenance costs or an accelerated renewal programme.	Above-ground assets are generally well monitored. Regular asset inspections and scheduled maintenance will ensure condition and performance is updated. Adoption of the asset management information system (AMIS) will help to standardise procedures and data collection and recording.	Low	Low
Demand patterns Both total demand and the daily/seasonal patterns have been accurately assessed.	The factors contributing to changes in demand, such as population, lifestyle, climate and economic development have been included in future projections.	Other influences such as Smart Metering and the Internet of Things are likely to have a beneficial influence on the current demand pattern by reducing the peaks.	Low	Low

Assumptions which are specific to flood protection and land drainage assets are:

Risks & Assumptions	Discussion	Responses	Confidence in Assumption	Risk
Development in flood prone areas New development will not occur in flood prone	Development in flood prone areas is controlled through the local resource management plans (WARMP & MSRMP)	The Proposed Marlborough Environment Plan will be define the flood prone areas and will be robustly enforced	High	Low
Land use Agricultural land-use in rural areas will continue to develop as projected	Viticulture will continue to grow in line with current projections be a significant industry and land use in the Marlborough region over the next 50 years	Existing flood defences and land drainage will continue to maintained and upgraded to the current level of service. The levels of service will be reviewed in the light of the hydrologic modelling of the Lower Wairau	Medium	Low
Impacts of climate change There remains some uncertainty on the extent and timing of climate change impacts in the region.	The Council follows the recommendations of the Ministry for the Environment and research and advice from international organisations.	Infrastructure is designed for the worst case projections but only constructed 'as and when' necessary. This approach maintains the maximum flexibility and defers investment.	Medium	Medium
Network capacity That Council's knowledge of network capacity is sufficient to accurately programme capital works.	Hydrologic modelling of the Lower Wairau was undertaken in 1994 and will be updated in 2020. Modelling of urban drainage and other river systems are being developed	Land-use changes, run-off , flow-paths and weather conditions are constantly changing Accurate and calibrated models are important tools for predicting the impact on river flows. Modelling the south Blenheim urban system provided the basis for strategic development plan.	Medium	Medium

Risks & Assumptions	Discussion	Responses	Confidence in Assumption	Risk
Land Availability the Council will be able to secure land and/or access to land to enable completion of projects	Statutory powers for land procurement are the option of last resort	Negotiation and agreement with landowners can be time consuming but is generally considered worthwhile to maintain goodwill with local stake-holders	High	Low
Human Resources There have been increasing shortages in skilled and experienced technical and construction staff.	Large earthquakes and damaging storms has caused major damage to national infrastructure and resulted in high demand for engineering contractors, managers and technicians	Councils recruitment policy and contract strategy is flexible to respond to market demand	High	Low

Chapter 6: Financial Summary

6.1 Financial Strategy & Policies

The Council has developed a number of key strategies and plans that meet statutory requirements and explain how future financial demands will be met.

The Council's Financial Strategy, the Revenue and Financing Policy, the Treasury Policy and the Development Contributions Policy form the basis for the Council's financial planning

These policies and plans are regularly reviewed and updated, and the review cycle usually corresponds with the three-year update of the Long Term Plan.

The Council's financial statements are published in detail in the Long Term Plan and the Annual Reports. They are prepared in accordance with the Local Government Act 2002 and comply with Generally Accepted Accounting Practices in New Zealand. They comply with New Zealand's International Financial Reporting Standards (NZIFRS) and other applicable financial reporting standards as appropriate to public benefit entities. All documents are scrutinised and approved by Audit New Zealand.

6.2 Financial Strategy

The Financial Strategy was updated and published for public consultation in April 2018. The strategy seeks to demonstrate how Council will:

- ensure that the levels of rates and borrowing are financially sustainable and kept within pre-set limits
- maintain levels of service
- maintain the assets it owns on behalf of the community
- provide for growth and changing demand patterns within the District
- fund improvements to infrastructure and other community facilities
- manage Council's investments and liabilities.

Council's responsibility for financial prudence is defined by statutory obligation and is recognised in the Financial Strategy, as follows:

"Under section 101 of the Local Government Act 2002, Council considered its financial management responsibilities where it must manage revenues, expenses, assets, liabilities, investments and general financial dealings prudently and in a manner that promotes the current and future interests of the community. The Council also considered whether it was sustainable to undertake the level of capital expenditure proposed in the Long Term Plan together with increased operating costs associated with the higher debt level. If the Council has too much debt then future ratepayers will subsidise current ratepayers. If population growth, which is expected to fund the growth portion of assets incorporated into the capital expenditure programme, does not occur or occurs at a slower rate this may either increase rates or slow the delivery of capital projects."

The strategy to asset **renewals** is as follows:

"The policy of fully funding depreciation except for Community Assets has been continued in the Long Term Plan 2018–28 and is considered an appropriate measure to ensure the concept of intergenerational equity is maintained. That is, current ratepayers will pay for its use and a share of its replacement cost in relation to the assets provided."

Regarding **growth** the strategy states:

"Council believes that, as development increases the consumption of its current infrastructure capacity and accelerates the requirement for new infrastructure, developers should bear the cost of this increased demand.

"Through the application of its Development Contributions Policies to fund the cost of this additional infrastructure, Council is seeking to achieve an appropriate balance between encouraging growth and reducing the potential for additional burden on the ratepayer.

"Undertaking development in a planned, co-ordinated manner can reduce costs as infrastructure development is not responding to "adhoc requests" for isolated, scattered, piecemeal development. Responding to adhoc development can mean that parts of the infrastructure networks are replaced earlier in their life than optimum while allowing other parts of the network to remain comparatively underutilised."

Regarding **levels of service** the strategy states:

"During the development of the 2018–28 Long Term Plan, the Council considered how to maintain its current levels of service, operating expenditure and capital expenditure needed to replace existing assets and provide new infrastructure and facilities to meet the levels of growth that are forecast within the 10 years of the Long Term Plan. The Long Term Plan as presented should, for the majority of activities, enable Council to maintain current levels of service."

The Rivers & Drainage Activity is not planning for a major increase in the level of service provided but has investment over the course of the Long Term Plan to ensure the infrastructure meets the current standards. Four kilometres of stopbank on the Lower Ōpaoa River, upgrades to existing drainage connections and continuing upgrade programme to the terminal pump stations will be required to ensure the levels of service are met in an extreme event.

The Financial Strategy makes it clear that to achieve the required financial prudence there were four main factors to consider:

- "*The estimated expenses of achieving and maintaining the predicted levels of service provision set out in the Long Term Plan, including the estimated expenses associated with maintaining the service capacity and integrity of the assets throughout their useful life;*
- *The projected revenue available to fund the estimated expenses associated with maintaining the service capacity and integrity of assets throughout their useful life;*
- *The equitable allocation of responsibility for funding the provision and maintenance of assets and facilities throughout their useful life;*
- *The funding and financial policies."*

Council's Financial Strategy sets out the strategic financial direction, the external and internal factors expected to have a significant impact (in particular over the next 10 years), and the approaches used to fund this scenario in a prudent manner.

The strategy identifies that in general:

- growth driven capital expenditure is funded by development contributions
- capital expenditure to increase levels of service, eg; stopbank upgrades is funded by borrowing
- renewals capital expenditure is funded from revenue — rates and charges — set to recover depreciation expenses, and is accumulated until spent. This funding source

emphasises the importance to Council of continually fully funding depreciation on infrastructural assets.

- In practice any funds available are used before new loans are drawn down, to avoid paying interest unnecessarily; except in the case of development contributions which are only ever used to fund growth projects.

The major rivers and drainage projects are:

- Upgrade 4kms of 'first generation' stopbanks on the Lower Ōpaoa River
- Complete the extension of drainage connections for each property >1 hectare
- Upgrade of main pump stations
- Lower Wairau Flood Plain Hydrologic Re-modelling

The capital investment outline over 30 years is shown in the Infrastructure Strategy 2018–48. In the later part of the LTP planning horizon the outcome of the hydrological re-modelling of the Wairau Plain and the subsequent consultation with stake-holders will have a major influence on infrastructure investments. Determining the levels of service required in the light of landowners' expectations and the forecasts for climate change is likely to be the most influential factor for Rivers investment strategy for the next 20 to 30 years

6.3 Revenue and Financing Policy

The following is based on the Council's Revenue and Financing Policy the full version of which is included in the LTP

"The Revenue and Financing Policy provides a summary of Council's funding policies in respect of both operating expenses and capital expenditures. Council reviews its funding policy at least every three years. The last review was completed prior to the initiation of the 2018-28 Long Term Plan (LTP) and changes adopted are detailed in paragraph 12.

Sources of funds available to Council are as follows:

- General rates.
- Targeted rates.
- Lump sum contributions.
- Fees and charges.
- Interest and dividends from investments.
- Borrowing.
- Proceeds from asset sales.
- Development contributions.
- Financial contributions.
- Grants and subsidies.
- Other sources permitted by statute.

In determining which funding sources were appropriate, Council gave consideration to the following matters in relation to each activity to be funded. The Councils determination for the Rivers and Land Drainage department is shown:

The community outcomes to which the Rivers and Land Drainage primarily contributes;

Environment, People, Economy, Connectivity and Living

The distribution of benefits between the community as a whole, any identifiable part of the community, and individuals;

The Council plans flood protection to best to protect life and property in the floodplain and to preserve or enhance the environment and amenity values of river corridors.

Targeted Area = 80%, District-wide = 20% Individuals = nil

The period in or over which those benefits are expected to occur and the extent to which the actions or inaction of particular individuals or a group contribute to the need to undertake the activity;

The ratepayers in the floodplain (residents and businesses) in the area directly affected by the planning and subsequent works benefit directly through avoiding the risk of floods and potentially through increased property value.

Owners and providers of infrastructure (telephone, roads, rails etc) also benefit directly by avoiding damage to their assets.

Ratepayers in the surrounding economic 'catchment' adjacent to the floodplain benefit indirectly through their integration with the area affected by the flood protection scheme.

The regional community also benefits indirectly through protection of their means of access around the region.

The costs and benefits, including consequences, for transparency and accountability, of funding the activity distinctly from other activities; and

The activity, being an essential service to the District, benefits all, although some more than others. Therefore varying rates apply across the District that take account of benefits provided.

Gravel extraction and quarry operations are 100% funded from user charges.

The overall impact of any allocation of liability for revenue needs on the current and future social, economic, environmental, and cultural well-being of the community.

Adequate river protection has a significant impact on the social, economic and environmental wellbeing of the community.

Prior to determining the "Residual amount to be funded by General-type Rates", Council identified all other funding sources appropriate to each activity.

Table 6-1 Sources of Funding

Flood Protection and Control	Targeted Rates	Fees and Charges	Interest and Dividends from Investments	Borrowing	Proceeds from Asset Sales	Development Contributions and/or Financial	Grants and Subsidies	Other Sources
Operation Expenses	Yes	Yes	Yes	No	No	No	Yes	Yes
Capital Expenditure	Yes	Yes	Yes	Yes	No	No	Yes	Yes

The table shows the rating tools which Council has determined to be fair and equitable for the Rivers and Land Drainage activity.

Fees and Charges
These have been set at a level to recover private benefits where it is practical and economic to do so, unless there have been determinations arising from previous funding reviews to fund all or part of such benefits from rates.

Grants and Subsidies
These are sought and applied for whenever they are available.

General Revenues
These are allocated to geographic rating areas in proportion to the gross general-type rates and charges.

Separate differential categories are utilised for general-type rates and charges, and these are specified in each year's Funding Impact Statement. Council currently has six geographic areas and three categories of land use for each of these areas.

Separate Targeted Rates and Charges
The Wairau Valley District Rate is a separate targeted rate levied on the capital value of the land. Targeted rates and charges are levied to meet the full cost of water and sewerage schemes, refuse and recycling collections, defined roading improvements, defined marketing and tourism activities, and for other services where Council has been requested to levy such rates. In these instances Council believe separate targeted rates are the most equitable funding mechanism based of the benefits assessed for the targeted area. The details of the rateable areas are shown in Section 6.8.1.

In 2018 there was a modification to the weightings of groups within the Wairau Valley River Works Rates in order to adjust for a disproportionate valuation movement following 2017 District-wide revaluation.

General-Type Targeted Rates and Charges
Properties outside of the Wairau Valley Rating District are charged on a General-type Target Rate.

The allocation reflects Council's assessment of the benefits which should be funded by land value rates, and the benefits which should be funded by uniform annual charge. In these instances Council believe separate general targeted rates and charges are the most equitable funding mechanism based on the benefits assessed for each targeted geographic area.

Funding of Capital Requirements

In general, the sources of funds for capital expenditure will be utilised in the following order:

- Development and financial contributions.
- Capital grants and subsidies (where available).
- User charges.
- General revenue sources [see below].
- Council financial reserves, including Depreciation Reserves.
- Loan raising [which will impact on rates in the form of loan servicing charges].
- Targeted rates [directly charged].

General Revenue Sources

There are some revenue sources which are not directly linked to an activity but are utilised by Council to assist in funding a number of Council activities either directly or indirectly.

These include:

Dividends and Interest from Investments
- Funded to specified Reserves for particular purposes or events (eg: Emergency Events Reserve).

- Used to subsidise general-type rates and charges by way of general revenue allocation.
- Used to fund interest and funding costs on external borrowings.

Petroleum Tax

- Used to subsidise general-type rates and charges by way of general revenue allocation.

Asset Sale Proceeds

- Proceeds from the sale of non- activity assets are used to fund the forestry and asset sales reserve.

Development and Financial Contributions

- Contributions received from developments and subdivisions are applied towards the cost of infrastructure to mitigate the effects of growth. (Where capital expenditure can be funded from these contributions, Council will generally use these sources of funding to meet the cost of growth of the District in preference to other services).

Forestry Income

- Currently used to fund the forestry and asset sales reserve which is used to fund projects as determined by Council.

6.4 Development Contributions Policy

The Development Contribution Policy was reviewed and updated based on the latest forecasts and included in the Long Term Plan 2018–28. Development Contributions are used to finance infrastructure required for growth. The estimated costs of upgrades to river and drainage channels and pump station assets as the result of continued urban growth are included in the development contribution calculation.

Marlborough District has experienced significant growth over the last decade. Although this is often hailed as positive for the community, growth also presents a number of challenges. Not least is Council's task of expanding infrastructure networks to support the increased use of essential services.

The cost of expanding these networks is often high, and the issue of funding inevitably arises. Funding the expansion of these core networks entirely from general rates (or other indirect means) is inequitable, because existing ratepayers may neither cause these works to occur, nor materially benefit from them. As a result, alternative means for funding these capital works must be considered. Development contributions are one such source.

Council adopted a Development Contributions Policy effective from 1 July 2009. The Development Contributions Policy replaced the Financial Contributions Policy with the exception of the North West zone, parking contributions and where the new Policy is silent on issues in the operative Resource Management Plans.

Council considers the use of the development contributions mechanism under the Local Government Act 2002 provides a fair and robust means of recovering the cost of growth as compared to charging ratepayers.

The purpose of the development contributions is to recover an appropriate proportion of the costs of growth-related capital expenditure from participants in the property development process, rather than from general rates or any other indirect funding source. The full policy is included in the LTP.

Charges are calculated for each catchment and each activity on the basis of:

- the expected scale and timing of capital works required to service growth

- the expected rate and timing of developments for which the works are required.

The growth projections used to determine income from development contributions in the modelling are based on long run straight line averages using the Department of Statistics population projections. For infrastructure outside of Blenheim forecast Household Equivalent Units (HEUs) used in the modelling are higher than the Department of Statistics populations projections. This favours developers as it has the effect of reducing the modelled development contributions results. This approach recognises the slower development rates in these areas and the lack of economies of scale. The drivers for capital works projects are categorised into growth, improvement or maintenance of the level of service and renewal of existing capability. The costs and source of funding the work is apportioned accordingly.

The capital expenditure used for modelling what the appropriate charges should be includes:

- expenditure previously incurred to create spare capacity to enable future development to occur
- expenditure beyond the 10 year programme which is required to cater for the cumulative effects of growth
- an assessment of expenditure which relates to future growth beyond the life of the LTP.

6.5 Projected Expenditure

6.5.1 Maintenance, Renewal and Flood Damage Expenditure

All costs incurred through the ownership of infrastructural assets, and that directly relate

to the running of those assets, fall into two categories - maintenance expenditure or capital/renewal expenditure

Operations and Maintenance

- Routine – day to day maintenance which is required on an ongoing basis and is budgeted
- Planned Maintenance - non day today maintenance which is identified in advance and is incorporated into a maintenance budget for a defined time period
- Reactive – maintenance that is unexpected and is necessary to attend to immediately to continue operation of the service

Much of the value of flood control and river management infrastructure is within heavy engineering structures such as stop- banks, rock lining and manged floodway reserve land. These assets are maintained in perpetuity. Consequently. normal deterioration and minor flood damage is managed within the routine maintenance budget.

Renewals
Costs that are incurred to restore the service potential of the network

Assets such as pumps, pump stations, flood gates, culverts and pipeline as are included in the renewal expenditure.

Capital
Costs that add to the service potential of the network

A significant contingency budget is required for ‘provisional flood damage’ as a major flood will require significant expenditure to repair damaged structures or construct new protective structures.

In general it is accepted that damage from floods

<2yr ARI – routine maintenance

2yr – 20yr ARI – flood damage reserves

>20yr ARI – government subsidy, insurances capital works re-allocation

The Taylor Dam, stopbanks, earthworks, and channels are maintained in perpetuity their value is not depreciated and funds are not collected for their renewal. Other assets such as pump stations, pipelines, culverts and flood gates are assumed to deteriorate overt time and are depreciated accordingly.

With the exception of stopbank structure and performance there is good corporate knowledge of the condition of all assets (see Table 7-1) and there is good confidence in 'non-flood' maintenance expenditure projections. The operational budget for 2018-28 is shown in Figure 6-1 and Table 6-2.

All expenditure is shown at current, un-inflated, costs

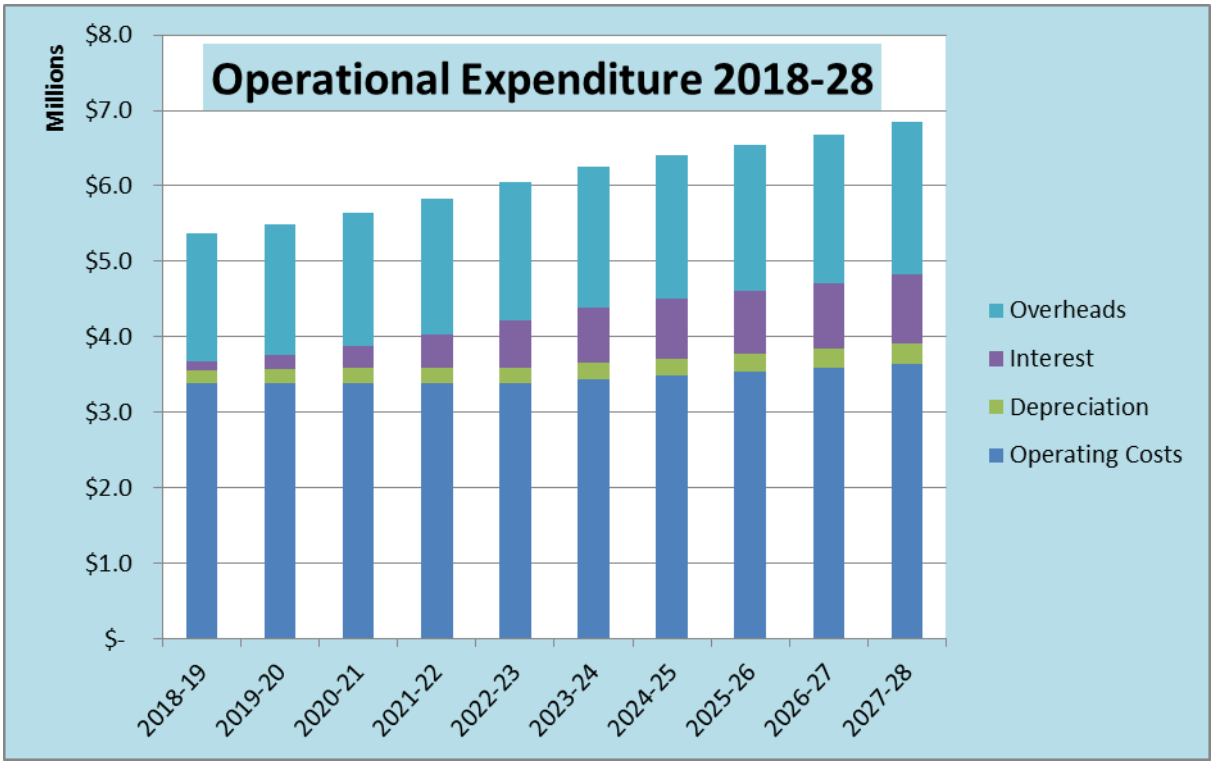


Figure 6-1 Projected Operational Expenditure 2018-28

6.6 Operating Costs

Table 6-2 Detailed Operational Expenditure 2018-28

River Leases	2017-18 $000's	2018-19 $000's	2019-20 $000's	2020-21 $000's	2021-22 $000's	2022-23 $000's	2023-24 $000's	2024-25 $000's	2025-26 $000's	2026-27 $000's	2027-28 $000's
Property Rentals	2,364	2,519	2,583	2,840	3,304	3,557	3,561	3,568	3,588	3,821	3,906
Disbursement Recoveries	126	134	134	134	134	134	134	134	134	134	134
Total external revenue	**2,489**	**2,653**	**2,717**	**2,974**	**3,438**	**3,691**	**3,694**	**3,702**	**3,721**	**3,955**	**4,039**
Rates	147	155	155	155	155	155	155	155	155	155	155
Property Management Charges	91	105	107	109	112	114	117	120	122	125	129
Legal	22	12	12	12	12	12	12	12	12	12	12
Other Operating Costs	17	21	22	22	22	22	22	22	22	22	22
Total operating costs	**276**	**293**	**296**	**298**	**301**	**303**	**306**	**309**	**312**	**314**	**318**

Rivers Outside Wairau Floodplain	2017-18 $000's	2018-19 $000's	2019-20 $000's	2020-21 $000's	2021-22 $000's	2022-23 $000's	2023-24 $000's	2024-25 $000's	2025-26 $000's	2026-27 $000's	2027-28 $000's
Greenscape Contracts	76	91	93	95	98	100	103	105	108	111	113
Personnel Costs	37	39	40	41	42	43	44	45	47	48	49
Interest - Internal Loans	36	31	29	28	26	24	21	19	17	14	11
Section Management	31	33	33	34	34	35	35	36	36	36	37
Contracts	30	11	11	12	12	12	12	13	13	13	14
Minor Works Contracts	28	41	42	43	44	45	46	47	49	50	51
Corporate Overhead Allocations	13	12	13	13	13	13	13	13	13	13	13
Other Operating Costs	2	2	2	2	2	2	2	2	2	2	2
Total operating costs	**252**	**260**	**264**	**267**	**271**	**274**	**278**	**281**	**285**	**288**	**292**

Wairau Floodplain Drainage	2017-18 $000's	2018-19 $000's	2019-20 $000's	2020-21 $000's	2021-22 $000's	2022-23 $000's	2023-24 $000's	2024-25 $000's	2025-26 $000's	2026-27 $000's	2027-28 $000's
Contributions - For Capex	200	-	-	-	-	-	-	-	-	-	-
Total external revenue	**200**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Greenscape Contracts	129	144	148	151	155	158	162	166	171	176	183
Personnel Costs	129	138	142	145	148	152	156	160	164	169	173
Depreciation	128	143	157	162	163	170	170	167	174	188	209
Section Management	108	115	117	119	121	122	124	126	127	128	131
Drain Spraying Contracts	100	106	109	111	114	116	119	122	126	129	133
Contracts	92	16	16	17	17	18	18	18	19	20	20
Minor Works Contracts	84	80	82	84	86	88	90	92	95	98	100
Power	62	72	74	75	77	79	81	83	85	88	90
Corporate Overhead Allocations	46	43	44	45	46	46	46	47	46	46	47
Interest - Internal Loans	16	45	75	157	275	389	436	421	405	401	413
Repairs & Maintenance	10	94	96	99	101	103	106	109	112	115	118
Other Operating Costs	6	25	26	26	27	27	28	29	30	30	31
Total operating costs	**910**	**1,022**	**1,085**	**1,191**	**1,329**	**1,470**	**1,537**	**1,540**	**1,553**	**1,586**	**1,649**

6.7 Capital Expenditure

The projected capital expenditure budget is shown in Table 6-3. Many of the projects are long term and require regular or annual expenditure. There is significant increase in expenditure forecast in 2020-23 as improvements identified through the Blenheim Stormwater Strategy enter the construction phase.

The drivers for capital works expenditure are identified and attributed to – Growth, Levels of Service and Renewal See Figure 6-2.

All expenditure is shown at current, un-inflated, costs

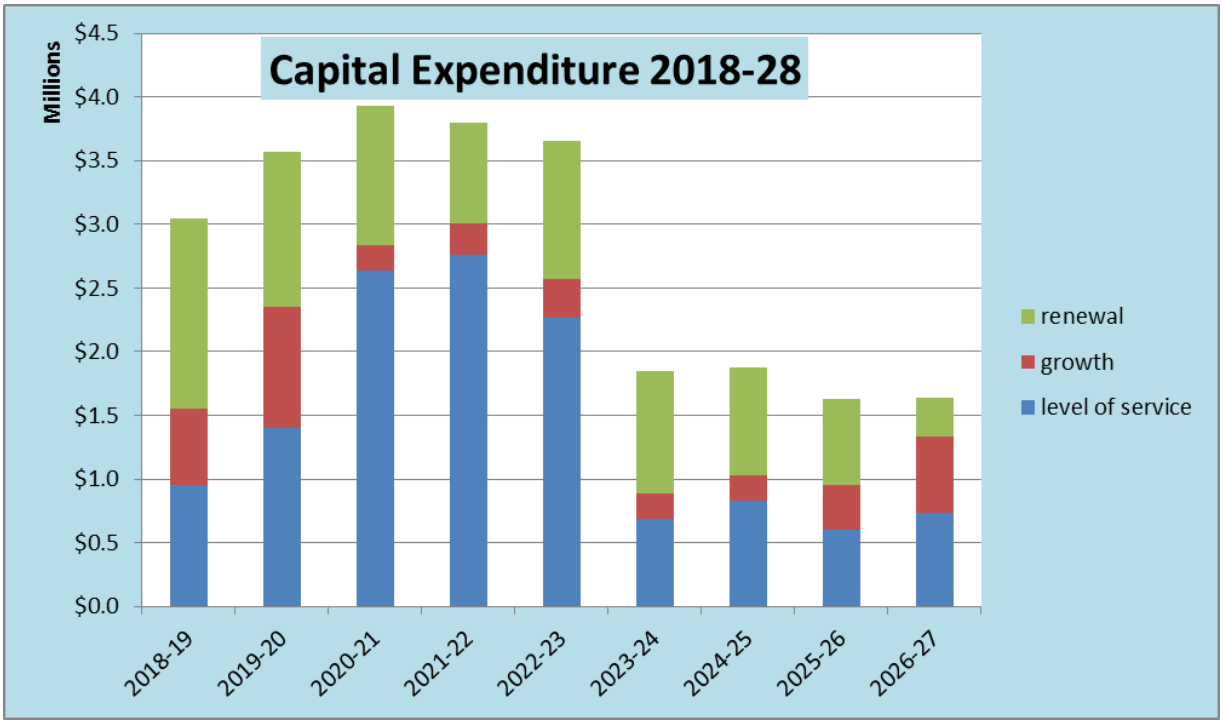


Figure 6-2 Projected Capital Expenditure 2018-28

Table 6-3 Projected Capital Expenditure Projects > $50,000

Flood Protection and Control Works	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**2025-26**	**2026-27**	**2027-28**
	$000's	**$000's**	**$000's**	**$000's**	**$000's**	**$000's**	**$000's**	**$000's**	**$000's**	**$000's**
Rivers WV: Lower Wairau	800	154	398	54	802	-	266	119	37	125
Rivers WV: Tuamarina below Rail Bridge	630	-	-	-	-	-	-	-	-	-
Rivers WV: Lower Ōpaoa	400	20	168	21	176	23	185	24	195	25
Rivers WV: Wairau Tuamarina	250	769	262	536	-	563	867	593	609	627
Rivers WV: Rivers Land Purchases	200	205	210	215	220	225	231	237	244	251
Rivers WV: Ruakanakana (Gibson) Creek	50	717	-	-	-	-	-	-	-	-
Rivers WV: W/Hills Soil Conservation	22	102	84	86	88	142	143	47	49	50
Rivers WV: Roses Overflow & Ōpaoa to SH1	20	20	-	43	-	45	-	47	-	50
Rivers WV: Wairau Diversion	-	-	210	-	-	113	-	119	-	-
Rivers WV: Waihopai below SH 63 Bridge	-	205	-	-	55	-	-	59	-	63
Rivers WV: Taylor Dam	-	-	-	-	-	563	-	-	-	-
Rivers WV: Taylor below Burleigh	-	154	42	54	44	-	46	-	49	-
Rivers WV: Taylor above Burleigh	-	51	-	54	-	56	-	59	-	63
Rivers WV: Riverlands and Witherhills St	-	-	21	-	-	23	-	-	24	-
Rivers WV: Ōpaoa above SH1	-	41	367	-	44	-	-	47	-	-
Rivers WV: Omaka River below Hawkesbury	-	205	45	475	157	98	102	119	244	-
Total Wairau Floodplain Rivers	**2,372**	**2,644**	**1,806**	**1,538**	**1,586**	**1,851**	**1,840**	**1,471**	**1,450**	**1,253**
Drainage Pump Stations: Blenheim	370	51	-	75	110	-	23	178	488	627
Drains: Blenheim Minor Rivers	250	871	2,261	2,368	2,260	133	136	59	-	63
Drainage Pump Stations: Rural	30	31	31	32	33	34	35	36	37	38
Drains: Rural Zone A	-	41	-	43	-	45	116	166	-	50
Total Drainage	**650**	**994**	**2,292**	**2,518**	**2,403**	**212**	**310**	**439**	**524**	**777**
Rivers ex WV: Pic/ Waikawa Minor Streams	20	20	21	21	22	23	23	24	24	25
Total additions	**3,042**	**3,659**	**4,119**	**4,077**	**4,011**	**2,085**	**2,172**	**1,933**	**1,999**	**2,056**

6.8 Funding Sources

6.8.1 Wairau Valley Scheme Differential Rating

A major source of funding is a differential rating scheme based on benefit to the ratepayers. This funding source is used for all river and drainage works within the Wairau catchment. This includes the Wairau floodplain floodways (the tributaries outside of the main Wairau scheme), the Wither Hills soil conservation works, the lower Wairau floodplain drainage areas, Blenheim and Wairau townships stormwater watercourses, Gibsons Creek, and floodway reserve land.

There are nine classes of protection, including four in the rural areas:

- Class A: Protected by stopbanks to a 100 year flood standard from Wairau and other flood plain tributaries and provided with drainage. (There are 150 km of drainage channels). Full rate of 100%.
- Class B: Stopbank protection as for 100 year flood but no drainage works required or provided. 63% of full rate.
- Class C: No stopbank protection provided, but significant bank edge stabilisation provided — includes land within floodways. 49% of full rate.
- Class D: Remainder of the catchment. Some channel clearing work otherwise just indirect benefit of flood protection activities. 11% of full rate.

There are five classes in the Blenheim urban areas:

- Class U1: Full stopbank protection etc to a 100 year standard from Wairau and Taylor and Wither Hills streams and pumping of stormwater in flood times. 87% of full rate.
- Class U2: Protected by stopbanks and flood detention dam from the Taylor and Wither Hills streams. 61% of full rate.
- Class U3: Protected from the Wither Hills streams. 41% of full rate.
- Class U4: Indirect benefit. 30% of full rate.
- Class R: Rural townships of Renwick and Spring Creek. 61% of full rate.

The boundaries of these rating classes are shown in Figure 6-3. Note that Class D — the area of indirect benefit — is not specifically depicted. It covers the whole of the 4000 km² Wairau catchment apart from the areas specifically shown as classes A, B and C.

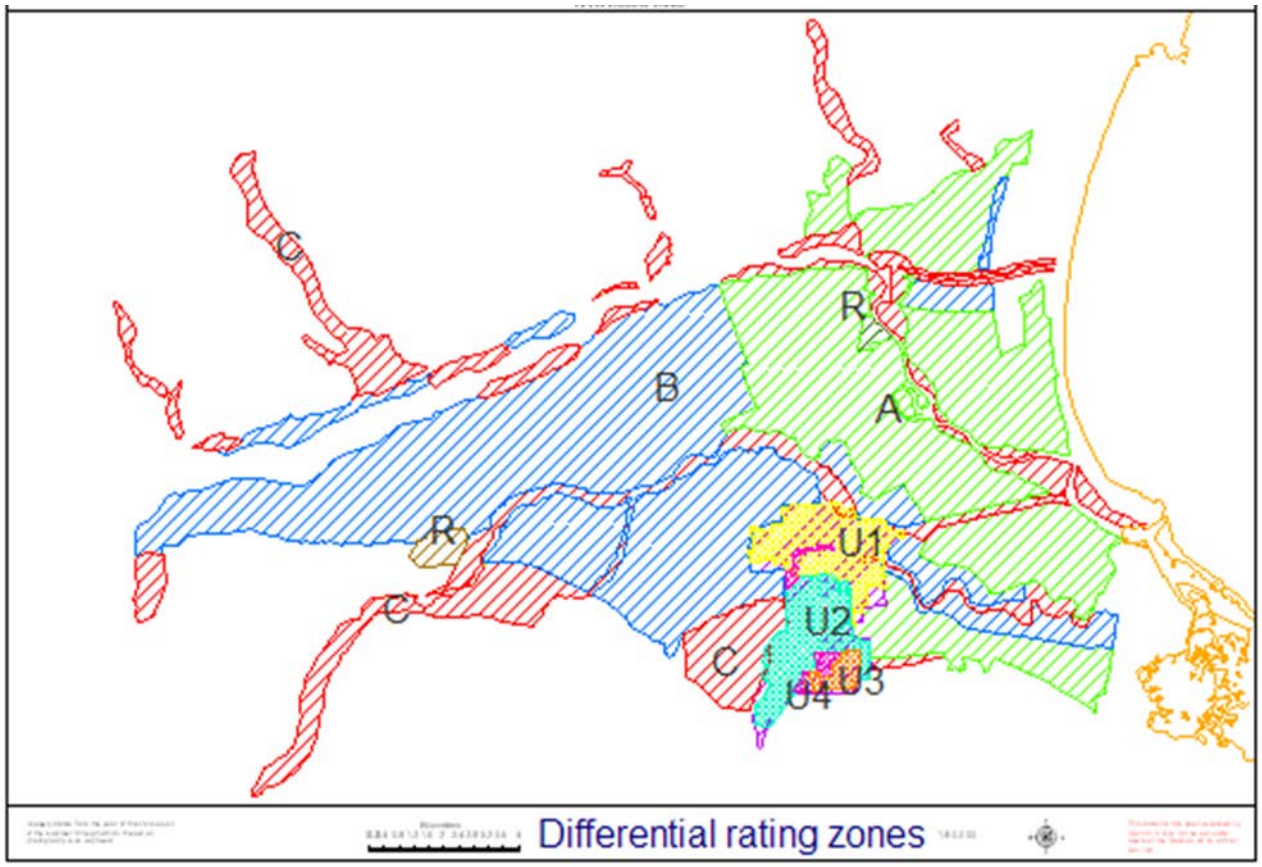


Figure 6-3 Rating Zones for Wairau Valley (River Control) Scheme

6.8.2 Sounds Area Geographic Rate

The funding sources for Picton and the Sounds river control schemes and stormwater are as follows:

District-wide Rates Residential/Rural	0.87%
District-wide Rates Commercial/Industrial	0.13%
Geographic Rate Picton Residential/Rural	36.42%
Geographic Rate Picton Commercial/Industrial	9.81%
Geographic Rate Picton Vicinity Residential/Rural	3.65%
Geographic Rate Picton Vicinity Commercial/Industrial	0.12%
Geographic Rate General Rural Residential/Rural	47.21%
Geographic Rate General Rural Commercial/Industrial	1.79%

6.8.3 Lease Income from River Control Reserve Land

Income from the commercial leasing of river control land is used as a funding source for flood protection activities, particularly for building up a financial reserve to respond to flood damage and to invest in capital projects.

6.8.4 Gravel Extraction Income

A supervision fee of 0.75 cents per cubic metre is charged for contractors extracting gravel from Marlborough rivers. This fee goes towards funding physical survey and aerial photography of the riverbeds, and staff time in supervising gravel removal.

Where Council owns or controls access to riverbed land on the Wairau River a further fee of up to $2.45 per cubic metre is charged. This extra fee goes towards funding the roading and river track network to the gravel extraction sites. It also pays for extra river control bank protection works which are required to manage erosion caused by gravel removal.

6.8.5 Quarry and Tree Nursery Income

Council operates its own quarries and tree nursery for its river control work. Large rock rip-rap (from quarries) and river protection trees (from the nursery) are 'sold' from the 'quarry/nursery' accounts to the river control account. There are also private sales from both the quarries and the nursery. These sales are used to offset the costs of large rock rip-rap or willow trees.

The income and charges from the quarry and nursery accounts are set to be self-balancing.

6.9 Reserves

Two reserve funds are available for Flood Protection and Drainage works

Flood Damage Reserve - an annual contribution into the fund is accumulate as a contingency for flood damage repair

Wairau River Reserve – capital accumulated from rate reassessment in the Wairau catchment is being drawn down for capital projects to avoid incurring loan interest charges

Chapter 7: Asset Management Practices

7.1 Introduction

The asset management objectives of the Rivers and Land Drainage department are:

7.1.1 River management

The purpose of river management is to stabilise river and stream beds and banks and address the adverse effects created by peak flood flows within rivers and streams.
Typical river management works include:

- Controlling bank erosion (by planting and fencing off river banks, construction of rock or other bank revetment works or construction of groynes)
- River training works (ensuring the flow paths of rivers are stable and optimum channel widths are maintained)
- Removing blockages and obstructions
- Gravel and sand management.

7.1.2 Flood Protection

The objective of flood protection is

- Management of flood risks and hazards associated with rivers
- Specific protection works as agreed with communities Management of flood risks and hazards associated with rivers

The processes deployed to achieve these goals are

- Bank protection works and riparian management
- Channel management including gravel and sediment management,
- Development control through resource and land use consent
- Maintenance and management of flood protection works
- Floodway land management including indigenous vegetation and production land
- Emergency response to flooding and other hazards.
- Specific protection works as agreed with communities

7.1.3 Catchment oversight

Catchment oversight also includes the maintenance of partnerships and relationships with key stakeholders across the zone. Cooperation with landowners and residents is vital to the efficient management of floodways and drainage channels. The objectives are to ensure the delivery of flood protection and land drainage activities as set out in the LTP.

7.1.4 Information & Advice

The department aims to provide information and advice to achieve the objectives during under normal operating conditions and to protect life and property during storm events

7.2 Decision making

Senior members of the Rivers and Land Drainage team assess the condition of critical assets and the highest priority actions to be undertaken when planning the operational and capital expenditure programmes.

Any changes to the proposed capital expenditure programme are based on staff recommendations to the Councillors. A recent example was a decision that other work programmes should be slowed down while staff responded to the impacts of the Kaikōura earthquake sequence.

The senior Rivers and Drainage Engineer is active member of the National Rivers Managers Group. The group is influential in developing national standards, coordinating policy and practices, liaison at a national level and sharing knowledge of common interests.

7.3 Asset Management Processes

Modelling - The department has in-house capability for hydrologic and hydraulic modelling but also commission specialist consultants for major project works. The southern Blenheim urban drainage model provided a robust platform for developing a stormwater/river drainage strategy for the Redwood Street/Town Branch Drain catchment.

The Wairau River Floodway Management Plan has been a mainstay of policy for the catchment area since it was developed in 1993. The upgrade of this model is programmed for 2019 and will be an equally important reference for future policy and level of service provision for the next 20-30 years.

Asset condition & performance - The Council is represented on the national Flood Protection Asset User Group. The group help to coordinate the activities across regional and unitary authorities across the country. They are currently developing a standardised format for the condition grading system for stopbanks and subsequent risk assessment. A uniform and consistent approach is essential for national river infrastructure asset management policy development

External expertise - Specialist consultants are commissioned for individual projects – design and supervision of capital works, modelling and other projects.

Close liaison with the large regional councils at Waikato, Wellington, Hawkes Bay and Bay of Plenty also provides policy and practice guidance and technical assistance to leverage the expertise in these organisations.

7.4 Data Quality

The data quality is regarded as good, although improvements in data management are desirable, as noted below.

Table 7-1 Assessment of Asset Data

	Stopbanks	Bank Protection	Urban Drains	Rural Drains	Culverts	Pump Stations	Pumps	Floodgates
Age	C	B	A/B	B	B	A	A	B
Material	B/C	B	A	N/A	B	A	A	A
Structure	B/C	C	A	A	B	B	A	A
Location	A/B	B	A	A	A	A	A	A

	Stopbanks	Bank Protection	Urban Drains	Rural Drains	Culverts	Pump Stations	Pumps	Floodgates
Criticality	A	A	A	A	A	A	A	A
Performance	C	C	B	A	B	A	A	B
Condition	C/D	C	A	A	B	B	A	B/C

A = Highly reliable — Data is based on sound records, procedures, investigations and analysis, documented properly and recognised as the best method of assessment. Data set is complete and estimated accuracy is +/- 2%.

B = Reliable — Data is based on sound records, procedures, investigations and analysis, and documented properly but has minor shortcomings, for example some data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or extrapolation. Dataset is complete and estimated to be accurate to +/- 10%.

C = Uncertain — Data is based on sound records, procedures and investigations, and analysis which is incomplete or unsupported or extrapolated from a limited sample for which grade A or B data are available. Dataset is substantially complete but 50% is extrapolated data and accuracy is estimated to be +/- 25%.

D = Very Uncertain — Data is based on unconfirmed verbal reports and or cursory inspection and analysis. Dataset is substantially complete and most data is estimated or extrapolated. Accuracy is +/- 40%.

The asset data held by the department is generally good except for structure and condition of stopbank and bank protection assets. Many stopbanks are very old. Their structure and condition can be estimated but more detailed work is required to confirm estimates to be able to reliably assess their performance in severe flood events.

7.5 Asset Management Information System

Marlborough's rivers and drainage assets are currently managed with key spreadsheets and accumulated staff knowledge of the assets. However this system has it limits in relation to tracking asset condition, the types of maintenance work, failure modes, costs of ownership and gaining better understanding of the asset performance so that efficiency strategies can be considered.

A key objective of the Rivers Section is the introduction of the corporate asset management information system (AMIS). The TechnologyOne AMIS module was adopted by the three waters department in 2014.

Migrating the current asset register data to a single system along with staff training and familiarisation with the system will be a major project. Shifting to the new software will take considerable staff resource but over time should lead to more accessible data on the condition of assets, and enable better forecasting of future maintenance and renewal requirements.

The adoption of the AMIS will also permit a single methodical approach to asset inspection, condition monitoring, maintenance cost allocation and routine maintenance scheduling.

7.5.1 Cost Effectiveness

Under Section 17A of the Local Government Act the Council is required to review the cost effectiveness of its governance, funding and delivery of good quality local infrastructure.

A paper, prepared by the chief financial officer, was presented to the Planning, Finance and Community committee of Council in June 2017. All Council Services were reviewed. The

following recommendation was presented to the committee regarding Flood Protection and Land Drainage

"*With the absence of an alternate supplier, the high level of contract works and the need to maintain a core competency and in this high skilled difficult to recruit in area, there is little opportunity for Council to improve the efficiency of delivery. As a result it is recommended that this Activity be exempted from further review."*

The recommendation was approved by the committee and subsequently the Council.

Chapter 8: Plan Improvement and Monitoring

8.1 Improvement Programme

Asset management planning helps the Council to manage its assets, deliver on the agreed levels of service, and to identify what operational and capital expenditure will be required over the next 10 years.

Establishment of a robust continuous improvement process ensures the Council is making the most effective use of resources to achieve the agreed levels of service and to plan for the future.

Improvements over the 2015–2018 period have been focused on maintenance of the existing assets. Planned improvements over the 2018-2021 period are listed below.

8.1.1 Asset Register

River and drainage asset data is currently held in a number of sources. The data will be extracted and migrated into the AMIS database structure.

Issue	Progress
Migrate existing asset data to the asset management information system (AMIS), linked to the financial system	Progress on transferring Rivers data to this system will be subject to budget being approved for staff resourcing to carry out this work.

8.1.2 Condition Monitoring

Asset inspections and monitoring data will be collected in accordance with NZWWA Assessment Guidelines and stored in the AMIS against the appropriate asset

Issue	Target Date
Ensure a methodical programme is developed and prioritised based on asset criticality and risk – particularly stopbanks.	2018/19
Ensure all stopbanks and rock-lining is inspected on-foot at regular intervals	2018/19
Improve the quality and consistency of condition grade recording and reporting systems	2018/19
Develop business intelligence reports to analyse asset condition data	2021

8.1.3 Performance Monitoring

Reports on topics such as service request response times, failure modes, performance of materials and fittings, operational costs, number and cost of reactive maintenance activities and maintenance costs of asset groups will be beneficial.

Issue	Target Date
Improved business intelligence reporting on asset performance	2021

8.1.4 Proactive Maintenance Scheduling

The introduction of the upgraded AMIS will facilitate the scheduling of preventive maintenance by operational staff. Scheduled work orders can be produced for routine maintenance work. Repairs and costs can be recorded against specific assets. Maintenance schedules can be

created on either a calendar or on an ‘hours-run’ basis. Further improvements will be achieved through customised data collection forms.

Issue	Target Date
Use AMIS to schedule routine inspections and maintenance	2020
Adopt good data collection standards for scheduled maintenance activities	2019

8.1.5 Financial

Issue	Target Date
Update asset valuation rates to reflect current contract costs	2018/19
Ensure contracts are presented to tenderers to attract competitive pricing	*On-going*

8.1.6 Growth

Significant amount of work is required to ensure new sub-divisions are adequately drained and protected from flooding. Close coordination of stormwater design is achieved through the Stormwater Action Group (SAG.) With eight zoned residential areas around Blenheim, other growth pockets identified for other townships and individual resource consent applications workload management can be problematic.

Issue	Target Date
Maintain coordinated stormwater design for new-divisions through liaison with the SAG.	Ongoing
Gather intelligence on planned developments to ensure designs can be prepared in a timely manner	*Ongoing*

8.2 Monitoring and Review Procedures

The asset management plan is formally reviewed and updated every three years. It captures the supporting information that was used in the development of the Long Term Plan (LTP) and Infrastructure Strategy.

The draft asset management plan is submitted to an external consultant for peer review and checked against the requirements of the Local Government Act and the criteria of the Office of the Auditor General. Recommendations from the peer review are considered for inclusion in the final draft.

The Council’s asset management plans are made available to the auditors of the Office of the Auditor General (OAG) during the audit of the LTP and the intervening Annual Plans.

Asset valuations and all supporting calculations are submitted to an external valuer for independent verification. The valuation is scrutinised by Audit NZ to ensure asset management is adequately resourced in future plans and budgets.

The asset management plan is presented to the Assets and Services committee for approval and subsequently to the full Council for acceptance.

Appendix 1: General Asset Management Issues

1. River Control Asset Management

1.1 River Control Works - Elements of Typical River

A typical river has the river control components of stopbanks, river fairway, vegetated river berms, bank edge protection (trees), bank edge protection (rock, structural).

These common river control elements are demonstrated by use of an example of a small gravel bed river (See Figure 4.) This is an example to demonstrate where such elements are typically located to make up a whole package of a riverbed system. Other rivers often have a greater or lesser degree of the various elements. Bigger rivers usually have a lot more rock work. Deeper, slower and narrower silt bed rivers usually have wider berms for the purpose of more waterway capacity to carry flood flows, and consequently much of which is kept clear of trees.

All elements need to be maintained, especially after flood damage.

Stopbank (1)

Usually constructed from compacted silt or silty gravel and surfaced with a robust grass to inhibit erosion. Typically 2 metres high, 4 metres top width, and a 12 metre base width. Stopbanks are rarely greater than 4 metres high.

River Fairway (2)

A width of river fairway in a gravel bed river is kept clear of trees and other vegetation by bulldozing, herbicide spraying, etc. The flood capacity of the river is provided by the product of the width of the fairway and the height difference between the river bed level and the stopbank level. If and where river bed aggradation occurs, gravel extraction is often carried out to maintain or enlarge waterway capacity.

Stopbank erosion protection (trees)

A buffer of such trees is planted on the berm separating the stopbank from the river fairway. This buffer of trees keeps high velocity floodwaters away from the stopbank and thus inhibits the stopbank itself from being eroded. Willow trees (3) now mature - which have been planted for their erosion resistant properties, and poplar trees (4) now mature - which have been planted because their “cable” root type is complementary to the “fibrous” willow tree root in resisting soil erosion.

In areas of more severe bank attack tied willow trees (5) on the outside of the bends lopped willow limbs have been tied by heavy wire to driven iron stakes (often railway irons) to provide even stronger erosion resistance, especially while the trees are still young and developing root systems. Although the root systems of Production/Protection trees are less good, pine trees (8) offer some erosion protection while also being of commercial value.

Where increased waterway capacity needs to be provided a large amount of the river berms is not planted in trees but is kept in grass, which enables the water to move faster.

Bank edge protection (rock, structural)

In an area of particularly severe river bank attack on the outside of a bend an earthen groyne or spur bank with a head of heavy erosion resistant rock rip rap (6) offers even greater protection against stop bank attack. Several of these may be placed at regular intervals. In some locations large concrete blocks (sputniks), or gabions of stones in wire mesh baskets is used instead of rock. An alternative to a rock spur bank/groyne is placing a fairly continuous length of rock rip rap (7) along the face of the river bank under heavy river attack. This can extend for tens or hundreds of metres depending on need due to severity of attack, and will reach from the top of the bank to the full depth of the river.

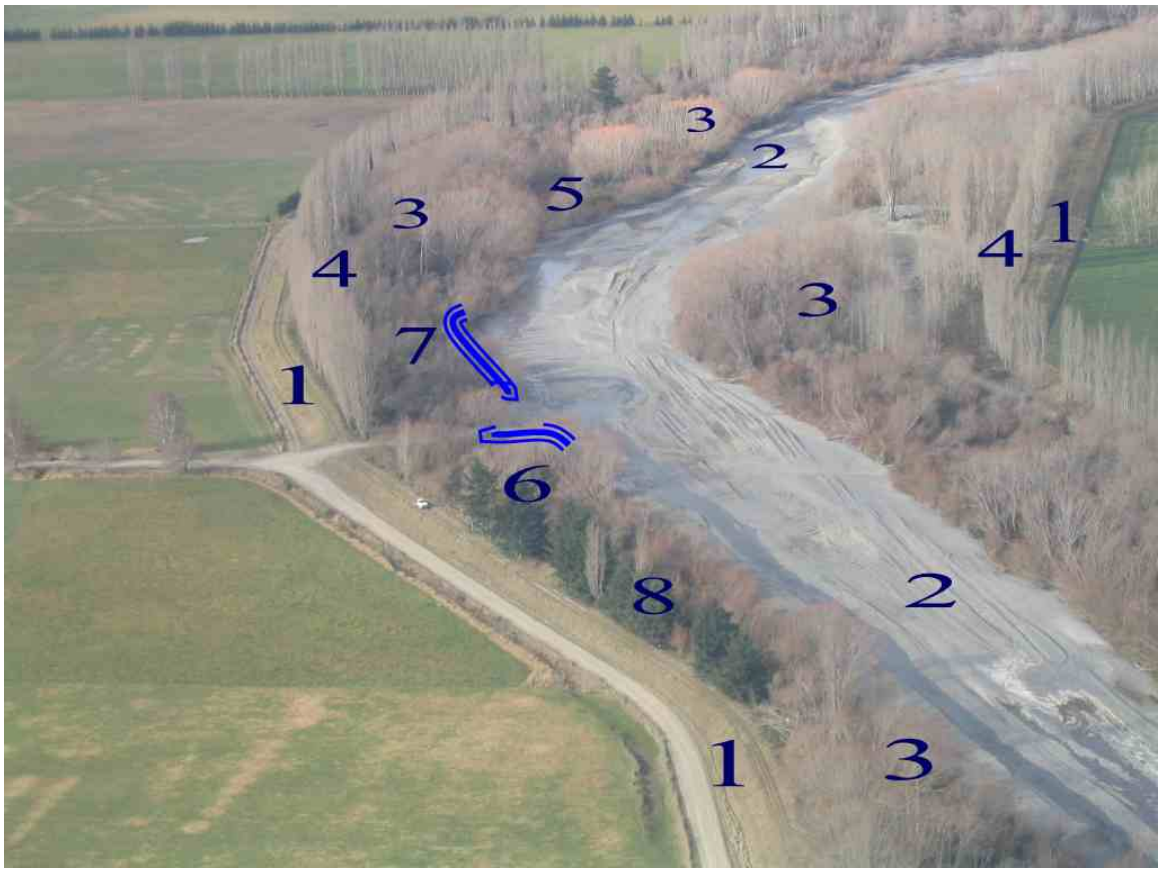


Figure 4 Elements of river control management

1.2 Design Issues - Rivers

Sedimentation:

Sedimentation is a natural process that fills up river channels and reduces flood capacity. The degree of sedimentation is not linear with time. It is related to catchment condition, tectonic activity and patterns of major storms. Sedimentation particularly occurs where flood flows have been reduced by damming and or diversions. Monitoring of sediment build up in river channels and assessing the impact on the level of service provided is a fundamental task of asset management.

Where the sediment is gravel there can be opportunity for commercial gravel extraction to remove surplus sediment at little cost to Council. If sediment cannot be readily removed by gravel extractors Council has to make provision in the form of new works. Minor sedimentation is covered as a maintenance activity.

New soil conservation works may be desirable where hillside erosion is causing sedimentation of channels that cannot be readily maintained.

Design Flood size (including climate change)

Design flood sizes are determined by examining historical flood records and presuming mathematical probability formulae for the occurrence of these events. Long records for the river in question are the best form of information. Where this is not available records from nearby rivers are used – though of course with less accuracy. If flow records are not available then rainfall information is used – also with lesser accuracy.

The climate may be changing which could result in increased flood flows. Flood flow monitoring for the major river systems over the last 10 years appears to show a change in flood frequency in the major river systems of the Wairau and Taylor – that the flood flows are going down! But very little should be read into this as the length of record is very short.

Or, alternatively, in some areas new analysis of flood flows is showing an increase in flood size because a longer record of analysis is now available. This particularly applies to the Sounds rivers flowing through Picton and Waikawa.

There is a need to upgrade some river systems because of increased design flood flows whether it be climate change or better records, especially for rivers that are sensitive to design flood flow size and/or for which the consequences of flooding are particular damaging.

Flood capacity (hydraulics)

The flood capacity of a river is determined by the width of the river, the height of the (stop)banks and the flow velocity. The velocity itself will be reduced by vegetation growing in the channel or floodway, or any changes in slope of the river system.

The hydraulics of many rivers is particularly complex. Wide river berms are one cause of complexity and it has been noted that flood levels on the extensive berms of the Wairau and Lower Ōpaoa rivers are often different from that in the main channel.

Other sources of complexity are where a degree of storage is provided by the channel (eg; Riverlands Co-op floodway).

Sophisticated computer modelling is required to analyse the hydraulics of such river systems with calibration against monitored floods.

Stopbank Erosion protection

High velocity river water will erode stopbanks. Riverbanks and stopbanks are susceptible to erosion from river flow attack. Rock rip rap, retards and trees are work components used to control this.

It is prohibitively expensive on rivers such as the Wairau to construct bank protection works everywhere that erosion could occur. Instead bank protection work has been constructed in locations where the river is, or has historically, attacked the riverbank. As the river meander pattern may change from flood to flood – especially in the steep braided rivers – the areas of severe bank attack can change thus requiring new bank protection work.

Stopbank structural integrity

Stopbanks are “dams’ that hold back water, and the issues involved in the structural performance for dams also apply to stopbanks. Design issues relate to the type of material used in the stopbank, its compaction during construction and foundation conditions – especially whether the foundation material is susceptible to piping under hydraulic head.

Flow control mechanisms

Design flood levels can be affected by backing up of a river outlet to the sea, or to another larger river, or at constrictions such as bridges. Constricting bridges are owned by another party – a factor that leads to further complication.

2. Drain and Stormwater Channel Asset Management

2.1 Drain and stormwater channel elements

A typical drain has the components of excavated channel, bank strengthening, pipe culverts, and often a pumping station at the drain outfall to pump through a stopbank to a bigger river. The attached photograph demonstrates these elements.

All elements need to be maintained.

Excavated channel

Shown in centre foreground - needs to be kept clear of aquatic and terrestrial weed and deposited sediment.

Bank revetment

The banks of the drain are strengthened in this case by gabions. Alternative strengthening is concrete or timber walls, or simply rock rip rap.

Pumping station

Water flows through screens across the channel into a pumping station that pumps under the stopbank into the main river when the river is in flood. The pumps are axial flow pumps with automatic start and stop electrodes and powered by electric motors.

Pipe culverts and floodgates

Pipe culverts under roads and stopbanks are common. In this example the entry to pipe culverts is beside the screens at the end of the channel. When the main river is not in flood the drain outfalls by gravity. A simple floodgate (flapgate) is mounted on the other end of the culvert to prevent back flow from the river when it is in flood.

2.2 Design issues drainage and stormwater channels

General

The design issues for drainage and stormwater channels are similar but different from those of large rivers. Generally the channels are of artificial construction often on a very flat slope and quite low flow velocity.

Sedimentation

Sedimentation by silt and fine sediments is a typical problem in drainage channels and requires regular excavation and removal.

Capacity and depth

Agricultural drains need to be typically at least a metre deep so as to keep water levels below the ground surface of the land being drained. Unlined drains of sufficient depth with battered earth banks usually also have sufficient capacity to carry the required flows. Flooding of land from drainage channels is acceptable – provided that it is for less than three days. However flooding of houses from urban stormwater channels is not acceptable, and a different level of service is required.

Blockage by weed

The blocking of drainage and stormwater channels by thick aquatic and terrestrial weeds is a major issue. The hydraulic performance of such channels can be reduced by a factor of 10 by such weeds. Regular annual removal by agrichemical or excavation is essential. The spread and extent of weed is increasing and new weeds regularly arrive in Marlborough. Conversely there is an increasing expectation from the public of more weed removal and there is generally increasing environmental (resource consent) constraints on the manner in which aquatic weed removal is carried out.

Bank strengthening

Erosion of banks is seldom a problem for drainage channels. However bank strengthening is often required to enable vertical or near vertical banks to be constructed. This is because drainage and stormwater channels have often been constructed where there is a lack of room – especially in urban areas or in roadways.

Flow control restrictions

Outletting into the sea or larger rivers is a major issue for drains. At high tide – or flood conditions – these outlet levels are higher than desired drain water levels. Simple floodgates (flapgates) are used to prevent back flow.

Pumping stations

Pumping stations are required on drainage channels where high downstream levels are encountered for long periods of time. Without the provision of pumping facilities such areas would be virtually unproductive and subject to extensive flooding for periods of the year. Pumping stations can be even more critical for urban stormwater channels feeding into larger rivers that are coincidently in flood.

3. Need for New Assets

3.1 River Flood Control (Main Rivers)

New river assets may be required for several reasons:

Demand Driver	**Reference**
New areas desire flood control protection; often because there is a gap between the public's desired level of service and current standards.	Level of Service
Land development increases the flood runoff from the land.	Growth
Awareness of increased size of floods due to climate change or better hydrological flood record.	Growth
Monitoring of flood events shows that the hydraulic performance of floodways is less than presumed in design.	Life Cycle Management
The height, size or strength of stopbanks and other river control structures are clearly inadequate or do not have an adequate margin of safety.	Life Cycle Management
Channel waterway capacity needs to be increased because sedimentation is reducing capacity.	Life Cycle Management
Changes to river meander pattern so that high velocity erosive flows are impacting on unprotected river bank and new bank protection works are required.	Life Cycle Management
Historic river control works have a detrimental impact on the river ecosystem; and new works to improve the ecology are desirable to mitigate the effects of those previous river control works.	Level of Service

3.2 New Areas

The main Wairau floodplain (below Waihopai confluence) interfaces with smaller tributary floodplains (Omaka, Fairhall, Taylor, Are Are, etc). Currently the upper stems of most of these

tributary floodplains are provided with the lesser standard of “Wairau tributary” flood protection. Increased viticulture development up these tributary floodplains could result in an increased level of service request to the 1 in 100 year standard of the Wairau floodplain by channel enlargement etc.

New protection works may also be required in areas of the Sounds undergoing residential development. Here it is likely that capital works would be a requirement of the developer and Council’s role would be to fund and manage ongoing maintenance. Okiwi and Ngakuta Bays are examples of this.

Urban, industrial and commercial development is creating more impermeable surfaces and thus causing increased runoff into the small rivers, streams and drains serving built up areas. This is occurring in all urban areas especially Blenheim, Picton, and Renwick. The Riverlands Industrial area is also expanding rapidly, including the rezoning of rural land to industrial zoning.

Increased flood run-off is anticipated to have occurred in much of urban Blenheim affecting urban pumping stations and both urban and rural stream channels. Recently completed modelling work in the Redwood Street catchment confirms that significant outfall upgrades are required to meet the desired flood standard.

Grape development also appears to be causing increased runoff on the gently sloping, moderately impermeable land of the southern valleys to the south of New Renwick Road and State Highway 63 to the west of Renwick.

3.3 Drainage

- Increased subdivision has resulted in some new properties not having access to a Council public drain within a rated Council drainage area, and new drains are required.

- Historic drainage works have a detrimental impact on the ecosystem; and new works to improve the ecology are desirable to mitigate the effects of those works.

- Drainage channels could be modified to provide a much better ecological or aesthetic habitat.

- There may be new areas desiring drainage that Council is currently unaware of.

3.4 Stormwater channels

- Expansion of Blenheim – to the north and west will require waterway and outfall culverts to be enlarged. Eventually at least one existing pump station, Caseys Creek, will require a capacity upgrade or replacement to meet outfall requirements during the infrequent large flood events in the Upper Ōpaoa River.

- Infill housing and increased runoff from existing urban areas will require enlarged channels and pumping stations. The key area being addressed at present is the Redwood Street/Town Branch catchment.

Appendix 2: Detailed Life Cycle Management

1. Wairau Floodplain Floodways and Main Rivers

This includes

1. Wairau Diversion
2. Lower Wairau
3. Wairau from Tuamarina to Waihopai Confluence
4. Waihopai
5. Lower Ōpaoa
6. Taylor
7. Taylor Dam
8. Upper Ōpaoa/Roses Overflow
9. Ōpaoa Loop
10. Omaka
11. Riverlands Co-op Floodway
12. Ruakanakana Creek (Gibsons Creek)
13. Doctors Creek.

1.1 Wairau Diversion

Channel characteristics (typical)

Type	:	Gently curving artificial channel through beach gravels
Length	:	4.2 km
Slope	:	0.07% (1 in 1500)
Channel Width	:	150 m
Floodway Width	:	300 m
Design Flood	:	3000 m³/sec Design Freeboard 0.6 m.

1.1.1 Issue: Channel Development – Wairau Diversion

The Wairau Diversion was constructed so as to take a large portion of the flood flow from the frequently flooding Lower Wairau. It was initially constructed as a 10 metre wide pilot channel within a 300 metre wide floodway from Bothams Bend to the sea, with only enough material excavated from the pilot channel so as to construct the stopbanks. Natural erosion of this pilot cut to a deeper and wider channel was intended to occur during floods with time. In fact deliberate excavation of hard points has been found to be necessary.

The Diversion has been regularly monitored at about three yearly intervals since its original construction in 1963. Monitoring of the Wairau Diversion has found that:

- The Wairau Diversion channel has enlarged by erosion by some 1.6 million cubic metres since its initial pilot cut excavation in 1963.
- This erosion has been by a mixture of natural erosion during floods, assisted by deliberate Council excavation of hard points during the 1990s.
- There has been little erosion enlargement since 1998, and a number of gravel silt islands have formed in the channel below the normal area of commercial gravel extraction.

- In a 700 m section on the true right bank the diversion has now eroded to or beyond the original design line and it is proposed to top up and strengthen the scour limiting rock placed at the time of the diversion construction.

The quantity of material that the Wairau Diversion has eroded is similar to the quantity that the Lower Wairau channel has aggraded. However the Diversion is less than half the length of the Lower Wairau. Therefore the rate that the waterway capacity of the Diversion increased from 1964 to 1998 was approx. twice the rate that the Lower Wairau channel reduced in capacity**.**

The Diversion will not enlarge significantly more – and nor is it desirable for it to enlarge much more due to adverse environmental consequences on the Lower Wairau River

The current capacity at the top end of the Diversion is estimated by detailed hydraulic modelling at 3000 m³/sec. This needs increasing to 3200 m³/sec to achieve scheme objectives. Further downstream, especially below Rarangi Bridge, the waterway capacity is already in excess of 3200 m³/sec.

Summary

The Diversion channel needs to be continually monitored with the aim of achieving the desired 3200 m^3 capacity likely requiring controlled gravel extraction and regular stripping of built up islands.

Rock armouring work is required where the channel has naturally scoured to the design channel width to stop development of undesirable meanders in the channel.

Main References

"Lower Wairau and Diversion Capacity" Report to Council" E B Williman October 1999.

"Lower Wairau and Wairau Diversion Hydraulic Analysis" K J Christensen Council Internal Report Sept 2006.

"Hydraulic Review of the Lower Wairau Floodway" L Kuta, Council internal report, June 2011.

1.1.2 Issue: Closure of Diversion Bar

The Wairau Diversion bar has only on a minor scale the problems that the Lower Wairau mouth bar has. The mouth does block completely at times and flows of up to approximately 10 m³/sec can seep throughout the 2.3 metre high barrier. Flows greater than this will overtop this barrier and scour out a new mouth. This backing up effect of a mouth bar blockage is limited to 2 km due to the steepness of the channel upstream, and is of fairly short duration. There is no significant impact on flooding, or drainage. Extension of the existing guidebanks is not expected to be required.

1.1.3 Issue: Maintaining the erodible bank control structure at Diversion/Lower Wairau flow split

In July 2009 the erodible flow split bank was constructed so that 70% of the flow went down the lower Wairau channel in floods of up to 1400 m^3/sec. These regular and more frequent flood events are a major transporter of the finer sand/silt sized sediments that were accumulating in the lower Wairau.

The construction of the erodible bank has given a good level of control of smaller flood events. In large flood events greater than 1400 m^3/sec the gravel bank over tops, breaches and the full capacity of both channels is available to convey the flood flow. The bank has breached 8 times since construction and takes typically 1 – 3 days with a bulldozer to rebuild once river levels drop back to normal.

The erodible bank is working is providing the flow control as designed and the most recent lower Wairau bed survey (Feb 2013) indicates a minor scouring of fine sediments, the first period of degradation since the Diversion was constructed in the mid-1960s.

The construction of the erodible bank has had a number of minor side effects including erosion of the natural ground spit at Bothams Bend where the bulldozer bank joins up to, and some minor erosion of the true left bank below the rail bridge immediately adjacent to the erodible banks rock head.

In late 2013 a new rock head was constructed against the natural Bothams Bend peninsular by placement of fill to shape and 3000 tonnes of large rock. The erodible bank is now pushed up against this rock wall. Plans are underway to repair the currently minor erosion of the true left bank immediately downstream of the rail bridge.

There is no man made control structure to proportion the flow down the Diversion and the Lower Wairau channels. The natural bed levels are the control mechanism. The deposition and erosion pattern in this flow division area is the predominant factor in determining the flow split.

The size, shape and waterway capacity of the Lower Wairau River channel is a delicate balance between its sediment transport capacity, the flood flow regime, the river mouth opening and any changes in supply of sediment to the river system. The construction of the Wairau Diversion changed this balance and has led to aggradation of the Lower Wairau channel.

This aggradation is deleteriously affecting flood capacity, drainage, water quality ecological values, recreation, and aesthetics of the Lower Wairau.

Monitoring on patterns of Lower Wairau aggradation indicate that the larger floods scour the Lower Wairau while a quieter flood period results in aggradation. This indicates that suitable flow control at the mouth of the Wairau Diversion could reverse the aggradation presently occurring in the Lower Wairau channel – with associated flood protection, ecological, recreational and drainage benefits.

The construction of “full flow” control gates at the head of the Diversion is one possible option. Control gates have been used at other locations in the country, notably in the Manawatu. The Lower Manawatu/Moutua Floodway provides an example of flow control being successfully used to minimise sedimentation in a system very similar to the Lower Wairau/Wairau Diversion.

This indicates that a gated flow control structure at the mouth of the Diversion would work, it will be very expensive. No estimate has been made, but is likely exceed $20 million dollars.

An erodible gravel bank as a flow control structure will be much cheaper. Such erodible banking will act partial flow control and will be positioned to divert a higher percentage of Wairau river flow down the Lower Wairau channel during lower to medium flood events than occurs at present. The design provides for the bank to fail during larger floods. These larger floods will then flow through the main Lower Wairau channel and the Wairau Diversion through to the sea as they do at present. The erodible bank will be around 500 metres long and 1.9 metres high and it will have “a lower section” 100 metres long at a specific location which will ensure a reliable failure and make it easier to repair. It is proposed to rebuild the erodible bank after each flood. The design is based on the successful operation of a similarly designed bank on the Wilberforce River near Lake Coleridge in Canterbury.

The main reason for the need for the proposed erodible banking (and other river control works on the Lower Wairau) is because that channel is aggrading through the deposition of sand and silt.

The overall aims of this partial flow control are to:

(a) To halt the current aggradation of the Lower Wairau River that has occurred through the deposition of sand and silt; and to reverse the trend by encouraging scour of this deposited sediment.

(b) This will increase the flood capacity of the lower Wairau system.

(c) The water quality of the lower Wairau River will improve, including reducing salinity. This in turn will improve the ecological and recreational values of the lower Wairau River.

(d) The river is becoming shallower through siltation which directly impairs recreational values of rowing, swimming and kayaking. This will be corrected.

(e) To increase average flows in the Lower Wairau River that is better for ecological habitat.

(f) Improve the self-scouring process of the Wairau Bar so as to improve the tidal flux through the bar. This in turn will improve the ecological values of the Waikārapi Lagoon (Vernon Lagoon) and also improve gravity drainage of the lower plains watercourses.

Main Reference:

"The use of a flow control structure to erode deposited sediment from the Lower Wairau River" K J Christensen 2006.

"A first look at effects from the Erodible Bank on the Lower Wairau River's Mean Bed level" L Kuta internal memo, May 2013

Summary of new works required

Some additional rock edge control works as required

1.2 Lower Wairau Floodway

Channel characteristics (typical)

Type	: Deep narrow silt bed river
Length	: 9 km
Channel Width	: 120 m
Floodway Width	: 350 m
Slope	: Tidal, flood slope 0.05% (1 in 2000)
Design Flood	: 2300 m^3/sec Design Freeboard 0.5 m.

Issue: Sedimentation

Adequate flood capacity of the Lower Wairau has been a long-standing issue for Marlborough. Stopbanks were first built around the 1890 period, generally close to the river bank. In those days there were three river boards flanking the Lower Wairau River, two on the northern bank and one on the southern bank. The different boards were differently funded and built the stopbanks in their respective areas to different standards.

However not enough flood capacity was provided, especially as stopbanking further up the Wairau was preventing spill out upstream and thus concentrating all flow into the Lower Wairau River. The blocking off of the Ōpaoa distributary channel in 1914 was a particular action that increased flood flows in the Lower Wairau. Government review led to a single river board being formed in 1921 – called the Wairau River Board – with the responsibility of dealing with flood control works in a holistic manner.

In the late 1920s the Wairau River Board moved back the stopbanks in several locations on the Lower Wairau so as to enlarge the floodway to deal with the flood problems, as well as raising the stopbanks. This was carried out at six locations; the Peninsular Road (south bank), Morrins Hollow (north bank), Parker (north bank near Dicks Road), Wairau Pa, Beatsons overflow (south bank) and Maori bend (north bank). Most of this floodway land was purchased by the Wairau River Board, or alternatively compensation was often paid for land now being part of the floodway.

Flood breakout continued to occur during the 1930s, 1940s, 1950s and 1960s, with stopbank repair and minor upgrading at regular intervals in an ad hoc manner; though still not achieving adequate flood protection for the Lower Wairau plains. Flood breakout was occurring about every six years.

Consequently in 1964 the Wairau Diversion was constructed by the Marlborough Catchment Board so as to share the flood burden with the Lower Wairau. It was expected that the Diversion would remove the future need of any further upgrading to the Lower Wairau floodway, and indeed that minimal maintenance would be required from then on.

The Diversion was required to enlarge by scouring – it was not up to size by the time of the 1983 floods- and unfortunately the Lower Wairau, at the same time has silted up – albeit at a lesser rate.

By 1999 the combined capacity of the Diversion and Lower Wairau had enlarged sufficiently to reach the required floodway capacity of a 1 in 100 year return period flood – about the size of the July 1983 flood; and that siltation had slowed, but from 1999 siltation increased again since then.

River channel cross sectional survey has been carried out regularly at about 6 yearly intervals since 1989 and less regularly before then. This monitoring of the Lower Wairau river channel has found that:

- Since the mid-1960s there has been aggradation of some 1.9 million cubic metres of sediment.
- This represents an average build-up of 1.5 metres depth, and narrowing of the channel by some 15 metres.
- The 1994 to 1999 period had very little aggradation. This was a period of significant flood activity in the river. On 11 occasions in this period the flow exceeded 1500 m^3/sec – twice the normal average, and one of 3800 m^3/sec.
- Conversely the 1999 to 2005 period was a period of the greatest rate of aggradation on record. This was a period of very little flood activity, with only three floods exceeding 1500 m^3/sec – half the long term average, and the largest of only 2000 m^3/sec.

This silt deposition is due to the reduction in flows with the construction of the Diversion in 1963 and its increasing development particularly since 1972. The reduction in the sediment transporting capability of the freshes and floods is proportionally greater than the reduction in flow.

The effects of the Lower Wairau siltation are:

- Reducing floodway capacity.
- Detrimental ecological effects on fauna and flora, including in the Waikārapi Lagoon (Vernon Lagoon).
- Poorer water quality, increased salinity.
- Impaired drainage.
- Impacts on rowing and general boating activities, and other recreational activities.

A package of new works was approved to address these issues. The works completed included:

- Extension of the rock guide wall at the sea outlet of the Lower Wairau so as to improve the outlet efficiency.
- Strategic sediment removal especially in the Spring Creek outlet area.
- Removal of spurbanks blocking Beatsons overflow.

- Raising/strengthening of low sections of stopbank on both sides of the river. The south bank works are completed with the north bank works still to be completed,

- Removal of thick impeding crack willow trees within the floodway which slow floodwaters, and targeting those trees that have no bank erosion protection benefit and/or no ecological or aesthetic value. Some back planting of less impeding native trees was to be carried out – such as cabbage trees (Ti Touka).

- Construction of the flow split bank at the Bothams Bend Diversion/Lower Wairau flow split confluence.

All the above improvement works have been completed except for the main sections of stopbank raising on the north bank due to property ownership/access issues and there is one further section of willow clearing that would be ideal to complete.

Initial monitoring suggests that the package of works has stopped the ongoing sedimentation and in fact that there was a small decline in overall bed levels. The floodway capacity improvements won't really get tested until we have a flood event exceeding about 3000 m^3/sec.

Main references:

"Lower Wairau Sedimentation Proposed Remedial Works" Report to Council E B Williman Nov 2006.

"Hydraulic Review of the Lower Wairau Floodway"; L Kuta, internal report, June 2011.

"A first look at effects of the Erodible Bank on the Lower Wairau River's Mean Bed Level, L Kuta, Internal memorandum, May 2013.

Issue Inadequate floodgated culverts

Several of the drainage and pump culvert pipes under the stopbanks are short, and these are potential failure paths. There are several such culverts not of adequate length. Lengthening these culverts is desirable.

Simple floodgates (or flap valves) are constructed on the outlet of these culverts to prevent water flowing back from the river. These floodgates, while essential for preventing the backflow of floodwater, are claimed to adversely affect movement of whitebait and other fish into the drainage network. Replacement of floodgates for culverts in strategic locations with side hung floodgates easier for fish passage will be part of a staged programme.

Main reference

"Wairau Drainage Plan 1996" Council Management Plan, R M Fitzgerald.

Issue: Wairau River Mouth Bar

(i) The Wairau river mouth bar is a natural feature that has a dominating effect in normal river flows on Wairau estuary levels, the Wairau lagoons, the lower Wairau to upstream of Ferry bridge, and the lower Ōpaoa. Even in flood flows a poor configuration of the bar has resulted in raising flood levels many kilometres upstream both in the Wairau and its tributaries the Lower Ōpaoa and the Riverlands Co-op floodway.

The bar is formed by a combination of marine forces, tidal flows into the Waikārapi Lagoon (Vernon Lagoon) and river flows from the lower Wairau and to a lesser extent the lower Ōpaoa.

The marine storm wave forces are very important. In times past they formed a bar typically extending a kilometre to the north. When such a bar formed there would be significant water friction loss down this extra distance of coarse gravel bed channel. In these situations the water level in the whole lower Wairau upstream is kept at virtual high tide levels with little or no tidal variation.

This has a significant environmental effect on the Lower Wairau, lower Ōpaoa and Waikārapi Lagoon (Vernon Lagoon). With this partially closed bar the water there may stay almost completely devoid of saline water, or conversely stay with an extensive saline wedge.

Gravity drainage of the extensive areas of flat lower plains into the lower Wairau is prevented and expensive drainage pumping required.

With a direct open mouth there is twice daily flushing of saline water, tidal water level variation in the lower Ōpaoa and lower Wairau and good gravity drainage.

Boat access across the bar is also much better with a direct mouth outlet and was a concern of Harbour authorities when the Wairau and lower Ōpaoa were important for shipping.

The Wairau bar is typically built by waves to a height of 2.3m above sea level. It can be overtopped by floods that occur from time to time and when this occurs a direct mouth is then scoured out. This scouring takes some time to achieve, and in a fast rising flood the flood water levels upstream may be much higher for some period. This can lead to overtopping of stopbanks.

Once a direct new mouth is formed the cycle begins to repeat itself with sea forces gradually extending the bar further north.

These combined tidal flushing flows and river flows can be concentrated by a guide bank to inhibit the development of the bar. At least three such guide banks or jetties have been built by river or harbour authorities over the last 85 years starting with the Harbour Authority of the day in 1897. A rock bank some 500 metres long, was built as part of the Wairau Valley Scheme in 1961. In 2009 this banking was extended by another 120 m to form the guide bank we have today.

This 1961 rock guide bank, at a cost of $1 million in today's terms was very effective at keeping a direct open river mouth. Since its construction only twice, in 1974 and 1992, had the mouth partially blocked. In both occasions reopening of a direct mouth was helped by mechanical excavation which enabled a new mouth to open and scour out in a relative small fresh in the river. However by the early 2000s the partial mouth blocking was getting progressively worse and a decision was made to extend the control groyne

Summary of new works required

- Regular inspection and maintenance of the rock guide wall particularly after storms leading to heavy seas at the river mouth.

- No further capital works proposed at present.

"Lower Wairau Sedimentation Proposed Remedial Works" Report to Council E B Williman Nov 2006.

1.3 Wairau (Tuamarina to Waihopai Confluence)

Channel characteristics (typical)

Type	:	Semi braided gravel bed river
Length	:	22 km
Floodway Width	:	800 m (reduced from 1000m in 1958)
Fairway Width	:	400 m (reduced from 600m in 1958)
Slope	:	0.3% (1 in 300), but steepens from 1 in 700 at Tuamarina to 1 in 200 at Waihopai Confluence.
Design Flood	:	5500 m^3/sec Design Freeboard 0.9 m.

Issue: Sedimentation

(i) The prospect of gravel build up in this reach of the Wairau River was a major concern for a long time. The Marlborough Catchment Board established a set of 30 river cross sections over the reach for survey which has been carried out regularly at approx six yearly intervals since 1958; and regular analysis of this survey.

Up till 1991 gravel deposition exceeded gravel extraction with an average deposition of 90,000 m^3/year of gravel deposited in this reach.

Such deposition was reducing the flood capacity of the river.

Commercial Gravel extraction from this section of the river was encouraged.

Over the last ten or so years the rate of gravel extraction has greatly exceeded the rate of gravel deposition. The floodway capacity of the river is up to design capacity.

However should extraction continue at too high a rate flood protection works (stopbanks and groynes) in some areas will be undermined increasing the risk of failure in large floods and making reinstatement much more expensive.

This necessitated a comprehensive review of Wairau gravel extraction activities. In order to shift gravel extractors away from sites becoming over-extracted on to more appropriate sites and maintain an economic gravel supply in the mid 2000s Council approved a range of gravel extraction policy actions for the Wairau downstream of the Waihopai confluence.

- *That defined annual limits for specific sites are set. Permits will not be issued for more than one year.*

- *That differential increased gravel extraction charges be imposed on extraction from the Wairau riverbed reserve land mainly under Council control. Class A rates would be imposed on sites most convenient to extract from and with least river control benefit. For sites hardest to extract from and of greatest river control benefit Class E rates would apply. Classes B, C and D classes progressively intermediate between A and E.*

- *That all gravel extraction from the river is required to be accurately measured by surveyed stockpile or similarly verifiable method.*

- *That the charges and the setting of cost categories for the various sites be reviewed on an annual basis.*

- *That specified acceptable access routes will be included as part of the contractor's permit. The 6 km of Tuamarina Track from south of Tuamarina pocket township westward around the hills will also be excluded from use by contractors. Where feasible to construct, river berm tracks will be preferred to narrow under-strength local roads.*

- *That speed limits be gazetted for gravel extraction using Council river berm land.*

- *That new environmental constraints such as seasonal timing of extraction due to bird nesting concerns also be incorporated into permit conditions as and when relevant information comes to hand.*

- *That Council will also offer to extract and stockpile gravel for extractors where wanted. The charge for such stockpiled gravel will be further increased so as to incorporate Council's stockpiling costs.*

- *That Council will provide for minor extractors by provision of such stockpiles of gravel. This will usually be at two sites, one in SH 6 area and one in the SH 1 area.*

- *That the increased income from the gravel charges be put towards roading construction/maintenance costs to access the gravel extraction sites; to be set aside for quarried rock rip rap for expected increased river bank maintenance stabilisation work; and for increased monitoring/supervision costs.*

- *That the Rivers and Drainage Engineer consult with the various gravel extractors with regard to allocating specific sites on an equitable basis.*

- *That the contractors be advised that abuse of the permit conditions will result in Council withdrawing the gravel permit.*

These policies have now been in place for close to 10 years and considered to be working well. The most recent gravel extraction quantity review was completed in mid-2012 and an allocation of 130,000 m^3 set for the 2013/14 monitoring year with a 10% reduction in the year following.

Gravel demand is now exceeding supply and contractors are being either directed to hard rock quarries or to the Loddon Lane area of the Upper Wairau River for supplementary supply to their current allocations.

Main Reference

"Statement of Proposal Wairau River Gravel Extraction Policies" Council resolution Dec 200

"Changes in the Wairau River Bed", L Kuta, internal report, July 2012.

"Wairau Gravel Review", report to Assets & Services Committee, October 2012.

Issue: Stopbank Erosion Protection

Stopbank erosion protection is a very important issue because of its very high expense.

The Wairau Valley Scheme sought to impose a single thread channel training pattern on the river. The major advantage of this single thread channel was the expected stable meander pattern that was achieved. Rock bank protection work would then only be required on the outside of the defined bends. The initial design of heavy bank protection was only about one-third the total length of stopbanks

However a stable meander pattern on the intended alignment has not developed; and further review indicates that this initial 1960 design was an optimistic wish.

Some form of continuous bank protection works are required on both sides of the river for its full length.

Willow trees provide some bank protection but are not strong enough to hold direct attack of the Wairau River. They are very valuable as back up to training bank rock lines and can prevent washing out of the rock line by overtopping flows

Trees, when developed, are also capable of resisting river attack of lesser river braids. Piled retards with willow or other tree limbs lashed on are used to strengthen the tree plantings. These have been in the form of driven rail iron piles, or willow limbs constructed as a cruciform shape. These retards are particularly useful in strengthening tree planting during early years of tree growth.

If greater river attack is later experienced, stronger bank protection works are needed.

There are two main alternatives for providing stronger protection.

- A continuous rock lined guide or training bank, parallel with the river, and backed up with a band of willow trees.

- Rock headed groynes at right angles to the river, use considerably less rock and are therefore cheaper. Again, tree planting in between the groynes is useful back up and will inhibit turbulent eddying flows between the groynes.

Over the last 20 years new bank protection works in the form of willow tree planting and rock work has been carried out. Further new work of this nature will still be required.

Issue: Berm erosion

Extensive areas of grassed berms, especially where there are old channels, need some plantings of trees to reduce berm velocities and scour potential. Berms need a careful blend of tree planting and open pasture. Planting options include:

- Bands of shrubby willows;

- Protection/production commercial tree planting;

Any new or replacement plantings need to be examined for the situation on its merits. This is a continuous process as pine plantations are harvested and willow buffer zones are either strengthened where less than ideal or being replaced after flood damage.

Main Reference

"Wairau River Floodways Management Plan 1994". Council Resource Management Plan.

Probable new works required

New willow tree bank protection work.

New rail iron retards.

New river tracks for gravel extraction truck use.

Upgrading Council roads for gravel extraction truck use.

Rock training bank or spur bank upgrades, particularly upstream of SH 6 where bed degradation has led to undermining of some existing works.

Ongoing management of existing protection/production tree planting. Some harvesting of existing blocks can be expected over the life of this plan.

Regular repair of rock bank protection work.

1.4 Waihopai (Wairau Confluence to 500 metres upstream of SH 63 Bridge)

Channel characteristics

Type	: Wide Braided gravel river
Length	: 2 km
Fairway Width	: 150 metres
Slope	: 0.6% (1 in 160)
Design Flood	: 1200 m^3/sec

No new capacity improvement works are required or likely to be required in the foreseeable future. However it is proposed to strengthen existing edge protection works at two key locations beginning in 2017/18.

Main reference

"Lower Waihopai Flood Levels" Internal memo K J Christensen May 2003.

1.5 Lower Ōpaoa/Taylor

Channel characteristics (typical)

Channel blocks were put across the Ōpaoa Loop in 1967 to separate the Upper Ōpaoa from the Lower Ōpaoa. The lower Ōpaoa/Taylor is now a single river up through Blenheim, until the Doctors Creek tributary on the west side of Blenheim.

(Up to Doctors Creek confluence)

Type	:	Deep narrow silt bed river
Channel Width	:	30 m
Floodway Width	:	150 m
Slope	:	Tidal, flood slope 0.025% (1 in 4000)
Design Flood	:	170 m³/sec Design Freeboard 0.4 m.

Issue: Sedimentation

(a) Situation

Generally cross section survey of the river channel has been carried out at 10 yearly intervals since 1957.

Downstream of Riverlands (Butter Factory) corner the lower Ōpaoa channel has been extremely stable, with no change in width, position or channel bed levels.

From Riverlands corner up to Taylor river confluence some deposition of the channel has occurred. This deposition is of silt, sand and fine gravels and over 30 years is at a maximum of 1 metre at the downstream end of town at the confluence of the lower Ōpaoa and Taylor. Downstream the deposition steadily reduces for the 2.5 km to Riverlands corner.

The Taylor Dam, Ōpaoa channel blocks, and Munro street gravel trap now reduce the amount of sediment that would have potentially deposited in the Lower Ōpaoa. In the upper Taylor gravel extraction has been halted, allowing the build-up of a paving layer of large gravels that inhibit further bed erosion.

To date this aggradation has not significantly reduced flood capacity or drainage efficiency. However at low flow it is proving a nuisance for large commercial tourist boats on the river.

Possible new works required

Dredging the Lower Ōpaoa/Taylor is a possibility, albeit difficult because of access constraints. No specific provision has been made within this plan but ongoing monitoring may determine at some point that the work is required.

Issue: Waterway Capacity

Prior to the construction of the Taylor dam the 1 in 100 year flood for the Taylor (at the dam site) would have been approximately 270 m³/sec. The Taylor Dam, constructed in 1965 and the outlet of which was adjusted in 1980 has (together with the 1967 Ōpaoa Loop channel blocks) reduced this design flood to 108 m³/sec. To these figures needs to be added some 62 m³/sec of inflow from Doctors Creek, Rifle Range Creek and other tributaries.

More recently considerable berm improvements have also been carried out on the Lower Ōpaoa by berm shaping works that have removed berm material and shaped the berms to more readily carry flood water. As part of the process the overhanging willow trees that have steadily

been growing and impeding the flood have also removed. These works have been carried out from Blenheim to the Waikārapi Lagoon (Vernon Lagoon) enabling the water to get away more easily from town. The July 2008 flood demonstrated how effective these works have been.

There is no apparent need at the present to further increase the waterway capacity; though if there was a need the best option would appear to be dredging of the river from Blenheim to Riverlands corner – which is also desirable from a boat navigation reason.

Issue: Stopbank structural integrity

The Lower Ōpaoa stopbanks are typically 1.2 metres with 1 metre top width and steep sides. Inconsistent original construction, animal damage and vehicle crossing damage is reducing the strength and height of the stopbanks in places. This is particularly so where fencing is along the top of the stopbank. Stopbank improvement works have been underway for some time with about 84% of the of the total length of stopbank now considered up to standard and about 20 % still requiring upgrade.

These remaining stopbank improvement works are scheduled to be completed over the term of this plan. There is about 4100 m of stopbank to bring to standard or 16.5% of the length maintained.

Main References

"Wairau River Floodways Management Plan 1994" Council Resource Management Plan.

"Lower Ōpaoa, Taylor, Doctors Hydraulic Analysis and Required River Control Works" Report to Council E B Williman May 1997.

"Internal email memo from Roger Fitzgerald dated 25 August 2014" with schedule and cost estimate of remaining upgrade works

Probable new works required

For the Taylor through Blenheim, walls and buildings comprise the "stopbanks" in some locations. Over the last 20 years these have been steadily upgraded and or replaced until this work is now nearing completion. The remaining works are considered to be;

- 100 m of crib wall immediately upstream of the Boathouse Theatre that is proposed to be replaced.

- A section of private building foundation wall immediately upstream of the Alfred Street bridge that we understand the owner intends to strengthen and thereby making it flood proof.

There are still a number of sections of Taylor River stopbank downstream of the Burleigh bridge and upstream of the Hutcheson Street bridge that are located in private land where land purchase/upgrade/relocation works are desirable but have been given are a low priority as flood failure risk is considered low to very low. Some provision has been included in the plan to tackle these sections of stopbank as the opportunities arise to work with the landowner.

1.6 Taylor (Above Doctors Creek Confluence to Farm Park)

Type	: Deep narrow silt bed river
Channel Width	: 30 m
Floodway Width	: 150 m
Slope	: Tidal, flood slope 0.025% (1 in 4000)
Design Flood	: 170 m^3/sec Design Freeboard 0.4 m.

Issue: Bank erosion protection of riparian land

Land development upstream of Doctors Creek confluence is now making any erosion of riparian land less acceptable.

Probable new work required

Increased bank protection work by rock or trees - a modest increase in the capital expenditure budget has been provided to continue construction of new bank protection works or strengthening existing. In addition this will be backed up with an active willow planting programme as part of routine maintenance.

Work will also continue on developing (tidying, levelling, planting, track upgrades) the secured berm area as part of the general development of the Taylor River reserve.

1.7 Taylor Dam

Issue: Dam emergency spillway for Probable Maximum flood

During 2014 a comprehensive safety review of the Taylor Dam was completed. This concluded the review of the flood hydrology and hydraulics of the Taylor dam as well as a comprehensive inspection and review of the construction records.

The key outcomes of the safety review were;

- The emergency spillway is marginally inadequate to pass the minimum 1 in 10,000 year flood event. There are a variety of options to address the problem including minor raising of the dam crest and spillway adjustments.
- The dam requires some upgraded monitoring infrastructure including improved toe seepage manholes, crest survey points and location of the outlet pipe underdrain.
- The main outlet culvert needs some further resealing work to the construction joints.
- Some additional safety fencing at the outlet structure.

Provision has been included in the Rivers budget to complete this work.

Main References

"Design Floods for Taylor Dam Marlborough" NIWA Client Report CHC00/788 July 2001.

"Taylor Dam PMF" Opus International Consultants 2004.

"Taylor Dam Spillway Review" Damwatch Services March 2007.

"Taylor Dam Comprehensive Safety Review 2013", Tonkin & Taylor report.

1.8 Upper Ōpaoa and Rose's Overflow

Channel characteristics (typical)

(Channel blocks were put across the Ōpaoa Loop in 1967 to separate the upper from the lower Ōpaoa. The upper Ōpaoa and Roses Overflow is really a single, albeit artificial river channel).

Type	:	Artificial watercourse on Wairau floodplain
Length	:	16 km
Channel Width	:	10 m
Floodway Width	:	200 m
Slope	:	0.06% (1:600), varying from 0.1% (1:1000) at Roses Overflow to 0.25% (1:400) at Omaka Confluence
Design Flood	:	600 m^3/sec up to Fairhall Confluence, 400 m^3/sec above Confluence
Design Freeboard	:	0.4 m on right bank up to Fairhall Diversion 0.3 m for left bank above Fairhall Diversion.

Issue: Waterway capacity

Historically the upper Ōpaoa carried flood flows of over 1000 m³/sec from the Wairau and was typically several hundred metres wide. Over the last 30 years the stopbanks have been reconstructed so as to narrow the floodway to only carry the design flood of the Omaka and Fairhall tributaries. The waterway is unusual in that a narrow main channel carries typically only 20% of the design flood and the majority is carried on the wide floodway berms. This is a legacy of the artificial nature of the watercourse in that the flood flows are much less now than the flood flows that laid down the original channel. Current flood flows are unable to erode out a bigger cleared channel.

It is therefore particularly important that the floodway berms are kept in as a hydraulically efficient waterway. For optimum conditions the floodway would be in grass with a minimum of trees, bushes or scrub.

The hydraulic calculations of waterway capacity to carry the design flows assume reasonably good hydraulic conditions on the berms. Berm conditions are good for much of the floodway. Council recently purchased a further 6 ha of floodway opposite Waipuna Street to continue improvements to the floodway flow capacity.

Main Reference

"Roses Overflow/Upper Ōpaoa Hydraulic Review. Council Internal Report K J Christensen June 2004.

New works required

Further tree removal downstream of the Grove Road (State Highway 1) Bridge.

Possible new works

Further land purchase as opportunities arise. Not all the land is in Council ownership yet, and it is desirable that it should.

1.9 Fairhall River (to New Renwick Road) and Omaka River (Upper Ōpaoa Confluence to Hawkesbury Road Bridge

Type	:	Braided gravel river
Length	:	4.8 km braided gravel river
Slope	:	.8% (1 in 130)
Fairway Width	:	50 m
Floodway Width	:	150 m
Design Flood	:	400 m³/sec Design Freeboard 0.4 m.

Issue: Fairhall floodway maintenance

The Fairhall has a nearly 2 kilometre diversion from its former, pre 1930 channel. The 150 flood of 210 m³/sec, even though the floodway is very flat graded. Down each side of the floodway is a single row of ageing Lombardy poplars that need to be removed and the stump holes repaired to maintain the integrity of the stopbank. This work is underway.

Periodic excavation of gravel from the central channel is also required to maintain a low flow channel and clear the stormwater outfall from the airport.

Between the top of its diversion and New Renwick Road the Fairhall divides into its tributary Mill Stream and the mainstream Fairhall. Neither of these are stopbanked, but both are quite entrenched rivers. Both channels just coped with the July 2008 flood event, which was an approx 1 in 20 year return period event hence. In the current partly vegetated state the channels are probably not up to full design standard, and need enlargement.

Main Reference

"Southern Valleys, Blenheim and Picton Flood 31 July 2008" Report to Council E B Williman August 2008.

Probable new works required

Tree clearing of Fairhall and Mill Stream is the practical solution to improve the capacity of those streams.

Issue: Omaka River stopbank protection works

The Omaka River is stopbanked along the majority of the reach from the Hawkesbury Road Bridge down to the Upper Ōpaoa River confluence. The river slope is relatively steep meaning high velocity flood flows during major events. This river requires either strong (heavy rock) edge works where there is only room for a narrow berm to the adjacent stopbank or a strengthened willow buffer zone where there is more room.

The Omaka River floods of 2011 and 2014 damaged the aging existing works and significant renewal/upgrade of the protection works is proposed during the term of this plan.

1.10 Ōpaoa Loop

The Ōpaoa Loop is a 2.5 km reach of river that formerly joined the Upper Ōpaoa and Lower Ōpaoa rivers, and carried large flood flows. The flat graded reach was not significantly stopbanked and considerable flooding occurred of adjacent urban land in the May 1966 flood event. The loop was subsequently blocked at both the upstream and downstream end in 1967. Gated 1.8 m culverts at both ends allow for low flows to be diverted through it.

The Ōpaoa Loop now has a much lesser flood role in dealing with stormwater from urban Blenheim.

However, being an urban river, the aesthetics and other environmental aspects of this channel are very important. There is also significant potential recreational use.

There is some build-up of sediment immediately downstream of the upstream control gates. Both the upstream and downstream control gates are also due for a mid-life overhaul.

Probable new works required

Refurbishment of control gates.

Ongoing bed level monitoring.

1.11 Riverlands Floodway

Type	:	Straight artificial channel for drainage and floodwater from Wither Hills Streams
Slope	:	Tidal 0.025% (1 in 4000)
Length	:	7 km plus 1.7 km of channel within Waikārapi Lagoon (Vernon Lagoon)
Design Flood	:	up to 26 m^3/sec Design Freeboard 0.2 m.

The Wither Hills streams include Mapps, Dry Hills, Fifteen Valley, Sixteen Valley, Sutherlands and Wither. These latter two flow through and also receive stormwater from 'Blenheim' urban areas.

Issue: Sedimentation

The location of this flat graded channel at the base of the erosion prone Wither Hills is likely to result in sedimentation of the channel with reduction in waterway capacity. For this reason a low

level floodway berm is required to enable future machine access to excavate out such deposits. This low level berm also increases the flood capacity of the floodway. Currently the low level berm is not continuous along the floodway.

Issue: Inadequate waterway capacity

Stopbanking exists on both sides of the Riverlands floodway for a distance of 3.5 km below Blenheim to where higher ground levels are intercepted, and for the left bank for the full length to the Waikārapi Lagoon (Vernon Lagoon).

Main Reference

"Riverlands Floodway Hydraulic Review" Council Internal Report K J Christensen May 2002.

New works required

On the right bank from Cob Cottage to upstream end of the new Wine Business Park subdivision the required new stopbank is required to be built in association with excavating a low level berm.

On the left bank a new stopbank is required from Cob Cottage Road downstream to the Railway embankment then downstream of the main Riverlands industrial area to raise some isolated low points down to Cloudy Bay Drive. It is proposed to acquire a strip of land known as the "pan handle" adjacent to the Pernod Ricard winery to help facilitate this section of left bank upgrade.

1.12 Wither Hills Streams

These are tributary streams of the Riverlands floodway that flow off the Wither Hills.

- Sutherland stream was controlled and diverted to flow into the Riverlands Co-op floodway with a major upgrade in 1986.

- Wither Stream flows through the most urban developed area. Flood design standards are now needed to be higher than when the Stream channel was initially enlarged by channel excavation in the 1960s when the land was mainly undeveloped. Ironically the intrusion of the urban development reduced the waterway capacity of the channel and inhibited its economic maintenance.

Following a report from Davidson Ayson (1991) the Council decided to improve the waterway capacity by construction of a detention dam at Harling Park, and reconstructing the Wither Hills as an open concrete channel.

- Rifle Range Creek was upgraded following the 1980 flood on the area, and again in 2002 following a review.

- Mapps Stream and Dungeys Gully Stream were upgraded as part of an overall rural residential development in 2000.

New works

No new works are envisaged in the immediate future.

1.13 Doctors Creek

A previously proposed Doctors Creek diversion was previously proposed to assist in reducing the flood risk from the Taylor River through Blenheim

McNabb (1993) showed that farming practices have adapted to the extensive ponding in the Battys Road/Bells Road area on the occasions of Doctors Creek flooding, and that relatively little expenditure is justified for agricultural benefit.

Currently the land on which ponding takes place is not zoned as floodway. The expected area of land over which ponding would occur in a one in 100 year flood event is approximately 300 hectares.

Channel enlargement, road bridge enlargement and banking are options are to reduce the ponding area and so benefit rural residential lifestyle land use near Blenheim. More detailed investigation would be required to do this. However no major upgrade is proposed for the foreseeable future.

Proposed further improvement works

Minor floodway enlargement and berm lowering just upstream of the Taylor River confluence to improve hydraulic efficiency at this point.

1.14 Lower Tuamarina River

The lower Tuamarina River from downstream of the Railway Line is part of a stopbanked floodway designed to cope with either a 1% AEP event in the Wairau River (typically during a large Wairau flood event Wairau water will flow back upstream into the Para Swamp) or a 1% AEP event in the Tuamarina River or a lessor combination of both.

The Tuamarina River is continuously stopbanked on at least one side from the confluence with Waterfall Creek down to the Wairau River confluence

Issue: Bank erosion damage on the true left bank over the lower 750 m of the channel

Over a number of years willow and other tree growth had partially blocked the lower section of channel and just as concerning hid some gradual erosion damage that was reducing the berm width at the base of the adjacent stopbank. This section of stopbank is really a Wairau River stopbank and must be maintained in very good condition to ensure its security in a large flood event.

The Tuamarina flood event of June 2014 was unusual in that it had a large flow from the Tuamarina Valley but Wairau River levels were close to normal winter flows. As a results a strong downstream flood occurred which ripped out many of the overhanging willows, severely damaged the existing mouth control groyne and exacerbated the pre-existing left bank erosion over three left bank locations.

Works are planned to repair the flood damage including;

- Removal of remaining willows and fallen trees – completed.
- Reconstruction of the left bank berm over the three identified erosion reaches and rocking to permanently protect.
- Reconstruction of the right bank mouth control groyne at the Wairau.
- Replanting of the true right bank with appropriate species.

Funding has been included in the capital programme for this work.

Issue: Check of stopbank height and condition upstream of the Kaituna-Tuamarina Track Bridge.

There is some concern that some sections of this bank may be under height during a 1% AEP flood event in the Wairau River.

It is proposed to detail survey the bank (crest level and condition) and undertake any minor improvements to ensure the bank meets Level of Service requirements.

2. Wairau Tributaries outside the Floodplain

2.1 Description of Issue

Activities on the Wairau tributaries have little effect on the main Wairau Floodplain and are of different communities of interest. A considerable amount of work was done on these tributaries in the 1960 to 1992 period when government subsidies were available. The Wairau River above the Waihopai Confluence is considered to be a tributary in this context.

The works consisted of rock lined training banks, channel cleaning, tree planting, minor stopbanking, and minor diversions. The work on these tributaries was complicated by being poorly defined as what work is to be done to achieve what standard of river control.

With the government subsidy, the expenditure was also considerably in excess of rating money from the areas, and often of doubtful economic value.

Much of the specific works were done to benefit individuals only – and not a community scheme.

Under the Wairau River Floodways Management Plan (1994) Council decided to discontinue maintenance of the stopbanks, rock lined training banks, tree planting, groynes, other rock work and other constructed river control assets.

However channel clearing of tree and weed growth or stranded tree debris is relatively cheap and having benefit to ratepayers over extensive lengths of each tributary. Even on a low budget therefore, it is feasible to devise a programme of works that is to the benefit to the community of interest, and predominantly paid for by this community. Under the Wairau River Floodways Management Plan (1994) Council therefore decided to continue to maintain keeping the channels of these tributaries clear.

Council therefore does not have any constructed assets within these channels.

Council policies are therefore:

(i) To carry out channel clearing work (including flood damage repair works) with the intention of maintaining clear stable channels as far as practical and economic.

(ii) To use the annual rate intake from the relevant tributary benefitting areas as a guide to the scale of activity to be carried out.

(iii) Where the affected landowners, desire more extensive river works then jointly funded works may be carried out with Council contribution of up to 50%.

Where the tributaries are large braided rivers there is some difficulty in defining what the sensible width of the river channel. The following have been adopted

Wairau above Waihopai to Wye Confluence

A generally 600 metre wide fairway to a defined location.

Waihopai (for 6 km above SH 63)

A 150 metre wide fairway.

Fairhall (above New Renwick Road)

A 30 metre wide fairway channel.

Omaka (above Hawkesbury Road Bridge)

In places the current fairway remains too narrow despite widening by erosion during a number of flood events since 2008. In addition in places no edge buffer zone exists due to either flood damage or over encroachment by grape development.

A 50 metre wide fairway is desirable. It is to be noted that historic river control works together with natural tree growth have narrowed the accepted river channel to less than 25 metres in many places – a width that is inadequate to carry large flood flows.

Most adjacent vineyard owners have now recognised that it is in their interest to leave an adequate fairway to provide for flood capacity and to undertake edge protection works typically some combination of rock and willow planting to provide a good buffer between the active channel and productive vineyard. Accordingly since floods of 2011 and 2012 Council has assisted about 6 to 8 properties with the design and construction of new works, with the works to be "owned" by the landowner paying.

Council will continue to undertake the channel clearing, flood debris removal role and has made some contribution to the new protection works

It would be technically possible to stopbank the low lying sections of land adjacent to the upper Omaka. A minimum design would be a 50 m width cleared fairway, flanked by a buffer of 15 m of willow plantings on each side to provide bank protection. The total floodway width would be 100 metres, and would require some existing grape plantings to be ripped out. There is no current interest in this next level of protection works upgrade.

Further new works

The probable course of action is development of a 50 metre wide channel over time by the removal of trees in the channel and managed gravel extraction. This should really be considered as overdue maintenance work on the channel. Further landowner initiated works as required.

Tuamarina River (Railway to Lindens Road and including Koromiko tributary)

Large flood events occurred in the Tuamarina River in April and June of 2014. The flood events confirmed the need for an active channel clearing programme in the Tuamarina River backed up by assistance to landowners with bank protection works as required. Overland flows during these flood events were extensive and scoured out a flood underpass bridge in Speeds road. A new development adjacent to Sounds Airs Koromiko airstrip will require an active inspection and clearing programme to keep the properties closest to the river safe.

Good progress has however been made over the last two or three years to reduce the overgrowth of crack willow and remove obvious blockages. A large one had been located the top end of the Para Swamp and required heavy machinery to clear. Similarly an emergency channel clearing done in the about 4 km of the lower Koromiko tributary paid benefits in the subsequent June event.

Similarly the Rivers Section now has a management understanding for the maintenance of the central channel through the Para Swamp that will maintain some flood capacity without compromising swamp restoration objectives.

Need for new works

Nothing proposed but continuance of the active channel clearing programme and regular contact with adjacent landowners.

References

"Tuamarina and the Para Swamp" report to Assets & Services Committee by Brin Williman, July 2005

"Para Wetland Restoration and Development Plan" prepared by Nelson/Marlborough Fish and Game and the New Zealand Game Bird Habitat Trust, April 2012.

3. Wither Hills Soil Conservation

The valuable and important soil conservation works on the Wither Hills need to be to be maintained by ensuring that there is good grass and tree vegetation and other soil conservation works. Much of the trees and grass were destroyed by fire of December 2000. The grass vegetation was re-established in 2001/2 together with check dams in the main streams. Further tree planting and earthworks are required.

A Wither Hills Farm Management Plan has been approved by Council which clearly sets out sets out the dual objectives of soil conservation and public recreation for the land.

The lease for grazing of the farm park was recently renewed with a lessee very much on board with the manner in which the land can be farmed.

In 2013 the required work programme and budgets were reviewed to ensure that an appropriate work programme with adequate resourcing was in place to achieve soil conservation objectives. The review was driven by a combination of the Taylor Road housing development altering where the key farm facilities (wool shed, stock yards) were located, a recognition that some of the faces vulnerable to tunnel gully erosion needed reworking and a desire to speed up some retirement gully planting.

The enhanced work programme was adopted as part of the 2014/15 annual plan, and has been incorporated into the 2015-25 budget numbers.

Work is well underway including the design of the Redwood Street woolshed upgrade and tunnel gully contour ripping completed above Rifle Range Creek.

Main references:

"Wither Hills Catchment Control Scheme – scheme review 1980" Marlborough Catchment Board report R MacArthur.

'Wither Hills Erosion Management – Re-establishing Cover for Erosion Management following the December 2000 Fire. Report to Council PALMS Ltd, July 2001.

"Wither Hills Farm Park Management Plan". A Council adopted report September 2003.

"Wither Hills - Blenheim's playground", Power point presentation June 2013.

4. Land Drainage

4.1 Lower Wairau Channel Network

Provision of adequate drainage channels and the maintenance of natural watercourses and drains for flood drainage mitigation purposes has been a priority for the lower Wairau floodplain for many years. The present drainage area is best described as an area of some 8,000 hectares generally to the east bisected by the main river systems and drained by 150 kilometres of Council maintained scheduled watercourses and drains. Council also maintains 25 rural flood protection and drainage pumping stations and 249 floodgated gravity outlets to the main river systems.

Main Reference

"Wairau Drainage Management Plan" A report of Council. R M Fitzgerald Nov 1996.

4.1.1 *Pumped Drainage*

These are areas which are dependent on the pumping stations especially during times of river floods.

Without the provision of pumping facilities these areas would be virtually unproductive and subject to extensive flooding for periods of the year. The flooding potential of these areas has been increased by the continued development of the drainage channel network and the introduction of 'foreign' stormwater to the pumping catchments from adjacent areas. Areas: 1, 2, 3, 4, 5, 6, 8, 9a. See Figure 16 Lower Wairau Drainage Catchments

4.1.2 *Pump Assisted*

These areas are assisted by pumping operations when high river levels close gravity outfalls. Gravity drainage is usually available for significant periods of the year. Areas: 7, 9b, 10, 11, 12, 13, 14, 15a and b.

4.1.3 *Gravity Drainage*

These are areas that rely totally on gravity drainage. This backing up of storm run-off is usually of short duration and significant flooding only occurs in localised areas. Some of the drainage areas do not discharge to river outfalls but instead discharge unimpeded to lower-lying drainage areas or via control structures which regulate overflows. Areas: 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26.

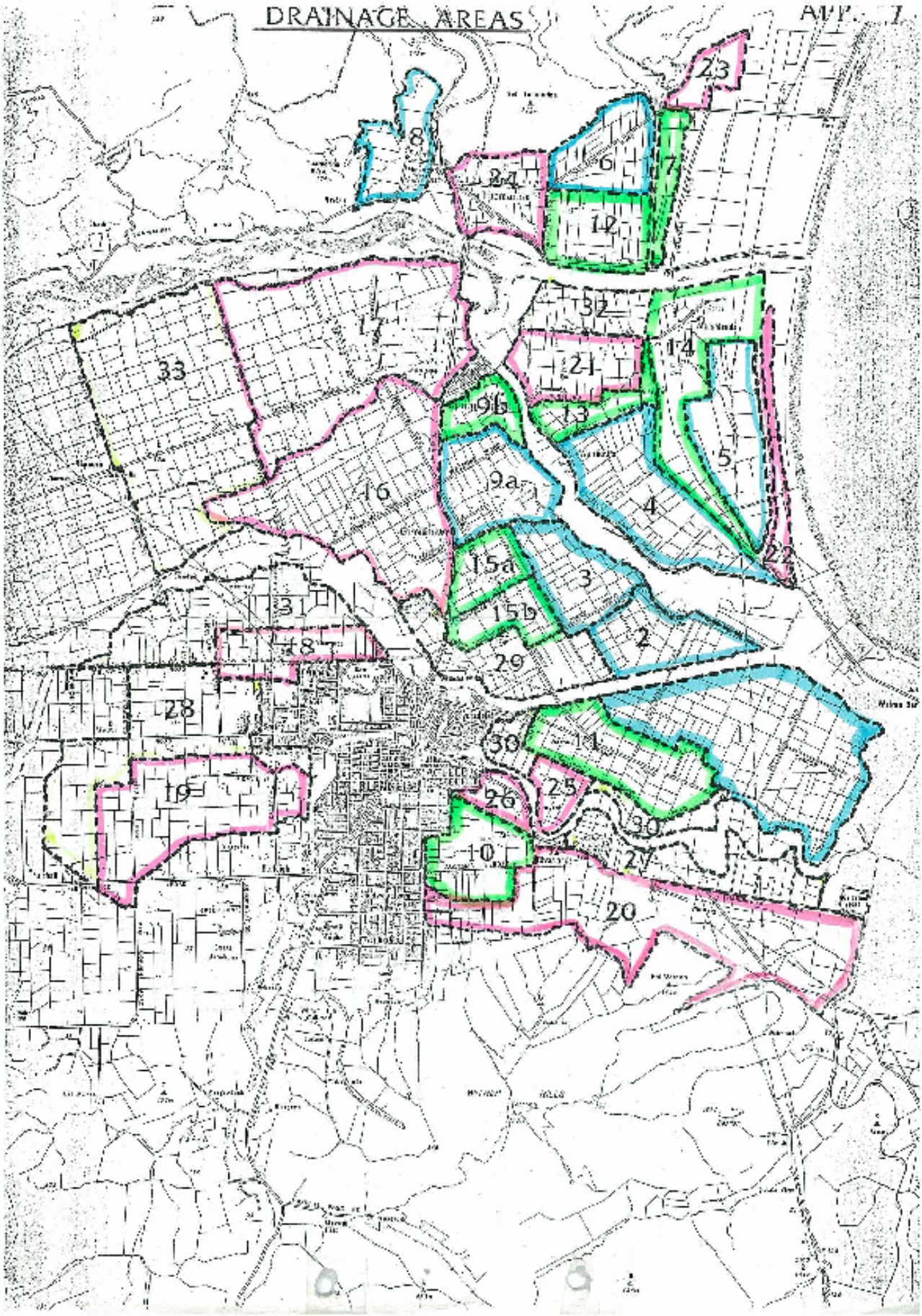
4.1.4 *Contributing Drainage Catchments*

These areas adjoin the above three types of area in various locations and contribute "foreign" water into the systems. These catchment areas in effect receive betterment from the downstream drainage infrastructure. Areas: 27, 28, 29, 30, 31, 32, 33.

4.1.5 *Waikārapi Lagoon (Vernon Lagoon) Area*

A total of 4.5 kilometres of drainage channel are outside the formal stopbanking systems and require periodic maintenance which primarily comprises machine excavation of sediments. This is necessary to provide for tidal inflow/outflow to optimise drainage levels and also provides for adequate flood channel capacity to convey sediments in times of high Wither Hills run-off.

It has been observed that channel maintenance works enhance tidal flows and help provide a dynamic and healthy environment within the area to the west of Chandlers Lagoon and the Upper Lagoon.


DRAINAGE AREAS
APP. 1
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4.1.6 Schedule of Lower Wairau Watercourses maintained for Land Drainage purposes

The below table is a summary of watercourse and drain classification and ecological management categories, with abbreviations as follows.

Outlet type: G – Gravity; PA – Pump assisted; P – Pumped.

Flow regime: PF – Permanently flowing, UD – Usually dry.

Grade: Moderate – slope usually steeper than 0.2%; Flat – slope usually between 0.2% and 0.05%; Very Flat – slope usually less than 0.05%

Management Category

Category A High ecological values or revegetation/habitat and fish spawning values. High public expectation as to environmental outcomes integrated with specific drainage and flood control requirements.

Management plans required with enhancement programmes, operational constraints and hydraulic outcomes specified.

Category B Specific ecological values identified. Maintenance operations to be carried out in accordance with Resource Consent conditions and site specific standards maintained as defined by a general "Code of Practice". Performance standards may be able to be specified but subject to seasonal variations.

Category C. No ecological/habitat values that warrant special maintenance techniques. Operations in accordance with consent conditions to meet drainage/flood protection/ structural requirements. Programmed maintenance regime. Some advance scheduling of maintenance activities possible with delegation to contractors for meeting performance standards.

Category D High public expectation for attainment of drainage/flood protection values and avoidance of economic losses. Impractical and uneconomic to provide for other values. Drainage maintenance undertaken on an as determined/needed basis to maintain a high order of flood control and drainage efficiency subject only to resource consent conditions.. May be performance based with avoidance of flood loss critical factor.

Watercourse and Drain Classification for Weed Management

Waterway	Length (m)	Drain Size	Catchment Draining to	Outlet Type	Flow Regime	Grade	Management Category
Bells Road No 1	483	medium	Doctors	G	PF	moderate	C
Bells Road No 2	240	medium	Doctors	G	PF	moderate	C
Camerons Creek	1045	medium	Doctors	G	PF	flat	B
David Street	60	medium	Doctors	G	PF	flat	B
Doctors Creek	3825	large	Doctors	G	PF	flat	B
Douglas No 2	240	medium	Doctors	G	PF	moderate	B
Fairhall Co-op	2255	large	Doctors	G	PF	flat	B
Fairhall School Creek	845	medium	Doctors	G	PF&UD	moderate	B
Golf Course Creek	1610	medium	Doctors	G	PF	moderate	B
Morrisons	485	small	Doctors	G	PF	moderate	C
Old Fairhall Creek	4325	large	Doctors	G	PF	moderate	B
Osgoods	200	medium	Doctors	G	E	flat	B

Watercourse and Drain Classification for Weed Management							
Waterway	**Length (m)**	**Drain Size**	**Catchment Draining to**	**Outlet Type**	**Flow Regime**	**Grade**	**Management Category**
Yelverton	845	medium	Doctors	G	E	flat	B
Dr C	1005	medium	Grovetown	PA	PF	flat	C
Dr H	720	medium	Grovetown	P	PF	flat	C
Awarua Park	195	medium	Grovetown	G	E	moderate	C
Awarua Park West	160	medium	Grovetown	G	PF	moderate	C
Dr A	1086	large	Grovetown	P	PF	very flat	A
Dr B	241	large	Grovetown	P	PF	very flat	A
Dr C1	160	small	Grovetown	PA	UD	flat	C
Dr D	1410	medium	Grovetown	PA	PF	flat	C
Dr D 2	442	small	Grovetown	PA	E	flat	C
Dr D1	160	small	Grovetown	PA	UD	flat	C
Dr F	1370	medium	Grovetown	PA	E	moderate	C
Dr G	820	medium	Grovetown	PA	E	moderate	C
Dr H 2	400	small	Grovetown	PA	E	flat	C
Dr H1	725	medium	Grovetown	PA	E	flat	C
Dr I	845	medium	Grovetown	PA	E	flat	C
Dr J	600	medium	Grovetown	PA	PF	flat	C
Dr K	725	medium	Grovetown	PA	PF	flat	C
Dr M	1045	medium	Grovetown	PA	PF	flat	C
Dr N	3440	large	Grovetown	G, P	PF	moderate	C
Dr N 1	400	small	Grovetown	G	PF	moderate	C
Dr N2	700	medium	Grovetown	PA	UD	moderate	C
Dr O	5150	medium	Grovetown	P, G	PF	moderate	B
Dr O1	200	medium	Grovetown	G	E	mm	C
Dr P	240	small	Grovetown	G	PF	flat	C
Dr Q	744	medium	Grovetown	G	PF	moderate	C
Dr R	1210	medium	Grovetown	G,P	PF	flat	C
Dr S	605	small	Grovetown	PA	E	flat	C
Dr V	565	small	Grovetown	PA	UD	flat	C
Dr W	360	small	Grovetown	G	E	flat	C
Dr X	645	medium	Grovetown	P	PF	flat	C
Dr Y	725	medium	Grovetown	P	PF	flat	C
Dr Z	505	small	Grovetown	P	PF	flat	C
Dr W extn		small	Grovetown	G	UD	flat	C
Grovetown Lagoon	2,230	large	Grovetown	PA	PF	very flat	A
Kennedys	1770	medium	Grovetown	PA	PF	flat	C
Kennedys Overflow	284	medium	Grovetown	PA	PF	flat	D
Murrays Road between Dr R & Q		small	Grovetown	G	UD	flat	C
Murrays Road E	800	small	Grovetown	G	UD	moderate	C
Murrays Road W	820	medium	Grovetown	G	PF	moderate	C
Sadds	1408	large	Grovetown	P	PF	very flat	C

Watercourse and Drain Classification for Weed Management							
Waterway	**Length (m)**	**Drain Size**	**Catchment Draining to**	**Outlet Type**	**Flow Regime**	**Grade**	**Management Category**
Staces	360	medium	Grovetown	G	PF	flat	C
Wallaces	1165	medium	Grovetown	PA	PF	flat	C
Blind Creek 0-1450	1450	large	Pembers			flat	A
Blind Creek 450-4325	3875	large	Pembers	P	PF	flat	B
Blind Road	705	small	Pembers	G	UD	flat	C
Bruces	400	medium	Pembers	PA	PF	very flat	C
Dooles	520	small	Pembers	G	E	flat	C
DR Evans	805	small	Pembers	PA	UD	flat	C
Gundys	563	medium	Pembers	PA	UD	flat	C
Hill	400	small	Pembers	P	PF	very flat	C
Hunters Road	1370	medium	Pembers	PA	PF	flat	A
Pembers Road	1530	large	Pembers	P	PF	very flat	D
Peters	121	small	Pembers	PA	UD	very flat	C
Pickerings	1045	small	Pembers	P	PF	very flat	C
Pukaka Pondage	724	large	Pembers	P	PF	very flat	C
Pukaka Stream	2655	large	Pembers	G	PF	very flat	A
Quarry Drain	665	medium	Pembers	G	PF	very flat	C
Rarangi Road (Nth)	500	medium	Pembers	G	E	flat	C
SH No 1	700	small	Pembers	G	UD	flat	C
Thomas Road	1850	large	Pembers	P	PF	very flat	D
Township Drain	845	medium	Pembers	G	E	flat	D
Bowns Creek - 0-400	400		Spring Creek Tribs			moderate	A
Bowns Creek 400 - 905	505	large	Spring Creek Tribs	G	PF	moderate	B
Cravens Creek 0-800	800		Spring Creek Tribs			moderate	A
Cravens Creek 800-1372	570	large	Spring Creek Tribs	G	PF	moderate	B
Dentons Creek	1170	large	Spring Creek Tribs	G	PF	moderate	B
Dowlings Creek	2820	large	Spring Creek Tribs	G	PF	moderate	
Footes	905	medium	Spring Creek Tribs	G	PF	flat	B
Ganes Creek	1085	medium	Spring Creek Tribs	G	PF	moderate	B
Giffords Creek	2715	medium	Spring Creek Tribs	G	PF &E	moderate	B
Halls Creek	520	large	Spring Creek Tribs	G	PF	moderate	B
Hollis Creek	1448	medium	Spring Creek Tribs	G	PF	moderate	B
Marris Creek	1900		Spring Creek Tribs	G	PF	slope	B
Rapuara Rd	565	small	Spring Creek Tribs	G	E	moderate	C
Roses Creek	3660	medium	Spring Creek Tribs	G	PF	moderate	B
Spring Creek Res east	240	small	Spring Creek Tribs	G	PF	flat	B
Spring Creek Res West	250	medium	Spring Creek Tribs	G	PF	flat	B
Spring Creek	10,665	large	Spring Creek Tribs	G	PF	flat	A
Whites	1220	medium	Spring Creek Tribs	G	UD	flat	C
Bays	600		Swamp Road				
Eyles	820	medium	Swamp Road	P	E	very flat	C

Watercourse and Drain Classification for Weed Management							
Waterway	**Length (m)**	**Drain Size**	**Catchment Draining to**	**Outlet Type**	**Flow Regime**	**Grade**	**Management Category**
Frosts	2112	medium	Swamp Road	P	PF	very flat	C
Jeffries	1930	large	Swamp Road	P	PF	very flat	C
Swamp Rd	2515	large	Swamp Road	P	PF	very flat	C
Upper Dillons 1	400	small	Swamp Road	PA	UD	flat	C
Upper Dillons 2	820	medium	Swamp Road	PA	UD	flat	C
Barnetts Ck	845	small	Tuamarina	P	E	moderate	C
Cow CK	966	large	Tuamarina	G	PF	moderate	C
Hastilows Ck	2115	large	Tuamarina	P	PF	flat	B
Parkes Bros	1207	large	Tuamarina	P	PF	flat	C
Tuamarina Lagoon	262	large	Tuamarina	P	PF	flat	A
Wakefield St	850	small	Tuamarina	PA	UD	flat	C
Waterfall Ck	1400	large	Tuamarina	G	PF	flat	C
Chaytors Pump	200	large	Wairau Pa	P	PF	very flat	D
Connollys Rd	420	small	Wairau Pa	PA	E	very flat	C
Corrys Outlet	100	large	Wairau Pa	G	PF	very flat	A
Cresswells	400	small	Wairau Pa	G	UD	very flat	C
Dicks Drain	1170	medium	Wairau Pa	P	PF	very flat	C
Dunkinsons Ck	2010	large	Wairau Pa	G	PF	flat	B
Marukoko 0-1250	1250	large	Wairau Pa			very flat	B
Marukoko 250-3015	2765	large	Wairau Pa	PA	PF	very flat	C
Outlet Drain	220	large	Wairau Pa	P	PF	very flat	A
Pa Drain	605	small	Wairau Pa	P	PF	very flat	C
Pipitea Ck	1610	medium	Wairau Pa	G	PF	very flat	A
Pukaka	1951	large	Wairau Pa	PA	PF	very flat	A
Rarangi Road	483	medium	Wairau Pa	C	UD	flat	C
Roberts Drain	1460	large	Wairau Pa	P	PF	very flat	A
Smith & Dicks	705	medium	Wairau Pa	G	PF	very flat	C
Wells Drain	1045	medium	Wairau Pa	G	PF	flat	B
Aireys	485	medium	Woolley & Jones	PA	E	very flat	C
Aubrey's	483	medium	Woolley & Jones	G	UD	very flat	C
Glovers	724	medium	Woolley & Jones	G	UD	very flat	C
Jones Rd	724	small	Woolley & Jones	G	UD	very flat	C
Lower Wairau 0-362	362		Woolley & Jones				A
Lower Wairau 362-2815	2453	large	Woolley & Jones	P	PF	very flat	C
Lower Wairau Pump	320	large	Woolley & Jones	G	PF	very flat	D
Sutherlands	485	small	Woolley & Jones	G	UD	very flat	C
Woolley & Jones 0-200	200	large	Woolley & Jones				B
Woolley & Jones 200-2412	2212	large	Woolley & Jones	P	PF	very flat	D
Harvey Rices	2736	large	Riverlands	G	PF	very flat	A
Hocquards	705	medium	Riverlands	G	UD	very flat	C

4.1.7 Proposed extension of drainage network

The current drainage network is currently under review to reflect land use changes, subdivision and general land use intensification and need to rationalise maintenance responsibility for some existing drains (including roadside and some private drains) that are not part of the formal network but are integral to an equitable level of service being provided. The current network was last formally reviewed as part of preparation of the 1960 Wairau Scheme proposal.

A network extension proposal has been prepared and is out with benefitting and affected landowners for comment. Briefly the proposed network changes can be summarised as follows;

- An additional 13 km of drain to be added to the network which is a 4% increase on the currently managed network.
- Of the 13 km of drain to be added 4.5 km is existing roadside drain, 9.5 km is existing privately maintained drains and 1.3 km of new drain is proposed.
- The intention is to provide drainage outfall to all (or nearly all) properties greater than 1 Ha within the defined drainage areas. Therefore nearly all landowners will have direct access to a Council maintained drain and will not have to rely on a downstream neighbour maintaining their drain.
- The estimated capital cost to bring the new drains up to standard and improve some existing drains is $300,000. Maintenance costs are forecast to increase approximately in proportion to the additional length of drain to be maintained.

Provision for both the capital implementation and additional maintenance costs have been included in the draft Rivers budget from 2015/16. The capital works are proposed to be spread over three years. The new network is proposed to be adopted in May 2015 following receipt of landowner comments and consideration of any appropriate changes to the new network.

Proposed new works

New drains, new culverts, drain bank stabilisation work, riparian ecological plantings.

Reference

"Wairau Lower Floodplain Land Drainage – Network Review", report to the Assets & Services Committee, November 2014.

4.1.8 Council access for maintenance

The majority of watercourses and channels managed for public drainage purposes are on private land and only a third is on Council reserve or road reserve. With the increased value of land, a change of land use type, and a changing public attitude it has become more contentious for council to expect free access maintenance, particularly within the immediate vicinity of Blenheim.

In more built up areas itis therefore desirable to acquire more robust riparian access arrangements by:

- Local Purpose Reserves (Drainage) to be created where access is necessary, or
- Entry easements or right of ways be created as appropriate, or
- Land acquisition be undertaken where required by property owners.

This access formalisation process is undertaken only when necessary and usually trigged by either capital works upgrades by Council, or land subdivision or development by the landowner. An annual land purchase budget of $200,000 per year is provided to undertake these acquisitions as required.

4.2 Flood control pumping stations: Rural Area

4.2.1 Probable new works - general

The rural pumping stations were upgraded under the 1996 Wairau Drainage plan to achieve a revised level of service. No further significant capacity increase is suggested at present. However there is a need to install telemetry equipment at most of these rural pumping station sites, and install telemetry control equipment at selected control gate sites.

Details for individual stations are as follows.

4.2.2 Lower Wairau

Constructed in 1957 to serve an area of 212 hectares and is equipped with a single PPF 12/14 pump. Later a dual speed motor was fitted to provide a maximum pumped rate of 18,000 litres per minute and more recently a PPF 9/10 pump with a multi-speed motor for low speed operations with subsequent low drainage channel velocities and low water levels being obtainable if necessary.

Data

Main PPF 12/14 discharge	18,000 l/min
Multi-speed PPF 9/10 discharge	12,250 l/min
Combined total discharge	30,250 l/min
Drainage capability	14 mm/24 hrs
Pumping control range	300 mm - 600 mm above MSL

4.2.3 Pembers Road

Constructed in 1957 to serve a drainage area of 203 hectares with an additional catchment of 165 hectares of hill country. Equipped with two PPF 12/14 pumps.

Pump capacity was increased 40% in 1971 in conjunction with the Thomas Road pumping station construction. Pump capacity was further modified in 1984 by the fitting of a dual speed motor to one pump.

Data

1971 upgraded discharge	31,800 l/min
1971 upgraded drainage capability	12.70 mm/24 hrs
Pumping control range	400 mm to 1200 mm above MSL

4.2.4 Dillons Point

Constructed in 1959 to serve an area of 695 hectares this station is equipped with three PPF 12/14 pumps giving a maximum discharge of 38,500 litres per minute, and a drainage capability of 8.20 millimetres per 24 hours. More recently a PPF 9/10 pump replaced one of the 12/14 pumps and dual speed motors installed.

Data

Total discharge 2 x PPF 12/14 pumps	36,000 l/min
1 x PPF 9/10 pump	12,000 l/min
Proposed total discharge	48,000 l/min
Proposed discharge capability	10.25 mm/24 hrs
Pumping control range	00.0 mm to 600 mm above MSL.

4.2.5 Chaytors Drain

Constructed in 1961 to serve an area of some 500 hectares is equipped with twin PPF 12/14 pumps discharging 23,000 litres per minute. Dual-speed motors have more recently been installed.

Data

Discharge	36,000 l/min
Drainage capability	10.5 mm/24 hrs

Problems continue to be experienced with weed and debris blockages and secondary debris screens located 75 metres upstream of the pumphouse are recommended.

4.2.6 Swamp Road

Constructed in 1978, this station differs from normal design in that dual-speed motors are fitted to the two PPF 9/10 pumps to give four rates of discharge as required by operating conditions. More recently re-equipped with twin dual-speed PPF 12/14 pumps is a practical option. The effective catchment is 320 hectares.

Data

Two multi-speed PPF 12/14 pumps discharge	36,000 l/min
Drainage capability	16.2 mm/24 hrs
Pumping control range	350 mm to 600 mm above MSL

No gravity drainage is available at the pumping station site. The total drainage area served comprises three distinct portions. An area to the south of Dillons Point Road is afforded flood protection in that excess flood water can transfer northwards to the pumping catchment. The western portion of the catchment is deliberately limited as to drainage flow rates to avoid inundation of lower land areas adjacent to the pumping installation.

4.2.7 Rouses Drain

Constructed in 1965 to serve an area of 390 hectares and equipped with twin PPF 12/14 pumps. Drainage flows are contributed to by both the surrounding area and Roberts Drain via a control structure. No serious problems are known to exist but pumps are deteriorating due to age with one pump dating from 1936.

Data

Existing pumped discharge	24,000 l/min
Existing drainage capability	8.9 mm/24 hrs
Pumping control range	minus 300 mm to 300 mm above MSL

Addendum

This pumping station serves a very low lying area of land and drainage inflows from the Roberts Drain area to the north are controlled by a weir structure. Drainage water levels are approximately 400 mm higher within the Roberts Drain system due to major spring inflows with the Marukoko system at the lower level with little flow gradient. This level control must be maintained for optimum drainage and to assist in reducing spring inflow rates.

This structure is of a ‘stop-log’ type and should be modified to an adjustable gate activated by rack and pinion drive. The continuation of the flow control structure operation is recommended to provide for optimum drainage.

4.2.8 Roberts Drain

Constructed in 1968 to serve an area of 275 hectares and equipped with twin PPF 12/14 and more recently upgraded by fitting of a new PPF 15/18 pump and repowering the remaining PPF 12/14 with a dual-speed motor.

Data

Total discharge (25,000 + 18,000)	43,000 l/min

Drainage capability	22.52 mm/24 hr
Pumping control range	minus 200 mm to 400 mm above MSL

Addendum

Further lowering of pumping levels is not recommended due to significant spring inflow to the system, and level control provided by the Wairau Bar Road culvert invert levels.

This drainage system is acknowledged as having habitat values (whitebait) and the gravity floodgates have been modified to hinge from the side. Machine maintenance of the outfall drain to the Wairau River is critical to the operation of the drainage system

4.2.9 Tuamarina Lagoon

Constructed in 1970 and equipped with one high capacity PPF 12/14 pump.

The pump station has been modified with larger pump forebay and extended decking slabs (1990) and further structural works are not necessary. Significant lagoon storage is available but pumping rate is low considering the location and hill run-off. More recently fitted with a PPF 15/18 pump.

Data

Pumping capability	25,000 l/min
Drainage capability	22.6 mm/24 hrs
Pumping control range	2.5 metre to 3.5 metre above MSL

4.2.10 Parkes Bros

Constructed in 1970 this station is equipped with a MacEwan 300 millimetre diameter pump installed at 25 degrees to the horizontal as motive power was originally intended to be by diesel motor. More recently modified to incorporate a standard PPF 12/14 axial flow pump.

Data

Pumping capability	17,400 l/min
Drainage capability	22.6 mm/24 hr
Pumping control range	3.0 m to 3.0 m above MSL

4.2.11 Thomas Road

Constructed in 1970 and equipped with twin PPF 15/18 pumps this station serves a drainage area of 192 hectares. The drainage capability obtained from the combined pumping of Pembers and Thomas Road pumps is the highest in the rural area at 260 millimetres in 24 hours for the 460 hectare catchment.

Data

Pumped discharge	59,100 l/min
Drainage capability	260 mm/24 hrs
Pumping control range	700 mm to 1200 mm above MSL

4.2.12 Blind Creek

This structure was built as part of the above Thomas Road scheme and was intended to transfer a pre-determined amount of drainage water to Thomas Road during Wairau River floods.

A new pumping facility has recently been commissioned at this site and the transfer of drainage water to Thomas Road discontinued. A single PPF 15/18 axial flow pump is fitted.

Data

Pumped discharge	25,000 l/min
Pumping capacity	19.3 mm/24 hrs
Pumping control range	800 mm to 1400 mm above MSL

4.2.13 Woolley and Jones

Constructed in 1972 to serve an area of 300 hectares of farmland and is equipped with twin PPF 12/14 pumps fitted with dual speed motors. Staged pumping capability between 9,000 and 36,000 litres per minute and the pumphouse.

Data

Existing pumped discharge (maximum)	36,000 l/min
Existing drainage capability	17.3 mm/24 hrs
Pumping control range	MSL to 400 mm above MSL

4.2.14 Pukaka Pondage

Constructed in 1972 to serve an area of 120 hectares and equipped with a single high capacity PPF 12/14 pump with a maximum discharge of 17,500 litres per minute. More recently upgraded with a PPF 15/18 pump.

Data

Pumping capacity	25,000 l/min
Drainage capability	29.80 mm/24 hrs

No upgrade needed at present.

4.2.15 Grovetown Southern and Northern

The southern pumping station was constructed in 1961 to serve an area of 1,200 hectares. It also includes the small township of Grovetown, but stormwater from this source is a minor component of runoff. This station is the largest operated by the Council and is equipped with twin PPF 18/22 pumps with maximum discharge of 74,000 litres per minute.

The improved drainage efficiencies from regular maintenance and culvert upgradings the run-off is being rapidly transferred to the low lying Grovetown area which has undergone intensive residential development. The Grovetown lagoon provides considerable storage to buffer flood flows. If Grovetown lagoon levels exceed pumping output capability then these floodwaters irreversibly overtop Steam Wharf road and into the Woolley and Jones catchment downstream.

A similar sized northern pumping station has been recently constructed in 2000.

Data

Combined discharge	148,000 1/min
Drainage capability	17.6 mm/24 hrs
Pumping control range	300 mm to 900 mm above MSL

4.2.16 Watsons Road

This pump station was constructed in 1984 to drain a rural catchment of 140 hectares and to provide for the discharge of excess stormwater from the township of Spring Creek. The station is equipped with one PPF 12/14 pump fitted with dual speed motor with a maximum capacity of 18,000 litres per minute.

A PPF 15/18 pump is also installed and has a pumped capacity of 25,000 litres per minute and is only operational if significant storm flows eventuate from Spring Creek.

Data

Existing maximum pumping capacity	43,000 l/min
Existing drainage pumping capacity	18,000 l/min
Existing drainage capability PPF 12/14	18.5 min/24 hrs
Existing overall pumping capability	44.2 mm/24 hrs
Pump control range	N/A

Addendum

An important feature of the system is the provision of storage for run-off water within a "control environment" in the event of a major spillage of contaminants from the industrial area of Spring Creek. Supplementary slide gates and weir controls are recommended for installation to provide for this controlled situation.

4.2.17 Tuamarina (Pioneer Place)

A small submersible Flygt pump was installed in an existing stormwater manhole in 1995 to pump excess storm runoff directly to the river when gravity outfalls were closed by high river levels. These works were undertaken primarily to remove runoff from the State Highway and to reduce surface flooding of residential properties and the Tuamarina Hall.

Electrical starting equipment is mounted at ground level and discharge piping is of steel fabrication and installed over the Tuamarina River stopbank. A debris screen is located within the drainage channel prior to the entry to the manhole and piped floodgated outfall and roadside litter is prevented from entering this outfall system.

Existing pumping capacity	50 litre/sec.
Drainage capability	N/A
Pump Control Range	N/A

4.3 Floodgated Gravity Outlets

A total of 249 floodgated gravity outlets have been installed under river stopbanks and now form an historic and integrated part of the drainage and flood protection network.

A significant number of floodgated culverts exist within the river stopbanking systems on the lower plains. A total of 249 floodgated outlets have been installed to provide flood protection from high river levels for the drainage district.

In summary the floodgated outlets by type are as follows:

Pumping station outlets	25
Fibreglass floodgates	24
Side hung wooden gates	16
Steel "Top Hung" MacEwan type	172
Concrete "Top Hung"	12
Outlet total	249
(Individual floodgate total)	305

An investigation of the methodologies and effectiveness of floodgate mechanisms is warranted with a view to assisting fish passage where possible without compromising flood protection standards.

Detailed analysis is required of methodology and effectiveness of gravity floodgate operation to rivers and comparison between side hung gates, top hung steel, top hung fibreglass for the purposes of whitebait spawning at specific locations.

Proposed new works:

The inventory of floodgates is currently being assessed for condition and appropriates including such factors as condition, appropriateness and security.

Once the gates have all been assessed, and any emergency repairs completed, the gates will be scheduled for renewal and upgrade as required including some of the older concrete headwall structures.

Capital funding has been provided from year 4 of this plan to do this work.

Note: The previous 2008 version of this plan estimated that for safety and effectiveness and ecological reasons some 20 new fibre glass gates, 20 new gabions outlet headwalls, three new side hung floodgates, and five new steel floodgates are desirable and a further five "Penstock" type gates are installed to provide supplementary flood protection at sites where failure of a floodgate is likely to cause substantial flooding.

5. Urban Stormwater Disposal

5.1 Channel Network

5.1.1 Blenheim

The small urban watercourses of Murphys, Fultons, Town Branch, Waterlea, Wither, etc receive stormwater from a piping reticulation network to subsequently discharge through pumping stations or gravity into the main rivers of the Taylor, Ōpaoa, and Riverlands Co-op. A total of eight flood mitigation pumping stations directly serve the town with a further two joint rural and urban pumping.

Even where the channels are of adequate capacity there are situations where a lack of room requires that the banks be stabilised by gabions or concrete walls or rock rip rap.

Detailed analysis of the expected stormwater runoff into these watercourses has recently commenced as part of a Blenheim interdepartmental stormwater strategy investigation.

Murphys Creek was reviewed in 2006, and more recently in 2012/13 with regard to waterway capacity and has been shown to be adequate for all likely stormwater discharges into it from present development. However a diligent ongoing aquatic weed management programme is required!

In 2012 a large new stormwater main was constructed down Middle Renwick Road to provide initially for the Westwood commercial development and ultimately urban growth on the west of Blenheim. This pipe is currently only consented for the Westwood flows.

Significant analysis including flow modelling, including an analysis of Taylor River back water levels to assess likely impacts of additional flow from the growth area of the catchment at full development. Similar work is underway to look at the likely impacts of water quality and ecological habitat of proposed additional stormwater. This work includes significant consultation with residents adjacent to Murphys Creek. At the completion of this study a decision will made on what, if any, additional stormwater discharge resource consent will be applied for. The alternative is to extend the Middle Renwick Road stormwater pipe all the way to the Taylor River.

For either option the Rivers Section management of Murphys Creek will be essentially unchanged. Even with additional stormwater discharge at Middle Renwick Road no channel or culvert upgrades are required. The key management issue will be to continue an appropriate and regular aquatic weed and riparian vegetation control and deal with any minor bank erosion issues promptly.

Fultons Creek has been reviewed in 2006 with regard to waterway capacity and has been shown to be adequate for probable stormwater discharges into it, though a detailed analysis of the likely stormwater discharges into Fultons Creek taking into account the new western rezone

areas has not yet been carried out. Preliminary analysis indicates that with appropriate development this provides for onsite detention storage of stormwater any necessary upgrades of Fultons Creek will be minor.

Town Branch Drain network (including Alabama and de Castro drains) has been shown by preliminary examination to be well under capacity for the existing stormwater discharges into it, let alone desirable new discharges into it.

A detailed investigation is currently underway. The hydrological analysis is complete including a preliminary look at upgrade options. A detailed computer hydraulic model is currently being built that links the pipe network in town with the open channel outfall network. The model will be used to assess the design requirements for the various upgrade options and enable more accurate costings. The option analysis is due to be completed by June 2015 with a recommendation on a preferred option for implementation.

The likely outcome is channel upgrades over some sections of Town Branch Drain, alterations to the Tremorne Avenue Drain outfall, an additional outfall pipe to the Ōpaoa River possibly via the Snowdens Drain outfall and additional storage/pumping capacity to deal with outflow during periods of High Ōpaoa River levels.

The upstream Redwood Street pipe network will be upgrade (size and renewal of key trunk main down Redwood Street and feeder mains) and outfall flow split amended to the adopted preferred upgrade option.

Preliminary estimates suggest that the upgrade of the key trunk main pipes, Town Branch drain channels and outfalls to the Taylor and Ōpaoa Rivers will cost somewhere between 5 and $10 million.

Waterlea Creek - A preliminary investigation indicates that the stream is of adequate capacity unless there is more urban development of the catchment. In addition the Waterlea Creek pump station has been upgraded to provide adequate capacity and ability to operate before Nelson Street is closed due to surface flooding from the Taylor River.

Wither Stream - A 1991 review resulted in a major channel upgrade and the construction of a flood detention pond on the Harling Park tributary. The upgrading works were carried out in 1992/93. Flood levels from more recent floods indicate that a 1 in 50 year return period is likely to be greater than assessed in 1991. More investigation is required of this, but this is currently a low priority work item

Camerons Creek was shown by a preliminary study in 2002 to require upgrading works in the likely event of urban development of the catchment.

The hydraulic capacity of Camerons Creek was further reviewed in early 2014 as part of a study to better determine Old Fairhall/Camerons Creek upgrade requirements should the catchments of both these waterways be rezoned from Rural to residential. The key outcomes of the study for Camerons Creek included;

- The existing culvert under Battys Road would need upgrading including to allow for the sewer main crossing that substantially reduces existing culvert capacity.

- Consideration should be given to lowering the old Fairhall outlet culvert to improve efficiency and provide for fish passage.

- A new pump station will be required to provide outfall during infrequent periods of Taylor River/Doctors Creek flooding in the event of significant further development in the catchment.

The proposed rezone of the upper catchment from rural to residential (PC 70) was turned down by the hearing Commissioner, so none of the above improvements is proposed for the near future. Staff however took the opportunity to work with the developer doing a 6 section

development at the end of Purkiss Street to obtain appropriate river reserve including room for a future pump station, upgraded the Old Fairhall stopbank and tidied the Camerons Creek outfall.

Caseys Creek requires a major outfall channel upgrade to enable development of the Blenheim North rezone areas – Plan Change areas 64, 65 and 67. Investigation and preliminary design of the required works is underway. Preliminary information of the likely scope of works is as follows:

- Upgrade of most private driveways to from the Deluxe Motors property downstream to equivalent of 1.8 m culvert. About 12 required.
- New 90 m outfall pipe require under upper Ōpaoa stopbank including inlet and outlet headwalls and floodgating.
- Adjustments to the existing pump station including two new 450 mm pump outfall pipes including lengthening by about 25 m.
- Regrading of outfall channel from just upstream of the existing Waipuna Street culvert to Ōpaoa River confluence.
- Channel cross section upgrading of the section of channel within the Upper Ōpaoa floodway. This has been allowed for in the development of the adjacent sports fields.
- Channel stabilisation (both sides) over most of the 1150 m length of channel that is parallel to old Renwick Road.

The aim is to have the preliminary design and scoping work including consultation with Marlborough Roads, Marlborough Lines and key adjacent landowners complete by June 201 All going well it is intended to apply for the necessary resource consents for both the stormwater discharge and outfall upgrade works in the latter part of 201

The total estimated cost of the upgrade works is about $1.8 million to be largely funded by a zone levy.

Main References

"Murphys Creek Hydraulic Analysis" Council internal report. K J Christensen January 2007.

"Fultons Creek stormwater" Application for resource consent based on a report of T H Jenkins June 1997.

"Fultons Creek Flood Flows upstream of Murphys Road" File memo. E B Williman December 2006.

"Town Branch Drain Stormwater Investigation Brief" Memo to Connell Wagner. E B Williman January 2008

"Wither Stream Report" Report to Council. Davidson Ayson Consulting Engineers February 1991.

"Camerons Creek Study" Report to Council. Davidson Partners April 2002.

"Urban Expansion in Western Blenheim & Required Channel Works, L Kuta internal report, May 2014

New works

Upgrading of Town Branch Drain network and Caseys Creek to meet existing and future growth requirements.

5.1.2 Other urban stormwater streams

Riverlands Industrial (Industrial Estate):
The Riverlands industrial drain ability to drain the Industrial Estate was examined in 2002 and as a result a new pumping station was constructed at the discharge exit to the Waikārapi Lagoon (Vernon Lagoon) and other channel upgrading activities. With rezoning of more land in the area to Industrial a further review was carried out in 2006. The resulting channel upgrading work is essentially complete.

School Creek (Renwick):
A review was carried out in 1993 resulting in diverting the upper rural part of the catchment direct to the Omaka River and an upgrade of the channel to carry the urban stormwater flow. No new works are envisaged.

Terrace Creek (Renwick):
An analysis of Terrace creek hydraulics has been carried out in 2008 and the capacity of the channel shown to be sensitive to assessments of likely stormwater runoff, especially soakage to groundwater. Further investigation is required to determine if any channel works are required. This investigation will need to take into account the proposed rezoning of the Renwick lower terrace area to large lot residential and consequent need for greater control and regular maintenance of the outfall channel. It is proposed to commence the lower terrace flood hazard investigation in 2015/16.

Endeavour Stream (Waikawa):
Urban expansion of Waikawa required analysis of this stream system with the required upgrade costs being met by the developer. No new works are expected unless there is further urban development, and if so the costs are likely to be met by the developer.

Picton/Waikawa Minor Creeks:
The various minor creeks carrying urban stormwater in Picton and Waikawa are likely to need upgrading work. Such work will need interface with the pipe stormwater network controlled by another section of Council.

Main References.

"Riverlands Industrial Estate Design flood Level update" Internal report. K J Christensen August 2006.

"Waikawa Hydrological Assessment and Hydraulics of Endeavour stream" Internal report. K J Christensen April 2004.

"Upper Terrace creek Capacity report" & "Lower Terrace Creek Capacity report. Opus International Consultants. March and June 2008.

"Growing Marlborough – Renwick" report to the Regional Planning & Development Committee, August 2014.

5.1.3 Schedule of watercourses maintained for urban stormwater purposes.

The below table is a summary of watercourse and drain classification and ecological management categories, with abbreviations as described previously.

Watercourse and Drain Classification for Weed Management							
Waterway	**Length (m)**	**Drain Size**	**Catchment draining to**	**Outlet Type**	**Flow Regime**	**Grade**	**Management Category**
Industrial Drain	750	large	Riverlands	G	PF	very flat	D
Riverlands Industrial 0-1529	1529		Riverlands				A
Riverlands Industrial 1529-5120	3589	large	Riverlands	G	PF	very flat	D
Snowdens	905	medium	Riverlands	G	E	very flat	C

Watercourse and Drain Classification for Weed Management							
Waterway	**Length (m)**	**Drain Size**	**Catchment draining to**	**Outlet Type**	**Flow Regime**	**Grade**	**Management Category**
Adams Lane	160	small	Stormwater Blen	G	UD	flat	C
Caseys Dr A	2535	large	Stormwater Blen	PA	PF	flat	B
Caseys Dr B	1207	medium	Stormwater Blen	PA	E	flat	C
Chinamans Dr	160	medium	Stormwater Blen	G	PF	flat	B
Cooper & Morrison		medium	Stormwater Blen	G	UD	flat	C
Fultons Creek 0-200	200	large	Stormwater Blen	G		flat	A
Fultons Creek 1018-1368	350	large	Stormwater Blen	G		flat	A
Fultons Creek 200-718	518	large	Stormwater Blen	G		flat	A
Fultons Creek 2515-4005	1488	large	Stormwater Blen	G	UD	flat	C
Fultons Creek 368-1911	543	large	Stormwater Blen	G	E	flat	A
Fultons Creek 718-1018	300	large	Stormwater Blen	G		flat	A
Fultons Creek 911-2515	604	large	Stormwater Blen	G	UD	flat	A
Murphys Creek	2090	large	Stormwater Blen	G	PF	flat	A
Old Renwick Road	645	small	Stormwater Blen	G	UD	flat	C
Taylor berm - Bank Street	50	medium	Stormwater Blen	G	PF		B
Taylor berm - Dashwood Street	50	large	Stormwater Blen	P	PF		B
Taylor berm - High Street	50	large	Stormwater Blen	P,G	PF		B
Taylor berm - Murphys Creek	150	large	Stormwater Blen	G	PF		B
Taylor berm -Fultons Creek	50	large	Stormwater Blen	G	PF		B
Taylor berm- Waterlea Creek	30	medium	Stormwater Blen	P,G	PF		B
Waterlea racecourse Ck	545	medium	Stormwater Blen	P,G	PF	flat	B
Alabama Rd	1045	large	Stormwater Blen	P	PF	very flat	D
De Castros	220	medium	Stormwater Blen	P	UD	very flat	C
Railway	300	medium	Stormwater Blen	P	UD	very flat	D
Rileys	725	medium	Stormwater Blen	P	PF	very flat	D
Town Branch	2055	large	Stormwater Blen	P	PF	very flat	D
Town Abattoir Br	720	large	Stormwater Blen	P	PF	very flat	D

2. Urban Pumping Stations

2.1 Alabama Road (Blenheim Urban and Rural)

Constructed in 1963 to serve a combined rural (140 ha) and urban Blenheim (80 ha) catchment and equipped with twin PPF 12/14 pumps.

The station is powered with dual speed motors for each pump giving total flow rates of 28,000 litres per minute (low speed) and 38,000 litres per minute (high speed).

This drainage area is an integrated component of the Town Branch System drain network which is also served by the Abattoir Pumping Station discharging to the Ōpaoa.

Observations on recent floods and computer hydraulic modelling show that the pumping capacity of the station is well under size, and an upgrade to deal with increasing urban stormwater runoff is required.

Data

Existing low speed discharge 28,000 l/min

Existing high speed discharge	31,800 l/min
Pump control range	N/A
Drainage capability (rural and urban)	
Existing overall rate	36.5 mm/24 hrs

2.2 Caseys Creek

Constructed in 1970 to serve a rural area of approx 120 hectares and a more recent urban area of 10 hectares and potentially increasing urban area. Equipped with two PPF 12/14 pumps. The drainage rate in excess of 20 millimetres per 24 hours appears reasonable but any overspill escapes into urban areas to the south. The increasing urban component also needs to be catered for.

An upgrade is desirable. Pumping capacity can be increased by installing a third PPF 12/14 pump with a higher speed motor.

Pump forebay and debris screen area also require modification to the adjusted standard of 6.0 metre screen width. The gravity culvert intake requires incorporation within the screened area to provide for the screening out of roadside rubbish and debris and for the prevention of deposition of rubbish within the Ōpaoa River system.

Data

Existing pumped discharge	24,000 l/min
Existing drainage capability	18.4 mm/24 hrs
Pumping control range	N/A

Addendum

Gravity drainage to the Ōpaoa River is available except during major flood events. Normal maintenance routines are required and no ecological factors of any significance have been noted.

2.3 Town Branch Drain (Abattoir)

This pump station was constructed in 1983 to serve a 50 hectare rural area and also serves an urban eastern Blenheim of some 150 ha. The station is equipped with twin PPF 15/18 pumps with a capacity of 54,000 litres per minute and also provides for emergency pumping of borough sewage to the river.

Observations on recent floods and computer hydraulic modelling show that the pumping capacity of the station is barely to size, and an upgrade to deal with increasing urban stormwater runoff is needed especially if there is further urban development. Further investigation of this is required, including the option of partial diversion to the Snowdens drain and the construction of a completely new pumping station on that drain. Any major new urban development would be required to fund such a new pumping station.

Data

Existing pumped discharge	54,000 l/min
Pump control range	N/A

Addendum

Stringent drainage maintenance regimes are necessary within the drainage system to provide for optimum flows and water level control adjacent to the urban area of Blenheim.

2.4 High Street Aviary - (Blenheim Urban)

This station was originally constructed in 1953 with a pump of 450 millimetre diameter axial flow type with a capacity of approximately 25,000 litres per minute serving an 80 hectare urban catchment encompassing the commercial area of Blenheim. The basic design of the pump forebay and screen area is inadequate.

Data

Existing discharge	25,000 l/min
Existing discharge capability	39 mm/24 hrs
Pumping control range	N/A

The station is not up to capacity to deal with the required stormwater runoff coincident with high Taylor River levels. A review is underway as part of the interdepartmental stormwater strategy.

2.5 Main Street (Blenheim Urban)

This pump station was constructed in 1953 and serves an urban catchment of 40 hectares and has low pumping capability. The pump forebay and debris screens are inadequate. The pipelines serving the pump station have been enlarged in size and major upgrading of the pumping is required. A review is underway as part of the interdepartmental stormwater strategy.

Data

Existing pumped discharge	7,000 l/min
Existing pumping capability	20 mm/24 hrs

2.6 Redwood Street (Blenheim Urban)

This station was constructed in 1953 and is equipped with a mild steel fabrication 450 millimetre diameter pump with a capacity of 25,000 litres per minute serving an urban catchment of some 130 hectares. The drainage capability is 30 millimetres in 24 hours which is low.

A full upgrading of this station is considered necessary. A review is underway as part of the interdepartmental stormwater strategy.

Data

Existing pumped discharge	25,000 l/min
Existing drainage capability	27.7 mm/24 hrs
Pumping control range	N/A

2.7 Monro Street (Blenheim Urban)

Constructed in 1963 to serve a primarily urban catchment of 40 hectares and equipped with two PPF 12/14 pumps.

Data

Existing pumping discharge	24,000 l/min
Existing drainage capability	86 mm/24 hrs
Pump control range	N/A

Addendum

Pumping capability at 86 millimetres in 24 hours appears adequate but pumphouse forebay area and debris screen width are inadequate and should be modified. As with Waterlea Creek, the adjacent gravity culvert (floodgated) should be incorporated within the new pumping forebay to provide for screening out of debris and rubbish to prevent deposition of unwanted material within the river system.

2.8 Waterlea Creek (Blenheim Urban)

Constructed in 1961 and equipped with twin 300 millimetres diameter pumps this station potentially serves an urban area of 120 hectares including Waterlea Racecourse and Park. Partially upgraded in 2007/8, and this upgrading needs to be finalised.

Total Discharge

PPF 12/14	12,000 l/min
2 new PPF 15/18 pumps	50,000 l/min
Proposed total discharge	62,000 l/min
Proposed discharge capability	74.4 mm/24 hrs

An important feature of this outfall point is the amount of debris, rubbish and weed that are discharged into the Taylor River system. The debris screens serving the flood pumping station will also screen the gravity outfall and preclude the deposition of urban rubbish within the river system.

2.9 Andrew Street (Blenheim Urban)

Constructed in 1964 to serve an urban catchment of 44 hectares and equipped with twin PPF 9/10 pumps.

The pumping rate of 57 millimetres in 24 hours is marginal and problems of street flooding are known to exist. The pumphouse forebay and screened area presently provided is inadequate and difficult to clean and modified and extended debris screens are also necessary. It is cost-effective to incorporate a new pumping sump within the modified forebay and this will enable the fitting of a third pump (PPF 12/14).

Data

Existing pumping capacity	17,500 l/min
Existing drainage capability	57 mm/24 hrs
Pumping control range	N/A

Recommendation

To fit an extra PPF 12/14 pump in a new pumping sump.

Proposed total discharge	27,500 l/min
Proposed drainage capability	89 mm/24 hrs

2.10 Boyce Street (Springlands) (Blenheim Urban)

This pump station was built in 1992 to serve the Springlands area. The pumping equipment comprises two PPF 15/18 pumps with a total pumping capability of 36,000 litres per minute.

The duty requirement of this station is such that the drainage capability of 75 millimetres in 24 hours is indicative only as the contributing area is unclear, and the performance may be much better than this.

Data

Existing pumping capacity	36,000 l/min
Existing drainage capability	75 mm/24 hours
Pumping control range	N/A

2.11 Probable new works – Blenheim pumping stations

Several of the Blenheim urban pumping stations need major upgrades to achieve the required level of service, and others more minor upgrades. Those requiring major upgrades are Main Street, Redwood Street, Alabama Road, and High street. A new pumping station on Snowdens Drain is likely to be preferred to a major upgrading of Abattoir pumping station on the Town Branch Drain network. Minor upgrading is required for Caseys Creek, Andrew Street, Monro Street and Waterlea Creek.

There is also a need to install telemetry equipment at most of these pumping station sites.

Further detailed investigation of the details of the required upgrading is underway as part of the interdepartmental stormwater strategy.

2.12 Riverlands Industrial Pumping Station

A new pumping station was built in 2004 for a combined Riverlands Industrial 52 ha and. Rural 280 ha catchment.

The station is equipped with two PPF 18/18 and one PPF 12/14 axial flow pumps.

Data

Existing pumping capacity	
Low level pump 1 PPF 12/14	13,000 l/min
pump 2 PPF 18/18	32,000 l/min
pump 3 PPF 18/18	32,000 l/min
Drainage capability	N/A
Pumping control range	Start MSL Stop – 200 m

2.13 Riverlands Industrial Estate

The Industrial Estate road network has been designed as a ponding area with some secondary overflow paths when levels are particularly high. Including the storage and flow routing provided by the road storage is very important in controlling levels in the Industrial Estate.

2.14 Picton (Dublin Street Pumping Station)

This station was upgraded in 2006 and is now equipped with two PPF 18/18 pumps.

Data

Existing pumping capacity 70,000 litre/min	
Drainage Capability	N/A

2.2 Urban Floodgated Outlets

Due to the probability of major flood flows into the Taylor River there is potential for extensive damage to occur within this area should flood protection structures malfunction or fail. Outlets are itemised in more detail as follows: For these important locations penstock gates are recommended as in effect a double floodgate to provide flood protection.

Waterways for which these penstock gates are desirable are Redwood Street Pumping Station, High Street Pumping Station, Leeds Quay, Auckland Street, Waterlea Creek, Andrew Street Pumping Station, Fultons Creek, and Murphys Creek.

6. Ruakanakana Creek (Gibsons Creek) System

River intakes from the Wairau River supply old ephemeral floodplain channels of the Waihopai and Wairau River which have been upgraded and need maintenance.

Both intakes consist of a river entry point that leads via a supply channel to control gates located where the channels pass through the river stopbanks. The Wairau intake is for up to 2.5 m^3/sec, and the Waihopai one for up to 1.2 m^3/sec.

The two abstraction channels join to one channel some 3.5 km from the Waihopai intake, and 1.5 km below the Wairau intake.

The combined Gibsons Creek channel then takes up to 2.7 m^3/sec for a kilometre before it divides into a north branch and a south branch. A dividing structure proportions the flow 60% south channel (1.6 m^3/sec) and 40 % north channel (1.1 m^3/sec). The channels each flow some 6 km before joining again. The northern channel also supplies 0.1 m^3/sec a far north channel

that flows some 3.5 km before re-joining the north channel again. The south channel supplies the Southern Valleys Irrigation Scheme with up to 0.9 m³/sec.

The single combined Gibsons Creek channel then flows a further 6 km before joining the Upper Ōpaoa River.

These river abstractions need to be kept operable on a 24 hours a day seven days a week basis within the constraints of the resource consents. All the components need to be maintained to adequate capacity and standard including removal of silt build up in the channels.

The system has more than enough capacity to supply the needs of the SVIS and the groundwater recharge that occurs. No expansion is expected.

7. Waitohi and Waikawa Rivers

This includes:

1. Waikawa River
2. Waitohi River
3. Kent Street Creek

7.1 Waikawa River

Channel characteristics (typical)

Type	:	Narrow incised channel through urban area.
Length	:	1 km
Channel Width	:	18 m
Slope	:	0.14% (1 in 70) Confluence
Design Flood	:	70 m³/sec Design Freeboard 0.6 m.

7.1.1 Issue: Sedimentation

In heavy floods gravel is brought down from upstream, compromising flood capacity. Such sediment is difficult to remove due to limited riparian access. A gravel trap has therefore been constructed upstream of the urban section of channel.

7.1.2 Issue: Waterway capacity and channel width

Waterway capacity has been achieved by excavation of this reach and design flood levels are below ground level.

The required waterway capacity is achieved by ensuring an adequate width of channel. The required width of 18 metres has been achieved over much of the channel, these lengths of channel being in Council ownership. There are two short reaches that the channel width is only 14 metres. Negotiations are well in hand to purchase this land – some under multiple Maori land title- so as to enable the channel to be excavated to its required width.

7.2 Waitohi River

Channel characteristics (typical)

Type	:	Narrow incised river through urban area and reserve land.
Length	:	1.5 km
Channel Width	:	25 m
Slope	:	0.07% (1 in 150) Confluence.
Design Flood	:	90 m³/sec Design Freeboard 0.4 m.

7.2.1 Issue: Inadequate capacity of triple culvert under wharves

The Waitohi River outlet to Picton Harbour passes through a 320 metre long culvert under the railway sidings at the port. It was constructed in 1970 by the then Marlborough Harbour Board to enable the port to be developed for the interislander ferry. This culvert is of limited capacity and has resulted in flooding of the upstream industrial area occurred in July 1998 and February 2004.

The culvert is now owned by Port Marlborough Ltd.

The culvert and has three barrels, each 3.86 m wide by 2.05 m high. The ceiling is constructed using double-T units, which severely restrict the flow as soon as the water surface touches the ceiling. Based on examining a range of hydraulic conditions, the capacity of the existing culvert is estimated at 65 m³/s. before flooding of Picton urban industrial area would occur.

Flood flow assessments show that credible 50-year return period flood estimates range from 70 to 110 m³/s, with a middle value of 90 m³/sec. The 50 year standard is that prescribed in the Building Act. MDC's preferred design flood standard is the 100-year flood which is 10% higher than the 50-year flood estimate. The February 2004 flood of 130 m³/s was assessed as a 200-year return period event.

Flood detention storage at the rugby grounds has been estimated to absorb some 5 m³/s off a flood peak. Therefore, the existing culvert plus an allowance for flood detention could accommodate a peak flood flow of 70 m³/s. Based on the hydrology of the upstream catchment MDC wish to have the culvert upgraded to a minimum of 85 m^3/s to accommodate a peak flood flow of 90 m³/s, otherwise planning restrictions may have to be imposed on new buildings in the Picton urban industrial zone. An upgrade size of 120 m³/sec (1 in 100 year flood) would be even better.

Various options of greater or lesser flood improvements have been looked at because of the high costs involved and the wide range of cost/benefits of the different options.

7.2.2 Issue: Flow constriction - Canterbury Street Bridge and sewer/weir

A flow constriction exists at the Canterbury Street Bridge due to the small capacity of the bridge and a weir immediately upstream. The weir is to protect a gravity sewer line just below the surface. To get rid of this constriction requires lowering or raising the sewer line and installing a sewer pumping station. It also requires a new bridge. A partial alternative to this is to define the surrounding riparian land as being a flood hazard with limitations as to its use.

7.2.3 Issue: Flow constriction - building foundation

A flow constriction also exists where a subdivision occurred 30 years ago and the river has been substantially constricted to 10 metres width instead of the typical 20 metres. The constriction is by earthworks for garden development and out buildings. No detailed investigation has been carried out, but the only practical solution appears to be the removal of the constriction, which will also involve land purchase negotiations.

7.3 Kent Street Creek, Buller Street Branch

Channel characteristics (typical)

Type	: Narrow channel through urban area.
Length	: 1.2 km
Channel Width	: 5 m
Slope	: 0.17% (1 in 60) Confluence.
Design Flood	: 15 m³/sec

7.3.1 Issue: waterway capacity

The channel is only about half the size required to carry the design flood. Most road culverts are undersize as is the channel itself as it passes through urban properties. Upgrading works will

require major enlargement of culverts and structural banking of the channel. A more detailed investigation is currently underway with consultants to define engineering options and costs.

7.4 New Works Required

Expensive engineering works are desirable to upgrade the Waitohi River and its tributary the Kent Street Creek. Preliminary estimates of costs are in the millions. Further investigations are underway to refine the costs. A budget for the work has yet to be approved by Council.

An alternative option for Council is to define the affected area as having a flood hazard, with restrictions on minimum floor levels for new buildings. This much less expensive option represents a substantial drop in level of service provided and may not be acceptable to the community.

8. Floodway Reserve Land

8.1 Introduction.

Council floodways are located on the 20,000 hectare Wairau floodplain downstream of the Wairau confluence. The purpose of these floodways is to carry flood waters without scouring its stopbanks. The floodway consists of the active non vegetated river channel and vegetated berms. The vegetated berms only flow during flood time.

The need to manage the active river channel to readily carry flood flows is obvious.

Careful management of the floodway berm land is also required. This care is required as to the degree and type of vegetation required at the location; and the degree of earth works and banking; including not allowing solid fencing.

The floodway land is a combination of public and private land. Council river management restrictions on private land may constrain the aspirations of the land owner for the land. Council ownership of the floodway land is the appropriate solution where there is potential conflict between the Council and the land owner.

Public land includes Crown riverbed, crown marginal reserves and other reserves. Some is controlled by DOC, other land by LINZ. LINZ and DOC have indicated that they are generally comfortable with Council river management policies for the floodways.

Council controls a considerable amount of land by direct ownership as a reserve or in freehold title; or as a Crown reserve vested in Council, or as legal unformed road reserve, or as esplanade reserve, or an interest through an esplanade strip or other form of easement.

8.2 Floodway areas

The areas of the Wairau floodplain floodway land are shown in the below table.

		Area - hectares	
Floodway	**Council or Crown Owned**	**Privately owned**	**Total Area**
Waihopai	95	3	98
Wairau	1782	83	1855
Wairau Diversion	179	5	184
Lower Wairau	441	125	566
Omaka	37	24	61
Fairhall	27	15	42
Upper Ōpaoa	124	175	299
Roses Overflow	73	21	94

		Area - hectares	
Floodway	**Council or Crown Owned**	**Privately owned**	**Total Area**
Taylor	76	27	103
Lower Ōpaoa	85	102	187
Riverlands & tribs	19	17	36
Spring Creek	30	10	40
Pukaka	8	7	15
Totals	**2976**	**614**	**3590**

These areas do not incorporate the potential for accretion or erosion where the legal boundary is a riverbed boundary.

8.3 Secondary Land Use of Floodways

Much of the floodway land comprises active river channel, or tree plantings for bank erosion protection, or is land occupied by the stopbanks.

However there is some 950 hectares of Council owned floodway land for which there are secondary uses available.

Currently this land is used as

- Public amenity and recreation areas 115 hectares
- Council owned production/protection forestry 167 hectares
- Commercial lease 641 hectares
- Ecological plantings 26 hectares

8.5 Issues

8.5.1 Further floodway land purchases

In various areas Council needs a higher degree of floodway management than the private landowner is comfortable with. The Upper Ōpaoa and Riverlands Co-op floodways are examples of such rivers. There is a need for Council to carry out further floodway land purchases in these situations.

8..5.2 Council access for maintenance beside drains and small watercourses

The majority of small watercourses and channels managed for public drainage purposes or urban stormwater are on private land and only a third is on Council reserve or road reserve. With the increased value of land, a change of land of land use type, and a changing public attitude it has become more contentious for Council to expect free access maintenance. It is therefore desirable to acquire more robust riparian access arrangements by

- Local Purpose Reserves (Drainage) be created where access is necessary, or
- Entry easements or right of ways be created as appropriate, or
- Land acquisition be undertaken where required by property owners.

8.5.3 Land Management maintenance costs

There are various costs associated with management of floodway land.

Commercial leases are self-funding, as is commercial forestry.

Other costs are:

- Fencing, roading, land preparation for non-profit making leases – sports clubs etc.
- Land preparation, sign posts, grass mowing, scrub control for public amenity and access.
- Planting, fencing and maintenance of ecological plantings.
- Noxious weed control.
- Good neighbour tree maintenance and removal of fallen trees across boundaries.

Regular inspections are also required to ensure that the floodway land is being utilised by lessees and the public in the manner that is intended.

8.4 Land *management* options

There are various options for secondary land use of much of the floodway land. This ranges from commercially profitable leasing, or forestry, to non-profit activities such as public recreational use or ecological planting. The attractiveness of the options change from time to time.

Council needs to be cognisant of the opportunities and constraints of the many and various pieces of floodway land. A database of all floodway land is maintained and staff are employed specifically to keep abreast of this issue.

8.5 *Pastoral* grazing of floodway land dirtying water etc

Pastoral grazing of floodway land is a common secondary land use. There is an issue of the animals potentially contaminating the watercourse and or damaging stopbanks and river control plantings.

The preferred grazing animals are sheep.

Cattle, deer, and goats will only be allowed to graze Council floodway lease land provided that they are adequately controlled by fencing, stocking rates or other means to prevent contaminating the water or damaging stopbanks or plantings.

Appendix 3: Background to the Rivers and Land Drainage Service

The levels of service (or performance standards) are discussed separately for each subset.

1. Wairau Floodplain Floodways

The 20,000 ha main Wairau floodplain has a long history of flooding and drainage problems and various local government bodies have set about fixing the problems since early pakeha settlement 150 years ago. The floodplain is generally that land downstream of the Waihopai confluence, north of new Renwick road, or otherwise bounded by the hills and the sea.

Flood control management has the unusual feature that flood hazard improvement for one 'community' may be at the expense of worsening flood hazard for a neighbouring 'community'. This occurred in Marlborough in the late 19th century. The Lower Wairau River Board was responsible for the southern half of the Wairau floodplain, and the Spring Creek Board the northern half. (There were also three other minor river boards).

Each board then built stopbanks on its side of the Ōpaoa River to a higher level – so that any flood breakout would be away from their own district but into the neighbouring district. River diversions that were carried out had a similar effect.

After 40 years of flooding and wrangling the Government stepped in with the public hearings of the Wairau River commission in 1917. The commission endorsed the action of blocking the Ōpaoa distributary channel from the Wairau and other major diversions, but on the requirement that a single river board would in future be responsible for all river control works in the Wairau floodplain for the benefit of all.

The enactment of the 1917 Wairau River Commission recommendations in endorsing the blockage of the Ōpaoa breach and the other blockages and diversions of Wairau floodplain channels established the direction of river control works on the Wairau floodplain. Blenheim and residents on the south side of the valley got their way in blocking the Ōpaoa breach, but on the understanding of continuing responsibilities for ensuring the adequacy of the Wairau River and other watercourses down the full length of the floodplain.

The level of service defined in the 1917 decision was for "the largest flood hitherto observed with a reasonable margin of safety". This 1917 decision underpins flood standards for the floodways of the Wairau floodplain.

This was again publicly discussed in the Wairau Valley (river control) Scheme 1960, which proposed a 200 year return period flood for the Wairau – but with limited flood information to determine this figure. Other major floodplain rivers were based on estimations of the largest flood measured in the previous 50 years.

A thorough review was again carried out in the Wairau Rivers Floodway Management Plan 1994 (WRFMP). A 1 in 100 year return period flood was adopted for the standard all the main rivers of the Wairau floodplain – and with the benefit of 30 years of good flood flow record. (The 1994 reassessment of a 1 in 100 year flood is in fact greater than the 1960 assessment of a 1 in 200 year flood). In this document it was noted that all river patterns have been highly modified by previous river and catchment boards' diversions. None of the waterways are carrying their original 'natural' flood flows.

The WRFMP was put out as a resource management plan so as to ensure the maximum public consultation. A community consultation group was set up for discussion of issues; and the plan was appealable to the Environment Court. No appeals were made.

A view expressed by some Blenheim residents was that the river control works that protect the town have been completed long ago, and they find difficulty in relating the continuing expense on the Wairau and other rivers to their situation.

Blenheim – or Beavertown as it was known in earlier days, was at the confluence of a number of river systems – Taylor, Fairhall, Omaka and significantly the upper Ōpaoa that was a distributary channel of the Wairau.

To bypass the town, the original channels were diverted or blocked. Fairhall and Omaka water was diverted north into the Upper Ōpaoa/Rose's Overflow and the distributary channel of the Wairau – the Ōpaoa breach – was blocked in the Conders area. The areas that these flows were diverted to now had to deal with much larger flood flows.

The authorities of the day were faced with legal battles to justify the protection of Blenheim, apparently at the expense of such locations as Tuamarina, Renwick, Grovetown and the Lower Wairau.

It was accepted – this acceptance forms the basis of the rating principle – that Blenheim could not expect to carry out works to protect itself at the expense of other areas. It was also accepted that the protection of the other areas should be carried out concurrently with or even ahead of, the work to protect Blenheim.

This principle holds as firmly today as when it was first promulgated by the 1917 Wairau River Commission.

Fundamentally, the standard for all river works on the Wairau floodplain derive from blocking the 'Ōpaoa breach' in the Conders area, and other historic diversions to protect Blenheim. This sets the standard for all the floodplain and a commitment on all floodplain ratepayers.

The fact that the rivers were diverted many years ago is not an issue, as the river systems take many years to adjust and the Council must continue upgrading and maintaining the whole interlinked system to a consistent standard.

Improving and maintaining this jigsaw of interlinked modified waterways on the floodplain to an appropriate standard carries with it the responsibility that all flood control work on these Wairau floodplain floodways should be planned, promoted and funded as one scheme to a uniform high standard.

The standard (levels of service) was set to be for the floodways and major rivers to be upgraded to be able to carry a 1 in 100 year return period flood.

The 1998 Proposed Wairau/Awatere Resource Management Plan incorporated the 1994 WRFMP into a broader district and regional resource management plan. The flood control aspects of this resource management were not appealed against.

An objective of this plan is the following level of service:

- "*to obtain a floodway capacity and standard of protection for flood sizes up to a 1 in 100 year return period for the major rivers of the Wairau (Rural 3 zone) floodplain*."

This level of service cannot be altered without a resource management plan change.

These floodways include the Wairau, the Lower Wairau, Wairau Diversion, Ōpaoa, Taylor, Omaka, Riverlands Co-op and others.

The standard is achieved by building and maintaining stopbanks, river diversions, detention dams, stopbank erosion protection (rock and trees), river channel clearing, channel excavation, channel training, flow control gates and other miscellaneous structures.

Main references

"Wairau Valley Scheme" Report of the Marlborough Catchment Board - C C Davidson 1960.

"Wairau River Floodway Management Plan" Council Resource Management Plan E B Williman 1994.

1.1 Wairau Floodplain Tributaries

Wairau tributaries to the main floodplain have a lesser history of flooding, erosion and drainage because there is less of a hazard, and/or less economic necessity to do full flood protection or channel alignment works, and/or a lessor need for local government to carry out activity as a community effort (this includes the main stem Wairau above Waihopai).

Under the Government subsidised 1960 Wairau Valley Scheme significant river works were carried out on these tributaries as a source to the sea scheme with considerable Government subsidy. For example attempts were made to train the braided Wairau (above Waihopai) with rock work and trees to a narrower 600 metre width curving channel; significant river training/bank erosion etc works were also carried out on the Onamalutu, Omaka, Tuamarina, Waihopai and other rivers. Some stopbanks were also built.

The 1994 Wairau River Floodways Management Plan reviewed those works with public consultation as discussed above. As a result the level of service was reduced to only that of maintaining the river channels as cleared stable channels as far as practical and economic. This was because the works in the main consist of individual elements and each element protects a single or only a few landowners and therefore a community scheme was not required to construct river control works, which were also generally uneconomic. Council's decision was not appealed against.

Under this policy Council has stopped maintaining the previously constructed rock work, trees, gabions, stopbanks and other physically constructed assets. The Wairau/Awatere Resource Management Plan confirmed this policy.

- Council's level of service is to keep the river channels clear of trees and debris.

Under NAM's guidelines these river channels are not assets that can be valued so Council no longer owns any river control assets for the Wairau tributaries.

Council is prepared to pay landowners up to 50% of the costs of private bank protection, stopbanks and other river control assets that they wish to construct.

1.2 Soil Conservation

The Wairau Valley Scheme 1960 contained many soil conservation measures as part of its source to the sea flood control and erosion containment policies. These were reviewed in the 1994 WRFMP, and a decision taken to discontinue carrying out further soil conservation works. The exception is for the Wither Hills where active soil conservation operations of tree and grass planting and management, check dams, and stock control is carried out.

A major fire on the Wither Hills in December 2000 confirmed the need for continuing such soil conservation works so as to minimise the likelihood of sediment erosion depositing in rivers downstream and creating a flood hazard. Two relevant reports are the basis for Council's policies.

> "Wither Hills Erosion Management – Re-establishing Cover for Erosion Management following the December 2000 Fire (2001)".
>
> "Wither Hills Farm Park Management Plan – (2003)".

The level of service can be summarised as:

- Minimal sediment is deposited in watercourses at the base of the Wither Hills.

1.3 Wairau Floodplain Land Drainage

The low lying land of the lower Wairau Floodplain has several thousand hectares less than 2 metres above sea level. Drainage of this land greatly increased agricultural productivity and facilitates road construction and operations. There has been a long history of drainage works by a variety of organisations since Pakeha settlement. The 'drainage' activity here includes flood control from small local streams.

Drainage works consist of channel excavation, keeping channels clear of aquatic weed and siltation, floodgates, culverts, pumps and miscellaneous structures. Channel excavation is a mixture of deepening existing natural watercourses and/or straightening and diverting watercourses, and/or excavating entirely new drainage channels in locations where surface flow did not previously occur.

While the Marlborough District Council took over this function in 1992 there had been a succession of previous Drainage authorities with the earliest noted being the Pukaka River and Drainage Board (formed in 1878), and the large Grovetown drainage district was formed in 1944.

Under the Wairau Valley Scheme (1960) the then Catchment Board took over the 1200 ha Grovetown Drainage District which had fallen into disrepair. The WVS reconstructed the various channels, installed floodgated culverts and constructed a pumping station.

Over the years further areas on the plain were added under specific request and (Catchment) Board resolution.

By the earlier 1990s some 8,000 hectares were benefiting from the newly amalgamated Marlborough District Council drainage works and much of this area was also served by pumping stations.

Following drainage problems during a wet winter in 1995 a major review was carried out with consultation through a community panel and resulting in the "Wairau Drainage Plan 1996". This resulted in Council approving an upgrading of the pumping stations of the drainage network and other works.

The management of aquatic weed has required several specific resource consents. The resource consent application process has resulted in comprehensive public discussion on the manner in which aquatic weed is removed including how much is left, when and by what methods removal is carried out. There have also been environmental studies on specific rivers that have also focussed on the manner and frequency of weed removal so as to ensure or enhance ecological habitat. Other branches of Council have been leading these studies which impact upon the "level of drainage service" provided by Council. Weed left in land drainage channels for ecological reasons can impair the drainage level of service provided in the event of heavy rain.

There is no simple performance measure to assess the quantity or quality of maintenance works required for maintenance of scheme standards. In a long period without significant rainstorm or river flood event the asset value and performance standard can be maintained at a moderate cost and conversely following serious events high levels of expenditure may be necessary and may follow through to a subsequent financial year.

Council's current policies re Wairau land drainage levels of service can be summarised as:

- To maintain a public land drainage channel where three or more landowners require one.
- To clear those watercourses/drainage channels of impeding weeds up to twice a year.
- To clear silt build up in drains, usually requiring excavation at approximate eight year intervals.

- To maintain floodgated outlets to the major rivers so that backflow is minimised in times of river flood or high tide.

- To supplement gravity drainage with pumping stations so that maximum ponding period on the paddocks is three days in a 1 in 10 year rainfall event; this generally requiring pumping station capacity of removing 15 mm rainfall in 24 hours.

- To carry out aquatic weed removal in an ecologically sensitive manner with methodology targeted to be specific to particular watercourses.

- The riparian margins of selected channels to be managed in an aesthetic and ecologically sensitive manner.

During 2013 and 2014 considerable work has gone into reviewing the formally adopted network managed and maintained by Council. This was last formally done in 1960 when the current network was adopted as part of the then new Wairau Valley Scheme.

Since 1960 there has been significant intensification of land use and subdivision, a trend towards viticulture and an expectation of a generally high level of service. The proposed new network will add 15.3k m (about 5.4% increase) to the currently managed network of drains and increase the level of service to a direct connection to all properties over 1 ha in size. Note most of the drains proposed to be brought into the Council managed network already exist so only require bringing up to standard.

The network review proposal is out for consultation with benefitting and affected landowners and the final change to the network is proposed to be adopted by Council at its meeting in May 2015.

Reference – "Wairau Lower Floodplain Land Drainage – Network Review" report to A & S Committee, November 2014.

1.4 Blenheim, Riverlands, Picton and Renwick Stormwater Outfalls

The management and operation of the stormwater carrying urban stream channels and pumping stations is very similar to that of rural land drainage.

Differences are that a higher level of service is required for flood management. The channel network should be able to cope with a 1 in 50 year return period flood event so as to meet the standards that the Building Act 2004 imposes on building floor levels. Pumping stations are required when local stormwater runoff coincides with high water levels in the receiving rivers.

The hydraulic requirements of these channels are determined by the stormwater pipe network feeding into them. This stormwater pipe network is dealt with by another section of Council under a different asset management plan. The design of these two components is being integrated as part of the stormwater strategy.

The manner in which Council deals with its urban stormwater is under review as part of an interdepartmental Council stormwater strategy. This includes design guidance for determining the likely runoff quantities, pipe network capacity, secondary the pumping stations capacity, the receiving watercourse capacity, water quality aspects and required resource consents.

Removal of aquatic weed from urban watercourses is also for aesthetic and health reasons as well as hydraulic efficiency. The LTCCP process can be used to assess if residents require a higher standard than currently being provided or better aesthetic/environmental values. It should be noted that several of the watercourses and pumping stations drain a mixture of urban and rural land.

The key areas of work underway;

- Detailed hydrologic and hydraulic review of the combined Redwood Street and Town Branch drainage network to determine the best solution for meeting the 1 in 50 year design storm level of service standard, the upgrades required and a proposed work programme.

- Hydrologic and hydraulic review of the Caseys Creek catchment and Ōpaoa River outfall to determine upgrades required to service the Blenheim north urban growth area.

- How best to deal with expected additional stormwater discharge in the upper Murphys Creek catchment due to urban growth. Residents are concerned that additional stormwater will degrade the water and general environmental quality of this spring fed creek and have asked Council to by-pass pipe the additional upper catchment stormwater to the Taylor River.

1.5 Ruakanakana Creek (Gibsons Creek) Rewatering

One of the branches of Gibsons Creek was a distributary channel of the Waihopai River. It flowed over the floodplain to join the Upper Ōpaoa River (also a distributary of the Wairau). The flow in the Gibsons Creek/Ōpaoa River augmented groundwater levels by leaking and also benefited ecological values of several rivers and streams in the lower Wairau plains.

River control works early in the 20th century blocked off these distributary channels from the Waihopai and Wairau rivers. There was considerable public concern following this.

As a result of this public concern one of the first tasks constructed under the Wairau Valley Scheme 1960 was a diversion of up to 2.8 m^3/sec from the Waihopai to re-water Gibsons Creek.

The Waihopai River however cannot supply this amount of water during low flows. Furthermore under the Wairau/Awatere Resource Management Plan 1998 this abstraction was reduced at times of low river flow to 0.35 m^3/sec (to benefit competing Waihopai River users). At times of higher flow up to 1.2 m^3/sec may be taken.

Following public requests for irrigation for viticulture a resource consent (with associated considerable public consultation) was obtained in 2003 to also abstract water from the Wairau River into Gibsons Creek so as to supply the Southern Valleys Irrigation Scheme (SVIS), augment groundwater recharge to the Wairau aquifer and ecological benefits for lower plains watercourses.

The level of service was determined by a publicly representative water management group set up as a resource consent condition to establish a water management plan.

The level of service (within resource consents constraints) is:

- To supply the requirements of the SVIS.

- To provide continuous flow to the sea in the Gibsons Creek/Ōpaoa system without flooding riparian land, and thereby also maximising groundwater recharge of the Wairau aquifer.

1.6 Council River Control Floodway Reserve Land

Council owns or manages a considerable amount of floodway reserve land for the purpose of conveying floodwaters. The need for Council to acquire floodway land is to ensure that the land is managed in such a way as not to compromise the performance of the floodway. For example in some areas the hydraulic performance of the floodway is critical and the planting of trees needs to be limited to ensure this hydraulic performance. Conversely in other floodways trees are desirable to slow flood waters and thus reduce the likelihood of erosive scour of the stopbanks. More floodway land is being purchased all the time.

While the main purposes of the floodway land is for river control much of this land also has secondary land uses – public access, commercial leasing and ecological plantings.

Historically one of the secondary level uses – where appropriate – has been the planting of commercial forestry.

Under the Wairau River Floodways Management Plan 1994 (and its consultation process), policies were made to facilitate public recreational access on Council floodway land and to plant native and other amenity/ecological plantings.

Council has more recently in 2004 formed a public working party on landscaping matters that has as one of its objectives ecological and amenity planting on river floodway (and other) Council reserve land.

The level of service can be summarised as:

- The space required for flood control works is not compromised.
- Much of Council floodway land is accessible for public recreation.
- To plant and maintain at least 20 hectares of land in ecological/amenity plantings.
- To utilise other floodway land for economic gain by forestry and/or leasing.

1.7 Sounds Watercourses Flood Management

There has been limited flooding of residential areas in the Marlborough Sounds.

The need for Council to have river control works to a defined standard has arisen from the legislation in the early 1990s of the Building Act, Resource Management Act 1991 and local government amalgamation.

Public concern from flooding has arisen following flood events especially in Picton/Waikawa in 1998 and 2004. This has led to Council investigation, analysis and public consultation with concerned resident user groups.

Council's desired level of service is:

- For the urban and residential areas of Picton and Waikawa to obtain a river capacity and standard of protection for flood sizes of up to 1 in 50 year return period for the Waitohi, Waikawa and their major tributaries; and higher if practical.

It should be noted that Council (Marlborough Catchment Board) formerly maintained a Te Hoiere/Pelorus Valley river control scheme, but maintenance of those river control assets lapsed in 1990 following withdrawal of Government subsidy and public consultation on the matter.

Appendix 4: Valuation Details

1. Valuations

1.1 Introduction

As part of its statutory obligations, Marlborough District Council is required to determine the replacement cost of their assets, the current depreciated value and the annual decline in service potential (DISP).

It should be noted that only 3% of Council's river control assets are funded by depreciation, the other 97% being maintained in perpetuity. Thus this valuation of the river control assets is of less importance for funding management than for other Council infrastructure assets.

(a) Rivers Protection Works

- Stopbanks, Dams
- Bank protection
- Retards and trees

(b) Drainage Works

- Structures, Culverts, Gates
- Excavations, Drainage, Diversions
- Pumping Stations

The Table below summarises the values of the valuation (in $000s)

RIVER & DRAINAGE ASSET VALUATION - DEPRECIATED REPLACEMENT COST

SUMMARY OF ASSET VALUES

VALUED AT 30 June 2018 **in $000's**

River	Earthworks (ORC/DRC)	Rock work (ORC/DRC)	Trees & Retards (ORC/DRC)	Misc Structures (ORC)	Misc Structures (ODRC)	Excavation (RC/DRC)	Pump Stns (RC)	Pump Stns (ODRC)	Total ORC	Total ODRC	Depreciation To Date ($1,000's)
Lower Wairau	$10,793	$7,659	$453						$18,905	$18,905	$0
Wairau Diversion	$6,264	$5,336	$20			$16,056			$27,677	$27,677	$0
Wairau - Tuamarina to Waihopai	$36,427	$37,268	$3,686	$102	$102				$77,483	$77,483	$0
Lower Ōpaoa / Taylor	$8,040	$1,473	$68	$896	$896				$10,477	$10,477	$0
Taylor Dam	$7,084	$687		$3,883	$1,825				$11,653	$9,595	$2,058
Upper Ōpaoa / Roses / Omaka	$16,321	$2,617	$428			$1,585			$20,951	$20,951	$0
Riverlands / Wither Hills streams	$4,374	$148		$1,299	$1,299				$5,821	$5,821	$0
Misc Floodplain watercourses	$6,401	$75		$3,470	$3,470				$9,945	$9,945	$0
Drainage Assets				$6,001	$6,001	$12,907	$10,503	$5,894	$29,411	$24,801	$4,610
Picton	$140	$1,615		$854	$854				$2,609	$2,609	$0
TOTAL	**$95,844**	**$56,878**	**$4,655**	**$16,504**	**$14,447**	**$30,548**	**$10,503**	**$5,894**	**$214,932**	**$208,265**	**$6,667**

This valuation has been undertaken in accordance with Financial Reporting Standard NZ IAS 16 Property, Plant & Equipment and the New Zealand Infrastructural Asset Valuation and Depreciation Guidelines.

The valuation has calculated the funding to allow for the decline in service potential using the straight line depreciation method.

This valuation has been prepared exclusive of GST.

1.2 Valuation Report

1.2.1 Background

This valuation covers the Wairau Flood Plain Rivers and Drainage Asset networks Marlborough District Council own and operate. The completed valuation assigns a replacement cost, a depreciated value and calculates annual loss of service potential to each component of each asset network. The valuation was last carried out in 2015.

Prior to commencing this 2018 valuation a methodology was agreed between Council Staff and peer reviewer Alexander Hayward Ltd (Registered Valuers).

The assets have been valued at component levels based on the practical ability to identify and manage the asset at that component level.

For this valuation Age has been used on all depreciable asset components as a factor to calculate the value of the asset.

The upper Wairau above the Waihopai River and some of the tributaries off the Wairau Plains have river protection works. Historical infrastructure on these rivers is no longer maintained by Council and are not valued. Neither are natural river channels nor land beneath rivers.

1.2.2 Scope

The valuation was carried out on the following asset components:

- Rivers - earthworks, rockworks, trees and retard, excavations, miscellaneous structures.

- Drainage - excavations, miscellaneous structures, pump station, mechanical and electrical and structures.

2017-2018 asset additions did not form part of the revaluation.

1.3 Valuation Process

1.3.1 Data Sources and Verification

Rivers and Drainage asset information for the valuation has been obtained from Asset Registers held as Excel spreadsheets for asset management planning purposes.

1.3.2 Data Procedures

- Most of the rivers and drainage assets are considered to be maintained into perpetuity, with maintenance work expensed, so apart from pump station assets and Taylor Dam structural components where depreciated replacement cost values have been calculated, the replacement cost is maintained.

- Where asset attribute information is missing in the database and the detail is not available on hardcopy plans, assumptions have been made on the attribute based on staff personal knowledge.

- If any assets are past their useful life and they are not planned to be written off or replaced in 2008 a residual life has been allowed in line with their replacement year as indicated in

the asset management plans. In assessing older assets the economic life has been modified by an age factor. For assets whose economic life has expired the factor has the effect of extending the useful life of the asset. Age factors used are those set out in the New Zealand Infrastructure Asset Management Manual 1996, but modified for local conditions.

1.3.3 Unit Rates

The unit rate for assets used in the calculation of the replacement cost are minimum costs of replacing an asset by another asset offering the same level of service most efficiently. Materials and plant costed are those that council would utilise today.

The unit rates used in the valuation have been obtained from contracts completed in the last five years and are an average of all situations. All items have been subject to a multiplier to cover design, administration and sundry expenses of constructing the item.

Other rivers and drainage asset costs have been obtained from completed contracts and quotes for plant from suppliers.

Reconstruction works on earth stopbanks following the Kaikōura earthquake has been undertaken at contract rates significantly higher than the units rates used for previous re-valuations. The rise in costs is thought to be partly due to a local shortage of good quality rock and the current high demand for earth-works contractors. It is thought that these circumstances may persist and it has therefore been decided to increase the rates for stopbank renewal. The new rates will be to selected stopbanks to a) avoid a sudden'shock' increase to renewal values b) as a precaution in case contract costs are a temporary peak. Stopbanks are not depreciated so the revaluation will not impact renewal funding.

1.3.4 Asset base lives

The valuation has adopted unlimited life for stopbanks, rockwork, rock groynes, channel works and drainage channels, together with their associated structures.

Base lives used in the pump station valuation are as set out in the International Infrastructure Asset Management Manual 2000, but modified by local experience of actual useful lives.

1.3 Depreciation Methodology

1.3.1 General

Three components; the *Replacement Value*, the *Depreciated Replacement Value* and the *Annual Decline in Service Potential* (DISP) have been calculated.

The Replacement Value is the value of the asset today should it be replaced. In calculating the value it is assumed that modern construction techniques are used but that the physical result replaces the asset as it exists.

The *Depreciated Replacement Value* is an accounting procedure that distributes the cost or value of an asset over its estimated useful life. Thus depreciation only applies to those assets with finite lives. Earthworks such as ponds, embankments and drains have an infinite life and have not been depreciated.

The formula used to calculate the *Depreciated Value* for pump station assets was:

Remaining life/economic life x replacement cost

where the remaining life is calculated from the base life and the date of construction of the asset.

The *Annual Decline in Service potential (DISP)* has been calculated using the straight line depreciation method. The formula used was:

1.3.2 Summary of Changes

- Valuation figures vary between 2018 and 2015 due mainly to general inflation on contract rates and material costs and the change in river works contract rates – as discussed above.

- An increase in the total length of rural drainage due the implementation of the extension of drains policy

Appendix 5: Ministry for the Environment guidance on climate change

The advice on the Ministry for the Environment website (updated December 2017) on the likely impacts of climate change in Marlborough is as follows:

“Projections of climate change depend on future greenhouse gas emissions, which are uncertain. There are four main global emissions scenarios ranging from low to high greenhouse gas concentrations. This page presents regional projections as a range of values from a low emissions to a high emissions future.

The projected changes are calculated for 2031–2050 (referred to as 2040) and 2081–2100 (2090) compared to the climate of 1986–2005 (1995).

Temperature — Compared to 1995, temperatures are likely to be 0.7˚C to 1.0˚C warmer by 2040 and 0.7˚C to 3.0˚C warmer by 2090.

By the end of the century, Marlborough is projected to have from 6 to 38 extra days per year where maximum temperatures exceed 25˚C. The number of frosts could decrease by around 7 to 19 per year.

Rainfall —Rainfall will vary locally within the region. The largest changes will be for particular seasons rather than annually.

Summer rainfall in Blenheim is projected to increase by up to 9 per cent by 2090.

According to the most recent projections, extreme rainy days are likely to become more frequent in Marlborough by 2090 under the highest emissions scenario.

Snowfall — The Marlborough region is likely to experience significant decreases in seasonal snow. By the end of the century, the number of snow days experienced annually could decrease by as much as 30 to 40 days in some parts of the region. The duration of snow cover is also likely to decrease, particularly at lower elevations.

Less winter snowfall and an earlier spring melt may cause marked changes in the annual cycle of river flow in the region. Places that currently receive snow are likely to experience increasing rainfall as snowlines rise to higher elevations due to rising temperatures. So for rivers where the winter precipitation currently falls mainly as snow and is stored until the snowmelt season, there is the possibility for larger winter floods.

Wind — The frequency of extremely windy days in Marlborough by 2090 is likely to increase by between 2 and 10 per cent. There may be an increase in westerly wind flow during winter, and north-easterly wind flow during summer.

Storms — Future changes in the frequency of storms are likely to be small compared to natural inter-annual variability. Some increase in storm intensity, local wind extremes and thunderstorms is likely to occur.

Sea-level rise — New Zealand tide records show an average rise in relative mean sea level of 1.7 mm per year over the 20th century. Globally, the rate of rise has increased, and further rise is expected in the future.”

Appendix 6: LTP Assumptions

Assumptions, Disclosure and Compliance

Assumptions

With any financial forecasting, a number of assumptions must be made. The following assumptions have been made in the preparation of this document. Also presented for each assumption is the "Level of uncertainty", "Risk" and "Financial Impact" for each.

Legislative

Assumption

Local Government may be significantly affected by changes in legislation as a result of a new Government being elected in late 2017. However, until the Coalition settles in fully there is no certainty as to its policy direction and specifics to achieve its desired outcomes. As a result of the uncertainty, it is assumed that legislative and Government policy changes will not significantly impact upon Council's current responsibilities and activities.

Level of Uncertainty

Medium.

Risk

It is highly likely that the new Government will want to advance its own agenda. As a result of local government having a very broad range of activities it is also very probable the cumulative effect on Council will be significant.

Financial Impact

To date Government's reforms have not reduced legislative obligations, costs or the impact on the ratepayer. It is too early to assess the financial impact of the Government's signalled policy announcements. However, it is expected that there will be specific requirements resulting from legislative change, the Havelock North Water Quality Inquiry and a continued issuance of National Policy Statements. However, Council is moving to address the likely outcomes of the Havelock North Inquiry in its infrastructure planning.

Inflation

Assumption

The costs, revenues and asset values reflected in this plan reflect the following "Forecasts of Price Level Change Adjustors to 2028" produced by Business Economic Research Limited (BERL) in September 2017 for the Society of Local Government Managers.

Label Year Ending	Planning and Regulation	Roading	Transport	Community Activities	Water and Environmental
	% change on year earlier				
June 2017	1.4	1.6	1.6	1.8	1.2
June 2018	1.8	1.9	1.9	1.7	1.8
June 2019	2.0	2.0	2.0	1.7	2.3
June 2020	2.1	2.2	2.0	2.0	2.5
June 2021	2.1	2.2	2.1	2.1	2.3
June 2022	2.1	2.3	2.2	2.1	2.4
June 2023	2.2	2.4	2.2	2.2	2.4
June 2024	2.3	2.4	2.3	2.3	2.5
June 2025	2.3	2.5	2.4	2.3	2.6
June 2026	2.4	2.6	2.5	2.4	2.6
June 2027	2.4	2.7	2.5	2.4	2.7
June 2028	2.5	2.8	2.7	2.6	2.8
20 year average % pa	2.3	2.5	2.4	2.3	2.6

BERL also consolidates the above adjustors into a consolidated Local Government Cost Index (LGCI) which is further split between operating and capital expenditure.

Year ending	OPEX	CAPEX	TOTAL
	annual average % change		
June 2017	1.5	1.5	1.52
June 2018	1.8	1.8	1.80
June 2019	2.0	2.0	2.06
June 2020	2.2	2.2	2.12
June 2021	2.2	2.2	2.17
June 2022	2.2	2.2	2.21
June 2023	2.3	2.3	2.35
June 2024	2.3	2.4	2.29
June 2025	2.4	2.4	2.41
June 2026	2.5	2.5	2.53
June 2027	2.5	2.6	2.55
June 2028	2.6	2.7	2.64

Level of Uncertainty

Medium to high.

NB: The forecast increases for Capital Expenditure are generally higher than operating cost increases and it is the Capital Expenditure that has historically driven rates increases.

Risk

There is a risk that the local inflation rates may be higher or lower than the national averages forecast by BERL.

Financial Impact

Should local inflation exceed the national average, this could result in either an increase in rates and debt servicing or deferral of capital projects which may impact upon the level of service that can be provided.

Interest Rate on Council Borrowings

Assumption

Council has assumed a long term interest rate on internal loans of 5.5% for the entire 10 years covered by the Long Term Plan. External interest rates may vary depending on the term of the debt and prevailing market conditions.

Level of Uncertainty

Medium.

Risk

As a result of the continuing impact of the Global Financial Crisis and the expectation of increased interest rates in the future, Council has adopted a conservative position compared to current market rates to mitigate the risk associated with interest rate movements. Council has adopted this approach as interest rates can increase significantly within short timeframes, as has happened in the past. Council will attempt to mitigate the impact of interest rate rises with a prudent hedging programme that operates in accordance with its Treasury Policy. However, because of Council's current low debt level, its ability to hedge significant amounts of its forecast debt is limited.

Financial Impact

Increases in interest rates above 5.5% will result in higher debt servicing costs and rates funding requirements. Council only debt (internal and external) is currently forecast to peak at approximately $225 million. As a result a 1% increase in interest rates above the 5.5% forecast would result in increased interest costs of $2.3 million.

Population Growth

Assumption

In preparing the Long Term Plan Council has assumed population growth will occur at slightly above the Department of Statistics medium population growth projection. Population growth is further discussed in the Key Issues and Infrastructure Strategy sections of the Long Term Plan.

Level of Uncertainty

Low.

Risks

Population growth occurs at rates above or below the level forecast with corresponding impacts on the revenue received from rates and development contributions.

Financial Impact

If population growth occurs at a slower rate than forecast, then the level of development contributions received will be lower than expected. However, there is the opportunity to mitigate the financial impact by slowing the Capital Expenditure programme. It is not expected that levels of service will be impacted upon significantly.

Economic Life

Assumption

Council has made a number of assumptions about the useful lives of its assets. The detail for each asset category is shown in the Statement of Accounting Policies. The useful lives are consistent with Council's experience with respect to its ongoing replacement programme.

Level of Uncertainty

Low — above ground.

Medium — below ground.

Risk

Assets wear out and need to be replaced earlier than anticipated.

Financial Impact

Depreciation and borrowing costs would increase if replacement Capital Expenditure was required earlier than anticipated. However, these impacts could be mitigated in part by reprioritising the Capital Expenditure programme. There may also be an increase in maintenance costs to keep the asset operational until it is decided to proceed with replacement.

Subsidy Rates

Assumption

The New Zealand Transport Agency (NZTA) has recently reviewed its financial assistance policy and it is assumed that Council will retain, for the period of the Plan, its current subsidy rate of 51% for road maintenance and construction works.

Level of Uncertainty

Low.

Risk

NZTA will either reduce the subsidy rate and/or toughen the criteria for the inclusion of works in the qualifying programme.

Financial Impact

If the subsidy rate is reduced, either a reduction in the level of service or an increase in rates would be required. Council is already receiving very good pricing for road maintenance compared to other Local Authorities, through its collaboration with NZTA in the form of Marlborough Roads.

Natural Disasters

Assumption

Should a major natural disaster occur the District could be faced with significant repair and reconstruction costs. Council has estimated the maximum probable loss (MPL) cost as a result of a major earthquake, flood or tsunami at approximately $485 million, following a joint Treasury supported exercise with AON and Tonkin and Taylor. It is assumed that this forecast is accurate. It is also assumed that:

- The forecast contributions from the Local Authority Protection Programme (LAPP), insurance, Government and the NZTA will be received.
- Through a combination of Council's reserves, investment realisation, credit facilities and rescheduling capital and other works, Council can meet the remaining costs associated with a major disaster over a seven year period.
- As a result of a second earthquake occurring in Christchurch, Council has also modelled the financial impact of second significant event. Through the use of the same mechanisms identified in the two bullet points above, Council could meet the remaining costs associated with a second major disaster over a seven year period post the second event.

The LAPP fund is a mutual pool set up to assist councils cover their share of damage to "below ground" and river protection assets resulting from a significant natural event. At the time the fund was formed commercial insurance alternatives for these assets was not available. There was also a clear requirement from Central Government that any assistance given to rebuild infrastructure following a disaster will only be made available if Council has made adequate financial provisions to cover its own repair obligations.

Above ground assets are insured through commercial insurance. These costs are in addition to LAPP contributions. Insurance costs have increased over recent years as a direct result of national and international disasters. Council has mitigated the effect by

joining with Nelson City and Tasman District councils and a pool of over 600 Australian Local Authorities.

2016 Kaikōura Earthquake. Council is still investigating the damage caused by the November 2016 Kaikōura earthquake. Evidence suggests the earthenware sewerage network pipes in Blenheim and Picton have sustained extensive damage. The LTP includes a provisional $12.0 million for their replacement over 10 years. Council is working with Government officials and its insurers to reduce the amount it must fund itself. Strengthening work is also required for a number of Community Facilities. These allocations have reduced the dedicated Emergency Events Reserve to a forecast balance of just over $9 million at 30 June 2018. Council had intended to rebuild this Reserve using the surpluses from the General Revenues Account, but the forecast balance in 2028 is still only $3 million. This is because of the expected ongoing funding demands from Road and River damage following rainfall events and the reduction in revenue into the account resulting from the decision to reduce the interest rate assumption. While Council would like to increase this balance over time, it is also aware of its ability to reprioritise its capital works programme, probable insurance and Government funding and its total Reserve position. As a result Council believes that it has sufficient capacity to meet its obligations should a significant natural disaster occur without the need for an immediate rates increase.

Level of Uncertainty

Low.

Risks

The actual costs of recovery from a major natural disaster are higher than the forecast MPL of approximately $485 million.

Financial Impact

Should Council's current estimate of MPL and existing arrangements prove inadequate, either an increase in debt and corresponding increase in rates or a slowing in the rebuild would need to occur.

Taxation Framework

Assumption

Council has assumed that existing taxation framework for the Marlborough District Council group will continue for the period of the Long Term Plan.

Level of Uncertainty

Low.

Risk

That the Inland Revenue Department (IRD) takes a view that Council's Holding Company structure is inconsistent with taxation legislation resulting in an increase in associated tax costs.

Financial Impact

Council has mitigated the potential for this to happen by obtaining independent legal advice and a "Binding Ruling" from the IRD on the establishment of MDC Holdings Ltd. Council has not deviated from the principles determined at establishment, so the risk and financial impacts should be low.

Asset Ownership and Valuation

In the preparation of the Long Term Plan it has been assumed that Council will retain:

- Ownership of MDC Holdings Limited and its subsidiaries:
- Its ownership share (88.5%) in Marlborough Regional Forestry, with Kaikōura District Council owning the remaining 11.5%.
- Ownership of all substantial assets currently owned.

It has also been assumed that Council will revalue its major assets annually.

Level of Uncertainty

Low.

Risk

The asset values shown in the Long Term Plan have been adjusted based on the BERL indices. The risk is that the results of actual revaluations may be higher or lower than those disclosed in the Long Term Plan.

Financial Impact

If asset revaluations are higher than forecast, this will increase the resulting depreciation cost and rates as Council moves to provide for asset replacement.

Sources of Funds for Capital Expenditure

The Financial Strategy identifies the expected sources of funds for Council's Capital Expenditure programme. It has been assumed that the funds identified for each of these sources will be received.

Level of Uncertainty

Low.

Risk

That the forecast funding will not be received as forecast.

Financial Impact

As it is proposed to fund Capital Expenditure from a range of sources it should be possible to compensate a funding shortfall from one source with funding from another i.e. borrowing. If it is decided to increase borrowing a debt servicing cost and a corresponding increase in rates will arise. The alternative is to slow Capital Expenditure especially if the project is growth related and the funding shortfall relates to Development Contributions.

Climate Change

Council has assumed that the climate changes in relation to rainfall, temperature and sea level will occur as predicted. It has been further assumed that climate change will have minimal impact over the period of the 2018–2028 Long Term Plan. This topic is considered in greater depth in Council's Infrastructure Strategy. This is appropriate given this Strategy covers a longer 30 year period.

Level of Uncertainty

Low.

Risk

That asset and hazard planning has not adequately assessed climate change.

Financial Impact

For the period of the Long Term Plan, the financial impact is assessed as low as climate change on the whole is occurring very slowly, providing extended lead times for mitigation measures if required.

Emissions Trading Scheme (ETS)

Any direct impacts of the ETS through potential price increases are assumed to be covered by Council's inflation assumptions and thus factored into the forecasts.

Specific ETS costs relating to waste and landfill have been incorporated into those estimates, together with the increased revenue that will be received.

Pre 1990 forestry has been registered. Any costs associated with the ETS will be minimal given Council's rotation and replanting policy.

Level of Uncertainty

Low.

Risk

The impact and scope of the ETS may be more than assumed.

Financial Impact

The Council will face increased compliance and operating costs, which if significant enough, may require higher fees and charges or increased rating requirements to fund them. However, Council had already taken steps to reduce the landfill liability and fix the price of the Emission Trading Units that will be required to be surrendered for the first three years of the Scheme's operation.

Resource Consents

Council has assumed that it will continue to hold and comply with appropriate resource consents to enable it to continue its activities, especially in relation to sewerage and stormwater.

Level of Uncertainty

Low.

Risk

Appropriate consents are either not renewed or require improvements in level of service before being granted. The trends in Resource Consent requirements are covered more fully in the Infrastructure Strategy.

Financial Impact

The main financial impact could occur if levels of service require improvement before a resource consent renewal is granted. The resulting increase in costs will likely require an increase in borrowing which in turn will impact on rates.