



REGIONAL ASSET MANAGEMENT PLAN

TŌ TAI AO – HE AHA NGĀ
TINO TAKE?

FLOOD PROTECTION AND
CONTROL WORKS
RIVER MANAGEMENT
LAND DRAINAGE



Peer reviewed by Zone Managers, and ICM Director May 2021

Approved for release by Business and Technical Services Section Manager on 01 July 2021

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ACKNOWLEDGEMENTS

River and Catchment Management Committee members (Councillors, community and iwi members)

Integrated Catchment Management Directorate

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Owner of the document

The Owner of this document is the Manager, Business and Technical Services. If you have any suggestions for additions to this document or have found any errors, please pass them on to this person.

Change register.

Version	Release Date	Change Description
1	6 th July 2018	2018/19 Regional Asset Management Plan Available for use within Council
1.1	9 th January 2019	Updated with requested changes in appendix A4, and to Glossary of Terms
1.2	25 th January 2021	All sections reviewed, and updated with new information ready for LTP discussion with RCMC

EXECUTIVE SUMMARY

The purpose of Regional Asset Management Plan is to provide a line of sight on how the Waikato Regional Councils (WRC) mission is being translated through to the routine and improvement actions that are being performed on the flood protection, river management, and land drainage assets managed by the council.

Strategic Direction

The mission of the WRC is to ensure we balance the needs for a healthy environment, strong economy, and vibrant communities.

The WRC has several long-term outcomes relating to each of these three key priorities. Regarding the assets used for flood protection, river management, and land drainage the key strategic outcomes are:

- Land use is appropriate for long term sustainability.
- Communities are less vulnerable and more resilient to natural hazards, and the effects of climate change and changes to society and the economy.
- Economic growth ensures natural capital and ecosystem services are maintained.

Purpose of Integrated Catchment Management

The management services provided by the Integrated Catchment Management team within the WRC include:

Flood Protection

1. The management, renewal, and maintenance of major flood control schemes to the agreed level of service.
2. Operation of the flood warning system.

River Management

1. Protecting and stabilising riverbanks.
2. Controlling bank erosion.
3. Removing blockages.
4. Ricer channel, gravel and sand management.

Land Drainage

1. Management of natural and built infrastructure to support productive pastoral farming.

Integrated Catchment Services

1. Biosecurity and biodiversity management.
2. Protect and enhance the regions natural heritage.
3. Manage relationships with community groups involved in ecological protection and restoration.
4. Education, raising awareness of agricultural sustainability issues and promoting best practice.

Of these works, the first three (flood protection, river management, and land drainage) are in the scope of the WRC Regional Asset Management Plan. This document does not cover Integrated Catchment Services work, nor does it cover land drainage work which is administered by District Councils.

Purpose of Regional Asset Management Plan

This document includes summaries of:

- “Levels of Service” required from the flood protection, river management and land drainage assets.
- Roles and responsibilities of various council and community functions in the management and improvement of our asset base.
- Management expectations for the operation, maintenance, renewal, condition monitoring of the asset base.
- Key planned improvement initiatives to increase the effectiveness of delivery of Level of Service Requirements and efficiency in management of assets.

To enable:

- A common understanding of the WRC asset management processes for the flood protection, river management, and land drainage related infrastructure.
- Visibility of service level expectations from the asset base, associated levels of risk exposure, options, and costs.
- Discussion on the long term works programmes development approach and how they will be funded.
- A common communication tool for use with staff, council, catchment committees, sub committees, iwi, key stakeholders and ratepayers.
- Management tools and processes that are live and adaptable regarding the changing needs of the assets.

Level of Service

The aims of the flood protection and control and integrated catchment management activities are:

- To meet legislated requirements in the management of our assets.
- To meet WRC Long Term Plan requirements.
- To manage the design, operating, maintenance, condition monitoring, renewals and the review of and improvement of activities of our assets to meet agreed levels of service.

Flood Protection

- To provide the regional community with an agreed level of protection from floods.

River Management

- To manage the capacity and functional requirements of the rivers, while balancing agreed levels of environmental protection and enhancement.
- To manage erosion levels and improve bank stability through activities such as riparian planting.

Land Drainage

- To manage land drainage infrastructure to provide an agreed level of drainage for productive pastoral land.

Major Asset Types

The key asset types managed under the Regional Asset Management plan are:

- Pump Stations
- Flood gates
- Stopbanks & Spillways
- Detention Dams
- Drains
- Fencing

The assets owned and managed by WRC were re-valued in December 2016 and have been split by the services provided as follows:

Table 1: Current Valuation of WRC Asset Base

Services Provided	Optimised Replacement Cost (ORC) \$	Optimised Depreciated Replacement Cost (ODRC) \$
Rivers and Catchment Management	\$553,992,930	\$401,505,634
Land Drainage	\$30,886,533	\$28,299,754
Total Asset Value	\$643,260,310	\$462,538,879

Responsibility for delivery of Regional Asset Management Plan

The Waikato region has four major river catchment areas spanning eleven District Councils. The day to day operation, maintenance, monitoring of works, and engagement with the local community is managed by operations teams for each catchment area through catchment and drainage committees.

Table 2: Alignment between WRC River Management area and associated District Councils

River Catchment Area	District Councils in Area	River Catchment Area	District Councils in Area
1. Coromandel	Thames Coromandel Hauraki	3. West Coast	Waitomo Otorohanga Waikato
2. Waihou & Piako	Thames Coromandel Hauraki Waikato Hamilton Matamata Piako South Waikato	4. Waikato River (including Lake Taupō and Waipa River)	Taupō Rotorua South Waikato Waitomo Otorohanga Waipa Hamilton City Matamata Piako Waikato

WRC Business and Technical Services Team manage the renewals process, procurement process, valuation process, cross catchment areas assessment works, hazard evaluation & resilience strategies, collation and storage of technical information, coordination of environmental compliance and best practice, and overarching asset management requirements.

Key issues and current response

A number of regionally significant issues and trends have been identified that will have an effect on the asset management activities for the integrated catchment management directorate. The table below provides a summary of key issues across the region and the current response to address these issues.

Table 3: Key issues and current strategy and responses to address the risk

Key issue	Strategies to address key issues
<i>Climate change</i>	Establishment of regional standards and guidelines. Continued investment in flood risk forecasting and prediction tools. Monitoring how extreme weather events and their effect on asset functionality and condition. Identified responses are incorporated into works programmes.
<i>Growth and development</i>	Reviewing changes in planning and policy development, including growth strategies, to review Levels of Service required and if asset management plans are delivering required levels.
<i>Treaty of Waitangi Settlements</i>	Ongoing discussions and involvement of iwi in land usage strategies.
<i>Sustainability of schemes</i>	Review how sustainability of schemes is calculated, and how Levels of Service could be discussed and changed in the future.
<i>Land use change</i>	Sustainable land management practices promoted across catchments. Engage with District Councils planning processes. Broaden scope of hydraulic modelling services to better inform sustainable development.
<i>Ageing assets</i>	Condition and performance assessments. Maintenance and renewal programmes.
<i>Environmental performance</i>	Monitor balance achieved between environmental and economic objectives. Comply with relevant legislation, rules and regulations and consent conditions where relevant.
<i>Natural disasters</i>	Assessment of all natural hazard risks. Management of flood risks. Raise community awareness as to emergency procedures and response.

Key issue	Strategies to address key issues
	Input to District Council plan reviews to highlight issues
<i>Knowledge fade</i>	Adequate resourcing Succession planning
<i>Community awareness</i>	Community education, promotion and engagement Regular community targeted information / publicity

Key Improvement Areas

Improvement in both the effectiveness of delivery of the Levels of Service required and efficiency in the management of the WRC asset base has occurred over the last 3 years. Key highlights have been the development and implementation of an Asset Management Policy, introduction of best practice project management practises, and review and alignment of Levels of Service requirements across the catchment areas.

Several new areas have been identified for improvement and are highlighted in the table below.

Table 4: Key asset management areas, and overview of planned improvement activities

Area	Improvement Activities
<i>Vision, Plans, and Guidelines</i>	Review management plans for sustainability of delivery of agreed levels of service.
<i>Management of Maintenance & Operation activities</i>	Develop common methodologies and ways of working across catchment areas to manage operations and maintenance tasks. Routinely review improvement requirements to enable delivery of these aspects
<i>Project Management and Governance</i>	Continue implementation and oversight of project management practises across renewals projects and other improvement projects.
<i>Health and Safety</i>	Develop cohesive safe system of work
<i>Level of Service measurement</i>	Review efficacy and quality of data and identify areas for improvement. Routinely review improvement requirements to enable discussions with communities

1 ORGANISATION OVERVIEW

1.1 Purpose, Vision, Objectives and Measures

1.1.1 Context

The Waikato is the fourth largest region in New Zealand covering most of the central North Island. It covers 25,000 square km (2.5 million ha) stretching from the Bombay Hills and Port Waikato in the north to Mokau on the west coast and across to the Coromandel Peninsula on the east coast. In the south it extends to the slopes of Mt Ruapehu and to the east the Kaimai Ranges. The region has several lakes including the country's largest, Taupō, and the longest river, the Waikato, which passes through eight hydro-electric dams and flows into the Tasman Sea at Port Waikato after a journey of 425 km from Lake Taupō. The region has one city (Hamilton) and 10 district councils, three of which lie across the regional boundary.

1.1.2 Organisation Purpose

Waikato Regional Council's (WRC) activities provide guidance and support for the sustainable development of the Waikato region, to ensure the region grows and develops in a way that keeps its values safe for future generations. WRC also has a broader responsibility in combination with others for the economic, social and cultural well-being of the regional community.

1.1.3 Vision and Mission

WRC revisited its strategic direction and priorities for the period 2019-2022, considering the Local Government Act amendments and internal and external drivers of change. The revised draft strategic direction is summarised in the figure below.

The strategic direction provides the framework to develop and priorities all work within the WRC.

A key aspect of the strategy is for WRC's flood protection, drainage, and river management endeavours are to provide sustainable infrastructure.

Our flood schemes protect 3000 km² of land, as well as critical services and infrastructure from the impact of floods. Being able to productively use this land boosts our regional economy by \$2.2b every year.

Most schemes were built in the 1960s and 70s. Expectations have changed since then and so have climate patterns. Urban areas are ever expanding too, meaning more stormwater runoff into our waterways.

The challenge now is maintaining and upgrading these schemes in a way that meets future needs without impacting the natural environment. And it must be affordable across generations of rate payers.

OUR PURPOSE

Working together for a Waikato region that has a healthy environment, strong economy and vibrant communities.

This means working alongside residents and ratepayers, community groups, central and local government, iwi, the primary sector and businesses. If we get it right, our region will be stronger, it will be economically resilient and people's quality of life better.

OUR VALUES

Responsible – doing the right thing
Effective – making a difference
Respectful – acting with respect

OUR CUSTOMER COMMITMENT

Exceptional customer service built on a foundation of authenticity, empathy and trust.

Figure 1: Waikato Regional Council Strategic Direction 2019 - 2022

1.2 Strategic Alignment

1.2.1 Community Outcomes

The key community outcomes that the WRC aims to achieve in meeting the current and future needs of communities regarding flood protection and control, and integrated catchment management are listed below.

Table 5: WRC Key Community Outcomes, that relate specifically to asset management

Area	Details
Healthy Environment	<ul style="list-style-type: none"> Land use is appropriate to its long-term sustainability It is safe to swim and take kai from all freshwater The full range of ecosystem types, including land, water and coastal and marine ecosystems, are in a healthy and functional state All soil quality indicators are trending positive
Strong Economy	<ul style="list-style-type: none"> Economic growth ensures natural capital and ecosystem services are maintained The Waikato region is moving towards a low carbon economy We are achieving best use of the regions fresh water New investment is attracted to the region through improved reputation and partnerships
Vibrant Communities	<ul style="list-style-type: none"> Communities feel like a valued part of the Waikato and take pride in the region Communities are empowered and supported to take action on agreed outcomes Communities are less vulnerable and more resilient to natural hazards, the effects of climate change, and changes to the social and the economy We support all parts of the Waikato to be as successful as they can be Co-governance with iwi is meaningful and effective

The complete list is available in the “Our Strategic Direction 2019-2022” document (Doc#16788839).

All asset related decisions should consider the “whole of life” requirements, and balance both financial and non-financial aspects.

1.2.2 Legislative Requirements

The WRC has responsibilities under various acts of parliament. A detailed list of the legislative framework WRC works under to manage their assets is located APPENDIX AA1.6.

Table 6: Legislative requirements for flood protection and drainage assets management by any council

Area	Details
Flood Protection & River Management	System adequacy and maintenance: The major flood protection and control works that are maintained, repaired and renewed to the key standards defined in the local authority’s relevant planning documents (such as its activity management plan, asset management plan, annual works programme or long term plan).
Land Drainage	<p>System adequacy: The number of flooding events that occur in a territorial authority district.</p> <p>Response times: The median response time to attend a flooding event, measured from the time that the territorial authority receives notification to the time that service personnel reach the site.</p> <p>Customer satisfaction: The number of complaints received by a territorial authority about the performance of its system, expressed per 1000 properties connected to the territorial authority’s system.</p>

1.2.3 Documentation Hierarchy

The Asset Management Policy requires the Asset Management Plan to meet both the council’s statutory obligations and mission.

The Regional Asset Management Plan does this by bringing together the strategic and tactical requirements laid out through legislation, the WRC mission statement and long term plans and policies. It provides a comprehensive picture of how the various documents are being translated through to the routine and improvement actions that being performed on the flood protection, river management, and land drainage assets managed by the council.

It also provides a summary on how well long term goals are being achieved, allowing a review of whether the current tactics are effective.

The diagram below shows the linkages between the Regional AMP, key legislative requirements, national and regional policy directive, WRC plans and policies, and other individual plans.

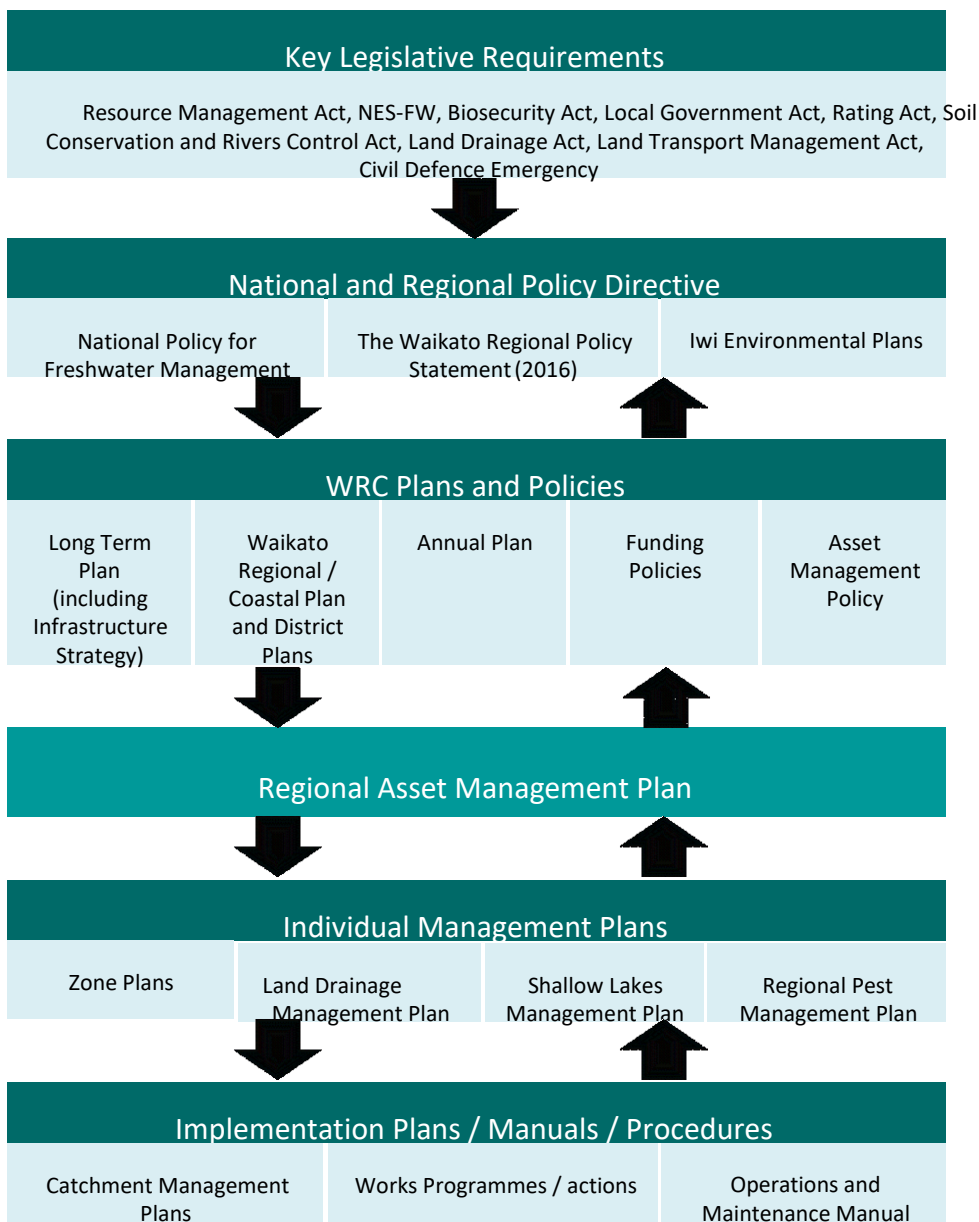


Figure 2: Documentation Hierarchy

1.3 The Services We Provide

The Regional Asset Management Plan (RAMP) focuses on the management of flood protection, drainage, and river management infrastructural assets.

It is expected that this is achieved through:

- Coordinated efforts within Integrated Catchment Management (ICM) group
- Clear line of sight at all stages of decision making to community outcomes
- In consultation with community groups and iwi
- Living the values of Waikato Regional Council everyday

The table below shows the works that are in scope for the delivery of the flood protection, drainage, and river management works to deliver on the council's legislative requirements.

Table 7: Council work areas in scope of the RAMP

Area	Details
Flood Protection	<ul style="list-style-type: none"> • Operating & Maintenance of flood control assets • Works programme to reduce deterioration caused by erosion & flood events • Technical investigations and strategies to balance environmental, community, and social-economic risks • Monitoring condition and effectiveness of asset management strategies • New capital works delivery, and upgrading existing assets where additional functionality is justified • Risk & Resilience reviews
River Management	<ul style="list-style-type: none"> • Operating & Maintenance of river management assets • Protecting and stabilising riverbanks • Monitoring & control of bank erosion • Removing blockages • River training works (channel management) • Gravel and sand management • Fence installation & maintenance • Land usage review management • Risk & Resilience reviews
Land Drainage	<ul style="list-style-type: none"> • Operating & Maintenance of land drainage networks (both natural, modified, and artificial) • Risk & Resilience reviews

1.3.1 WRC Works Areas Out of Scope of the RAMP

It does not cover other aspects of Council's work within catchments, namely Integrated catchment services, incorporating catchment planning and management, biosecurity, biodiversity and environmental farming systems. These are covered within other activity related documents.

While the work falls under the purview of the Integrated Catchment Management team and is important to the region, it is not directly related to the management and operation of our asset base. So is not in the scope of the RAMP.

2 ROLES AND RESPONSIBILITIES

2.1 Governance Structure

The Waikato Regional Council is governed by fourteen councillors elected from eight constituencies. The elected council delegates responsibility for various functions to several standing committees. Those committees provide oversight to various aspects of council management & prioritisation.

The Integrated Catchment Committee manages specific community requirements and provides oversight to the services provided for infrastructure and is supported and advised by 4 advisory sub committees.

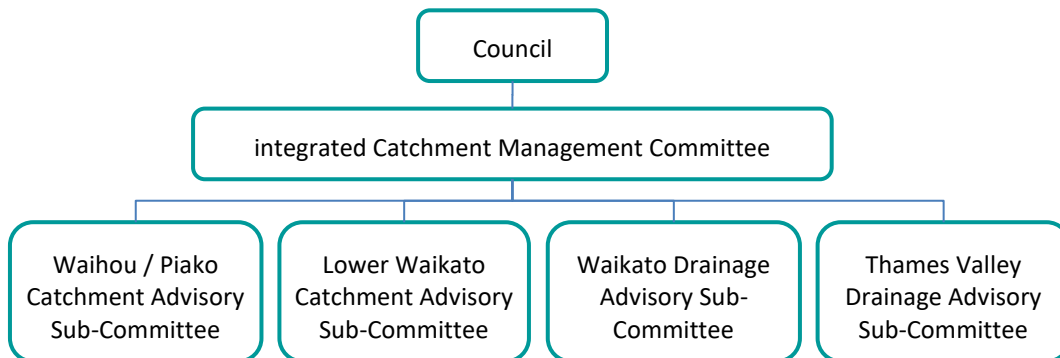


Figure 3: Subcommittee structure

2.2 Integrated Catchment Management Directorate Structure

Integrated Catchment Management Directorate fits into the governance structure as shown below:

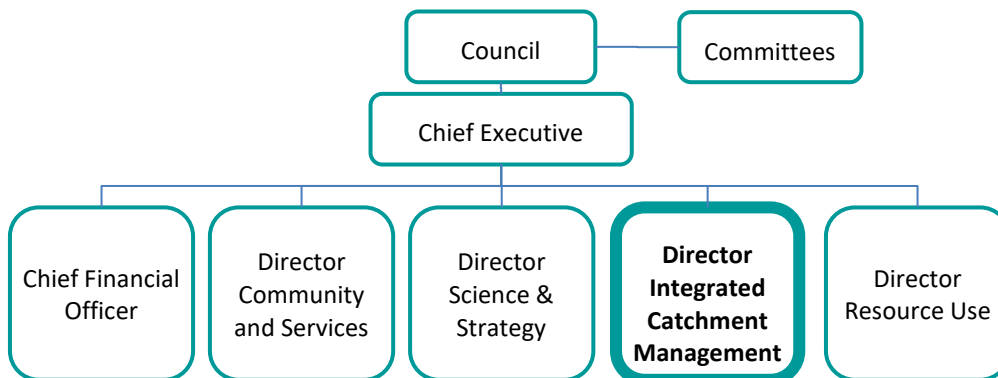


Figure 4: Council Directorates

The Director of Integrated Catchment Management is accountable for ensuring the Long Term Plan and Business-as-usual activities occur.

To manage these activities the ICM Directorate is split into 4 operational areas teams and 1 technical services team as shown below:

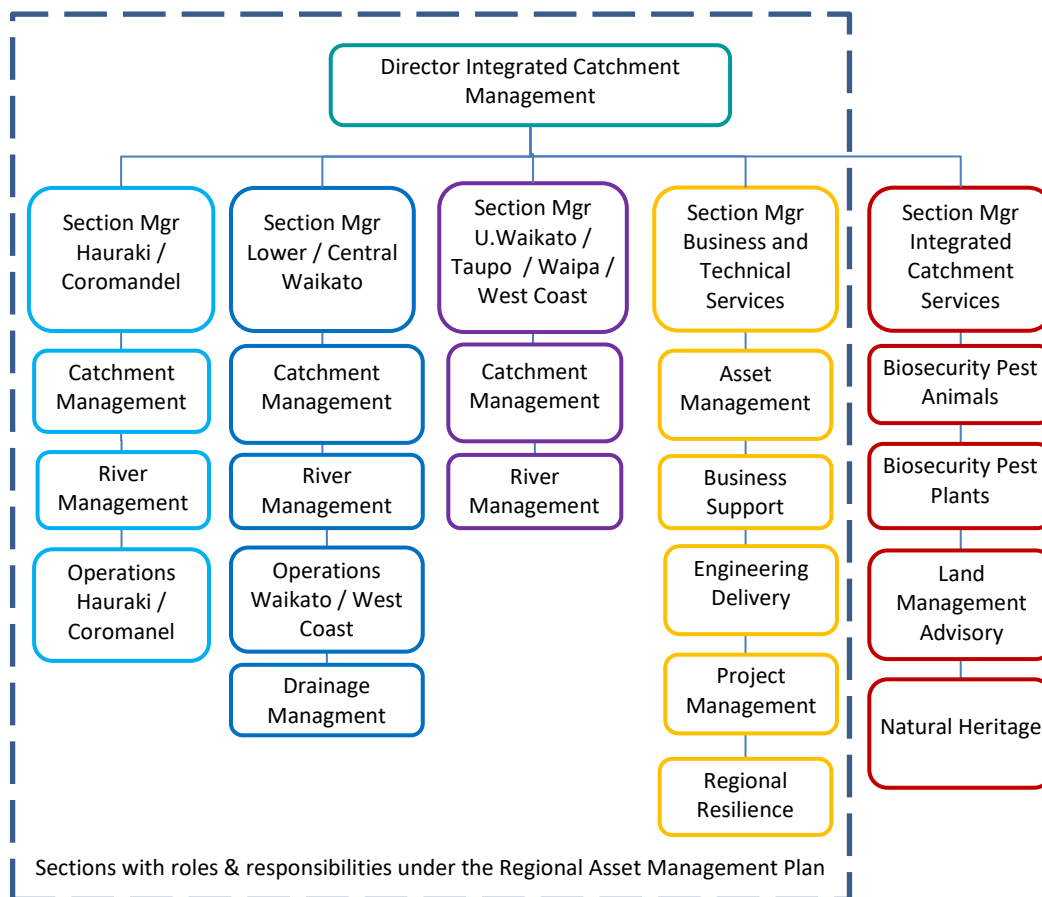


Figure 5: ICM sections within the dashed line are those related to the delivery of the Regional Asset Management Plan

2.3 Relationship Requirements

Relationships are key to ensure the level of protection and service offered by the infrastructure assets is maintained. This includes working with both internal and external stakeholders to ensure each catchments need are prioritised and managed.

Two key relationships are with the farmers in each catchment, and the iwi who have customary rights to specific areas. Those living within a flood protected zone, or drainage area pay a majority of the costs towards the upgrading and maintenance of each scheme or system. It is critical they know of works coming up, and the affect they will have on their future rates bills to ensure discussions around affordability occur if needed, or changing the levels of services provided occurs if the current levels are now not sustainable. Iwi provide a unique and complementary view of the land and waterways, and are involved when reviewing if a catchment requires different management practises.

More details of the key stakeholders, and specific requirements of interactions with those stakeholders are available in the APPENDIX AA2.1.

2.4 Leadership Commitment

Implementation of the Regional Asset Management Plan (RAMP) and Asset Management Levels of Service requires leadership commitment throughout the ICM Directorate.

This is demonstrated by:

1. Chief Executive and Director ICM endorsement of Asset Management Policy and Infrastructure Accounting Policy.

2. Section Managers, Zone Managers and Operations Team Leaders providing visible support and updates on Asset Management objectives, plans, and Levels of Service performance as part of regular BAU communications.
3. Roles and Responsibilities outlines in the RAMP embedded in WRC ICM organisation.

2.5 Role Accountabilities

The table below shows the key roles responsible for the delivery of the RAMP and Asset Management Levels of Service.

Table 8: Roles Accountable or Responsible for delivery of the Asset Management programmes within council.

Key Activities	Chief Executive	Director ICM	Zone Section Mgrs.	Zone Mgrs.	Operations T/L	BATS Section Mgr.	Asset Mgmt. T/L	Engineering Delivery T/L	Regional Resilience T/L	Bus. Support T/L	Finance T/L
Asset Management Delivery											
Asset Management (AM) Policy delivery and communication	A	R									
Establishment of RAMP & AM Levels of Service (LOS)		A		C	C		R	C			
Coordinate improvement plans across BATS & Operations			C	C		A	R	C			
Operations and Maintenance											
Establish Asset Management strategies for specific asset types				C	C	A	R	C	C		
Provide information on legislative requirements for asset types			A	C	C	C	R	C	C		
Collecting asset data, condition assessments, and levels of risk			A		R		C		C		
Maintenance prioritization, planning, scheduling, execution, and reporting			A		R		C				
Report on effectiveness of maintenance workflow and condition assessment processes			A		C		R	C			
New Capital and Renewals											
Capital renewals process management			I	C	C	A	R	C			
Capital renewals <u>portfolio</u> prioritization, planning, scheduling, execution, and reporting			A	R	C			C	C		
Major renewals <u>project</u> planning, scheduling, execution, and reporting			A	C	C			R	C	C	
Routine renewals <u>project</u> planning, scheduling, execution, and reporting			A		R			C	C		
Quality Assurance and Continuous Improvement											
Report delivery of Levels of Service to ICM SLT			A	R	C	C	I	I	I		
Information system management reporting						A	R				
Asset Health & Performance review across zones		A		C	C		R		C		C

Key

Responsible "the doer"	Ensures that the process or activity is undertaken and done (includes those who are assigned to the task)
Accountable "the buck stops here"	Ultimately accountable for the process or activity being completed appropriately (has authority to make decisions in relation to this process or activity) Responsible persons or groups are accountable to this role for this process or activity
Consulted "in the loop"	Not directly involved with undertaking the process or activity, but who are consulted/asked for input prior to process or activity being completed
Informed "kept in the picture"	Not directly involved with undertaking the process or activity, but who are informed of decisions and outputs as appropriate

3 LEVELS OF SERVICE

3.1 Overview

The Levels of Service document provides the link between the corporate and AM objectives and the measuring of “how” the technical and operational teams will show alignment and delivery.

The aims of the flood protection, drainage, and integrated catchment management activities are:

- To meet legislated requirements in the management of our assets.
- To meet WRC Long Term Plan requirements.
- To manage the design, operating, maintenance, condition monitoring, renewals and the review of and improvement of activities of our assets to meet agreed levels of service.

The levels of service requirements come from 4 sources, and through the development of the zone management plan works, can then be prioritised and executed. They are rewritten once every three years, and performance is reviewed quarterly.

Details on how the Levels of Service are developed are located in the appendix A3.

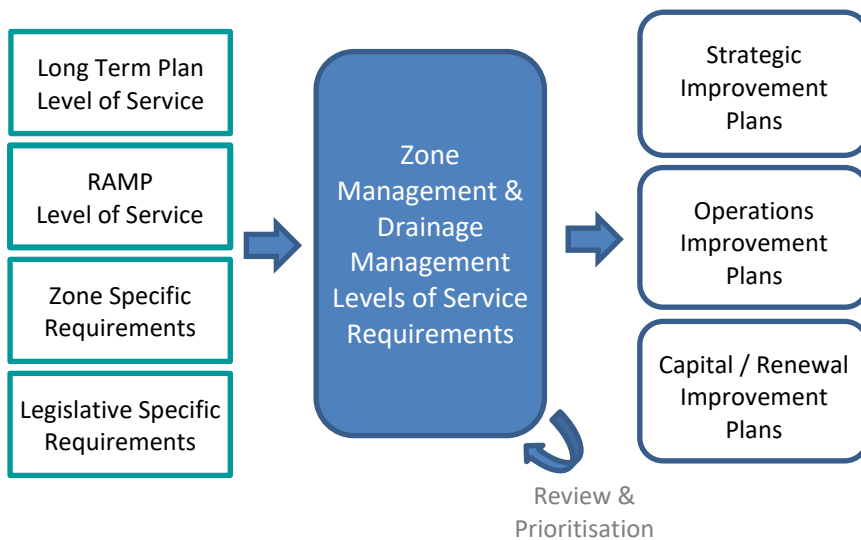


Figure 6: Diagrammatic sketch of where Levels of Service requirements fit

3.1.1 Measurement of achievement

Zone managers and Drainage Managers report to Management Committees on legislative requirements, and any other measures agreed with the committee at the frequency agreed with the committee.

Zone managers and Drainage Managers report to Section Managers on financial achievement of Long Term Plan and Business as Usual activities.

Changes in levels of service for specific drainage, channel, and flood protection systems are made only after consultation with the targeted ratepayers involved, through their respective sub-committee.

Owners of specific improvement plans aligned to achieving Level of Service measures will also report quarterly on progress to plan, and effectiveness of actions.

Past Performance against the targets is located in Asset Capacity and Performance section of RAMP.

3.2 Levels of Service Requirements

Below are the Levels of Service to measure the management and ensure capital and operational programmes are delivering the required outputs to the communities funding those works.

Details of the specific levels of service to be delivered by each flood protection scheme and drainage zone are located in Appendix A4.7

Performance to targets in the Asset Health Section 5.5.1

3.2.1 Flood Protection

Flood protection activities are aimed to reduce the likelihood that flooding will impact our communities. The council establishes, maintains and renews flood protection infrastructure such as stopbanks, floodgates and pump stations.

The infrastructure is designed to meet levels of service that are agreed with the community, and is maintained by a programme of regular inspections, routine maintenance and, in some cases, major renewals.

The key performance measures are detailed in the table below:

Table 9: Flood Protection Assets Levels of Service, Performance Measures and Targets

Key attributes	Level of Service	Performance Measure
<p>Safety: Ensuring the safety of property, people and stock by actively managing and maintaining agreed flood protection schemes to the agreed 'annual exceedance probability' (AEP) levels.</p> <p>Sustainability: Supporting the economic return of farm and urban areas within agreed schemes by ensuring they are protected from flooding and ensuring scheme land is managed in a manner that promotes its long term economic and biodiversity properties.</p>	<p>Major flood protection and control works are maintained, repaired and renewed to the key standards defined relevant planning documents (such as zone management plan, annual works programme or long-term plan).</p>	<p>Measure 1: Over 85% of planned mandatory maintenance* actions achieved each year</p> <p>Measure 2: 93% Rural and 95% Urban stopbanks are maintained to above designed flood height, as agreed within each zone</p> <p>Measure 3: 100% of flood recovery plans¹ implemented after all major events</p>

Details for the Level of Service for each zone, and where known each catchment are located in Appendix AA4.7. Also see 2021-2031 LTP Levels of Service and Performance Measures – Flood Protection (Doc#16089006)

Performance against each target is monitored throughout the year and a final measure reported as part of the annual plan results. These numbers are also annually audited by NZ Audit to ensure robustness of process followed.

Table 10: Historical and Current Flood Protection Performance against targets

Performance Measure	Actual Performance					Target
	15/16	16/17	17/18	18/19	19/20	LTP
% Planned mandatory Maintenance	56%	84.2%	89%	92.4%	90%	85%
% At or above design height – rural	91.6%	92.1%	92.5%	93.7%	93.6%	93%
% At or above design height – urban	n/a	n/a	n/a	93.6%	93.2%	95%
Flood damage identified & works done	Achieved	Achieved	Achieved	Achieved	Achieved	Achieved

¹ Flood recovery plans are agreed with Council before being implemented, are only developed after a substantial event, and are funded out of zone or regional reserves.

Performance Measure	Actual Performance					Target
	15/16	16/17	17/18	18/19	19/20	LTP
Flood recovery plans implemented after all major events				50% compliant	100% compliant	100% compliant

3.2.2 Land Drainage

Waikato Regional Council manages a system of natural and built infrastructure to provide adequate land drainage to support productive pastoral (and other) farming. The council has oversight of 92 land drainage schemes, which were set up based on a historic network of drains. Each scheme is fully funded under its own targeted rate.

Land drainage services safeguard the economic wellbeing of the region by maintaining the drainage network to provide landowners the ability to manage the water table on their properties, reducing the surface flooding resulting from rainfall events. Without these drainage networks, these areas of land would be less productive and largely inaccessible.

Table 11: Flood Protection Assets Levels of Service, Performance Measures and Targets

Key attributes	Level of Service	Performance Measure
<p>Safety: Ensuring the safety of property, people and stock by actively managing and maintaining agreed drainage areas to the agreed 'annual exceedance probability' (AEP) levels.</p> <p>Sustainability: Supporting the economic return of farm and urban areas within agreed drainage areas while meeting requirements for stock exclusion from waterways.</p>	To provide reliable water table management on land within drainage scheme for the purpose of maintaining pastoral growth	<p>Measure 1: Over 85% of planned mandatory maintenance* actions achieved each year</p> <p>Measure 2: Surface water ponding in a 24 Hour, 10%AEP rainfall event, is removed within a 3 day period².</p>

See 2021-2031 LTP Levels of Service and Performance Measures – Land Drainage (Doc#16088104)

Details for what a 10% AEP surface ponding event are for each drainage area are located in Appendix AA4.7.

These systems have been designed to manage a specific level of land runoff. If weather or ground conditions have changed, for example through ground compaction or drought, or internal / private drains are not maintained, some areas may begin to flood. This is outside the council's ability to control.

Performance against each target is monitored throughout the year and a final measure reported as part of the annual plan results. These numbers are also annually audited by NZ Audit to ensure robustness of process followed.

Table 12: Historical and Current Land Drainage Performance against targets

Performance Measure	Actual Performance					Target
	15/16	16/17	17/18	18/19	19/20	20-25
% Planned mandatory Maintenance	56%	84.2%	89%	92.4%	90%	85%
Number of reported incidences where it takes more than three days to remove surface water after the events with up to a 10% annual exceedance probability	n/a	2	3	0	0	≤5

² For the purpose of incorporating LOS into PS designs the above stated LOS should be read in conjunction with "Lower Waikato Pump Stations Performance Review" (Doc#11463114).

3.2.3 River Management

The council is responsible for managing rivers and streams in the Waikato region. The river management activity includes erosion control, gravel management and management of vegetation. It also seeks to achieve broader environmental outcomes such as habitat restoration and biodiversity enhancement. Programmes are based on priority and the level of risk to people and property.

The main focus of river management is on activities to improve the stability and capacity of rivers and streams. The purpose is to safeguard productive land, people and property, along with achieving broader environmental outcomes where the opportunity arises.

River management protects valuable soil from eroding, supports improving water quality by protecting waterways from sediment entry, and protects property from flooding damage. River management is therefore closely aligned to the flood protection activity.

Table 13: Flood Protection Assets Levels of Service, Performance Measures and Targets

Key attributes	Level of Service	Performance Measure
<p>Safety: Ensuring the safety and viability of rivers and tributaries by actively managing debris and erosion that could endanger lives, properties, and water quality.</p> <p>Life on Land and Below Waterline: Supporting communities to delivery biodiversity and pest management approaches when developing river structures.</p>	<p>To provide river management services to maintain priority rivers and streams channel capacity and stability while enhancing water quality, biodiversity and promoting sustainable use of land and water.</p>	<p>Measure 1: Over 80% of planned river work undertaken in priority rivers/reaches in each zone each year.</p>

See 2021-2031 LTP Levels of Service and Performance Measures – River management (Doc#16088104)

Performance against each target is monitored throughout the year and a final measure reported as part of the annual plan results. These numbers are also annually audited by NZ Audit to ensure robustness of process followed.

Table 14: Historical and Current Land Drainage Performance against targets

Performance Measure	Actual Performance				Target
	16/17	17/18	18/19	19/20	LTP
% Planned mandatory Maintenance	-	-	96.8%	93%	85%

3.2.4 Measuring Compliance to Level of Service measures

This section covers where needed, how we measure specific measures and key performance indicators.

Measure	Measured by
Flood Protection	
85% of planned maintenance actions achieved each year	Compare number of 'Required' planned flood protection asset maintenance actions in works programme with the number completed via Infor (IPS) using the Resource Planning and Progress reporting spreadsheet. This result is to be presented as a percentage
93% Rural and 95% Urban stopbanks are maintained to above designed flood height, as agreed within each zone	<p>IPS stores the design flood height and the actual height of the stopbanks. This allows a comparison to be made when a survey is done to determine if a stopbank is above the design flood height for individual sections of stopbank.</p> <p>IPS gets its design flood height data from a variety of sources including Service Level Reviews, Design Reports and Original Plans.</p> <p>IPS gets its actual height data from monitoring & as-built surveys carried out by surveyors and from LIDAR. Where actual heights have been sourced from traditional survey methods the stopbanks will be assessed via 100m sections sourcing the data from IPS. Where actual heights are sourced from LiDAR an oracle database has been used to store these results against 1m to 10m sections of stopbank.</p>
100% of flood recovery plans implemented after all major events	<p>When event triggers use of disaster reserve funding:</p> <p>Manual check that project scope for flood response actions exists in Discover, and actions are being monitored through Capital Project or Asset Management System</p> <p>Note: Data reserve funding can only be triggered by a Zone Manager making a request to use it based on the return period of a flood event. These types of events are not predictable and there may be years in which there are no events that trigger disaster reserve funding. In these years this aspect of the measure will be considered non applicable.</p>
River Management	
85% of planned maintenance actions achieved each year	Same method for measuring as Flood protection measure above
Land Drainage	
Surface water ponding in a 24 Hour, 10%AEP rainfall event, is removed within a 3-day period	Reviewing quarterly drainage reports to drainage committees for reported incidents from each scheme.
85% of planned maintenance achieved each year agreed within each scheme	Same method for measuring as Flood protection measure above. Specifically looking if drainage inspections have been completed, and remedial action (e.g. spraying) done.

4 DEMAND MANAGEMENT

The objective of demand management planning is to modify customer demand for services so as to maximise the use of existing assets and to avoid or defer the need for new assets or services.

Non-asset solutions can include insurance and change of land use. It considered that the most effective way of managing future demand for both new services and increased levels of service is via a multi-faceted approach.

Table 15: Demand management instruments

Element	Tool	Description
Legislation and regulation	Resource Management Act 1991	<p>Land use planning:</p> <ul style="list-style-type: none"> Discourage/prevent development of flood and erosion prone areas. Require all new developments to incorporate stormwater / runoff management to ensure the discharge to receiving waters remains unchanged, therefore neutralising the impact of population growth and development. <p>Control development within existing protected areas.</p> <p>Discourage/prevent environmentally unsustainable development</p>
Financial and economic	Funding policy	<p>Costs of works and services are borne by the beneficiaries in proportion to the degree of benefit received.</p> <p>Directly benefiting landowners required to fund 75% of capital cost of new or upgrade works.</p> <p>Require new works to be economically and technically sustainable.</p>
Education	Catchment Liaison and Land Drainage Committees Customer service	<p>Educate community to manage expectations for new or upgrade works.</p> <p>Encourage less intense land uses in some areas.</p>

4.1 Demand Drivers

The key regional drivers which could change and / or place additional demands on the services provided by the Integrated Catchment Management Directorate include:

- Economic conditions and affordability
- Land use change
- Climate change
- Risk of natural disasters and residual risk
- Environmental and regulatory performance expectations
- Business and knowledge capability

Details of the possible responses and the reasoning for the response chosen for flood protection and land drainage assets is available in the Infrastructure Strategy 2021-2071 (File location 75 05 85).

Table 16: Specific actions agreed to mitigate the critical demands effecting infrastructure assets

Key issue	Strategies to address key issues
Inability to pay for maintenance, renewals, and new works	<ul style="list-style-type: none"> Understand at a local level which schemes are close to being financially non-viable to plan engagement with those communities. Balance community’s ability to pay with demand for current and additional services.
Land Use Intensification, and increased runoff rates	<ul style="list-style-type: none"> Collaborate and share hazard management and land improvement knowledge with stakeholders. Review Levels of Service, and the sustainability of their delivery. Take more active approach to either advising best use of land types, and restrictive role in land use change withing flood protection and drainage areas.
Increased frequency and severity of storm events, increased droughts, sea level rise.	<ul style="list-style-type: none"> Collecting, assessing, and trending asset condition and performance. Replace / renewal of infrastructure to accommodate only the short to medium term effects. Investigate alternate building methodologies to reduce impact. Identified responses are incorporated into technical investigation, maintenance and capital renewals works programmes.
Managing planning, response, and recovery from a natural disaster	<ul style="list-style-type: none"> Continue to enhance monitoring to enhance flood warning system and enable land users more time to respond to dynamic situations. Robust relationship with CDEM, other tertiary authorities, and first responders to continue to evolve response planning. Maintain regional recovery funds for when a significant event does occur.
Increased regulatory demands	<ul style="list-style-type: none"> Take an active role in Special Interest Groups and other platforms to collaborate with other local government agencies. Develop methods to deliver increased environmental protection while supporting sustainable development before legislation takes effect. Continue to apply the decision-making frameworks being developed (SIDF, Pathways to the Sea).
Business Continuity from loss of staff capability (Knowledge fade)	<ul style="list-style-type: none"> Identify training and development solutions to meet the multiple requirements placed on work supervisor, team leader, and specialist staff roles when an adverse event occurs. Identify staff reaching retirement and create opportunities for them to mentor others and to capture their knowledge.

A more detailed summary of key risks and proposed solutions identified by the 50-year infrastructure plan can be seen in appendix A11

4.1.1 Principles applied to decision making

Analysis of these issues lead to the following principles being agreed:

1. We will maintain the established infrastructure and levels of service
2. We will collect and maintain the best possible data and information
3. We will take appropriate steps to replace existing infrastructure as required
4. Our decisions will take into account changing climate and morphological data

4.2 Sensitivity Analysis

The current levels of service are assessed as generally appropriate and largely meet the current community needs and expectations.

There is however demand for upgrading the level of service in some areas and providing new works in other areas. These will be managed in accordance with the demand management plan.

Climate change affects are being seen across the region through extended drought conditions. This causes land shrinkage affecting the cohesiveness of stopbanks, and potentially increased runoff rates affecting localised flooding if drainage networks have not been kept clear of debris and plant matter.

It is expected that in the next 20 years sea level increases will not have a significant impact, but from 20 years will begin to affect assets on the coromandel, and along the Thames coastline.

Table 17: Councils ability to manage long term infrastructure demand drivers.

Issue	Current Risk Level	Council's Ability to Influence
Ageing assets	Low	High
Climate change	Medium	Low
Environmental performance	High	Medium
Treaty of Waitangi Settlements	Medium	Low
Protection Nationally significant assets	Medium	Medium
Natural Hazards	High	Low
Land use change	High	Low
Community awareness	Medium	Medium
Knowledge fade	Medium	High
Technology changes	Medium	Low/Medium
Regulatory changes	Low	Medium
WRC strategy changes	Medium	High

5 ASSET HEALTH

5.1 Asset Overview

Below is a breakdown of the major asset types monitored and maintained by the Waikato Regional Council.

Table 18: Flood control and drainage assets owned and managed by council.

Service Area	Quantity	Service Area	Quantity
Flood Protection		Land Drainage	
Control Gates	3	Bridges	3
Detention Dams	11	Channels	2,061 km
Floodgates	448	Culverts	453 m
Pump Stations	116	Detentions	321 m
Stopbanks	607 km	Drop Structures	119 m
Weirs	24	Floodgates	34
River Management		Pump Stations	3
Bridges	10	Retaining Structures	252 m
Channels	2,130 km	Stopbanks	11 km
Culverts	744 m	Structures	21
Debris Traps	6	Weirs	1
Drop Structures	2		
Retaining Structures	13 km		
River Training Works	3 km		
Other Structures	53 km		

A detailed breakdown of asset types by zone is available in APPENDIX AA3.7

Their book value as of 31st December 2019 valuation is available in Section 0- Asset Valuation.

5.1.1 Overview of assets not owned

WRC is partially responsible for the management and maintenance of some assets which are on private land, but are instrumental in the flood protection or drainage network functioning correctly. This is due to the public good or protection they provide (as opposed to a singular individual).

These assets include:

- Over 17,000 ha of riparian and indigenous retirements adjacent to watercourses
- 358 ha of wetlands and 1,200 ha of forests
- Low voltage powerlines and power poles feeding land drainage pump stations³
- 5,500km fences
- 1.3km stopbanks on private land

A detailed list of the quantity of assets maintained but not owned by the WRC is located in APPENDIX AA4.3

³ In some instances the low voltage powerlines are owned by WRC dependant on the ownership definitions of the lines network providers.

5.2 Asset Summary: owned and managed assets

5.2.1 Asset Age

The major flood protection schemes were constructed between the 1960's and 1980's.

The majority of rivers and catchment assets are well within their expected lifespans and have significant life remaining. However there are a small number of 'pre-scheme' floodgates and pump stations in the Waihou Piako Zone that were constructed in the 1920-30's.

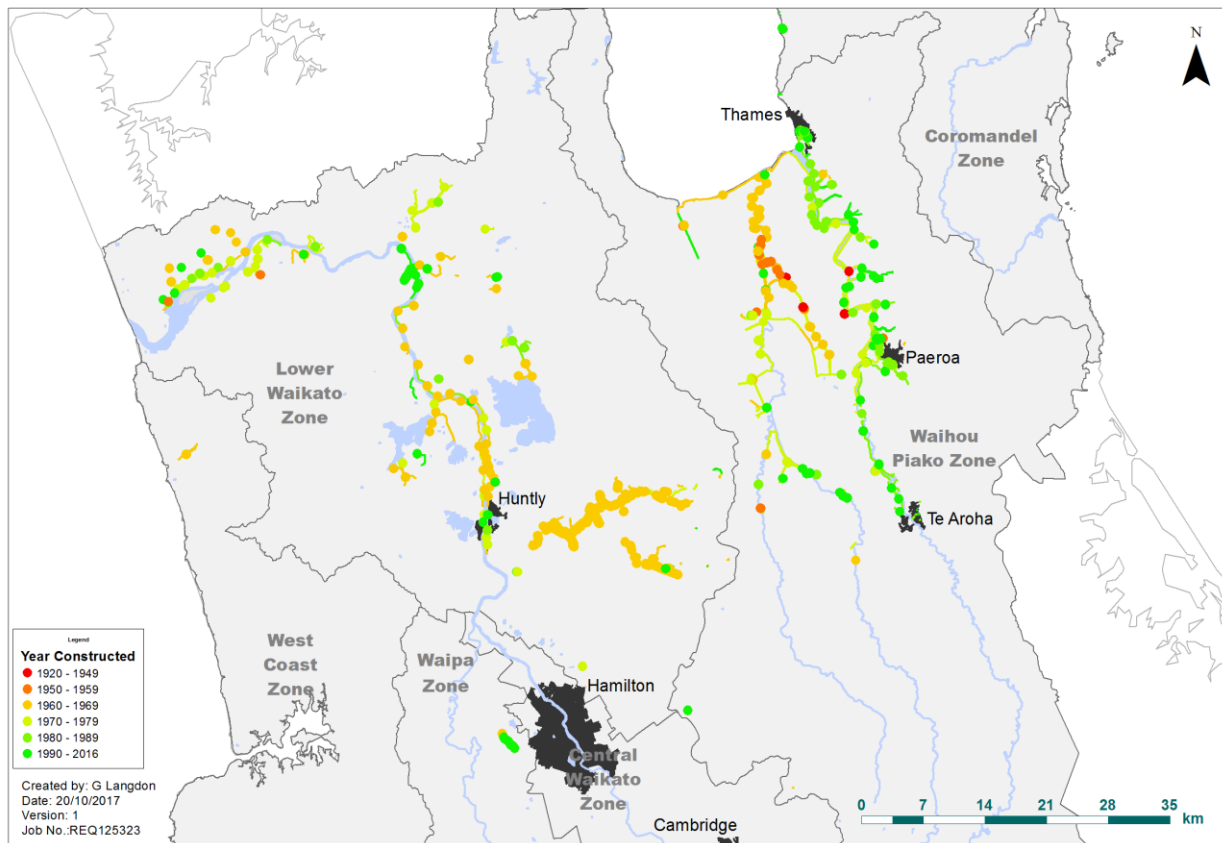


Figure 7: Age Distribution of Flood Protection Assets

The map in Figure 7 above shows when flood protection assets within the major schemes were constructed.

5.3 Typical Asset Issues

The following table contains the majority of the issues found across the Flood protection and drainage networks. These issues form that basis of condition inspections and structural survey programmes.

Asset	Key Issues
<p>Embankments (Stopbanks, levees, earth walls etc.)</p>	<p>Design</p> <ul style="list-style-type: none"> • Stopbank narrowness in some rural locations • Stopbank alignment being too close to the river channel increasing the risk of undermining • Settlement of stopbanks requiring top-up • Foundation stability due to geotechnical conditions <p>Land Use</p> <ul style="list-style-type: none"> • Stock damage • Toe erosion • Old large trees, blackberry, or gorse compromising structural integrity. • Keeping up with changes in stopbank height (i.e. channel capacity) to maintain existing levels of service and taking into account silting and/or aggradation of river beds, climate change and increased rainfall intensity • Land ownership and access issues • 3rd party structures affecting stopbank <p>Changes in functionality required</p> <ul style="list-style-type: none"> • Urban development in rural areas • Berm erosion / damage • Scheme review on hydraulic and
<p>Dams (Earthen detention dams)</p>	<p>Design</p> <ul style="list-style-type: none"> • Water seepage and internal erosion through foundation or wall of dam • Culvert design, and lack of compaction <p>Operation</p> <ul style="list-style-type: none"> • Spillway blockage leading to overtopping • Flood induced overtopping • Earthquake induced embankment cracking or deformation • Large trees compromising structural integrity <p>Change in Functionality</p> <ul style="list-style-type: none"> • Dam instability from using as detention rather than detention dam
<p>Structures (Pump stations, flood gates, weirs and dams etc.)</p>	<p>Design</p> <ul style="list-style-type: none"> • Electricity supply failures to pump stations • Pump failures • Earthquake damage to structures <p>Operation</p> <ul style="list-style-type: none"> • Weed control – causing pumps not running to capacity • Land ownership and access issues • Geothermal activity causing corrosion and undermining foundations • Tidal and saline erosion of floodgates and other structures • Vandalism • Scouring • Blockages due to debris in floodgates etc. and consequential backflow <p>Changes in Functionality required</p>

Asset	Key Issues
	<ul style="list-style-type: none"> • Insufficient capacity due to increasing required performance standards e.g. community expectations, climate change • Provision of fish passage when new assets are built/existing structures are replaced and after consideration of other environmental requirements
In River Structures	<ul style="list-style-type: none"> • Damage from high river flows • Pest infestation
Channels	<ul style="list-style-type: none"> • Excessive weed growth • Bank erosion from carp damage • Environmental issues e.g. timing of maintenance • Pollution and contaminated sites • Pest and weed control e.g. invasive exotic species • Regular maintenance is required to ensure design capacity is maintained
Drains	<p>Operations</p> <ul style="list-style-type: none"> • Weed control – causing less capacity or slower water flows than designed. • Bank Erosion • Silt Build up <p>Changes in Functionality required</p> <ul style="list-style-type: none"> • Insufficient capacity due to increasing population base within area or change in land use. • Peat Shrinkage: Surrounding land dropping in height, so drain no longer deep enough for existing needs

The FMECA analysis is available in 0

5.3.1 Condition monitoring results

The maps over the next few pages show the location and current condition of various key asset types, ranging from green for good, orange for average, and through to red for assets in very poor condition. The current condition of the asset is used to prioritise both maintenance and renewals work. Details of how condition is measured by asset type is located in APPENDIX AA4.7

The rate of deterioration is used for future planning & budget creation purposes. Using at a minimum the last three data points collected, condition data for each floodgate, stopbank and pump station can be trended, and used to

- Review condition monitoring inspection frequencies
- Renewals timetable
- Confirm effectiveness of Maintenance programme

Floodgates current condition:

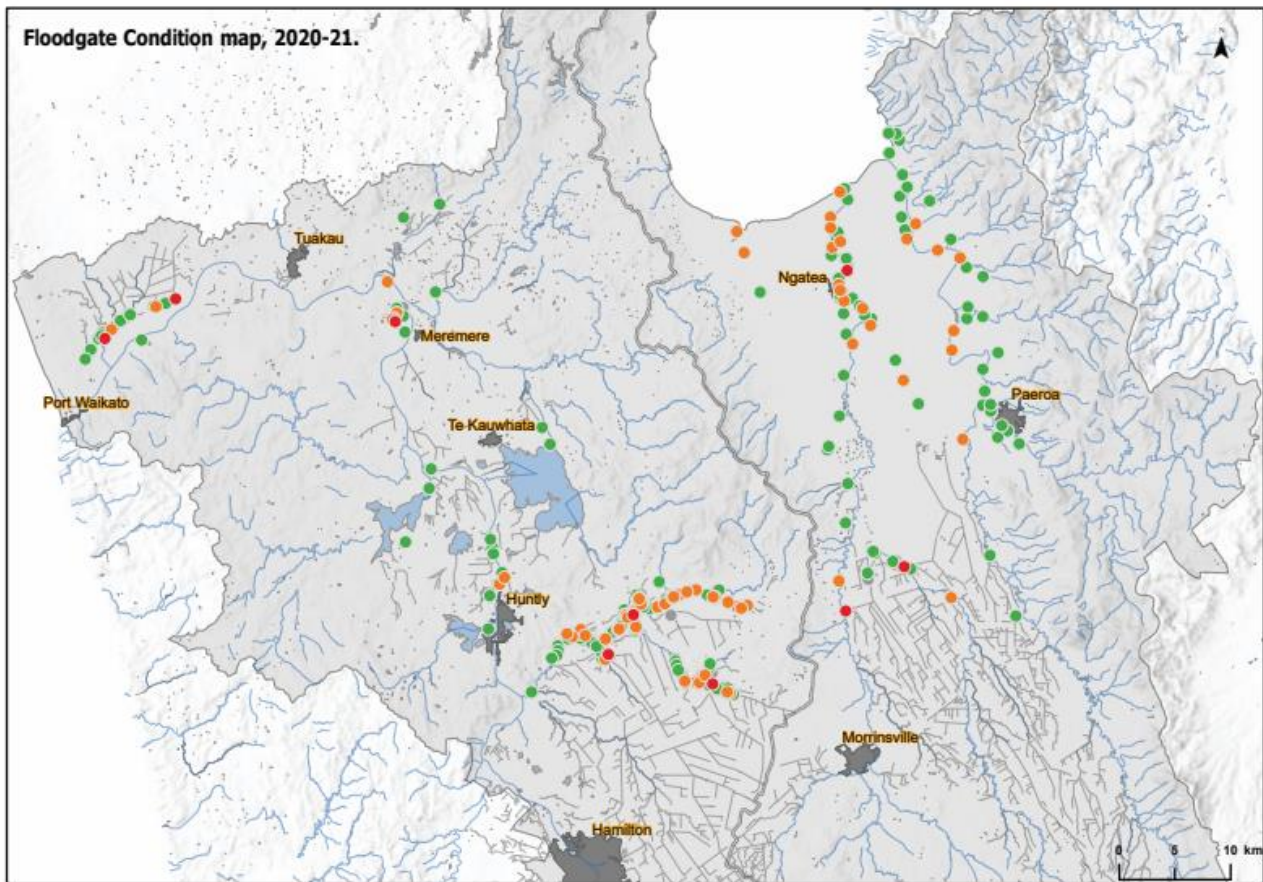


Figure 8: Flood gate condition 2020/21

Items that may impact on a floodgates condition are structural defects, not operating correctly, and worn or damaged components. Of the regions 440 floodgates, 354 (80%) are in an average to good condition. 86 floodgates in a poor to very poor condition, with plans either in place or being scoped to prioritise remedial works.

No new floodgates for new drainage or flood zones are planned to be built.

Investigation work in the Hauraki has identified an optimisation opportunity, with the 3 floodgates at the mouth of the Piako river (Mouth to Pipiroa Reach) can be reduced to 2 to optimise land water removal. This work is partially funded through the governments Shovel Ready initiative.

Several investigations completed at the request of landowners to lower the floodgate height have identified that lack of drain maintenance and incorrect drain slopes have caused ponding on farmland, not floodgate design.

Floodgates change in condition:

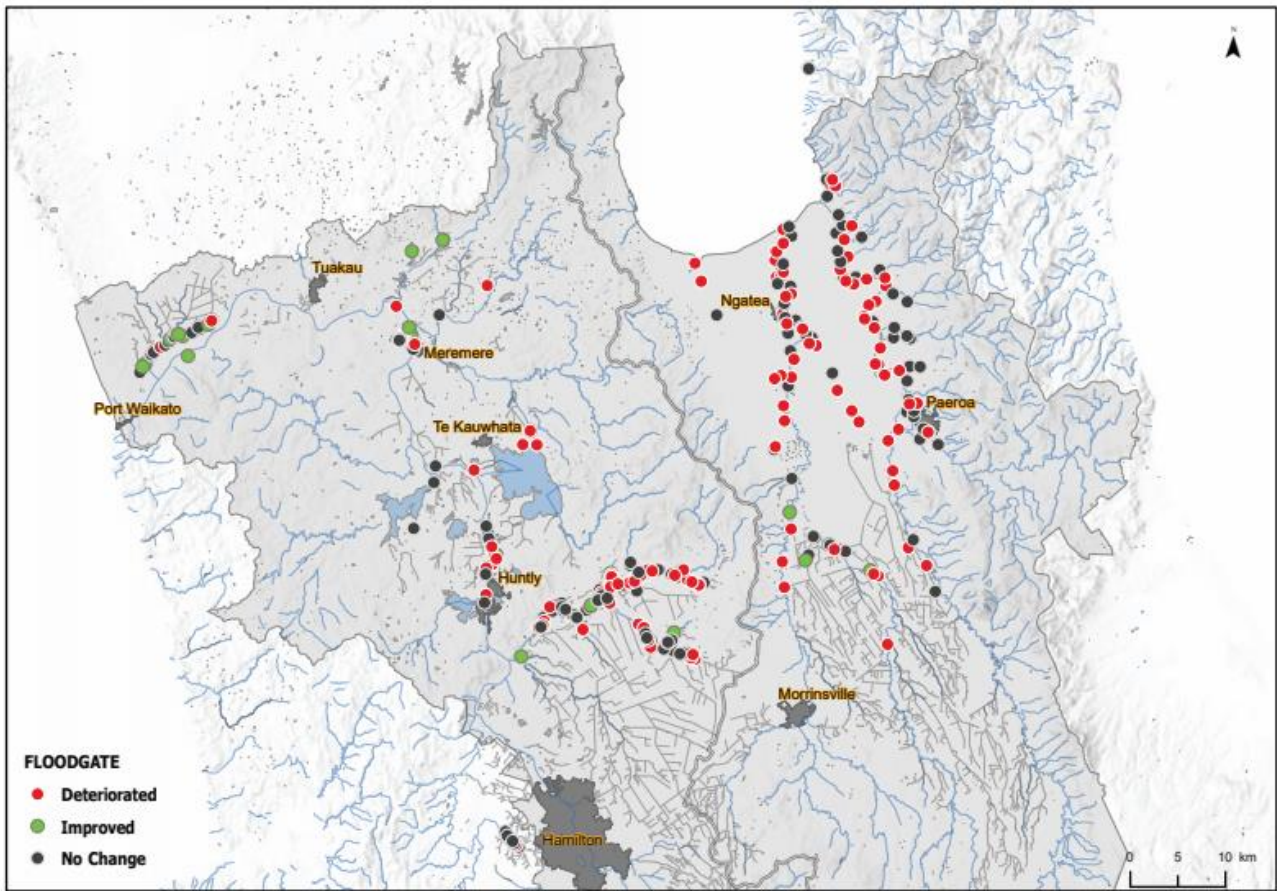


Figure 9: Flood gate change in condition over last year

The maps shown above shows the change in condition between 2019/20 and 2020/21 for Floodgates (Red = deteriorated, black = no change, and green = improved). Floodgates tend to deteriorate over an 8 to 20-year period, the rate dependant on the type of environment they are operating in.

Overall, the condition is stable or has improved for 57% of these assets through the maintenance and renewals programmes that have been underway. Deterioration of asset condition was observed for 43% of assets. As many of the floodgate gates are made from wood, this is not unexpected. The criticality of the asset is taken into account to determine when corrective maintenance or renewal is required, and its priority to ensure minimal risks to human and animal life.

Pumpstations current condition:

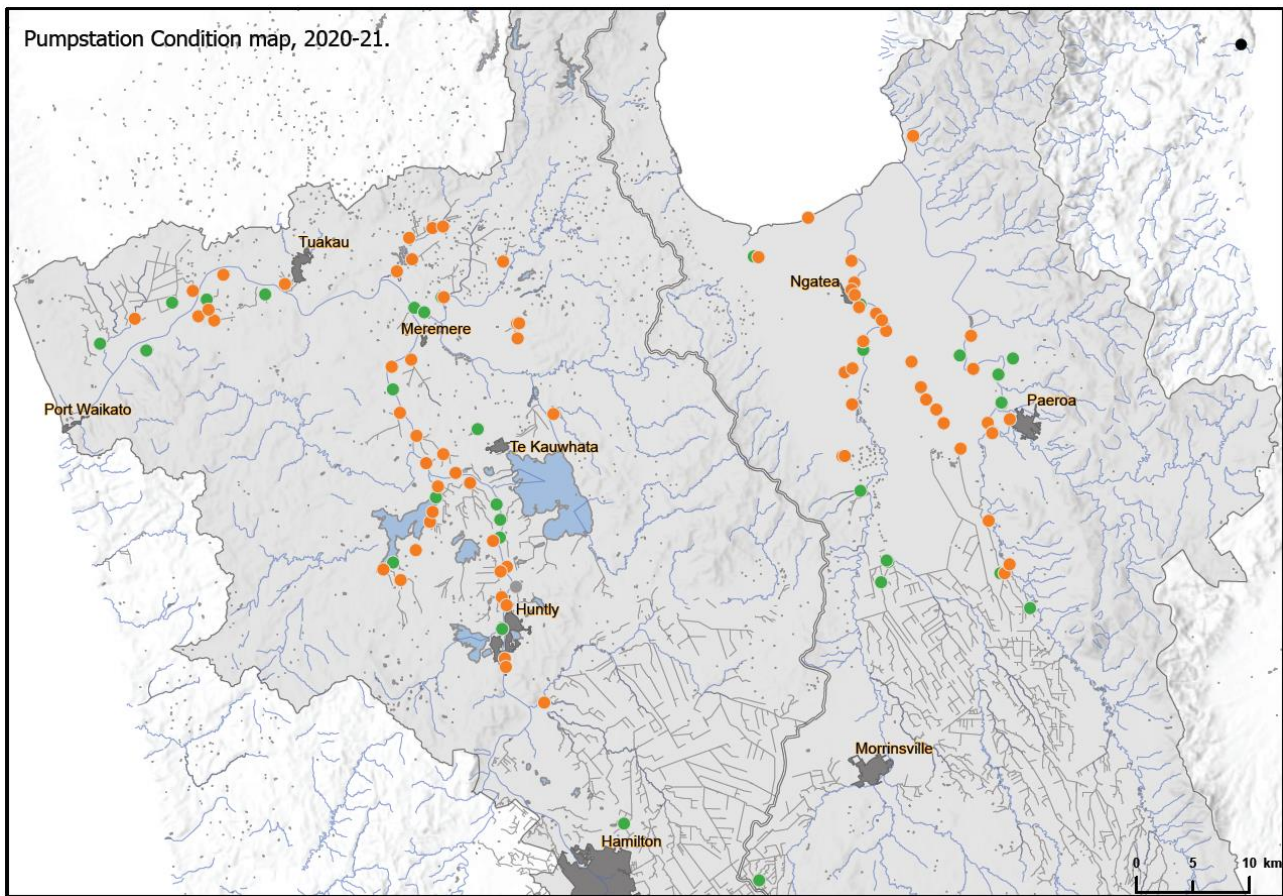


Figure 10: Pumpstations condition 2020/21

Pumpstation components are checked for structural integrity, cracking concrete, any damage or corrosion that may affect their operability, and electrical safety. Pumpstations that are in a good condition are shown as green, orange if average, and red when in a poor condition. 85 Pumpstations (out of 108, or 79%) in an average condition, with a further 23 in a good condition.

Across the region two to four pumpstations are rebuilt annually to continue to deal with damage, pump obsolescence (unable to buy spare parts to maintain the pumps) and land sinkage.

Government sourced shovel ready funding will enable a further 3 to 4 pumpstations to be rebuilt, taking into account environmental and fish movement in and out of critical catchments over the next 5 years.

Approximately 10 pump stations a year are overhauled to ensure they will operate optimally during storm events.

The intergenerational cost on the local landowners of capital renewals, and the sustainability of existing infrastructure has been an emerging issue over the last three years, leading to discussions with the local landowners on what is the most viable solution for their situation. This will continue to be a crucial topic for the next 20 years.

Pumpstations change in condition:

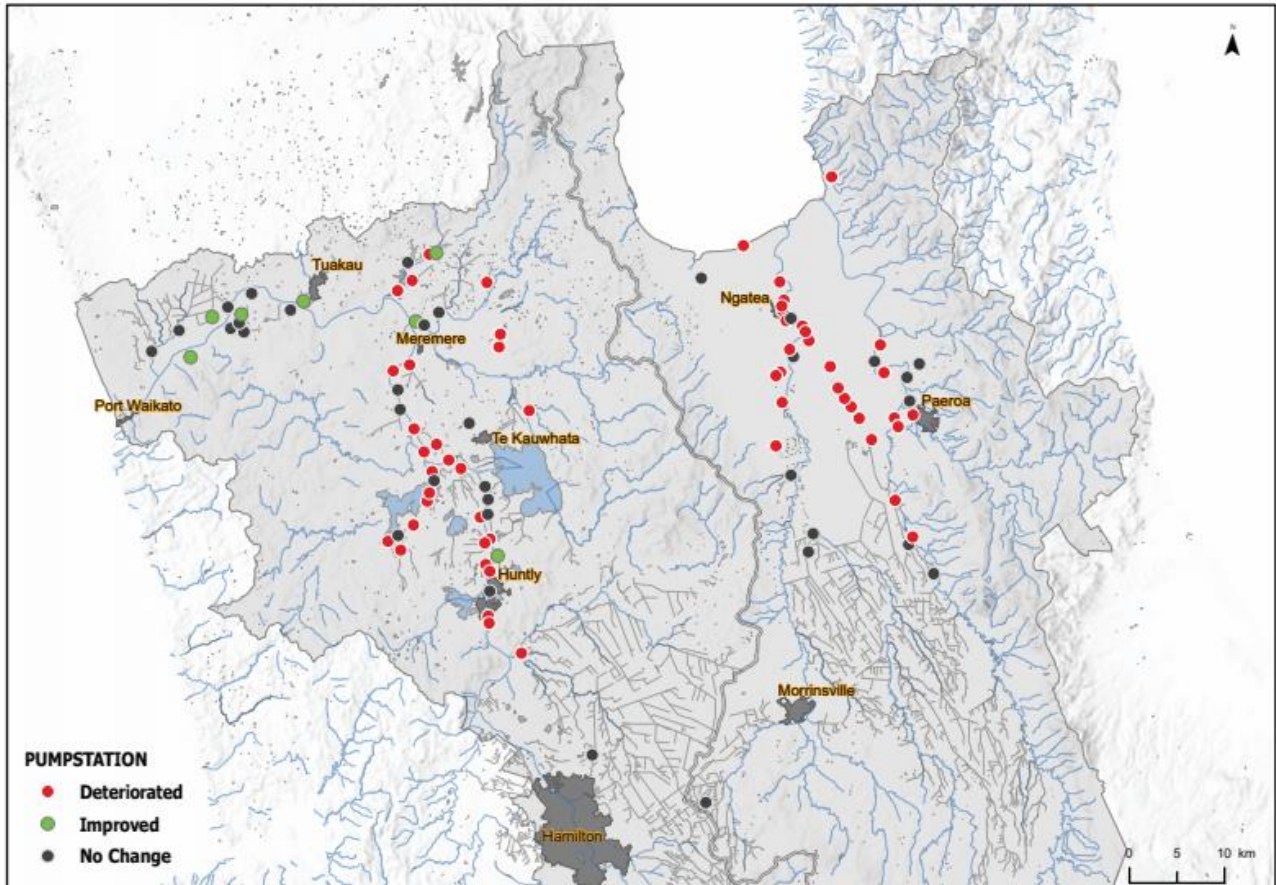


Figure 11: Pumpstations change in condition over last year.

The maps shown above shows the change in condition between 2019/20 and 2020/21 for all pumpstations (Red = deteriorated, black = no change, and green = improved, pink = no up to date data). Of the 108 Pumpstations, 56% or 60 assets deteriorated in condition.

Where a pumpstations condition is noted as deteriorating it results in those pumpstations being investigated to see if a change in the timing of maintenance and renewal works is needed, or if there are any new remedial works required to keep the pumpstations operational.

Where the pumpstations are also close to the end of their financial life an engineer has been out to assess the priority of any repairs or renewals to help inform the 10-year capital plan.

Scheme land & Stopbanks current condition:

A majority of the embankments and the land they sit on it leased out for use of local landowners, therefore Waikato Regional Council staff assess scheme land and the embankments condition annually checking for the following:

- Damage caused by stock and human impact
- Erosion
- Instability
- Grass cover and presence of weeds

It is important to recognise that the condition grade for an embankment is not a measure of whether the stopbank is at the required design height. That is assessed via the embankment performance grade discussed in appendix A4.9. Embankment renewal and maintenance decisions consider both performance and condition information.

505km of embankments (including stopbanks, flood walls, spillways and detention dams) are in good (green) to average (blue) condition of 517km total, leaving just 12km with some sort of issue on them (orange and red).

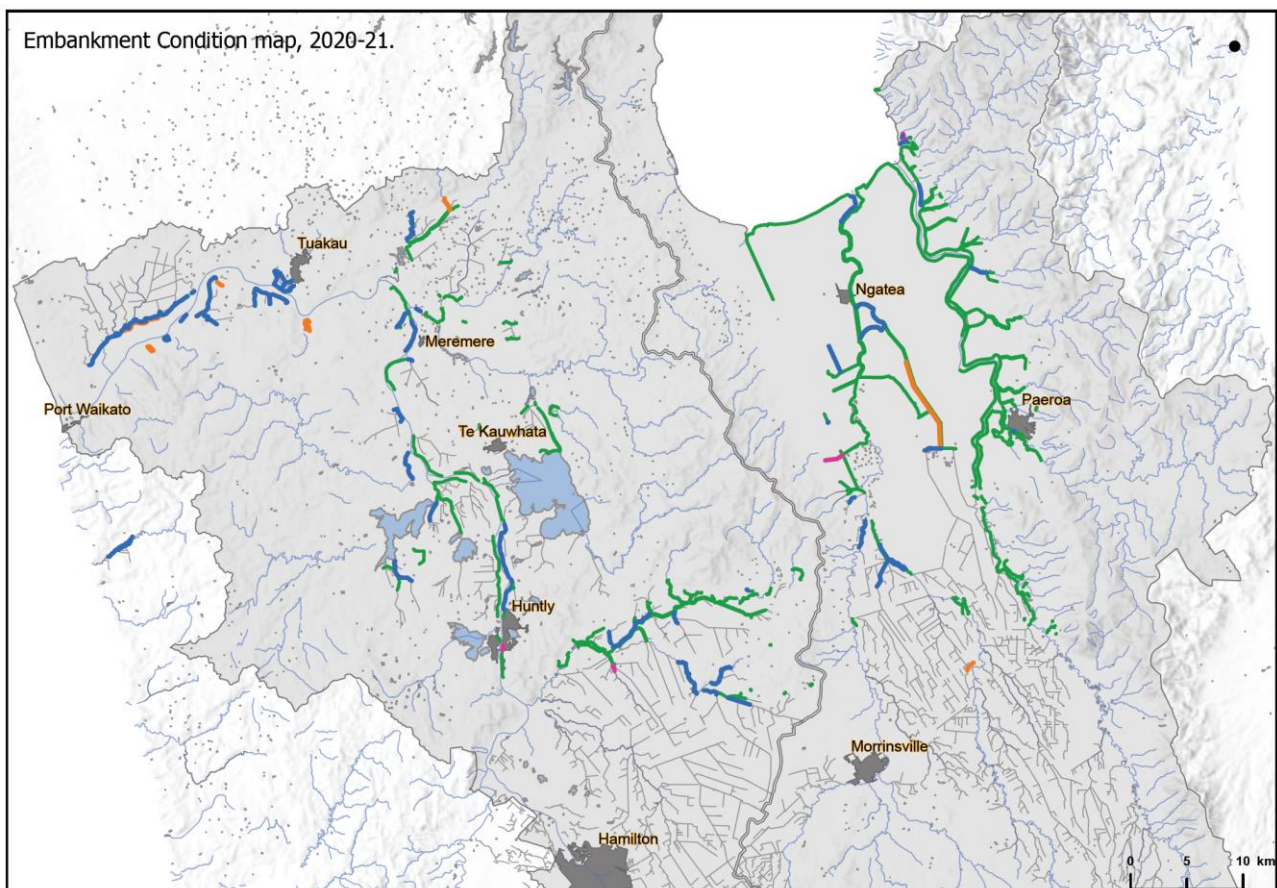


Figure 12: Stopbank current condition 2020/21

Over the last three years there was a reduction in the overall number of defects found on scheme land. Many of the new defects were related to stock damage and fencing issues and are easily rectified. The main causes of defects includes inadequate or damaged fencing, stock damage, undesirable vegetation (including plant pests and trees on stopbanks), vehicle damage, rubbish and various other damages.

There are a number of historical issues (E.g. vegetation, rubbish, and embankment damage) found on scheme land that had been licenced out, where the land is no longer leased by the licensee who caused the defects. These cases are rectified as funding in each catchment is made available.

Scheme land and Stopbanks change in condition:

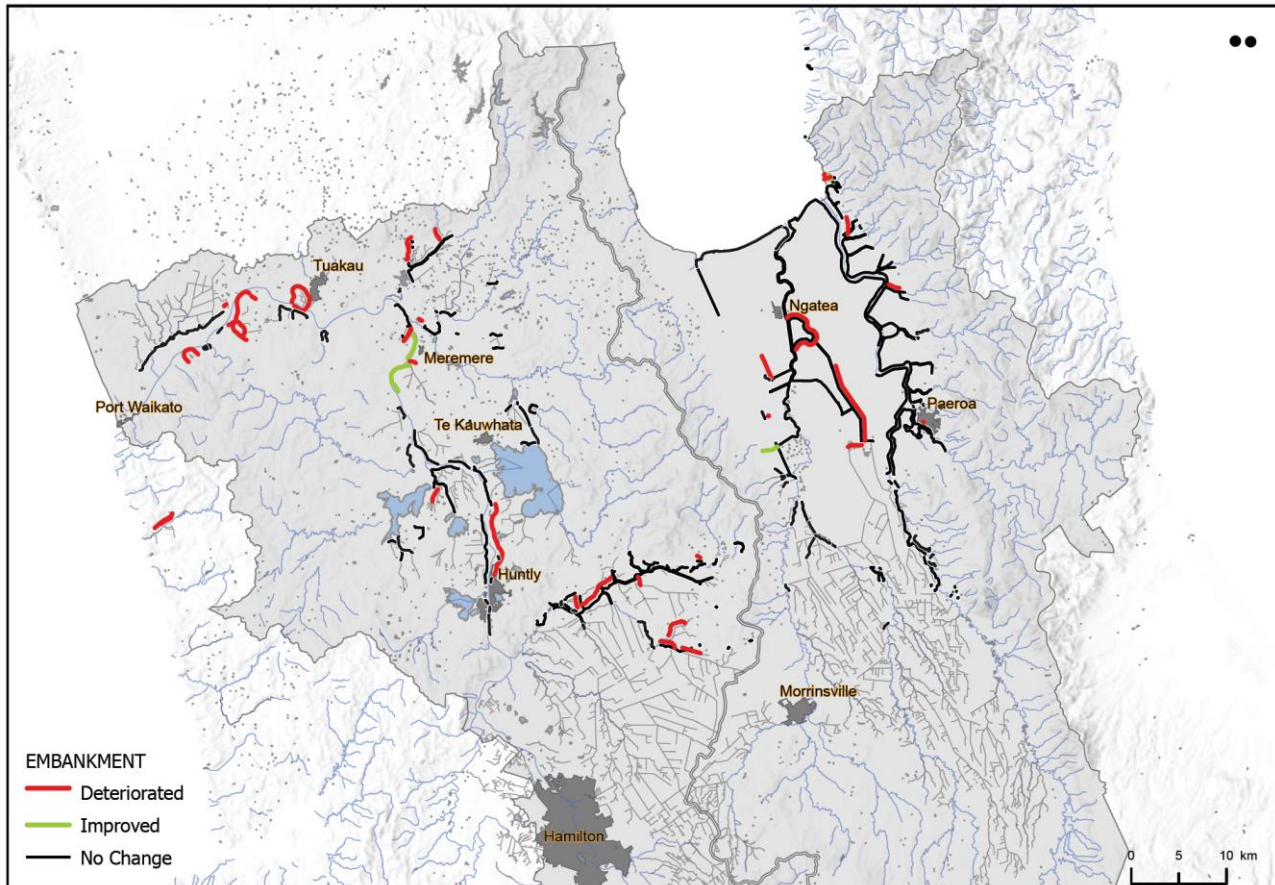


Figure 13: Stopbanks change in condition over last year.

The overall condition change is minimal, 83% or 430km either showed improvement or no changes. Where deterioration did occur, the key issues were the ongoing spread of pest plants such as yellow flag iris and alligator weed, or bull holes and stock damage.

5.3.2 Stopbank and Ponding Bank Performance

Due to the nature of the underlying soils that are present throughout the Waikato Region our stopbanks experience settlement over time. This is particularly prevalent for stopbanks built on peat or marine mud. This settlement reduces the height (crest level) of the stopbank and can lead to the crest level falling below the level required to protect against the design flood level.

The performance of the stopbanks in each of the relevant zones is shown in **Error! Reference source not found.** below. Stopbanks that are shown in green above the design crest level height. Stopbanks that have an identified area of any length within 10% of the crest level height are in yellow, or outside the designed flood level are shown in red.

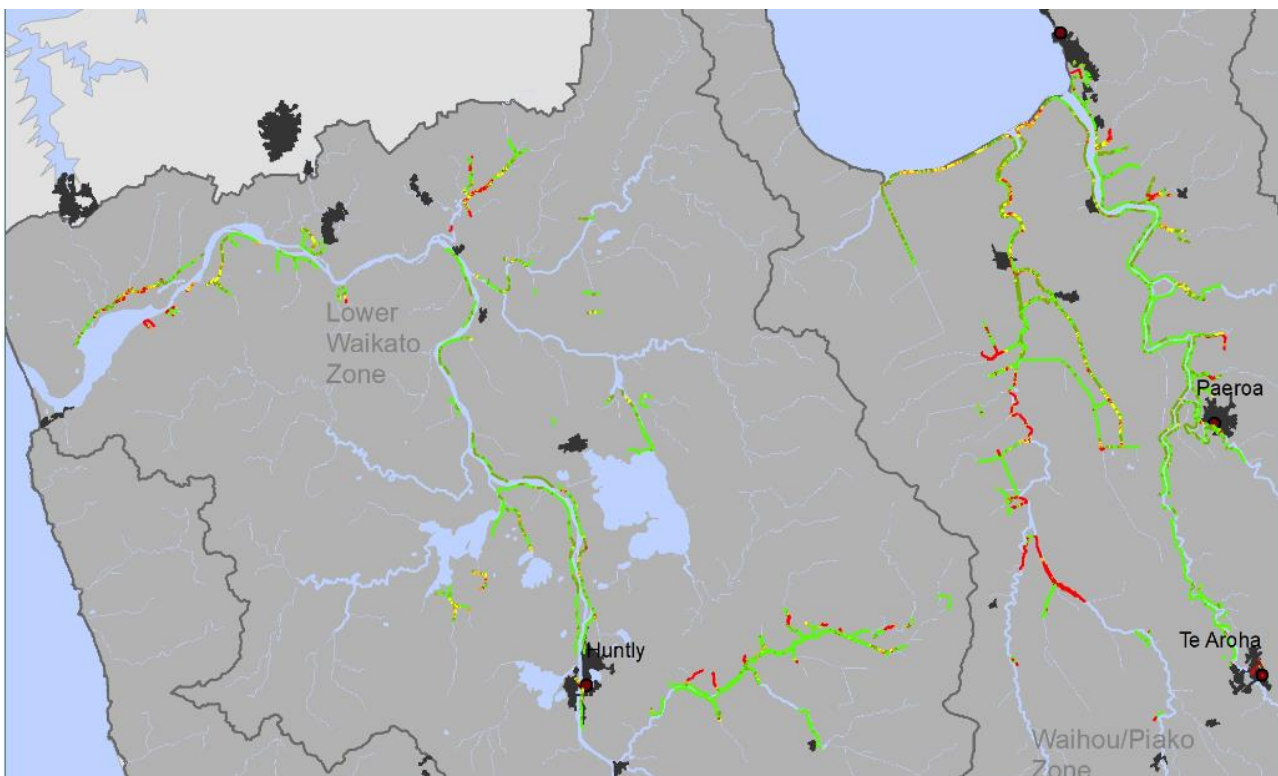


Figure 14: Stopbank current performance, by location

A three-year surveying plan is currently underway to update the stopbank performance data. This is identifying new areas for either height adjustments to be made or alternative technologies to traditional stopbanks to be explored.

Table 19: Current actions underway to resolve performance issues

Area	Actions underway
Tuakau to Port Waikato reach	The Lower Waikato Scheme review is currently underway, to determine if crest level heights are still appropriate for protection from a flooding event. The two stopbanks in this area highlighted in red will not be prioritised for capital renewal works until this review is completed.
North Huntly to Rangariri river reach	There are several sections along these banks where stock have caused low points beside fences, or where vehicle tracks have transverse the banks. Until the banks can be fixed sandbags are available for the low areas.
Hauraki foreshore & Ngatea northern bank	Works are currently in design stage to enact repairs on the low areas of the eastern and western foreshore banks
Piako Ponding Banks	In the last floods these banks were identified as being too high, and so the ponding areas did not activate as expected. This is currently under investigation to determine the appropriate actions needed going forward.

6 RISK MANAGEMENT

6.1 Overview

The WRC has a responsibility to assess the risks associated with the management and ownership of ICM assets and to best manage the activity with the resources available to avoid, mitigate or transfer the effects of any event.

Risks have been grouped into the following activity areas:

- General risks
- Asset failure specific risks
- Work or Task specific risks

A full description of all the risk management elements is available in the corporate risk management framework (Approved by Audit and Risk Committee, August 2019 – Doc#3375577).

6.2 Management of general risks

Risk management practises are aligned with ISO31000:2018.

Risk identification and management is the responsibility of all WRC staff, however the primary responsibility for the management of general risks fall to the Director and Chief Executive.

Any risk identified must be assessed for its impact upon operations, the environment, life cycle costs, social economic effect, the health & safety of our staff and the wider community, council reputation, legislative compliance, and resource consent compliance.

The most significant risks faced by ICM activities are evaluated in consultation with key Council officers. These risks relate to Health and Safety, ineffective business continuity planning, the impacts of climate change, conflicting objectives/aspirations, stopbank failure and environmental compliance failure.

APPENDIX AA5.8 summarises the risk action plan for these highest risk items.

6.3 Assets specific and system risks

6.3.1 Asset Risk and Resilience Strategies

The key risks ICM asset management programme are managing are:

- Failure of stopbank protecting an agreed area
- Failure to pump water from agreed area within an agreed time frequency
- Failure to keep agreed river systems flowing at the agreed rate and or agreed height

The level of service and zone plans provide the agreed performance requirements.

Ability to assess effectiveness of measures

The time to react to an emerging threat and therefore the responses available to prevent a failure are different for different river systems.

For example an extreme flood event on the Coromandel may start and conclude within 3 hours, whereas in the Lower Waikato zone may build over the week and be at extreme flood levels for several days or weeks. These two events highlight that while the same tools are available to both areas they may be ineffective in certain situations. E.g. the Coromandel would not have time from the point of realising there could be a flood event to enable effective sandbagging.

APPENDIX AA5.12 has a bowtie showing the preventive measures currently available to stop a failure of a stopbank protecting an agreed area. Bowties will also be developed during 17/18 year for the other two key risks above.

Duty of Care requirements

Under section 126 of the Soil Conservation and Rivers Control Act 1941 (SCRCA) WRC needs to ensure we are monitoring the condition and performance of stopbanks, and ensuring maintenance and renewals works are undertaken. A similar requirement exists for both drainage areas and river management.

The standard of care required is that stated in the levels of service in Section 3.

The WRC operates within a budget which is constrained principally by the level of rates revenue collected. This influences the level of monitoring, maintenance, and renewals work that can be performed. It also makes it impossible for the Operations team to immediately remediate all identified deficiencies in the flood protection, drainage, and river management schemes.

Instead the council applies a Risk Management approach to prioritise and allocate funding for these purposes.

Monitoring and Maintenance requirements

The mandatory condition inspections, performance inspections, and maintenance tasks should be reviewed regularly to ensure:

- All deficiencies in the network are currently identified
- All works are correctly prioritised

Prioritisation of inspection and maintenance works should take into account the likelihood of an event occurring, and consequence that would follow such an event.

The assessment on the maturity of these processes is shown in the Continuous Improvement section.

6.3.2 Critical assets

The identification of critical assets is an important component of overall asset risk management.

Critical assets are those assets that are likely to result in a more significant financial, environment, or social cost/consequence in the event of their failure to deliver the service required.

Flood protection and drainage assets that would have a major consequence if they failed are:

Asset Type	Effect			
	Environment / H&S	Reputation	Items of National Significance	Social / Economic Cost
Coromandel – Coromandel town scheme (inc. Karaka & Whangarahi)	○	●	●	●
Coromandel – Graeme’s Creek	○	●	●	●
Coromandel – Tapu Scheme	○	●	●	●
Coromandel – Te Puru Scheme	○	●	●	●
Coromandel – Waiomu Scheme (inc. Pohue)	○	●	●	●
Hauraki – Kauaeranga Scheme	○	●	○	●
Piako River – Ngatea Stopbanks	○	●	○	●
Taupo Area – Kiko Spillway	○	●	●	●
Tongariro River Flood Mgmt. Scheme	●	●	●	●
Waihou River – Kopu Stopbanks	○	●	○	●
Waihou River – Te Aroha Stopbanks	○	●	○	●
Waihou River – Turua Stopbanks	○	●	○	●
Waipa River – Otorohanga stopbanks	○	●	○	●

Asset Type	Effect			
	Environment / H&S	Reputation	Items of National Significance	Social / Economic Cost
Waikato – Whangamarino scheme	●	○	○	○
Waikato – Lake Waikare scheme	●	○	○	○
Waikato River – Rangiriri Stopbanks	○	●	●	●
Waikato River – Harris Street (Huntly West) stopbanks	●	●	●	●
Waikato River – SH1 (Huntly East) Stop banks	●	●	●	●

Key:

● High Risk if asset failed

○ Medium Risk if asset failed

Details of how criticality is performed is located in 0

Links to the analysis for each individual asset is available in Discover.

6.3.3 Decision making factors

One or more factors may be taken into consideration when determining if maintenance or replacement of an asset type is required:

Table 20: How WRC is applying asset information category options

Category	Details
Age of asset	Has the asset reached the end of its designed life?
Condition of asset	Condition Monitoring Information: Is the condition degrading at an unacceptable rate?
Location of asset	Is the asset protecting an urban environment, rural community, farming community, or some other item of regional or national significance?
Performance	Is the asset delivering its Level Of Service requirements, or alternatively has broken and requires fixing.
Efficiency of asset	Is asset delivering expected Life Cycle Costs? Or are we reviewing a need for improvements to energy, reliability, waste, etc.
Asset Criticality	Identifying those individual assets whose failure will have the most significant financial, environment and social cost / consequence in the event of their failure to deliver the service required.
Risk	Identifying if there is an H&S or Environmental risk to the public, the flora and fauna, the land, or our staff we cannot mitigate to an acceptable level?
Life cycle costing	Over the assets designed useful life are the ongoing costs to maintain higher than if we renewed

The categories column has standard categories used across multiple industries. The details column is how WRC is applying that category.

6.3.4 Application of categories

The table below shows which factors are currently taken into consideration when a decision on how and when asset is maintained or when it should be renewed:

Table 21: Maintenance and renewal decision making criteria

Asset Type	Age	Condition	Location	Performance	Efficiency	Asset Criticality	Risk
Bridges	No	Yes	Yes	Yes	No	No	Yes
Channels	No	No	No	Yes	No	No	No
Control Gates	No	Yes	Yes	Yes	No	No	Yes
Culverts	No	Yes	Yes	Yes	No	No	Yes
Debris Traps	No	Yes	No	Yes	No	No	No
Detention Dams	No	Yes	Yes	Yes	No	No	Yes
Drop Structures	No	Yes	No	Yes	No	No	No
Fencing	No	Yes	No	Yes	No	No	Yes
Floodgates	No	Yes	Yes	Yes	No	Yes	Yes
Plantings	No	No	No	Yes	No	No	No
Pump Stations	No	Yes	Yes	Yes	No	Yes	Yes
Retaining Structures	No	Yes	No	Yes	No	No	Yes
River Training Works	No	Yes	No	Yes	No	No	No
Stopbanks	No	Yes	Yes	Yes	No	Yes	Yes
Structures	No	Yes	Yes	Yes	No	No	Yes
Weirs	No	Yes	No	Yes	No	No	No

6.4 Work and Task Specific risks

There are a number of specific risk management initiatives that WRC have introduced to support operational risk management. These are documented in the WRC Business Continuity Policy and Framework (Updated November 2020, Doc#17586830). Those that are relevant to Flood Protection, River Management, and Drainage assets are summarised below:

6.4.1 Health and safety

The council is working to improve their “safe systems of work”, to ensure standard operating procedures, permit to work systems, hazard identification processes, and specific hazard task lists all work together to ensure the correct thinking and actions occur for each type of work conducted both in the depots and out in the field.

The health and safety policy and safety management systems in place to protect staff, contractors, volunteers, and members of the public from the hazards associated with operating, maintaining and replacement the flood protection and drainage assets.

6.4.2 Environmental compliance

A majority of the river, flood, and drainage maintenance work is conducted under the permitted activity guidelines in the [Waikato Regional Plan, and the NES-FW](#). A sample of jobs and work sites that are authorised by our resource consents are audited each year, to ensure the correct controls are being followed. The major reconstruction of infrastructure assets usually requires separate resource consent(s), to ensure any environmental effects for that specific site are managed. E.g. fish passage, temporary construction earthworks.

6.4.3 Emergency management

The emergency management systems are activated to manage adverse events that have the ability to affect the staff or community's day to day activities. These are unusual events or natural disasters which require more attention than responding to normal asset related or system faults.

ICM manages emergency incidents using an incident escalation system, which defines roles, responsibilities and processes for responding to incidents.

Different plans are used for preparing and responding to different and more extreme emergencies, which are discussed below:

Business continuity plan

This provides a tool to effectively react and respond to a crisis in a manner that ensures that its activities, provision of services and staff well-being are not unduly affected. For example, this was activated during the 2019 COVID lockdown.

Mercury high flow management plan

The High Flow Management Plan outlines the operational guidelines for management of the Waikato Hydro System at times of high inflows to the Waikato River Catchment.

This Plan demonstrates how the Waikato Hydro System will be operated (in order of priority) to:

- Meet dam safety requirements.
- Limit the adverse effects of a flood event that may arise from the existence and operation of the Waikato hydro system or from any other cause, including effects on Lake Taupō, the hydro reservoirs, and the Waikato River downstream of Karapiro.
- Assist the Waikato Regional Council in its role as flood manager.

Flood response plans

Both in the lead up to a potential flood event and during flood events, WRC staff monitor flood levels, forecasts river flows and levels and provides information to the general public and key stakeholders.

On the ground, inspections of the stopbanks and structures are undertaken throughout the event. Performance of the assets is recorded, and actions carried out to reduce risks of failure and ensure that pumpstations are operating to remove local catchment runoff from protected areas.

Daily reports on the scheme performance, remedial actions and response to inquiries are documented. Key stakeholders are kept informed at all times from the early stages of the floods. The Emergency Management Officer (EMO) acts according to a set of procedures as defined within the flood warning procedures manual, providing warnings to district councils; landowners and key recipients by telemetry radio links and supported by media releases to the public.

Local Flood response Manuals located in Discover Folder 30 40 14.

6.4.4 Civil Defence – Lifeline Utilities

The council and other Territorial Authorities have responsibilities for planning and response to emergencies as members of the Waikato Civil Defence Emergency Management (CDEM) Group.

Lifelines are the essential 'utility' services, which support the life of the community. These services include water, wastewater, stormwater, power, gas, flood protection, telecommunications and transportation networks.

Flood protection and river management measures help to avoid damage to roads and closure that may isolate certain areas. They also help to avoid damage to other essential services such as power, gas and telecommunications supply that can be affected by flooding.

In the event of a large, ongoing flood event, the council has CDEM coordination responsibilities as well as flood management responsibilities. The Waikato Regional Council works with the coordinators of the first responders to confirm that evacuation plans for all urban centres for which flood protection is provided, in an often-changing environment.

7 LIFECYCLE MANAGEMENT PROGRAMMES

The lifecycle management programmes cover the four key programmes of work necessary to achieve the required outcomes. These programmes are:

- Overarching Management Programme
- Asset Creation and Disposal Programme
- Operations and Maintenance Programme
- Asset Renewal Programme

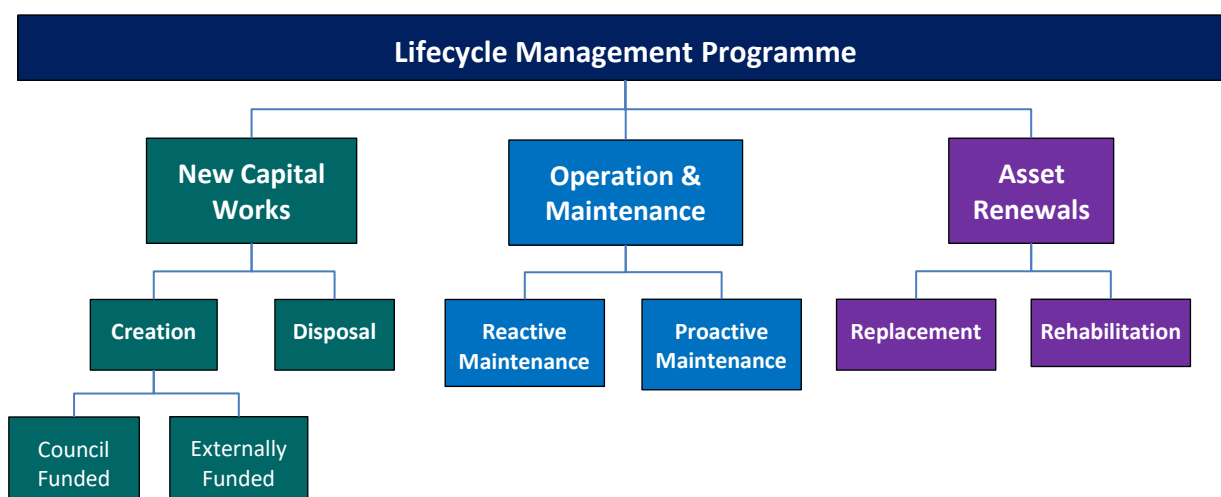


Figure 17: Lifecycle management categories

The overarching management programme is focused on the long-term sustainability of the Flood protection and drainage schemes, to ensure they deliver:

- level of service requirements
- improvements to the timeliness and effectiveness of works carried out
- prioritisation of capital and maintenance works based on scheme risk profiles and regional improvement priorities

Council have an obligation to ensure there is visibility of where community rates are being spent, and to show that works carried out are effective in delivering the agreed levels of service. As such there is a need to monitor and report on the condition and performance of the assets, and improvements being made to make planning, investigation, capital, and operational works more efficient in how they are conducted.

7.1 Maintenance vs. Capital Renewals

The operations and maintenance, and asset renewal programmes are focused on maintaining the current service levels of assets. The work is prioritised based on the condition of assets, and asset performance, and increased health and safety or emphasis on environmental requirements.

The improvement or assets occur within either the capital renewals process or the operations & maintenance process.

The new capital works processes are used when a community requests a new scheme, or when a community indicated a scheme is no longer required.

Any project, whether funded through capital or operational budgets, no matter the size is managed using the principles identified by the Project Management Institute (PMI) and the monitoring of their implementation will be run through the ICM Project Management Office.

Whether a task or piece of work is funded from a capital or maintenance is defined in the Infrastructure assets accounting document (Doc#16970363).

As per the IIMM definition:

Maintenance is “All actions necessary for retaining an asset as near as practicable to its original condition, but excluding rehabilitation or renewal. Maintenance does not increase the service potential of the asset or keep it in its original condition, it slows down deterioration and delays when rehabilitation or replacement is necessary.”

Renewals are “works to replace existing assets or facilities with assets or facilities of equivalent capacity or performance capability”.

Drain Maintenance

The drainage network is maintained to:

- Provide the ability for landowners to manage water from the land and its surface to sustain pastoral farming.
- Reduce surface flooding resulting from rainfall events.

Drain maintenance is undertaken through properties by spraying, mechanical clearing (diggers) and in a limited number of locations by hand cleaning.

Drains only need to be cleaned if their ability to function has been reduced by vegetation or silt.

Drain maintenance activities like inspections, emergency response, spraying and machine cleaning are carried out by Waikato Regional Council in most of the region’s land drainage areas. In a few areas we have special arrangements with landowners who manage this work themselves. These are documented in the Land Drainage Management Plan (Doc#13380473).

Flood Protection Scheme Maintenance

The flood protection schemes are maintained to:

- Protect scheme areas from an adverse weather event up to the level designed for (river heights, and duration of expected high flow).
- Provide the ability for scheme areas to be drained of any flood waters in adverse weather events.

Flood scheme maintenance is undertaken through properties to ensure the integrity of the stopbanks and pumping stations is maintained.

Stopbanks only need to be reshaped or their height increased if their ability to function (a.k.a. performance) has been reduced by erosion, or animal damage.

Flood scheme maintenance activities like inspections for damage or slumping of stopbanks, emergency response, spraying, equipment repair, and both manual and mechanical clearing (diggers) of pump screens, are carried out by Waikato Regional Council on all of the region’s flood protection schemes. In a few areas we have special arrangements with landowners or volunteers or the district council to manage the removal of weed from drainage networks. This is generally with whomever owns the drains feeding into a pump station.

7.1.1 Procurement and Contract Management

It is a council rule that a Purchase Order MUST be raised BEFORE any works are undertaken. There are two methods for raising purchase orders:

Asset related spend

1. Work instructions are created in asset management system
2. Check budget is available
3. Purchase order created

Non asset specific or Professional Services related expenditure

1. Work instructions are created in contractor database
2. Check budget is available
3. Purchase order raised
4. Check costs going to correct budget

The only time an exception may be permissible is during a Flood Emergency circumstance.

7.1.2 Capital works programming

The asset renewals programme aims to deliver the agreed Levels of Performance from the asset base while maximising their economic life.

Assets may be replaced if they are uneconomically maintainable or rehabilitated to bring them up to expected standards.

A 3 – 5 year capital renewals programme has been in place since 2014 prioritising major stopbank, pumpstation and floodgate rebuilds and replacements. Priorities are reviewed annually based on new condition and performance information collected throughout the year, and unexpected failures or understandings in the dynamics of the flood protection scheme.

Capital Works Management

Larger or complex renewals are managed by specialist project managers, whereas smaller or partial renewals of assets are managed by the operations and catchment management teams.

The major capital renewal and new capital works programme is reconfirmed at the start of each financial year.

RACIs are developed as part of the project plan for each major project to show key reporting, decision making, and financial responsibilities.

Annual work programme

The programming of investments is heavily influenced by many other factors including:

- The scale of the project
- The time taken and ability to obtain consents
- The complexity of design and construction
- The availability of funding
- The availability of contractor resources
- The amount of community interest
- The degree of dependency on other projects
- The degree of integration with projects being undertaken by other agencies

7.1.3 Maintenance works programming

Maintenance plans have been developed for each of the zones operated by the WRC. These plans outline the maintenance activities that are required to ensure the agreed levels of service for each scheme are met and to meet the requirements for typical river flows.

Maintenance Management

Maintenance Works are performed by the Operations Teams, Catchment Management teams, and River Management Teams. They report through to the section managers on delivery, and to the drainage and zone managers on financial expenditure.

The Asset Management team provide planning and scheduling support, specialist engineering support, and monitor quarterly whether KPIs are / will be achieved to provide an independent view to the senior leadership team.

Annual work programme

In developing the annual works programme, the following documents are reviewed and updated:

- Customer enquiries record
- Monthly operational and failure reports
- Bi-annual failure logging.
- Annual work prioritisation
- Capital, replacement & renewals programme
- Planned/schedule maintenance programme

7.2 Scheme Reviews

Scheme Reviews look at the ability of the flood protection scheme to deliver the level of protection agreed with the community. They do not look at the risk to the community if the scheme fails or the costs involved with maintaining that level of defence, if required this step is started after a scheme review has been completed.

Flood protection scheme reviews are performed for several reasons: at the request of the committee, when there has been a significant weather event that may have changed the morphological properties of the area, or at a routine frequency to update weather projections and check levels of service.

Scheme reviews rely on accurate LIDAR data, stopbank crest levels surveys, and historical rainfall information.

The current high-level scheme review programme, and links to the scheme review documents is in Appendix A6.

The current scheme priorities are presented at a zone level in APPENDIX B.

7.3 Works Management Reporting

Visibility of works completed, and their costs are tracked in several different WRC systems. They are:

- Capital works financials
- Operational works financials
- Capital and Operational work required / completed
- Capital works planning and scheduling
- Capital works project completion and lessons learnt
- Maintenance works task planning, scheduling, and execution

7.4 Key delegations for the management of assets

Table 22: Key Signoff points

Area	What	Director ICM	Section Zone	Zone Mgr.	Operations	BATS Mgr.	Asset Mgmt.	Engineering	Env. Compliance	Reg. resilience
Information & advice	• Guidelines: Standard Designs				C	A	C	R	C	
	• Technical: Asset Information – drawings & surveys					A	R	C		
	• Technical: Asset Information – current condition & performance				R		A	C		
	• Technical Asset Information – climate change, and longer-term changes in the region			C	C	A			C	R
	• Providing Flood & Drought Response information to other key stakeholders – local level	A	R	R	C					C
	• Providing Flood & Drought Response information to other key stakeholders – regional level	A	C	C	C					R
	• Assets: Mandatory tasks required per asset				C	A	R	C	C	
	• Land Licences: Acceptable land use			C	C	A	R		C	
	• Land Licences: Rateable value					A	R			
	• Requests for bespoke information around assets, schemes, river blockages, drainage issues		A	R	R		C	C		C
	• Provision of information to other TA's		C	C	C	A	C		C	R
WRC managed land plan	• Development and Updating			C	C	A	R		C	
	• Communication with stakeholders	A		R		R				
Zone Management Plans	• Development and Updating		A	R	I	C	I	I	I	C
	• Sign off		A	R		C				
	• Communication with stakeholders		A	R		C	I	I		C
Catchment and Harbour Management Plans	• Development and Updating		A	R	C		I		C	C
	• Sign off		A	R	C	I				I
	• Communication with stakeholders		A	R	C		I			I
Regional Asset Management Plan	• Development and Updating	C	C	C	C	A	R	C	C	C
	• Signing off – fit for purpose	A	R			R	I			
	• Communication with stakeholders	I		R	C	A	R			C
Land Drainage Management Plan	• Development and Updating		A	R	C		C		C	
	• Sign off		A	R	I	I	I	I		
	• Communication with stakeholders		A	R	C					

Area	What	Director ICM	Zone Section	Zone Mgr.	Operations	BATS Mgr.	Asset Mgmt.	Engineering	Env. Compliance	Reg. resilience
	• Monitoring implementation & application		A	C	R					
Operations and Maintenance Manual	• Development of maintenance schedule		A	C	R		R		C	
	• Review of maintenance schedules		A		R		C			
	• Scoping & Planning of work		A	R	C		C	C	C	
	• Keeping systems up to date & management of work execution				A/R		C			
	• Development of standardised procedures for completing work		A		R		C	C	C	
	• Ensuring delivery of work programme		A	R	R					
	• Ensuring quality expectations and improvement plan implementation			C	C	C	A	R		

7.5 Knowledge Management

We need to ensure we have the right information available, to make good decisions.

Table 23: Knowledge Management

Area	What	BATS Manager	Asset Engineer	Subject Expert	Risk & Resilience	Operations	Environmental Compliance	Zone Manager	Asset Management
Environmental Performance	Ensure assets meet expectations and legislative requirements around environmental performance			R			A		
Regulatory Compliance	Ensuring we know what we need to do to meet permitted activity and resource consent requirements for each asset for inspection, monitoring, and record requirements.			R			A		
Asset Design	Ensure as built design drawings received meet requirements needed to determine if performance levels will be met			R					A
Asset Data	Ensure Assets attribute information is set up correctly for future reference, and available for field staff			R					A

Asset Attributes

- Stored and accessible through the asset management system

Technical drawings

- Found in folder in Discover (file number xxx)
- Searchable by asset number and asset name

8 CONTINUOUS IMPROVEMENT

8.1 Improvement process overview

WRC has a strategic objective of managing their flood protection and land drainage assets in a way that ensures that the required levels of service are delivered in the most cost-effective manner for present and future customers. To help achieve this, a structured approach to infrastructure asset management, based on the International Infrastructure Management Manual (IIMM), has been adopted.

The vision of what the council wishes to achieve is explained in the table below:

Table 24: Shared vision on what success looks like when asset management within the council is 100% effective.

Area	Action Statement
People	I know what is expected of me, and have the tools and knowledge to do the job My people can do the jobs I ask of them
Strategy and Planning	I understand the effect nature and people have on my assets life and health We know and achieve the asset performance required
Condition Monitoring	We know what assets we have, manage, and can easily access them to do works We know the condition of our assets, how to look after them, and when
Capital Delivery (New and Renewals)	For any piece of work I know <ul style="list-style-type: none"> - The priority of the works - When it's going to occur - Who is managing it - How much it will cost - How it's going - How my risks and issues are being managed
Operations Work Delivery	I'm able to record issues found as I find them, and know how much they are costing me to fix I have visibility of how operations are progressing their routine maintenance tasks I know how I need to undertake the maintenance tasks to ensure compliance with permitted activities or resource consents
Demand and Risk Planning	I know my risks, what in place to stop them from occurring, and what to do it they do
Systems & Tools	I enter the information only once into the system I can get the information I need to make decisions

8.1.1 Current maturity

The level of current practices and procedures is assessed against the 180 criteria split across the sixteen IIMM Maturity Index categories. These same criteria have been used since 2014 to measure progress in improving the council’s asset management maturity.

The change in results is shown in the graph below:

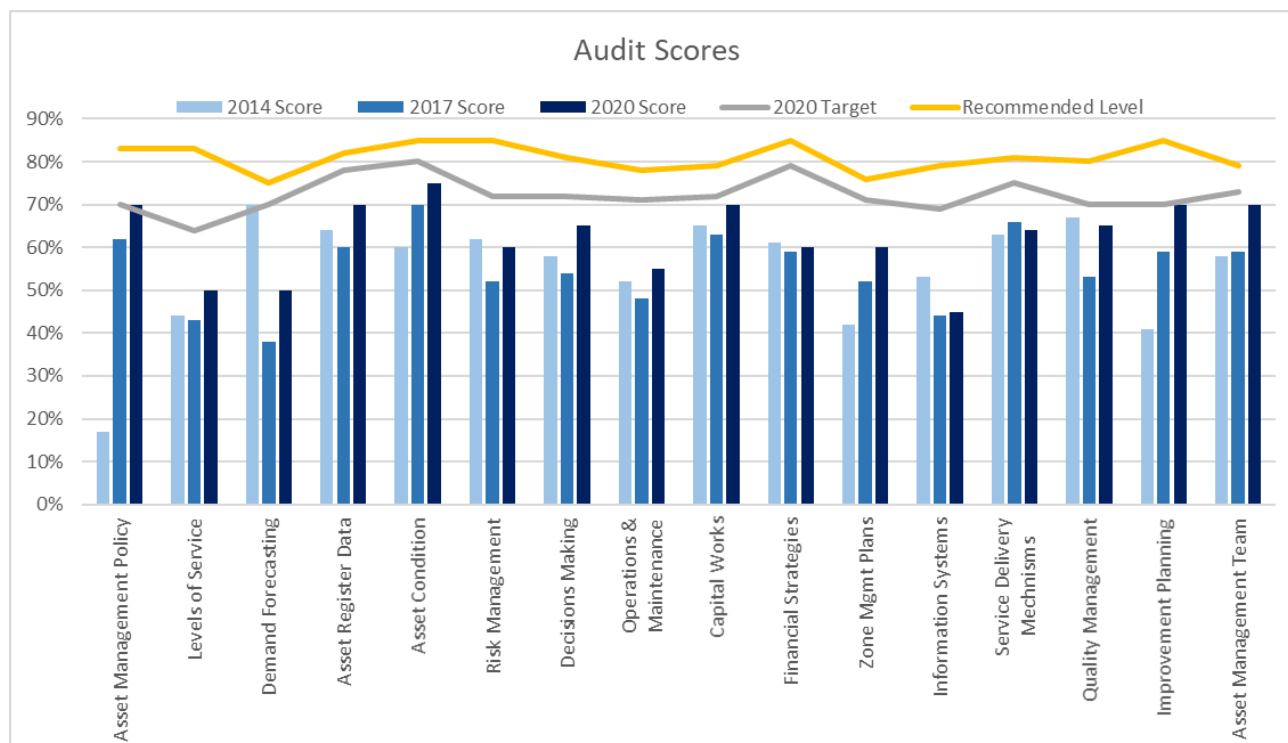


Figure 15: Councils Asset Management Maturity – Flood protection and Drainage asset management

The blue lines are the measured results every three years. The grey line was the target set in 2017, and the orange line is considered “best practice” level for any council.

It can be seen across multiple categories that there has been an improvement between 2017 and 2020.

8.1.2 Roles and Responsibilities

The Asset Management Programme Control Group of senior management representatives from across the organisation oversees progress of the improvement plan, and ensures the necessary resources were allocated to the improvement tasks.

The Asset Management Team Lead presents an overview of the initiatives and any current issues of potential risks that they pose to the overall delivery of the Asset Management Continuous Improvement Plan.

The designated project manager for each initiative is responsible for ensuring their work will be completed on time, and in the manner appropriate.

8.2 Continuous Improvement Plan

There are 5 improvement workstreams underway:

Table 25: Strategic asset management improvement focus areas

No	Work Stream	Key areas of work
1	Strategic Vision, Policies, and Guidelines	<p>Making sure our long terms plans and strategies are up to date to meet today's challenges through:</p> <ol style="list-style-type: none"> 1) Ensuring financial budgets built to enable Flood protection and drainage legislative requirements can be met and by using a risk approach. 2) Valuation of assets kept up to date, and processes improved. 3) Build strategy on how we will sustainably manage our scheme land.
2	Capital Project Execution Improvements	<p>Continue journey to robust capital project delivery for every project through:</p> <ol style="list-style-type: none"> 1) All projects have robust scoping process. 2) Quality plans in place for high risk projects. 3) Project pipeline actively managed. 4) Reduce project close out timeframes.
3	Health & Safety Practises	<p>Ensure safety is a part of everything we do by:</p> <ol style="list-style-type: none"> 1) Focus on improving safe systems of work.
4	Workflow Planning, Scheduling, and Execution Effectiveness	<p>Creating visibility of what we do, and efficiencies in the management of our assets by:</p> <ol style="list-style-type: none"> 1) Ensure new asset management system meets functional requirements to manage workflow. 2) Inspection programmes optimised. 3) Weekly planning and scheduling made sustainable. 4) Business process improvement. 5) Training coordination improvements between zones.
5	Level of Service measurement, modelling, and management	<p>Change the conversation occurring, to get a better understanding on the performance of our schemes.</p> <ol style="list-style-type: none"> 1) Understand performance and functional requirements of assets and schemes. 2) Investigate alternate methods for measuring level of service. 3) Work on methods to improve community understanding & resilience.

9 FINANCIALS

9.1 Introduction

For the WRC to undertake a sustainable, long-term approach to the management of infrastructure assets within the catchment zones it is essential to prepare long-term financial forecasts. This allows a long term view of how the asset will be managed, how much this will cost and when additional funding may be required to meet expected service levels. These financial forecasts are a culmination of the previously discussed aspects of the RAMP.

9.2 Work category definitions

All costs incurred through the ownership of infrastructural assets and, that directly relate to the running of those assets fall into three categories, Capital New, Capital Renewal and Operations and Maintenance expenditure. Under the generally accepted accounting practice (GAAP) the following definitions have been applied to the treatment of costs against infrastructure assets.

Table 26: NEEDS NAMING!!!

Category	Definition
Operations and maintenance	Operations and Maintenance expenditure is that required for the day-to-day operation of the zone while maintaining the current levels of service.
Capital - New Works	New capital works involves the creation of new assets, or works, which upgrade or improve an existing asset beyond its current capacity to account for future growth or improved performance in response to changes in usage or customer expectations of improved levels of service.
Capital – Renewals	Renewal expenditure includes rehabilitation and replacement of assets. The objective is to restore an asset to its original level of service. Renewals expenditure forecasts cover the cost of asset renewal through its whole lifecycle through to disposal of the asset.

See “Infrastructure accounting guidelines” for more details (Doc#11074070).

9.3 Funding Mechanisms

9.3.1 Funding of operational works

The costs of services are funded through a combination of income sources including:

- Ratepayers
- Internal borrowing
- Investment income
- Participating landowners
- Sale of items E.g. harvested poplar logs, hay, and silt dredging from canals
- Grazing licenses

The budgeted income from the investment fund is treated as an offset to general rate and does not directly fund any work programme. Internal borrowing is used to fund much of the river and catchment management works.

Specific debt repayment plans are in place with each affected catchment zone, funded from targeted rates, to ensure that this debt is repaid over an agreed time period (generally 10 years). Funds generated from the internal debt repayment are be added into the WRC’s general investment fund.

9.3.2 Funding of capital renewals works

With an annual depreciation of approximately \$5.8 million per annum, this is not sufficient to fund the current renewals programme solely through internal loans. To meet the ongoing costs for the renewal of council’s infrastructure assets, capital works are paid for through an external borrowing programme. Depreciation expense is used as a proxy for debt repayment, as this approach ensures that the repayment of debt is aligned with the useful life of the asset that has been constructed / renewed in accordance with principles of intergenerational equity.

9.4 Asset Valuation

The value of the flood protection and drainage assets as of 31st December 2019 totalled \$643 million NZD, and were split between the three service areas as shown in the table below:

Table 27: Value of WRC owned and managed assets

Service Area	Optimised Replacement Cost (ORC) \$'000	Optimised Depreciated Replacement Cost (ODRC) \$'000
Flood Protection	\$546,771	\$393,158
River Management	\$64,326	\$46,254
Land Drainage	\$32,163	\$23,127
Total	\$643,260	\$462,539

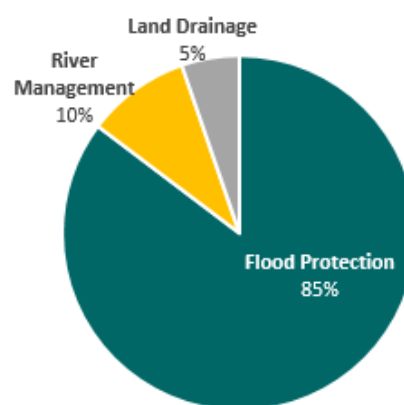


Figure 16: Value of assets by services provided

A review of asset values is conducted each year.

Between 2013 and 2019 the replacement cost for ICM’s assets increased from \$484 million to \$643 million. The valuation numbers below are used for asset management to support calculating long term asset renewals projections, identifying loss of service potential, and for financial reporting purposes.

Table 28: Replacement value by asset class

Asset Type	Replacement Cost	Optimised Depreciated Replacement Cost	Annual Depreciation
Bridges	\$3,528,804	\$1,534,538	\$43,545
Channels	\$42,608,068	\$34,894,319	\$172,746
Control Gates	\$3,548,646	\$777,363	\$72,302
Culverts	\$2,421,202	\$1,693,115	\$32,452
Debris Traps	\$277,401	\$207,684	\$2,772
Detentions	\$8,049,318	\$3,025,656	\$101,634
Drop Structures	\$61,382	\$10,388	\$1,227
Fencing	\$9,741,362	\$2,587,837	\$325,057
Floodgates	\$85,819,925	\$37,482,879	\$1,323,985
Plantings	\$303,414	\$303,414	\$0
Pumpstations	\$93,509,624	\$45,245,999	\$1,973,812

Asset Type	Replacement Cost	Optimised Depreciated Replacement Cost	Annual Depreciation
Retaining Structures	\$20,638,584	\$12,200,861	\$447,995
River Training Works	\$2,508,875	\$1,774,246	\$29,014
Stopbanks	\$365,538,704	\$317,988,397	\$1,792,141
Structures	\$4,304,015	\$2,488,494	\$146,703
Weirs	\$400,986	\$323,691	\$4,007
Totals	\$643,260,310	\$462,538,879	\$6,469,392

Accumulated depreciation is the total depreciation accumulated for each asset across its lifespan. For the purposes of valuing ICM assets, it is calculated as the optimised replacement cost minus the optimised depreciated replacement cost.

ICM asset valuations are completed in accordance with:

- Public Benefit Entity International Public Sector Accounting Standard 17, Property Plant & Equipment (PBE IPSAS 17)
- New Zealand Infrastructure Valuation and Depreciation Guidelines (Edition 2), issued by the National Asset Management Steering Group (NAMS).

During the course of the analysis some minor inaccuracies were found in the asset attribute details, understanding useful life of different asset classes, and the unit rates applied to construction work.

For more details of the process followed and detailed findings refer to WSP Waikato Regional Council Valuation of Infrastructure Asset Report, 31st December 2019 (Doc#16340515).

9.5 Historical Financial Performance

9.5.1 Operational Funding

Flood protection, river, and drainage assets consumes approximately one third of the council's annual operating budget.

The graph to the right shows the split of operational funding across the three major activities.

These figures include:

- Overheads, such as management and technical services activities.
- Operational and maintenance repair activities.
- Continuous Improvement activities related to the three asset areas.
- Extreme weather event reserves.

They do not include:

- Depreciation
- Catchment Management Activities

The funding spread across the zones for each area is shown below:

Overview: Operational budget

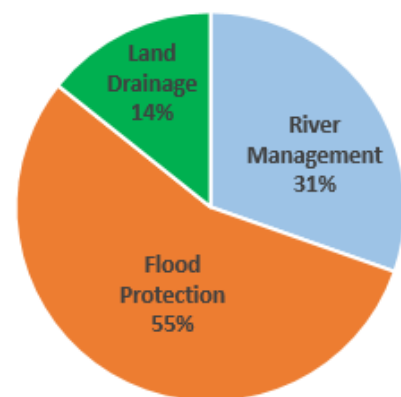


Figure 17: ICM operational task funding by asset related activity

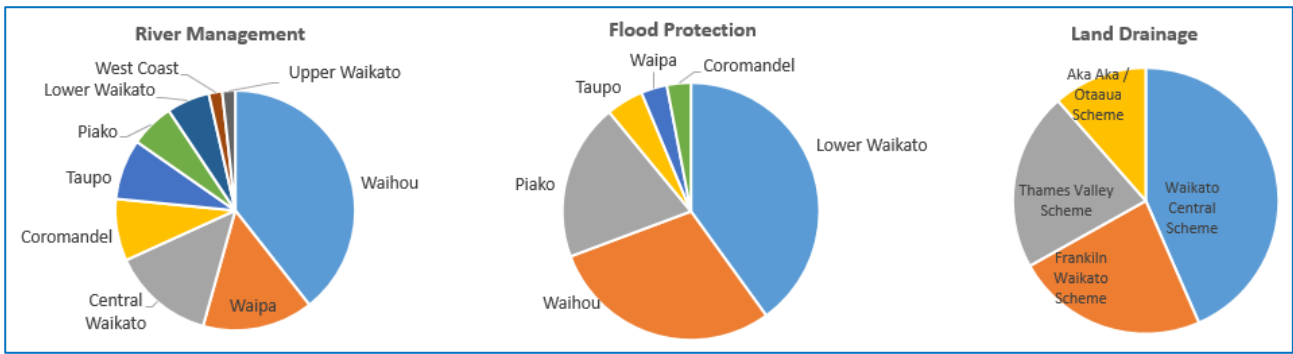


Figure 18: Funding for each activity type, as split across zones

A majority of the urban and rural flood protection assets are located in the lower Waikato, Waihou, and Piako areas. Whereas the Waipa protects mainly Otorohanga, Taupo the area of Turangi, and Coromandel several small communities.

9.5.2 Operational expenditure performance

Table 29: Historical annual operational budgets and actual spend (millions)

Year	15/16	16/17	17/18	18/19	19/20
Opex (millions)					
Yr. Actual	\$23.96	\$32.47	\$37.72		
Annual Plan FY Budget	\$22.62	\$30.92	\$30.59		
Revised FY Budget	\$21.68	\$29.04	\$30.49		
Yr. Actual / Annual Plan	106%	105%	123%		
Yr. Actual / Revised (approved) budget	111%	112%	124%		

9.5.3 Capital expenditure performance

Table 30: Historical annual capital budgets and actual spend (millions)

Year	15/16	16/17	17/18	18/19	19/20
Renewals					
Yr. Actual	\$6.45	\$8.83	\$11.58	\$9.15	\$4.88
Annual Plan FY Budget	\$6.96	\$11.62	\$16.15	\$11.83	\$13.77
Revised FY Budget	\$6.58	\$10.65	\$12.52	\$11.72	\$11.27
New works					
Yr. Actual	\$1.86	\$1.42	\$1.38	\$2.01	\$1.59
Annual Plan FY Budget	\$1.69	\$2.85	\$4.93	\$0.22	\$0.78
Revised FY Budget	\$1.45	\$2.17	\$2.07	\$2.25	\$5.61

One new works projects (Muggeridge's) and one major equipment replacement (Tamahere Vessel) were put on hold during 2019/20 due to uncertainty of funding, and several asset renewal jobs were put on hold due to changes in scope or resourcing delays.

9.6 Forecasted spend profile

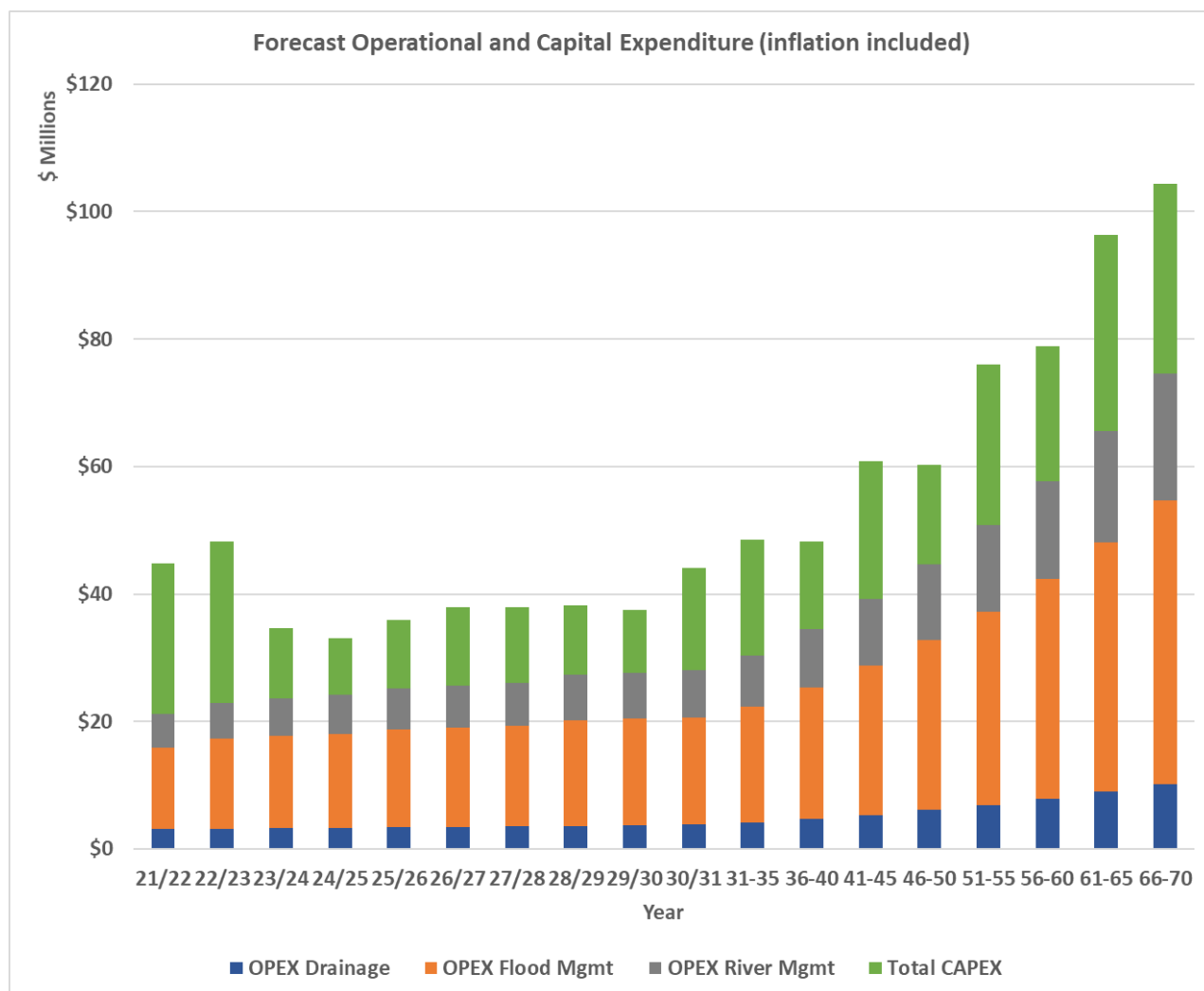


Figure 19: Total 50-year expenditure forecast (includes inflation). 1st 10 years are shown individually, 11 – 50 years are averaged for the 5-year period

9.6.1 Operational

Forecasted operational expenditure is expected to increase over the next 50 years due to

- Inflation (accounts for over 80% of the increases forecast)
- Increasing age of assets therefore reducing performance, so they need to run longer, and require more maintenance.
- Increasing compliance costs.

9.6.2 Capital renewals

For the first 10 years, confirmed works programmes and project estimates are the dominant influence on the forecast expenditure associated with asset renewals. Beyond the ten-year horizon, the combination of current asset values (determined through asset revaluation⁴) and remaining asset lives are used to estimate longer term renewal forecasts out to 50 years in the future. Where practical and safe to do so, the council has smoothed planned replacement programmes to ensure effective use of resources and management of risk. Critical assets have a lower threshold for action than non-critical assets.

⁴ Current asset values updated in December 2019

Refer to the “Infrastructure strategy in the 2021-31 long term plan” for more details (<https://www.waikatoregion.govt.nz/>).

Renewals profiles for the Flood protection schemes are located in APPENDIX B– Zone specific summaries.

9.6.3 New Capital

A majority of the council’s work is maintaining the existing infrastructure, there is minimal new capital projects in the pipeline for the next 10 years.

Future works to resolve demand issues that are programmed within the next three years are:

Table 31: Growth-related Asset Solutions

Asset Solution	Zone	Funding Source(s)
Muggeridge's pump station	Waihou Piako	50% Private landowners 17% zone 33% government funding ⁵
Kirikiri Stream Stopbank completion	Waihou Piako	Capital works funding policy
Lake Waikare Enhancements	Lower Waikato	Capital works funding policy
Tamahere Vessel	Lower Waikato	Capital works funding policy
River works (installation of groynes, weirs etc.)	Central Waikato Lower Waikato Waipa West Coast	Capital works funding policy

9.6.4 Data Confidence

1 to 3 year projected spend requirements: Reliable

4 to 50 year projected spend requirements: Uncertain

The table below highlights the potential variations that may be seen

Table 32: confidence in various inputs used to develop the 10 year and 50 year infrastructure financial forecasts

Area	Sensitivity	Effect on forecast	Reasoning
Reactive Maintenance	0% to 25%	Low	Reactive maintenance is subject to a range of influences including the weather and river flows etc.
Contingency Funding – Extreme Events	0% to 25%	Low	Major disaster (floods and earthquake) risks are provided for through self-reserving and membership of the LAPP mutual disaster damage fund.
Morphological changes to river	-50% to +300%	High	The unpredictability of changes in river size and location due to changes in the magnitude of frequent events means assets will need to retreat and instances where current scheme land becomes part of the river system and new scheme land needs buying.
Condition of assets	-20% to +20%	Low	Assets will always degrade but using asset condition in the analysis allows better prioritisation and for some work to be

⁵ This assumes shovel ready funding will be approved for the Muggeridge’s project. At time of writing this decision was still unknown.

Area	Sensitivity	Effect on forecast	Reasoning
			pushed out. If asset condition knowledge is low, then some areas at risk may be incorrectly prioritised.
Degradation rates of assets	0% to +50%	Low	Currently degradation rates are known for stopbanks. Better analysis of other asset classes will allow more robust renewal forecasts in the future.
Demand predictions – Climate change	-20% to +50%	Medium	Climate change has been built into the analysis. Minimal effects are expected in the next 10 years. The sustainable infrastructure strategy signed off by Council in 2020 will influence decisions into the future.
Demand prediction – urban development	0% to +30%	Minor	May lead to early renewal of some assets due to changes in level of service requirements.
Demand predictions – asset performance	0% to +200%	High	The effect of building on and draining areas composed of peat and marine mud and understanding associated land settling rates means assets are needing repositioning to continue to perform their function. The research is only at its embryonic stage and will be used in the future to help with future forecasts. Risk: Potentially halving asset life.
Construction costs: Source Material	0% to 25%	Minor	In the past build material has been sourced from nearby farms, future changes in resource management and bio security rules or alternatively all local material being exhausted may lead to a lack of available build material. Current costs to source material are double if buying and trucking into stopbank works site.

9.7 Policies

The WRC has several key policies that provide guidelines and procedures for dealing with treasury management activities; the determination of the significance of an issue, proposal, decision or other matter; how to perform in partnerships between WRC and the private sector. These policies are:

- WRC Treasury risk management policy
- WRC Policy on significance
- WRC Partnership and private sector policy
- WRC Infrastructure assets – accounting policies and guidelines.

9.8 Regional asset management plan assumptions

This Regional Asset Management Plan (RAMP) has been prepared based on the following assumptions:

- The scope of the plan does not include the services undertaken by council in regards to catchment planning and management, biosecurity, biodiversity, and environmental farming systems
- The plan is based on currently available information and data
- The effects of climate change are considered based on the Ministry for the Environment Guidelines
- Financial forecasts are for 50 years
- Financial estimates are to be updated as part of the 2021 LTP preparation / adoption process
- Existing levels of service are to be maintained
- Consultation with the community has been ongoing since the adoption of the last asset management plan
- There will be minimal change in applicable standards and technologies over the life of the plan
- Community groups will continue to take responsibility for certain areas
- This plan has not considered future budget constraints affecting contingency funds
- This plan has not considered changes to the NES-FW or NPS-FM and the influence this will have in this activity area.

9.8.1 Summary 10-Year Forecast Budget by Programme

Table 33: Forecast expenditure by budget type, across all zones, and all flood protection and drainage asset types (includes inflation)

Programme	Year 1 2021/22	Year 2 2022/23	Year 3 2023/24	Year 4 2024/25	Year 5 2025/26	Year 6 2026/27	Year 7 2027/28	Year 8 2028/29	Year 9 2029/30	Year 10 2030/31	Total
Operations and Maintenance Programme											
Flood Protection	12,859,160	14,085,722	14,502,826	14,738,082	15,366,962	15,540,423	15,748,147	16,589,951	16,673,601	16,780,687	152,885,561
River Management	5,282,472	5,597,722	5,838,639	6,122,769	6,369,385	6,567,179	6,769,932	7,036,467	7,280,211	7,490,388	64,355,163
Drainage	3,086,682	3,186,484	3,258,321	3,295,791	3,384,666	3,459,476	3,532,897	3,633,478	3,726,192	3,831,062	34,395,050
Capital Programme – Renewals											
Flood Protection	24,374,683	23,816,226	13,611,327	10,711,591	10,027,718	11,587,218	11,247,253	10,100,664	8,986,010	11,739,722	136,202,411
River Management	618,000	571,095	617,014	632,439	648,883	665,105	682,398	700,822	720,445	739,177	6,595,379
Drainage	-	-	3,515	184,975	77,422	36,761	-	83,619	180,065	3,441,648	4,008,005
Capital Programme – New Works											
Flood Protection	2,620,000	1,828,000		1,695,210	1,187,444	1,187,444	1,187,444	1,187,444	1,187,444	1,187,444	13,267,874
River Management	618,000	555,000	585,000	585,000	585,000	585,000	585,000	585,000	585,000	585,000	5,853,000
Drainage										2,495,170	2,495,170
Asset Disposals Programme											
Asset Disposal Programme	-	-	-	-	-	-	-	-	-	-	\$0
OVERALL TOTAL	49,458,997	49,640,249	38,416,642	37,965,857	39,647,480	39,628,606	39,753,071	39,917,445	39,338,968	48,290,298	420,057,613

10 SUPPORTING SYSTEMS

10.1 Asset Information Systems

The council is in the process of transferring over the next three years to a single enterprise system. This will enable efficiencies between financial, procurement, asset management, human resource management, and reporting.

Table 34: Asset Management Systems

System	Purpose
Infor	The Enterprise Asset Management System: Asset information, condition and performance data, valuation data. And the management of task planning, scheduling, execution, and closeout actions.
Fulcrum	Mobile data collection for collecting scientific data, bespoke auditing
GIS	Geographical asset information, used to show information spatially
Promapp	Process maps detailing business processes for the management of various council processes
Discover	Document management & filing of historic documentation, maps, photos, projects, audits etc.
Integrated Regional Information System (IRIS)	External enquiries logging system, that enables triage, responding to individual requests, and monitoring and reporting
Psoda	Project Management and Reporting system used for capital projects
Vault	Health and Safety system for capturing risks, near misses, and incidents, and the resulting investigations and actions.

10.2 Asset Information Management

The WRC has an asset register for all assets that contains:

- A definition of all assets including description and location
- Physical dimensions and capacity
- Asset age and replacement costs
- An assessment of asset condition.

Asset related data is collected and entered into the asset register. This data is under constant review with increasing accuracy being achieved through data validation by staff and contractors. The asset register and associated asset information is held in the Infor Asset Management System. Council uses this system as the primary asset management information tool. Categorisation of assets into types and attribute fields is hierarchical and fully customisable.

A spatial representation of the asset information is provided by an ArcGIS based Geographic Information System (GIS) which is linked to the asset database.

Glossary of terms

Annual Plan (AP)	The Annual Plan provides a statement of the direction of the WRC and ensures consistency and coordination in both making policies and decisions concerning the use of the WRC resources. It is a reference document for monitoring and measuring performance for the community as well as the WRC itself.
Annual Exceedance Probability	The probability of a storm event being exceeded in any one year
Aggradation	The accumulation of sediment in rivers and waterways due to sediment supply exceeding the waterways ability to transport sediment.
Asset Management (AM)	The combination of management, financial, economic, engineering, and other practices applied to physical assets with the objective of providing the required level of service in the most cost effective manner.
Asset Management System (AMS)	A system (usually computerised) for collecting, analysing and reporting data on the utilisation, performance, lifecycle management and funding of existing assets.
Asset register	A record of asset information considered worthy of separate identification including inventory, historical, financial, condition, construction, technical, and financial information about each.
Asset renewal	Major work, which restores an existing asset to its original capacity or the required condition (stopbank top-up etc)
Auditor General	The Auditor General of the New Zealand Audit Office.
Benefit cost ratio (BCR)	A ratio which compares the benefits accruing to customers and the wider community from constructing a project with at projects costs.
Brave Gen	WRC Database software for the management of resource consents
Capital expenditure (CAPEX)	Expenditure used to create new assets or to increase the capacity of existing assets beyond their original design capacity or service potential. CAPEX increases the value of an asset.
Climate change	A long term significant change in the average weather.
Community outcomes	Outcomes developed with the community, which outline the community's vision.
Components	Specific parts of an asset having independent physical or functional identity and having specific attributes such as different life expectancy, maintenance regimes, risk or criticality.
Condition monitoring	Continuous or periodic inspection, assessment, measurement and interpretation of resulting data, to indicate the condition of a specific component so as to determine the need for some preventative or remedial action
Condition rating survey	Survey carried out to assess the condition of assets.
Conquest III	WRC's previous Asset Management and Maintenance Action System
Critical assets	Assets for which the financial, business or service level consequences of failure are sufficiently severe to justify proactive inspection and rehabilitation. Critical assets have a lower threshold for action than non-critical assets.
Culvert	A structure that allows water to flow under a structure or other obstruction. Generally a pipe.
Current replacement cost	The cost of replacing the service potential of an existing asset, by reference to some measure of capacity, with an appropriate modern equivalent asset.
Deferred maintenance	The shortfall in rehabilitation work required to maintain the service potential of an asset.
Depreciated replacement cost (DRC)	The replacement cost of an asset spread over the expected lifetime of the asset.
Depreciation	The wearing out, consumption or other loss of value of an asset whether arising from use, passing of time or obsolescence through technological and market changes. It is accounted for the by historical cost (or re-valued amount) of the asset less its residual value over its useful life.
Detention Dam	Typically an earth dam/embankment built to catch and detain surface runoff and stream water flow in order to regulate the water flow in areas below the dam.
DISCOVER	WRC Document management warehousing software
Disposal	Activities necessary to dispose of decommissioned assets.
Edge protection	Rockwork or planting to help maintain the integrity of Stopbanks or other flood defences structures.

Enterprise Asset Management System (EAM)	A combination of software, systems and services used to maintain and control operational assets and equipment. The resulting insights help maintenance teams make better decisions, enhance efficiency, perform preventive maintenance and maximise investments in their physical assets.
Emergency work	The restoration work required to restore an asset damaged by a sudden and unexpected event (e.g. storm event) to its previous condition.
Embankment	In the Waikato Regional Council context the term 'Embankment' is used to refer to earth structures used to control flood waters. This includes the following asset types: Stopbanks, Spillways and Detention Dams
Floodgate	Adjustable gates used to control water flow for a variety of different reasons. Usually operated during high rainfall events.
Flood Protection Assets	Assets built to prevent or reduce the detrimental effects of flood waters on private and public property.
Geographic Information System (GIS)	Software which provides a means of spatially viewing, searching, manipulating, and analysing an electronic database.
Infor	WRC's current Enterprise Asset Management and Maintenance Action System
Level of Performance	Specific indicators that demonstrate how the asset or organisational process is doing in relation to delivering levels of service. They may be a customer performance measure or a technical performance measure.
Level of Service	Outputs a customer or community receives from the organisation. They should describe what the organisation is intending to deliver, including attributes relating to quality, reliability, responsiveness, sustainability, timeliness, accessibility and cost.
Life cycle management	A process of managing an asset from initial construction through to disposal.
Long Term Plan (LTP)	The WRC's 10-year programme setting out the community outcomes sought, key activities, levels of service, performance measures and funding.
Net Present Value (NPV)	The value of an asset to the organisation, derived from the continued use and subsequent disposal in present monetary values. It is the new amount of discounted total cash inflows arising from the continued use and subsequent disposal of the asset after deducting the value of the discounted total cash outflows.
Non-structural measures	Flood mitigation measures to separate the community from floodwaters.
Optimised renewal decision making (ODM)	An optimisation process for considering and prioritising all options to rectify performance failures of assets. The process encompasses NPV analysis and risk assessment.
Pumpstations	Facilities designed to pump large amounts of water from one place to another. Used by WRC to aid in removing surface water behind stopbanks during flood events.
Reach	A defined section of a river, used for management purposes
Remaining useful life (RUL)	Remaining Useful Life of an asset or asset component. (Generally Useful or Effective life less age).
River Management Works	Assets built to influence the course, characteristics, or flow of a river in order to provide some benefit to fish migration, water navigation, and landowners.
River Training Works	Structures built to alter the course of a river channel to suit a perceived need.
Stakeholder	A person or organisation who has a legitimate interest in an activity e.g. community, Iwi, etc.
Stopbank	An embankment adjacent to a river or watercourse, which retains floodwaters from flowing onto a floodplain.
Spillway	A section of embankment adjacent to a river or watercourse designed to be overtopped at a predefined flood level to relieve pressure on the downstream river system and flood protection scheme.
Structural measures	Structures or physical works constructed to keep floodwaters away from existing development e.g. stopbanks
Sustainability	The process of meeting the needs of the present community without compromising the ability of future generations to meet their own needs.
Weir	A man-made barrier across the width of a river channel used to alter river flow by slowing down the rate at which water moves downstream.

Acronyms

AEE	Assessment of environmental effects
AEP	Annual Exceedance Probability
AM	Asset management
AMIS	Asset management information system
AMP	Asset management plan
AP	Annual Plan
ARI	Average recurrence interval
AS/NZS	Australia and New Zealand Standards
BAP	Best appropriate practice
BATS	Business and Technical Services
BAU	Business as Usual
BRE	Business risk exposure
CDEM	Civil Defence Emergency Management
CE	Chief Executive
CM	Catchment Management
DOC	Department of Conservation
DRC	Depreciated Replacement Cost
EAM	Enterprise Asset Management System
EMO	Emergency Management Officer
EW	Environment Waikato ⁶
FM	Flood Management
GHD	Gutteridge Haskins and Davey
GIS	Geographic Information System
GR	General Risk
GRC	Gross replacement cost
H&S	Health and safety
IAM	Institute of Asset Management
ICM	Integrated Catchment Management
IIMM	International Infrastructure Management Manual
IMP	Iwi Management Plan
IPCC	Intergovernmental Panel on Climate Change
IRIS	Integrated Regional Information System
IT	Information technology
KPI	Key performance indicator
LCM	Life cycle management
LGA 2002	Local Government Act 2002
LIA	Land Improvement Agreement
LIDAR	Light Detection and Ranging

⁶ Name changed to Waikato Regional Council April 2011

LoS	Levels of Service
LTP	Long Term Plan
LWWCS	Lower Waikato Waipa Catchment Scheme
MFE	Ministry for the Environment
MFish	Ministry of Fisheries
NAMS	National Asset Management Steering (Group)
NES-FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NIWA	National Institute of Water and Atmospheric Research
NPV	Net present value
NZIAS16	New Zealand International Accounting Standard
NZTA	New Zealand Transport Agency
OAG	Office of the Auditor General
ODM	Optimised decision making
ORC	Optimised replacement cost
ODRC	Optimised depreciated replacement cost
ORDM	Optimised renewal decision making
O&M	Operations and maintenance
PMI	Project Management Institute
PMO	Project Management Office
QA	Quality assurance
RAMP	Regional Asset Management Plan
RAMSAR	Ramsar Convention
RM	River Management
RMA	Resource Management Act 1991
RPS	Regional Policy Statement
RUL	Remaining useful life
SCRCA	Soil Conservation and Rivers Control Act
SLA	Service Level Agreements
SLT	Senior Leadership Team
SNZ HB	Standards New Zealand Handbook (Risk)
SSoW	Safe System of Work
TA	Territorial authority
WRC	Waikato Regional Council
WRP	Waikato Regional Plan
ZMP	Zone Management Plan

APPENDIX A - GENERAL INFORMATION

A1 WRC Community Outcomes

A1.1 WRC Community Outcomes

Community outcomes are the outcomes that a local authority aims to achieve in meeting the current and future needs of communities for good-quality local infrastructure, local public services, and performance of regulatory functions. The WRC outcomes are connected to one another, so success in one area cannot be at the expense of another. As a result WRC seeks to make decisions that provide multiple benefits for the community now and in the future. The community outcomes are as follows:

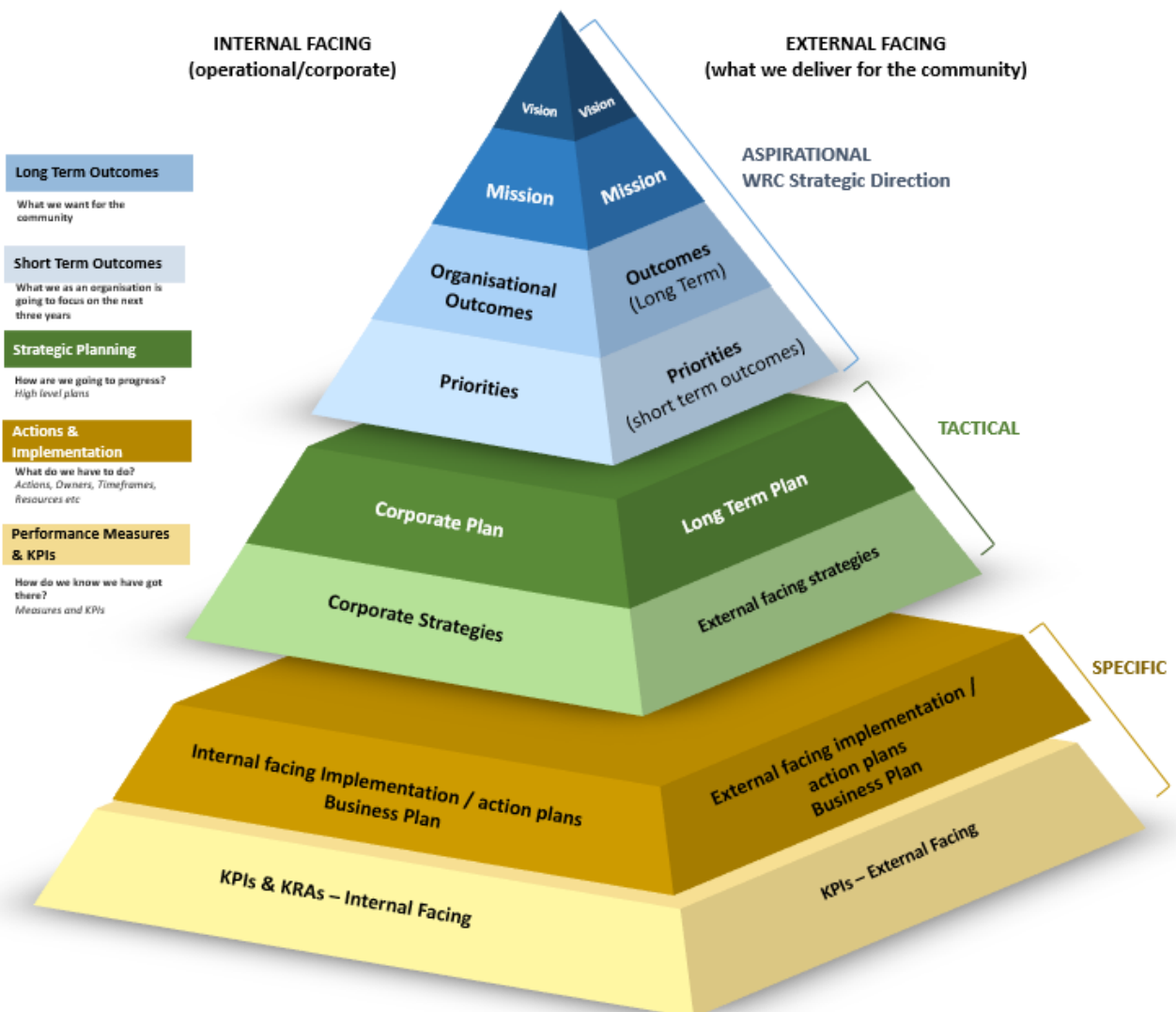
Table 35: Community Outcomes as outlined in 2014

Healthy environment <ul style="list-style-type: none">• Land use is appropriate to its long-term sustainability.• It is safe to swim and take kai from all freshwater.• The Waikato is predator free, in line with the New Zealand 2050 target.• The full range of ecosystem types, including land, water and coastal and marine ecosystems, is in a healthy and functional state.• All soil quality indicators are trending positive
Strong economy <ul style="list-style-type: none">• By 2034, household median incomes are above the New Zealand average (Waikato Means Business).• By 2034, value added per capita will grow by 2.8 percent per annum so that the Waikato region is in the upper third of regions in New Zealand for economic performance (Waikato Means Business).• Economic growth ensures natural capital and ecosystem services are maintained.• The Waikato region is moving towards a low carbon economy.• We are achieving the best use of the region's fresh water.• New investment is attracted to the region through improved reputation and partnerships.• The Waikato region benefits from having Auckland as our neighbour
Vibrant communities <ul style="list-style-type: none">• Communities feel like a valued part of the Waikato and take pride in the region.• Communities are empowered and supported to take action on agreed outcomes.• Communities are less vulnerable and more resilient to natural hazards, the effects of climate change and changes to the society and the economy.• People and communities are well connected to each other, to services (including health and other essential services), and to opportunities including recreation, education and jobs.• There is increased benefit from the use and protection of our amenity and recreational features and values.• Significant reduction in boating fatalities and road related fatalities and serious injuries.• We support all parts of the Waikato to be as successful as they can be.• We are inclusive of diversity and culture.• Co-governance with iwi is meaningful and effective.

A1.2 Strategic Alignment

The following diagram demonstrates how the internal and external facing parts of WRC align to provide continuity and a “line-of-sight” between long term outcomes, planning, strategies, plans and performance measures.

Figure 20: WRC Line of sight



A1.3 Catchment Oversight

Consultation Includes:

- Advisory committee reporting, and discussions
- Liaison with iwi
- Website, Facebook, and Instagram
- Consultation register

Annual and forward programmes are considered by community representatives in the form of the Integrated Catchment Management Committee, and 2 advisory committees, and reported to the wider community and the Council.

A1.4 Preparation and Contribution to Strategies and Plans

The following strategic documents and processes require regular review and monitoring:

- LTP Process
- Regional Policy Statement
- Waikato Regional Plan
- Whole of catchment management principals
- District plans etc.
- Local government reform

In addition, the following specific plans are prepared:

Zone Management Plans (ZMPs)

There are ZMPs for each of the eight management zones as follows:

Table 36: Zone Management Plans

Zone	Latest Full Review	Next Full Review
Coromandel	2012	2022
Waihou Piako	2017/18	2023
Taupō	2017	2023
Waipa	2017	2023
Upper Waikato	2014	2026
Central Waikato	2017	2023
Lower Waikato	2017/18	2023
West Coast	2016	2022

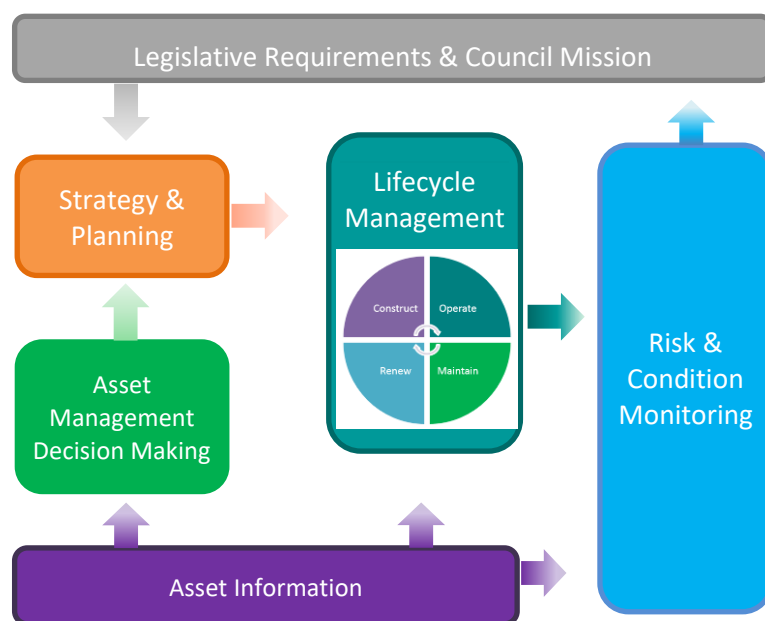
A1.5 Asset Management Framework

The model to the right is taken from the Institute of Asset Management (IAM).

It shows at a macro level the management process of the Integrated Catchment Management Directorate.

This section of the RAMP details critical workflows within each of these major areas, key inputs and outputs, and who is responsible for their delivery.

Figure 211: Key Components of the Asset Management Framework



The type of work that occurs in each box is listed below:

Area	ICM Work in each area
Legislative Requirements & Council Mission	Legislative Requirements WRC policies and strategies Long Term Plan,
Asset Management Decision Making	Technical Guidelines National Standards Failure Modes, and Asset Care Strategies
Strategy & Planning	Catchment oversight Regional Asset Management Plan Zone Management and Planning Asset Management Continuous Improvement Plans Drainage management plan Scheme land management plan Waikato River Management Plan
Lifecycle Management	New Asset build programme Operations programme Maintenance programme Renewals programme
Risk & Condition Monitoring	Reports back to committees & SLT on LOS performance & Asset performance Risk and Hazard Reviews Scheme Reviews Resilience Reviews Condition monitoring, audits, and asset surveys
Asset Information	Valuation and Work capture from lifecycle delivery programmes Asset attribute capture and improvement Digitisation of historical information

Table 37: Key Activities occurring within each section of the ICM AM Framework

A1.6 Legislative framework

The WRC has responsibilities under various acts of parliament. Those most relevant to this Regional AMP are summarised in the table below.

Table 38: Legislative Framework

Act	Requirements
LGA 2002 Schedule 10 Requirements	<p>The Local Government Act 2002 (LGA 2002) has prescribed that levels of service (LoS) must in future be developed from a community perspective.</p> <p>The LGA 2002 requires local authorities to consult their communities on funding and financial policies, the types and levels of service council propose and how they will be paid for, and the relationship between costs and levels of service provision. Schedule 10 requirements are set out in APPENDIX AA1.8.</p>
LGA 2002 Significance policy	<p>Section 90 of the Local Government Act 2002 requires each WRC to adopt a policy on significance, which:</p> <ul style="list-style-type: none"> • Sets out that the WRC's general approach to determining the significance of proposals and decisions in relation to issues, assets or other matters. • Sets out any thresholds, criteria, or procedures that are to be used by the WRC in assessing the extent to which issues, proposals, decisions or other matters are significant. • Lists the assets considered by the local authority to be strategic assets. <p>Section 97 of the Local Government Act 2002 requires that the significance policy shall identify all of the assets the WRC considers to be strategic, as defined in Section 5 of the Local Government Act 2002.</p> <p>The WRC has determined the Integrated Catchment Management Services assets to be strategic in nature.</p> <p>Any decision to transfer ownership or control of a strategic asset or a decision to construct, replace or abandon a strategic asset cannot be made unless it has first been included in the LTP (and in a statement of proposal relating to the LTP). All such actions relating to a strategic asset are automatically significant and must meet the requirements relating to significant decisions with the LGA, specifically Part 6, section 90.</p>
Health and Safety at Work Act 2015	<p>Assigns the council the role of the PCBU (person conducting a business or undertaking), and has the primary duty of care on any regional council worksite. Ensuring the safety of its own workers, contractors, and volunteers entering that site by:</p> <ul style="list-style-type: none"> • Making explicit that everyone has a role to play. • Makes clear everyone's responsibilities. • Focusses on managing work risk. • Requires those who create the risk to manage the risk. • Requires businesses to engage with workers and enable them to actively participate in health and safety. • Allows different methods to be employed (depending on the situation) in the management of health and safety risks.
Soil Conservation and Rivers Control Act 1941	<p>Assigns WRC the responsibility of control and management of all land with SCRC status within the WRC territory and authorises the WRC to grant licences to occupy over it.</p> <p>This Act gives WRC the authority to do works that:</p> <ul style="list-style-type: none"> • Control the flow of water towards, within and from watercourses. • Prevent the overflow of banks and reduce damaged cause by such events. • Reduce erosion by undertaking soil conservation activities. <p>WRC therefore has the responsibility of managing river and catchment systems and is empowered to undertake works to protect communities from floods and erosion</p>

	WRC may not dispose of soil conservation land; however it may consent to access for the purpose of exercising a mining permit.
Civil Defence Emergency Management Act 2002	The Waikato Regional Council, territorial authorities and emergency services have responsibilities in planning for and responding to emergencies, including river flooding. Under this Act, the integrated catchment management activities in relation to flood prevention constitute risk reduction measures. Integrated catchment management therefore needs to be part of the planning for and response to emergencies in order to minimise the effects of any hazards, particularly river flooding.
Resource Management Act 1991	<p>Under this Act, WRC has an obligation to provide for the sustainable management of natural and physical resources in the region. The WRC has two main roles in relation to this Act:</p> <ul style="list-style-type: none"> • WRC is tasked with protecting the environment, and specifically the natural resources, whilst still allowing communities to provide for the economic and social wellbeing. • In terms of service delivery, the WRC has a responsibility to avoid, remedy and mitigate any adverse effects of its integrated catchment management services activities. <p>Resource consents are used as a way of managing the potential adverse effects of activities and WRC has a role both as a regulator, assessing resource consents, and also as an applicant, applying for resource consents.</p>
Resource Management (Energy and Climate Change) Amendment Act 2004	This amendment to the RMA introduced a number of changes to the principal Act that explicitly require those authorities acting under the Act to consider the efficiency of the end use of energy, the effects of climate change and the benefits derived from the use and development of renewable energy.
Resource Management (National Environmental Standards for Freshwater) Regulations 2020	<p>These regulations are made under section 43 of the Resource Management Act 1991. These regulations come into force on 3 September 2020, however subpart 3 of Part 2 (intensive winter grazing) comes into force on 1 May 2021, and regulations 12 to 14 (stockholding areas other than feedlots) and subpart 4 of Part 2 (application of synthetic nitrogen fertiliser to pastoral land) come into force on 1 July 2021.</p> <p>These regulations deal with functions of regional councils under section 30 of the RMA but do not deal with the functions of territorial authorities under section 31 of the Act.</p> <p>The following parts have relevance to WRC activities and in particular asset management:</p> <ul style="list-style-type: none"> • Part 2 – Standards for farming activities • Part 3, subpart 1 – Standards for activities that have potential to affect natural wetlands • Part 3, subpart 2 – Standards for reclamation of rivers • Part 3, subpart 3 – Standards for passage of fish affected by structures (culverts, weirs, passive flap gates) • Part 4 – Local authorities can charge for monitoring of permitted activities. <p>If NES-FW permitted activities cannot be complied with resource consent is required if there is no existing resource consent authorising the activity.</p>
The Public Works Act 1981	Authorises the WRC to grant a lease, tenancy or licence to occupy on land held for public work on terms and conditions as determined by the WRC.
Land Drainage Act 1908	This Act describes the duties of Territorial Authorities for the provision and maintenance of drainage schemes in NZ. WRC has been given power over some drainage districts, and follows the guidance on land drainage and rivers protection in the Local Government Act mentioned above.

Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010	<p>The Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 has the purpose to</p> <ul style="list-style-type: none"> • give effect to the settlement of Raupatu claims under the 2009 deed • recognize the significance of the Waikato River to Waikato-Tainui • recognize the Vision and Strategy for the Waikato River • establish and grant functions and powers to the Waikato River Authority • establish the Waikato River Clean-up Trust • recognize certain customary activities of Waikato-Tainui • provide co-management arrangements for the Waikato River • provide redress to Waikato-Tainui relating to certain assets • recognize redress to Waikato-Tainui of the Kiingitanga Accord and other accords provided for in the schedule of the Kiingitanga Accord <p>Doc#8995281</p>
Vision and Strategy for the Waikato River	<p>The Vision and Strategy for the Waikato River is consistent with the overarching purpose of the settlement between Waikato-Tainui and the Crown to restore and protect the health and wellbeing of the Waikato River</p> <p>Doc#3007599</p>
Ngati Tuwharetoa, Raukawa and Te Arawa River Iwi Waikato River Act 2010	<p>This Act</p> <ul style="list-style-type: none"> • recognizes the significance of the Waikato River to Ngati Tuwharetoa, Raukawa and Te Arawa River Iwi • recognizes the Vision and Strategy for the Waikato River • establishes and grants functions and powers to the Waikato River Authority • establishes the Waikato River Clean-up Trust • acknowledges and provides process that may recognize certain customary activities of Ngati Tuwharetoa, Raukawa and Te Arawa River Iwi • provides co-management arrangements for the Waikato River <p>Doc#9811979</p>
Nga Wai o Maniapoto (Waipa River) Act 2012	<p>The overarching purpose of this act is to restore and maintain the quality and integrity of the waters that flow into and form part of the Waipa River for present and future generations and care and protection of the mana tuku iho o Waiwaia.</p> <p>Doc#2226790</p>

A1.7 Key Documents

The table below shows the documents available for the management of ICM activities.

Document Name	Document N° (where internal)
National Policy and Strategy	
Iwi Environmental Plans	File: 01 18 02
National Policy for Freshwater Management	Doc #2243853
Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010	Doc #8995281
Vision and Strategy for the Waikato River	
The Waikato Regional Policy Statement	Doc #10872820, File 16 24 01
Regional Policy and Regulation	
Regional Coastal Plan	
Waikato Regional Plan	

Document Name	Document N° (where internal)
Territorial authority plans (district or city)	
WRC Organisational Policies and Plans	
Asset Management Policy	Doc #3335456
Funding Policies	
Infrastructure Accounting Policy	Doc #1127759, #985755
River Flood Risk Management Strategy 2009	Doc #1694264
The Long Term Plan (LTP) 2018-2028	
Annual Plan	
Joint Management Agreements	
Co-Management Agreement for Waikato River Related Lands	Doc #2276497
Joint Management Agreement (WRRT)	Doc #2276511
Joint Management Agreement (TARIT)	Doc #2249272
Joint Management Agreement (Maniapoto)	Doc #2270282
Joint Management Agreement (Raukawa)	Doc #2201886
Joint Management Agreement (Tuwharetoa)	Doc #9545447
ICM Plans	
Asset Management 3 year improvement plan	
Asset Management procedures	See Promapp
Capital Project Improvement Plans	
Scheme Reviews	
Zone Management Plans	https://www.waikatoregion.govt.nz/council/policy-and-plans/hazard-and-catchment-management/zone-management-plans
National Standard	
AU/NZS 4360. Australian/New Zealand Standard for Risk Management.	
Managing Flood Risk – A process Standard, NZS9401: 2008	
National Policy Statement for Flood Risk Management (proposed)	
NZS 3910, Conditions of Contract for Building and Civil Engineering Construction	
Generic Management Guidelines	
Environment Waikato: Environmental Guidelines. (Environment Waikato, 2003)	
Environment Waikato: Floodgate Management Guidelines. (Environment Waikato, 1997a)	Doc # 916625
Environment Waikato: Infrastructure Assets Disaster Damage and Risk Management Policy (Environment Waikato 2004)	
Environment Waikato: Pump Station Management Guidelines. (Environment Waikato, 1997b)	Doc # 916623
Environment Waikato: Stopbank Management Guidelines. (Environment Waikato, 1995)	Doc # 4104297
International Infrastructure Management Manual (NAMS, 2015)	

Document Name	Document N° (where internal)
Waikato Regional Council: Infrastructure Assets Accounting Policies / Guidelines.	Doc # 11075063
Operational Protocols and Guidelines	
Asset Management Plan - Land Drainage – Review (Environment Waikato, 2004)	Doc #979085
Consent Requirements for Vegetation Removal (Environment Waikato, 2006)	
Environment Waikato Freshwater Fish Calendar (Environment Waikato, 2007)	
Erosion and Sediment Control Guidelines for Soil Disturbing Activities (Environment Waikato, 2002)	
Oil Spill Contingency Guidelines (Environment Waikato, 2006)	
Joint Management Agreement (WRRT)	Doc #2276511
Co-Management Agreement for Waikato River Related Lands	Doc #2276497
Waterway Crossings (Environment Waikato, 2006)	
Integrated Catchment Management Directorate – Environmental Best Practice Guidelines	

A1.8 LGA Schedule 10 Requirements and Significant Negative

LGA 2002 Schedule 10 requirement	LGA 2002 references	Section covered
Identify the rationale for delivery of the group of activities (including the community outcomes to which the group of activities primarily contributes)	LGA 2002 Schedule 10 – 2 (1) (b)	RAMP, Sections 1,2,3
Outline any significant negative effects that any activity within the group of activities may have on the local community	LGA 2002 Schedule 10 – 2 (1) (c)	50 year infrastructure strategy
The amount of capital expenditure that the authority has budgeted to meet additional demand for an activity	LGA 2002 Schedule 10 – 3 (1) (a)	RAMP: Section 9, and appendix 3
The amount of capital expenditure that the authority has budgeted to improve the level of service	LGA 2002 Schedule 10 – 3 (1) (b)	RAMP: Section 9, and appendix 3
The amount of capital expenditure that the authority has budgeted to replace existing assets	LGA 2002 Schedule 10 – 3 (1) (c)	RAMP: Section 9, and appendix 3
A statement of the intended levels of service provision that specifies any performance measures specified in a rule made under Section 261B of the Act (Mandatory measures)	LGA 2002 Schedule 10 – 4 (a)	RAMP, Section 3, Zone management plans
The performance measures that the local authority considers will enable the public to assess the level of service for major aspects of groups of activities	LGA 2002 Schedule 10 – 4 (b)	2018/19 LTP, and RAMP section 3
The performance target or targets set by the local authority for each performance measure	LGA 2002 Schedule 10 – 4 (c)	RAMP, Section 3
Any intended changes to the level of service that was provided in the year before the first year covered by the plan and the reasons for the changes	LGA 2002 Schedule 10 – 4 (d)	Zone Management Plans, and RAMP, Section 3
The reason for any material change to the cost of a service	LGA 2002 Schedule 10 – 4 (e)	50 year infrastructure strategy and RAMP, Section 9
A funding impact statement in relation to each group of activities of the local authority	LGA 2002 Schedule 10 – 5 (1) (a)	RAMP, Section 9, LTP documents
The sources of funding to be used by the local authority	LGA 2002 Schedule 10 – 5 (2) (a)	RAMP, Section 9, LTP documents
The amount of funds expected to be produced from each source; and	LGA 2002 Schedule 10 – 5 (2) (b)	Funding Strategy
How the funds are to be applied	LGA 2002 Schedule 10 – 5 (2) (c)	Funding Strategy / Accounting policy

A.1.8.1 Significant negative effects of this activity

ICM activities have the potential to have negative effects on receiving environments and community well-being. Potential negative effects have been identified in terms of their possible impact on the Cultural, Social, Economic and Environmental wellbeing of the community. The possible negative effects are outlined in the table below.

Significant negative effect	Cultural	Social	Economic	Environmental	Mitigation of negative effects
In-stream works may adversely affect water quality and ecological values	✓		✓	✓	Compliance with permitted activity and resource consent conditions Compliance with the WRC's Engineering Code of Practice and Guidelines.
Increasing rates to fund works may create economic pressures for communities			✓		Consult with community on all costs and options for levels of service through the LTP process
Aesthetic values may be impacted, for example losing river views because of stopbanks		✓			Consult with community on all costs and options for Levels of service through the LTP process
Removal / relocation of properties in high hazard risk areas may affect individuals and communities		✓			Consult with community on all costs and options for levels of service through the LTP process
Previous identified sites containing taonga (artefacts) or koiwi (bones) may be disturbed in the process of works	✓				Consult with iwi regarding sites of significance during the works planning process Implement ICM Accidental Archaeological Discovery Protocol
Inadequacy of existing assets to cope with large rainfall events causing flooding, which could result in social and economic hardship.		✓	✓	✓	Compliance with consent conditions Compliance with the WRC's Engineering Code of Practice and Guidelines.
Health and safety risks associated with the operation, maintenance, or construction of infrastructure		✓	✓		Ensure compliance with legislation and Health & Safety Management Plans. Maintain an Incidents Register.
Potential impacts on customer satisfaction due to service failure /delays /responsiveness		✓	✓		Monitor and report on Levels of Service and in Service provider contracts. Seek to resolve customer complaints "close the loop"
Access to waterways		✓	✓		Monitor requirements for access and liaise with the community as appropriate
Disruption to wildlife				✓	Programme works to minimise wildlife disruption avoiding fish spawning and bird nesting seasons
Gravel and/or sand extraction			✓	✓	Cross-section monitoring process

A2 Our Customers and Stakeholders

A2.1 Key Stakeholders

The WRC Mission is “Working with others to build a Waikato region that has a healthy environment, a strong economy and vibrant communities”. Supporting the Mission, the priorities include “Forge and strengthen partnerships to achieve positive outcomes for the region”. This approach is ably demonstrated by the relationships that the ICM Directorate have with customers and key internal and external stakeholders who have an interest in, and influence on, the activities of integrated catchment management, as follows:

Table 39: Key Stakeholders

Customer Group/ Stakeholder	Specific Requirements
Central Government	WRC must be consistent with central government legislation and incorporate Government policies, such as climate change, into decision making to ensure future proofing of flood protection schemes and related programmes.
Ministry of Fisheries (MFish)	River catchments support recreational and commercial freshwater fisheries. MFish ensure fisheries are used in a sustainable way and maintain aquatic ecosystem health. This is achieved through education, research and enforcement and includes managing activities related to customary, recreational or commercial purposes, including land-based aquaculture; special permits; and aquatic transfers.
Ministry for the Environment (MfE)	MfE own land in the Waikato region, some of which is currently administered by the WRC. The land consists of a mixture of floodway; stopbank retired areas and planted river and stream margins. Some of this land is to be transferred to the WRC and some may be involved in Treaty settlements.
The community — direct or indirect beneficiaries	<p>The WRC works closely with the community, involving them in the local decision making processes. Specific requirements are:</p> <ul style="list-style-type: none"> • Urban customers <ul style="list-style-type: none"> ○ Management of flooding (homes, sections, roads, public areas). ○ Maintain access ○ Minimise flood risks identified in LIMS ○ A clean and healthy environment ○ Access to, use and enjoyment of natural rivers, streams and wetlands • Rural customers <ul style="list-style-type: none"> ○ No significant loss of production or damage due to flooding ○ Maintain access ○ Productive capacity of farmland is maintained by reducing soil erosion ○ Soil and contaminant runoff to waterways from pasture is minimised. ○ Consultation with property owners most affected by flooding on solutions. ○ Consultation with community groups and achieving agreed outcomes. • Businesses <ul style="list-style-type: none"> ○ Reasonable and equitable charges ○ Minimise flooding of premises ○ Access of site or premises is maintained
Integrated Catchment Committee	<p>Committee membership includes WRCs constituent councillors, district councillors, representatives from iwi, DOC and representatives from throughout the catchments. The primary purposes of the committees are set out in the Committee terms of reference and include:</p> <p>To overview planning and monitor delivery of catchment management activities to provide within zones agreed priorities and levels of service for</p> <ul style="list-style-type: none"> • Asset management • Biodiversity and natural heritage operations

Customer Group/ Stakeholder	Specific Requirements
	<ul style="list-style-type: none"> • Biosecurity operations • Flood control programmes, land drainage programmes • Harbour and catchment management • Hazard management and community safety activities • River systems management, Soil conservation and land management programmes <p>(and)</p> <p>promote in relation to these responsibilities' collaboration between agencies and communities and opportunities for improving catchment management</p> <ul style="list-style-type: none"> • To provide advice on river and catchment related activities in particular. • To provide input and feedback in relation to the WRC programmes and activities. • To assist with the exchange of information between the WRC and the community.
Tangata whenua	<p>The WRC acknowledges the special position of tangata whenua within the region.</p> <p>Co-management arrangements are in place and include joint management agreements between iwi and the regional council on the way we will work together.</p> <p>Waikato and Waipa Rivers</p> <p>The principle iwi groups in our region are Waikato, Maniapoto, Raukawa, Hauraki, Te Arawa and Tūwharetoa. Within these iwi groups there are numerous hapū (sub-tribe). Iwi are often represented in an official capacity by an iwi authority, iwi trust board or rūnanga (Doc#10883560).</p> <p>Waikato-Tainui co-manage the Waikato River from the Karāpiro Dam to Te Puaha o Waikato (Port Waikato). The Ngāti Tūwharetoa, Raukawa and Te Arawa river iwi (specifically the hapū Ngāti Tahu - Ngāti Whaoa, Ngāti Kearoa - Ngāti Tuarā and Tūhourangi - Ngāti Wahiao) have co-management arrangements covering the Waikato River from Te Toka a Tia near Taupō through to Karāpiro. Ngāti Maniapoto have co-management arrangements for the Waipa River.</p> <p>Hauraki iwi Treaty settlement negotiations with the Crown</p> <p>Waikato Regional Council is looking forward to working with the Hauraki iwi to achieve an integrated and coordinated approach to the management of the Coromandel, Waihou and Piako catchment waterways.</p> <p>The council remains committed to providing high-level catchment management services for all communities in the Coromandel, Waihou and Piako catchment areas.</p> <p>Iwi throughout the region have expressed a desire to work in various forms of partnership with the Waikato Regional Council. Some of these aspirations are being embedded via Treaty of Waitangi settlements whilst others are expressed by memorandum of understanding and other formal and informal relationships.</p> <p>Under certain circumstances, at an operational level WRC engages with iwi in the form of Memorandums of Agreement / Memorandum of Understanding for specific project related activities.</p> <p>At present, the WRC has three MoU:</p> <ul style="list-style-type: none"> • Hauraki Maori Trust Board • Tuwharetoa Maori Trust Board • Raukawa Trust Board <p>Discussions are progressing with the Maniapoto Maori Trust Board.</p> <p>In addition to the MoU, iwi representatives also hold positions on catchment liaison sub-committees in their role of bringing Maori values and perspectives into these groups. Full details are available on the New Zealand Government website</p>

Customer Group/ Stakeholder	Specific Requirements
Landowners with land improvement agreements (LIAs)	<p>These agreements place obligations on both parties for the ongoing management and maintenance of the works in place. Agreements are in place in perpetuity (999 years) or 99 years unless altered by mutual agreement.</p> <p>Since 1992, no new LIAs have been entered into and they have been replaced by a new form of agreement referred to as the Memorandum of Encumbrance.</p>
Territorial authorities	<p>WRC staff work with the district councils in relation to the following:</p> <ul style="list-style-type: none"> • Obtaining resource consents, to maintain a local flood protection works. • Managing the interface between land drainage and flood protection assets/works. • Representation on catchment liaison subcommittee. • The council may be an affected party in terms of resource consents. • Input to local district planning processes.
Fish and Game New Zealand	<p>Fish and Game are responsible to the Minister of Conservation, but are independent from central Government. The regions' rivers come under the ambit of the Auckland/Waikato region. Much of Fish and Game's management activities are focused on advocacy, at both national and regional levels, to prevent deterioration of water quality. WRC works closely with Fish and Game in regard to resource consent requirements, both as an affected party, but also in discussion around the comprehensive consent process.</p>
New Zealand Transport Agency	<p>The WRC works in partnership with NZTA on projects/future works where resource consent is required and to ensure that roading works do not impede or impact on the performance of local flood protection schemes.</p>
Department of Conservation (DOC)	<p>DOC administers conservation land such as parks and reserves on behalf of the Crown. The land includes wetlands, marginal strips, and reserves along some rivers and streams and forest parks. DOCs management activities include the control of pest plants and animals, fencing and planting, as well as the control of water levels for some wetlands and lakes. DOC also monitors the condition of some lakes and wetlands as well as some of the threatened species that they support. Other activities include:</p> <ul style="list-style-type: none"> • Management of the whitebait fishery. • Managing threatened and alien invasive species. • Permits, concessions and advocacy. <p>Some of WRC flood and drainage scheme assets are located on DOC administered public conservation land. This includes 11 floodgates, 6 pump stations, 62km of stopbanks, and 16km of artificial or modified drainage watercourses.</p> <p>DOC sit on the Liaison Committees and are part of the decision making process within zones. This enables alignment between the WRC and DOC in sustaining the environment within zones, particularly the management of the wetlands and forest parks.</p> <p>WRC works closely with DOC in terms of resource consent requirements, both as an affected party and in discussion around the comprehensive consent process.</p>
Hydro Power Generators	<p>WRC has long-standing relationships with primary hydro generators Mercury and Genesis Energy. An important driver behind this relationship is the need to work closely on implementing a high flow management plan during times of flood.</p> <p>Genesis Energy works closely with WRC and Mercury to assist with flood management within the Taupō catchment. Resource consent conditions require Genesis to cease diverting water from outside the catchment into Lake Taupō when the level of Lake Taupō exceeds, or is clearly likely to exceed, its maximum control level.</p> <p>Other hydro operations on rivers in the Taupō catchment include:</p> <ul style="list-style-type: none"> • Kuratau hydro power plant (6MW) operated by King Country Energy Ltd. • Hinemaiaia hydro scheme (6MW) operated by TrustPower.

Customer Group/ Stakeholder	Specific Requirements
Science and Strategy (SAS)	The WRC SAS directorate provide key information on river flow and depth monitoring which they manage and also influence WRC's understanding and approach to Climate Change risks and impacts.

A2.2 Communication and consultation

Key contributors to the development of this Regional Asset Management Plan have been those Catchment Committees with significant investment in infrastructure. Discussions held during both the development and reviews of Zone Plans have also assisted in informing this asset management plan.

Development of councils Infrastructure Strategy, which has strong links with this plan, has also been subject to consultation with Catchment Committees.

Annual Plan and Long Term Plan consultative processes provide further opportunities for wider community input into asset management activities and work programme development.

WRC has a number of ways in which it engages with and informs communities and stakeholders. Policies, plans and strategies guide the ways in which this is carried out. See Table 40 below.

Table 40: Policies, plans and strategies

Documents	Explanation
Brand Guidelines, Te Reo Policy, Waikato Story	These documents guide the look, feel, language and tone of our communications, setting the foundation for a consistent and recognised brand.
Significance and Engagement Policy	Required under the Local Government Act 2002, this policy provides clarity about how and when communities can expect to be engaged in decisions made by council.
Māori Partnership Approach, Māori Engagement Framework, Digital Strategy, Customer Engagement Strategy, Stakeholder Engagement Strategy, Policy on Sponsorships and Partnerships, Customer Promise	These documents, which support council's strategic direction, guide decisions around who we communicate and engage with and how, ensuring our communications are customer driven.
People Strategy	This strategy is the driving document behind our internal communications.
Waikato Means Business, Future Proof, Waikato Plan	WRC is a significant partner in these strategies and plans. Our organisation's commitment to them includes the provision of communications services. In delivering this service we also ensure council's own communications align with and support the agreed messaging and objectives.

A3 Levels of Service

A3.1 Overview to process

The levels of service statements describe the outputs WRC intends to deliver to customers and other stakeholders.

Asset management (AM) planning enables the relationship between levels of service (LoS) and the cost of the service (the price/quality relationship) to be determined. This relationship is then evaluated in consultation with the community to determine the LoS they are prepared to pay for. For this reason, LoS must be written in terms the end user can understand and relate to.

A3.2 Principles

1. Levels of Service must be written in terms the end user can understand and relate to.
2. Levels of Service statements are to be provided for each ICM activity.
3. Each Level of Service statement is accompanied by one or more performance measures.
4. Performance measures should cover both lead and lag measures.

A3.3 Linkages between LoS and Community Outcomes

The LoS provide the link between the higher level corporate and AM objectives and more detailed technical and operational objectives.

Community outcomes are the outcomes that a local authority aims to achieve through the provision of infrastructure services. They form the basis for the WRC's service delivery, thus determining the LoS provided to the community.

The community outcomes are set out in Council's Strategic Direction 2016-2019 and will be reflected in the 2018-2028 LTP.

The WRC's Integrated Catchment Management (ICM) activities are linked to these community outcomes as demonstrated in Figure 6: LOS Linkages.

In Table 41 below, LoS statements are provided against each ICM activity. Each LoS statement is accompanied by one or more performance measures and is shown in greater detail in Section 3.

Table 41: Linkages between Community Outcomes and ICM Activities

Activity	Community Outcomes		
	Healthy Environment	Strong Economy	Vibrant Communities
Key: ● = Primary focus ○ = Contributes to			
Flood Protection	○	○	●
Land Drainage	○	●	
River Management	●	○	○
Integrated Catchment Management: Catchment planning and management	●	○	○
Business and Technical Services	○	○	●

A3.4 LoS Development Process

The WRC's LoS are reviewed on a three yearly cycle as part of LTP development. The LoS currently stated in this Regional AMP are those outlined in the 2015-2025 LTP and will be updated once the 2018-2028 LTP has been adopted in June 2018.

A3.5 Customer/Stakeholder groups and their needs and wants

ICM services provide benefits to a wide range of customers and stakeholders at varying levels. Shows the breakdown of customer and stakeholder groups and their interests and expectations in relation to ICM and land drainage services.

A3.6 Consultation

Maintaining an understanding of changing customer expectations is an ongoing process and is carried out through formal and informal consultation with customers. Permanent liaison Committees have been established within each of the eight zones where integrated catchment management services are provided. The Committees meet three to four times per year with the objective of reviewing the maintenance and capital works programmes and overseeing the management of service delivery. The zone Committees report and make recommendations to the Catchment Services Committee. Additionally, all customers have access to the annual plan and LTP process, where they can lodge submissions on the scheme works programmes or raise issues of concern.

Informal customer liaison is also undertaken by operations field staff, who work closely with landowners in regard to specific works and maintenance issues.

A3.7 Land Drainage vs. River Management vs. Flood Protection Assets

The purpose of land drainage LOS measures

The primary purpose of WRC managed land drainage networks is to manage water tables and clear ponded water to sustain pastoral farming only. It is designed to clear ponded water from paddocks within certain timeframes to minimise pasture damage, this is generally 3 days. Currently there are no alternate levels of service specified for areas where urbanisation has occurred, or where alternate crops (e.g. potatoes or maize) have been planted instead of pasture.

Our performance target is to clear ponding from a 24 hour 10% AEP rainfall event, where normal gravity outlet flow occurs, within 3 days. Within these parameters it is intended that a balanced level of drainage is delivered, while trying to ensure "over drainage" doesn't become a major issue.

The primary assets are the drainage network, are the drains themselves. The floodgates, which are part of the flood protection scheme assets, are to allow drainage water to flow through stopbanks into the river network. There are very few places (3) where pumps are installed specifically to transpose water over stopbanks for the purpose of land drainage.

The purpose of river management LOS measures

The primary purpose of river management works is to ensure there is a navigable channel maintained along each reach of the river. It also ensures where possible river bank erosion is minimised,

The primary assets are structures, such as weirs, groynes, and debris traps to maintain river flow rates and channels, and plantings and fences to maintain the banks.

The purpose of flood protection LOS measures

The primary purpose of flood protection is to manage river flows and flood zones during adverse weather events. It is also to remove flood waters that overtop river embankments for the agreed protected areas.

Our performance target varies depending on the agreed parameters of the weather event the area is being protected from. These range from a 10-year rainfall event through to a 100-year rainfall event.

The primary assets are the stopbanks / embankments to protect settlements and farming communities and the pumpstations to move water across a stopbank from what used to be a natural waterway.

A3.8 Scheme Capacity Performance Requirements

The Levels of Service (LOS) section is split into 3 parts:

1. The asset related LOS reported by all zones to their catchment committees.
2. The asset related LOS reported by specific zones to their catchment committees.
3. The specific performance expectations used within ICM to monitor efficiency and effectiveness of work.

Flood Protection

The table below is a summary of the expected performance of the flood schemes. The performance details for each scheme is located in APPENDIX AA3.8.

Table 42: System designed levels of exceedance

Annual Exceedance Performance (AEP)	Schemes Designed to meet AEP levels
1% (1:100 year event)	Tongariro River Waipa River Waihou: main channel except for Kirikiri scheme Huntly East and West Meremere East Rangiriri to Fosters Landing
2% (1:50 year event)	Tauranga Taupo River Waihou: all tributaries Piako scheme – all outside tidal zone (south of Maukoro landing) Waitoa Mangawara catchment areas 1 – 13
5% (1:20 year event)	Piako Scheme – 20 year event Ponding & spillway banks
10% (1:10 year event)	Piako Scheme – 10 year event Ponding & spillway banks Mercer, Waikokowai, Rangiriri, Meremere West, Tuakau, Onewhero
20% (1:5 year event)	Mangawara catchment areas 20-24 Rangiriri Spillway
100 year tide event, with a 2% AEP rain event	Piako scheme – From sea to end of tidal zone (Maukoro landing)

A3.9 Zone Specific Regional Requirements

The Central Waikato, Waihou Piako, Coromandel, and West Coast zones have no additional measurement requirements.

Taupō Zone

Alignment	Requirement	Measure
River Management Services		
Level of Service	Channel capacity and stability requirements met	Maintenance of channel capacity and channel stability in the Tongariro, Tauranga Taupō, and Hinemaiaia rivers, and the Hangarito canal. Through: <ul style="list-style-type: none"> • Maintain channels free of obstructions⁷ or significant blockages, • Address river and stream bank erosion on a prioritised basis where practicable
Other	Environmental impact managed	Manage pest plants where they may impact upon capacity and flow, and on a prioritised basis

Lower Waikato Zone

Alignment	Requirement	Measure
Main Channel		
Level of Service	Channel capacity and stability requirements met	Maintain the Waikato River main channel to agreed capacity and water levels

⁷ As appropriate as debris in channels will, in some instances, be important for the ecology of the river or stream.

A4 Detailed Asset Information

A4.1 Asset component definitions

Stopbanks & Rivers

The diagram below shows the terms used when discussing stopbanks and rivers.

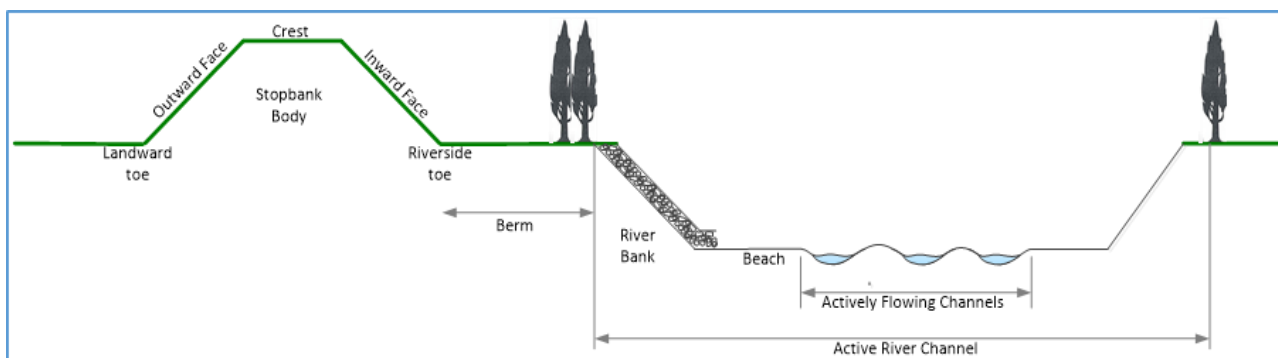


Figure 22: Cross section of stopbank and river

The diagram has been sourced from the “Flood Protection Assets Performance Assessment Tool” (Doc# [10955811](#)) as developed by the National River Managers Forum in 2017.

A4.2 Asset owned and maintained by WRC, quantities by zone

Asset Type	Units	Central Waikato	Coromandel	Lake Taupō	Lower Waikato	Upper Waikato	Waihou / Piako	Waipa	West Coast	Total
Flood Protection										
Bridges	Ea.				6		4			10
Control Gates	Ea.				3					3
Detentions	M				1,525		826			2,351
Floodgates	Ea.		5	25	279		139			448
Pumpstations	Ea.				64		52			116
Stopbanks	Km		1	8	249		349			606
Structures	Ea.		10	14	1		9			34
River Management										
Culverts	Ea.		2	2	6		34			44
Debris Traps	Ea.						6		1	7
Detentions	M						55			55
Drop Structures	Ea.						2			2
Fencing	km		2	2.5			154			158
Plantings	ha						390			390
Retaining Structures	km		1	4		0	7	1		13
River Training Works	km				2		0	1		3

Asset Type	Units	Central Waikato	Coromandel	Lake Taupō	Lower Waikato	Upper Waikato	Waihou / Piako	Waipa	West Coast	Total
Structures	ea			6	6		7	2		21
Weirs	ea	2		1	20		1			24

Asset Type	Units	Aka Aka/Otaua	Franklin Waikato	Thames Valley	Waikato Central	Total
Land Drainage						
Bridges	ea	3				3
Channels	km	86	266	757	952	2,061
Culverts	ea	11		1	3	15
Detentions	m				321	321
Drop Structures	ea			14	12	26
Floodgates	ea	14	1	12	8	35
Pump stations	ea			1	2	3
Retaining Structures	m			252		252
Stopbanks	km		5	4	2	11
Structures	ea		1	2	18	21
Weirs	ea				1	1

A4.3 Asset not owned but maintained by WRC, quantities by zone

Asset Type		Zone							Total	
		Taupō	U.Waik	Waipa	C.Waik	L.Waik	Wai/Pia	Coro		WestC
Bridges	N°		1			1				2
Access Track	N°						1			
Channel Works Site	N°			46	1	1	14		10	70
Channels	km	108	527	217	308	411	1,153	392	255	3,370
Compartment	ha		72.8	1		19.8	2.8		1	95
Culvert	m	750	50							50
Debris Dams	N°		1						1	2
Detention Bunds	m		350							350
Detentions	N°	5	1				8			1
Diversion Banks	N°		3	50			9			50
Pipe Drop Structures	m		20				5			11
Drop Structures	N°	1	3							
Erosion Control Other	ha		0.2	2			2	.2	6.5	7
Fencing	km	1,088	11.2	582.7	62.8	334.5	748.5	284.6	582.8	5,585
Floodgates	N°					4				4
Flumes	N°									8

Asset Type		Zone							Total	
		Taupō	U.Waik	Waipa	C.Waik	L.Waik	Wai/Pia	Coro		WestC
Ford Crossing: Rock	m						87	1		87
Indigenous Retirement	ha	20.4		1981.7	82.9	241.1	1830.5	517.5	2000.5	7,145
Plantings	N°						3			3
Protection Production Plantings	ha	34.7		820.9	3.6	23.6	210.3	1	19.6	1,272
Pump Stations	N°			3		4				4
Retaining Structures	N°									3
Riparian Retirement	ha	3300.3		546.5	142.4	1,088.3	590.3	575.3	995.8	10,022
Rip-Rap	N°			42						0
River Training Works	N°									1
Sediment Dams	N°									1
Sediment Ponds	m		73							
Space Planting	ha			94.7		1,957.3	10.1	6.3	184.4	2,279
Stopbanks	m			5		8,285				1,270
Stream Bank Erosion Control Plantings	ha			12.8		1,957.3		3.8	2.0	24
Wetlands	ha	110.4		38.0	7.0	9.4	40.6	57.6	55.9	358

A4.4 Asset Failure Modes

Stopbank: Common Failure Modes

Functional Failure Mode	Failure Mode	Failure Mode	Failure Mode	Root Cause	Characteristic
Stopbank overtopped	River Channel capacity reduced	Erosion of river channel			
		Degradation of river channel			
		Aggradation of river channel	Deposition of sediment	Low River flow	
			Increased soil loss upriver	Change in land use	
	Cross section or channel altered				
	Increase water volume	Significant hydrological changes	Change in rainfall distribution	Change in weather patterns	Random
			Land use change	Physical alterations to topography	
		More water in catchment area	Increased runoff	Changes to flora composition	
			Increased urbanisation		
	Action of surface water	Waves	Turbulent flow	Bends in river	
				Blockages in river	
			Wind on river		
			Tidal interaction		
	Stopbank level reduced	Stopbank slumping	Foundation settlement	Foundation composition	
				Foundation thickness	
		Stopbank build material settlement	Soil composition		
		Ongoing relative height reduction	Ground subsidence	Peat Soil oxidisation	Wear out
				Base soil lateral movement	
			Build Material too heavy for ground to support	Stopbank design	Wear out
			Too much material for ground to support	Base soil composition	Wear out
		Erosion	Too many Animal movements	Farmed area	Random
				Soil composition	
Too heavy animals			Farmed area		
	Soil composition				
Incorrect Stopbank geometry	Stopbank design		Wear out		
Incorrect stopbank location	Soil composition	Wear out			
Designed in failure point	Designed crest point	The need to relieve water pressure when river is too full			
Stopbank collapse	Wall integrity lost	Stopbank seepage	Flood event	Excess water pressure	
			Stopbank design		
		Toe erosion	Tree root growth		
	River Side Scoring	Erosion	Animal movements	Stopbank build materials	
			Water movements	Flood event	
			Animal Damage	Carp digging holes in bank	
	Land movement	Earthquake		Tectonic plate movement	Random

More details located in “Stopbanks Renewal Prioritisation Manual” ([Doc# 2730485](#))

Detention Dams: Common Failure Modes

Functional Failure Mode	Failure Mode	Failure Mode	Failure Mode	Root Cause	Characteristic
Dam Embankment failure	Water in dam longer than designed for	Significant hydrological changes	Change in rainfall distribution	Change in weather patterns	Random
		Change in catchment design	Land use change	Physical alterations to topography	
			Increased runoff	Changes to tree placement	
				Increased urbanisation upstream	
		Blocked spillway	Debris build up	Upstream works	Random
	Blocked culvert	Debris build up	Upstream works	Random	
	Piping Failure	Water seepage	Embankment surface damaged	Animal tracking	Random
				Lack grass coverage	Random
				Vehicle movements	Random
				Vegetation growth	Random
			Embankment core failure	Embankment core material not compacted	Infant
			Foundation failure	Ground subsidence	Wear Out
		Culvert Failure	Fill around culvert not compacted	Wear Out	
			Change of water pathway into culvert	Random	
		Internal erosion	Embankment core failure	Material choice	
Construction techniques					
Culvert design					
Dam overtopped	Dam embankment level reduced	Embankment slumping	Foundation settlement	Foundation composition	
		Loss of freeboard	Soil compaction	Animal movements	
			Earthquake damage		
	Embankment deformation	Water seepage	Embankment cracking	Earthquake	
	Increased water volume	Significant hydrological changes	Change in rainfall distribution	Change in weather patterns	Random
		Culvert blocked	Debris build up	Upstream ground slips	Random
				Silt build up	Wear out
				Trees debris size	Random
		Water flow path into culvert	Change topography design into culvert	Random	
	Decreased dam volume	Changes in dam shape	Increased vegetation		Wear Out
Build-up of silt			Upstream erosion	Wear out	

More details located in “Dam Safety Training Presentation” ([Doc# 12682863](#)). Details on how the Dams are managed see the documents in folder 75 10 15. Waikato Regional Councils Dams are:

Dam	Location
Maori Affairs	Lower Waikato
Waiti	Lower Waikato
Orakei	Lower Waikato

Dam	Location
Te Miro	Waihou/Piako
Kapukapu	Waihou/Piako
Waipaturawa	Waihou/Piako

Dam	Location
Cawley	Lower Waikato
Trubshaw	Lower Waikato
Jordans	Lower Waikato

Dam	Location
Te Poi	Waihou/Piako
Fullerton Green	Central Waikato
Kite Rd / Retention Drain	Central Waikato

River Channels: Common Failure Modes

Functional Failure Mode	Failure Mode	Failure Mode	Failure Mode	Root Cause	Characteristic
Loss of in river conveyance	River Channel capacity reduced	Degradation of river channel	Storm event	Increased water velocity and volume	
			Channel composition		
			Channel shape		
		Aggradation of river channel	Poor placement of structures	Velocity of flow surrounding structure	
			Deposition of sediment	Low River flow	
			Increased soil loss upriver	Change in land use	
Cross section of channel altered	Significant hydrological changes	Change in weather patterns			
Loss in river water quality	Erosion of (or damage to) berm	Turbulent flow	Bends in river	Soil composition	
			Blockages in river	Debris build up	
		Changes in river shape	Storm damage	Incorrect design Weirs & Groynes	
				Soil composition	
				Variations in river flow	
		More water in catchment area	Land use change	Debris build up	
				Physical alterations to topography	
		Increased runoff	Changes to flora composition		
			Increased urbanisation		
		Lack suitable edge protection	Loss of vegetation		
	Highly erodible berm material	Berm design			
	Animal activity	Increased pest animal population	Increased Carp Population		
		Farmed animal area	Animals accessing river		
	Erosion of river channel	Channel actively migrating	Channel design	Soil composition	
				Variable water volumes	
				Berm width inadequate	
	Erosion of catchment land	Third party activity		Vehicle access	
				Land management decisions	
		Inappropriate vegetation cover	Vegetation growth patters		Weather cycles
	Inappropriate plans introduced				
Invasive plant growth					

More details located in “Flood Protection Assets Performance Assessment Code of Practise” ([Doc# 9948080](#)).

Pump station Pumps: Common Failure Modes (Type 1 Direct driven axial flow pump, Type 2 Belt driven axial flow pump and Type 3 Submersible)

Pump Type 1 – Direct drive axially flow pump e.g. MacEwans PPF

Function	Functional failure	Failure Mode	Failure Effect	
Pump won't start	Pump fails to start/run	Electrical power loss	No electrical power	
		Electrical control circuit failure	No run signal	
		Electrical power circuit failure	Electrical trip, fire	
		Float-less switch fails opens	No run signal	
		Protection device failure	Motor burn out, fire	
		Motor bearing failure	Motor failure, secondary damage to shaft, housing	
		Motor winding failure (T2T)	Motor winding failure develops quickly into a short to ground (burn out), fire	
		Motor winding failure (short to ground)	Motor burn out, fire	
		Motor terminal failure	Insufficient electrical power, erratic operation, fire	
		Coupling failure	Pump decoupled from motor, reduced/no flow	
		Drive shaft failure	Pump decoupled from motor, reduced/no flow	
		Pump blockage	Seize pump, electrical trip	
		Pump bearing failure	Pump failure and secondary damage to shaft, housing	
		Cutlass/sleeve failure	Seize pump, electrical trip	
		Impellor failure	Pump decoupled from motor, reduced/no flow	
		Diesel gen set failure	No electrical power	
Diesel contamination	No electrical power			
Pump won't stop	Pump fails to stop	Float-less switch fails closed	Pump runs dry and secondary damage	
		Electrical control circuit failure	Pump runs dry and secondary damage	
		Electrical power circuit failure	Pump runs dry and secondary damage	
		E-stop circuit failure	Pump doesn't stop causing unsafe situation/secondary damage	
Pump runs at reduced capacity	Restricted water supply to pump	Land settlement	Cavitation, erratic operation, reduced flow	
		Blocked screen	Cavitation, erratic operation, reduced flow	
		Inlet structure collapse	Cavitation, erratic operation, reduced flow	
	Pump unable to produce design flow	Leaks	Flap jammed/restricted	Pump overload, reduced flow
			Outlet pipe restriction	Pump overload, reduced flow
			Motor torque reduced	Pump won't move design flow
			Coupling worn/damaged	Pump won't move design flow
			Shaft worn/damaged	Pump won't move design flow
			Pump blockage	Reduced efficiency, pump overload, reduced flow
			Impellor worn/damaged	Reduced efficiency, reduced flow
			Housing worn/damaged	Reduced efficiency, reduced flow
			Cutlass/sleeve worn	Reduced efficiency, reduced flow
Cavitation	Secondary damage to other components, reduced flow			

Pump Type 2 – Belt driven axially flow pump e.g. Gwynnes

Function	Functional failure	Failure Mode	Failure Effect	
Pump won't start	Pump fails to start/run	Electrical power loss	No electrical power	
		Electrical control circuit failure	No run signal	
		Electrical power circuit failure	Electrical trip, fire	
		Float-less switch fails opens	No run signal	
		Protection device failure	Motor burn out, fire	
		Motor bearing failure	Motor failure, secondary damage to shaft, housing	
		Motor winding failure (T2T)	Motor winding failure develops quickly into a short to ground (burn out), fire	
		Motor winding failure (short to ground)	Motor burn out, fire	
		Motor terminal failure	Insufficient electrical power, erratic operation, fire	
		Drive belts failure	Pump decoupled from motor, reduced/no flow	
		Pulley failure	Pump decoupled from motor, reduced/no flow	
		Drive shaft failure	Pump decoupled from motor, reduced/no flow	
		Pump blockage	Seize pump, electrical trip	
		Pump bearing failure	Pump failure, secondary damage to shaft, housing	
		Cutlass/sleeve failure	Seize pump, electrical trip	
		Impellor failure	Pump decoupled from motor, reduced/no flow	
		Pump won't stop	Pump fails to stop	Float-less switch fails closed
Electrical control circuit failure	Pump runs dry and secondary damage			
Electrical power circuit failure	Pump runs dry and secondary damage			
E-stop circuit failure	Pump doesn't stop causing unsafe situation/secondary damage			
Pump runs at reduced capacity	Restricted water supply to pump	Land settlement	Cavitation, erratic operation, reduced flow	
		Blocked screen	Cavitation, erratic operation, reduced flow	
		Inlet structure collapse	Cavitation, erratic operation, reduced flow	
	Pump unable to produce design flow		Leaks	Reduced efficiency, flooding, water damage
			Flap jammed/restricted	Pump overload, reduced flow
			Outlet pipe restriction	Pump overload, reduced flow
			Motor torque reduced	Pump won't move design flow
			Drive belts worn/damaged	Pump won't move deign
			Pulleys worn/damaged	Pump won't move deign
			Shaft worn/damaged	Pump won't move deign
			Pump blockage	Reduced efficiency, pump overload, reduced flow
			Impellor worn/damaged	Reduced efficiency, reduced flow
			Housing worn/damaged	Reduced efficiency, reduced flow
Cutlass/sleeve worn	Reduced efficiency, reduced flow			
Cavitation	Secondary damage to other components, reduced flow			

Pump Type 3 – Submersible pump e.g. KSB, Flygt

Function	Functional failure	Failure Mode	Failure Effect	
Pump won't start	Pump fails to start/run	Electrical power loss	No electrical power	
		Electrical control circuit failure	No run signal	
		Electrical power circuit failure	Electrical trip, fire	
		Float-less switch fails opens	No run signal	
		Protection device failure	Motor burn out, fire	
		Motor bearing failure	Motor failure, secondary damage to shaft, housing	
		Motor winding failure (T2T)	Motor winding failure develops quickly into a short to ground (burn out), fire	
		Motor winding failure (short to ground)	Motor burn out, fire	
		Motor terminal failure	Insufficient electrical power, erratic operation, fire	
		Coupling failure	Pump decoupled from motor, reduced/no flow	
		Drive shaft failure	Pump decoupled from motor, reduced/no flow	
		Pump blockage	Seize pump, electrical trip	
		Pump bearing failure	Pump failure, secondary damage to shaft, housing	
		Seal failure	Electrical short to ground, pump trip	
		Impellor failure	Pump decoupled from motor, reduced/no flow	
Pump won't stop	Pump fails to stop	Float-less switch fails closed	Pump runs dry and secondary damage	
		Electrical control circuit failure	Pump runs dry and secondary damage	
		Electrical power circuit failure	Pump runs dry and secondary damage	
		E-stop circuit failure	Pump doesn't stop causing unsafe situation/secondary damage	
Pump runs at reduced capacity	Restricted water supply to pump	Land settlement	Cavitation, erratic operation, reduced flow	
		Blocked screen	Cavitation, erratic operation, reduced flow	
		Inlet structure collapse	Cavitation, erratic operation, reduced flow	
	Pump unable to produce design flow	Leaks	Leaks	Reduced efficiency, flooding, water damage
			Flap jammed/restricted	Pump overload, reduced flow
			Outlet pipe restriction	Pump overload, reduced flow
			Motor torque reduced	Pump won't move design flow
			Coupling worn/damaged	Pump won't move design flow
			Shaft worn/damaged	Pump won't move design flow
			Pump blockage	Reduced efficiency, pump overload, reduced flow
			Impellor worn/damaged	Reduced efficiency, reduced flow
			Housing worn/damaged	Reduced efficiency, reduced flow
			Cutlass/sleeve worn	Reduced efficiency, reduced flow
Cavitation	Secondary damage to other components, reduced flow			

Pump station Switchboards: Common Failure Modes

Function	Functional failure	Failure Mode	Failure Effect
Supply 3 phase power to pump station	Unstable/insufficient electrical power (lost phase)	Contactor failure	Pump won't operate
		Termination failure	Pump won't operate
		Soft start/VSD failure	Pump won't operate
	No power	Contactor failure	Pump won't operate
		Termination failure	Pump won't operate
		Soft start/VSD failure	Pump won't operate
		Fuse failure	Pump won't operate
Power on when it should not be	Contactor failure	Pump won't stop/potential fire	
Provide control signalling (230V and DC voltages) to pump station assets	Asset fails to start	Switch fails	Pump /light/sockets won't operate
		Wiring failure	Pump /light/sockets won't operate
		PLC/electronic component failure	Pump won't operate
	Asset fails to stop	E-stop circuit failure	Pump doesn't stop causing unsafe situation/secondary damage
Protect persons from electric shock	Fails to prevent electric shock	Missing guards/doors/covers	Electric shock
		Exposed terminals	Electric shock
		Failed isolator	Electric shock

A4.5 Expected Asset Life

The current lifecycle expectations for ICM assets are shown below.

Asset Type	Asset Life (Years)
Embankments	
Stopbanks:	
Firm clay foundation	100
Clay foundation	100
Peat foundation	20
Sand foundation	60
Detention dams:	
Embankments and spillways	80
Pipes	80
Headwalls	80
Bunds	50
In River Structures	
Miscellaneous:	
Boat ramps	50
Weirs (rock/timber)	100
River training groynes	100
Rip Rap (rock protection)	50
Fish pass:	
Inlet	50
Channel	100
Pipe	60
Valve	50
Canals	100

Asset Type	Asset Life (Years)
Structures	
Control gates:	
Civil structure	80
Radial/slucice gates	50
Lifting gear	25
Power supply	20
Switchboard and controls	30
Building	60
Pump stations:	
Pumps and motors	25
Switchboards and controls	30
Screens	20
Power supply	20
Flap valves	50
Building	60
Inlet / outlet structures	80
Sump (concrete)	80
Discharge pipes	80
Floodgates:	
Barrels	80
Headwalls	80
Flap valves	50
Culverts:	
Barrels	80
Headwalls (timber)	50
Bridges:	
Concrete	100
Timber/steel	50

A4.6 Asset Specific Performance Expectations

These measures are for use within the ICM Directorate, to help identify which assets require prioritisation of improvement efforts. They are the “how we work” to achieve the Levels of Service.

Table 43: Internal measures of asset related work efficiency and effectiveness

Alignment	Requirement	Measure
General		
Healthy Environment	Management of council owned assets should ensure that the objectives of national and regional policies are complied with. e.g. national environmental standards, regional plans, regional policy statement and regional pest management plan	Internal and external (RUD) audits of compliance with resource consents and/or permitted activity rules achieves “full” compliance and demonstrates best environmental practice. Management of scheme land is able to demonstrate consideration and implementation of sustainable land management practices and environmental improvement as per the objectives and policies of the Regional Policy Statement.
	Development, maintenance, and renewal of assets takes into account and seeks to reduce or mitigate environmental effects	Applicable resource consent conditions and/or permitted activity conditions are complied with. ICM Environmental Best Practice Guidelines ⁸ are followed and implemented. The measures as detailed in the ICM Mitigation Plan for Comprehensive Consents ⁹ are followed and implemented.
Strong Economy	Strategies and Tactics used balancing economic and environmental sustainability	Financial impacts of not meeting LOS understood
Vibrant Communities	Communities less vulnerable, less dependent of flood control assets, and more resilient to flood hazards	Community impacts of not meeting LOS understood Communication and Direction during flood events
Operations Teams		
Work Planning and Scheduling	Achieve % of planned capital and maintenance works each year	Repairs and renewals visibly prioritised both within and across zones
		Able to report monthly progress of work <ul style="list-style-type: none"> • Spend to budget • % completion of planned mandatory inspection tasks • N° completed of planned, but not mandatory work • N° of unplanned works identified, and % completed
	View of forwards works programme of maintenance and capital works <ul style="list-style-type: none"> • Planned • Unplanned work 	
	Asset Audits completed	Condition inspections completed and any repair work identified for: <ul style="list-style-type: none"> • Stopbanks

⁸ Refer Discover Doc#8814325

⁹ Refer Discover Doc#3098247

Alignment	Requirement	Measure
		<ul style="list-style-type: none"> • Floodgates • Pumpstations • Rivers • Drainage • Detention Dams
Asset Management Team		
Land Management	Identify appropriate land use options across catchment management areas	<p>Able to measure monthly progress of work</p> <ul style="list-style-type: none"> • % WRC owned land information available on maps • Licensees land with defects & progress to repair • WRC land with defects & progress to repair
Information Management	Asset information available and accessible for decision making	<ul style="list-style-type: none"> • Long Term Plan reporting • Infor data audited and corrected as issues found • Available on Maps to wider council
	Defect identification and remedial works Information	<ul style="list-style-type: none"> • Scheduling tool that can prioritise, plan works, schedule, and report on execution and close off of maintenance and renewals works
Regionally managed works programmes	Structural Audits	<p>Audits completed to agreed scope, to agreed budget and within agreed time frame.</p> <ul style="list-style-type: none"> • Any changes brought to steering group at agreed frequency, and approved. • Use PMO templates and processes to manage work. • Risks and Issues actively managed.
	Stopbank Audits	<p>Performance Inspections completed to agreed scope, to agreed budget and within agreed time frame.</p> <ul style="list-style-type: none"> • Any changes brought to steering group at agreed frequency, and approved. • Use PMO templates and processes to manage work. • Risks and Issues actively managed.
Technical Team		
Scheme Reviews	Project managed and delivery expectations managed.	<p><i>Initiated in accordance with WRC PMO requirements</i></p> <p><i>Completed to agreed scope, to agreed budget and within agreed time frame.</i></p> <ul style="list-style-type: none"> • Any changes brought to steering group at agreed frequency, and approved. • Use PMO templates and processes to manage work. • Risks and Issues actively managed.
Regionally Managed Capital Works programmes	Capital Investigations	<p>Initiated in accordance with WRC PMO requirements</p> <p>Completed to agreed scope, to agreed budget and within agreed time frame.</p> <ul style="list-style-type: none"> • Any changes brought to steering group at agreed frequency, and approved. • Use PMO templates and processes to manage work. • Risks and Issues actively managed.
	Capital Design & Construction	<ul style="list-style-type: none"> • Initiated in accordance with WRC PMO requirements • Use PMO templates and processes to manage works. • Develop and manage standardised designs to use across schemes
Asset Specific		

Alignment	Requirement	Measure
All	Asset Information kept up to date	<ul style="list-style-type: none"> Attributes data is updated within 6 months of any asset being inspected or audited
Stopbanks	Work prioritised and completed within agreed timeframe	<ul style="list-style-type: none"> Stopbank repairs prioritised as per agreed risk criteria No identified performance grade 5 takes more than 3 years to be repaired. Any stopbank with a condition grade 4 or 5 is assessed and prioritised for repair within 48 months of discovery
Mechanical and Electrical Equipment	Any known H&S risks are being actively managed	<p>All overhead lines for pump stations and monitoring equipment have</p> <ul style="list-style-type: none"> (Yr. 1) Been identified (Yr. 2) loaded into system and have inspection plans in place
	Procurement Equipment Choices	<p>Standardised suppliers for all flood bank and drainage assets</p> <ul style="list-style-type: none"> Life cycle costing analysis applied Maintenance, operability, fish passage compliance and remote access considered
Detention Dams	Actively safeguard and maintain the structural soundness of our dams	<ul style="list-style-type: none"> Maintenance and survey requirements for each dam are known, and available for use Maintenance and surveys undertaken by personnel with suitable competence and training Any dam with a crest level grade 4 or 5 is assessed and prioritised for repair within 48 months of discovery

Lower Waikato

Defence Name	Protected area (ha)	Stopbanks						Floodgates			Pumpstations													
		Length (m)	Design information		Actual information		No	Actual information		No	Name	Design information					Actual information							
			Design standard (ARI)	Design freeboard (m)	Performance grade	Average condition Grade		Cross section area (m ²)	Average condition			Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity	Actual capacity	Approx actual ARI (yrs)	Average condition				
Huntly - Harris St.	1.2	80	100	0.61		2.0	1			0														
Huntly North	44.8	1215	100	0.61		2.0	1	2.5	2.0	2	Huntly north pump station		0.0	15.0										2.0
											Lake Hakanoa PS/FG													
Huntly - Parry Street	31.5	315	100	0.61		2.0	0			0														
Huntly South	16.6	2893	100	0.61		2.0	0			3	Pumpstation 1		0.0	16.0										2.0
											Pumpstation 2		0.0	10.0										2.0
											Pumpstation 3		0.0	3.0							0.18			2.0
Mangawara C 01	53.5	2410	50	0.30		2.0	5	0.9	2.0	0														
Mangawara C 02	516.1	6544	50	0.30		2.3	11	7.8	2.0	0														
Mangawara C 03	248.1	4598	50	0.30		2.0	15	5.5	2.0	0														
Mangawara C 04	589.8	7372	50	0.30		2.0	14	4.9	2.0	0														
Mangawara C 05	1278.7	8295	50	0.30		2.0	23	9.3	2.0	0														
Mangawara C 06	751.8	6820	50	0.30		2.0	14	6.6	2.0	0														
Mangawara C 07	328.6	7789	50	0.30		2.0	11	4.4	2.0	0														
Mangawara C 08	193.0	5037	50	0.30		2.0	2	2.1	2.0	0														
Mangawara C 09	1732.2	8405	50	0.30		2.3	9	11.2	2.0	0														
Mangawara C 10	79.0	4568	50	0.30		2.0	4	2.0	2.0	0														
Mangawara C 11	111.0	2174	50	0.30		2.0	0			0														
Mangawara C 12	389.2	8506	50	0.30		2.0	7	3.3	2.0	0														
Mangawara C 13	83.5	4095	50	0.30		2.0	9	0.9	2.0	0														
Mangawara C 20	14.5	1317	5	0.00		2.0	4	0.5	2.0	0														
Mangawara C 21	86.6	3678	5	0.00		2.0	14	3.1	2.0	0														
Mangawara C 22	156.1	3657	5	0.00		2.0	9	1.5	2.0	0														
Mangawara C 23	27.8	924	5	0.00		2.0	3	1.3	2.0	0														
Mangawara C 24	134.6	3004	5	0.00		2.0	8	1.1	2.0	0														
Lake Waahi	442.2	0					1	5.1	2.0	0														
Whangamaire pump area	977.4	0					1	0.4	3.0	1	Whangamaire PS		0.0	977.4							1.80	3.8	2.0	
Huntly west	3661.2	26352	100	0.30		2.0	4	7.5	2.0	8	Austins pumpstation		160.0	275.0	20.0	20.0	1.01	1.00	6.2	2.0				

Defence Name	Protected area (ha)	Stopbanks				Floodgates			Pumpstations										
		Length (m)	Design information		Actual information		No	Actual information		No	Name	Design information					Actual information		
			Design standard (ARI)	Design freeboard (m)	Performance grade	Average condition		Grade	Cross section area (m ²)			Average condition	Grade	Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity
											Blairs pumpstation	106.0	159.0	20.0	20.0	0.61	0.60	5.7	2.0
											Saxton pumpstation	0.0	100.2	25.0	25.0	0.29	0.60	141.6	2.0
											Golf Course pumpstation	544.0	536.0	20.0	20.0	2.50	2.61	7.0	2.0
											Guests pumpstation	221.0	284.0	20.0	20.0	1.17	0.75	1.6	2.0
											Hills pumpstation	110.0	173.0	20.0	20.0	0.66	0.60	4.6	2.0
											Okowhao pumpstation	217.0	168.0	20.0	20.0	0.89	0.90	5.9	2.0
											Pattersons pumpstation	230.0	1060.0	20.0	20.0	2.99	3.09	7.8	2.0
Mercer west southern	102.8	3000	10	0.61	4.0	3	1.3	2.0	0										
Mercer west Morrison Road	149.4	4795	10	0.61	3.8	17	3.6	2.0	0										
Mercer west northern	109.8	3200	10	0.30	2.0	2		2.0	0										
Waikokowai Furniss (DS)	99.9	2790	10	0.30	2.0	0			1	Furniss DS pumpstation	81.0	69.0	25.0	25.0	0.43	0.60	45.4	2.0	
Waikokowai Furniss (US)	18.9	1527	10	0.30	2.0	0			1	Furniss US pumpstation	0.0	28.0	20.0	20.0	0.06	0.04	2.3	2.0	
Waikokowai Harveys (North)	95.5	1765	10	0.30	2.0	0			1	Harveys pumpstation	190.0	100.0	25.0	25.0	0.84	1.10	38.4	2.0	
Deroles	104.8	2100	10	0.61	2.5	1	1.1	2.0	1	Deroles pumpstation	87.6	204.4				0.80	12.0	2.0	
Orton	249.7	1627	10	0.61	3.0	0			1	Orton pumpstation	726.6	311.4							3.0
Kimihia	319.3	2613	100	0.30	2.0	3	0.6	2.0	1	Kimihia pumpstation	68.0	28.0	20.0	10.0	0.19	0.30	18.4	2.0	
Motukaraka	1464.7	2081	100	0.46	3.0	1	0.1	2.0	1	Screw, duty & secondary	1544.0	2316.0	38.0	10.0	9.47	11.00			3.0
Rangiriri spillway	309.8	1812	20	0.00	2.0	0			0										
Rangiriri	110.7	2750	10	0.61	2.0	2	0.1	2.0	1	Rangiriri Nth pumpstation	77.0	86.0	20.0	10.0	0.28	0.90	135.1	2.0	
Waikato River RB: Rangiriri SW-Fosters Landing	2542.6	8014	100	0.30	2.0	5	0.8	2.0	4	Higgins pumpstation	7.7	69.3	20.0	10.0	0.10				2.0
										Halls pumpstation	60.0	110.0	20.0	10.0	0.27	0.40	6.8	2.0	
										Tabenels pumpstation	60.0	110.0	20.0	10.0	0.27	0.40	6.8	2.0	
										Kitcheners pumpstation	0.0	159.0	20.0	10.0	0.18			2.0	

Defence Name	Protected area (ha)	Stopbanks					Floodgates			Pumpstations											
		Length (m)	Design information		Actual information		No	Actual information		No	Name	Design information						Actual information			
			Design standard (ARI)	Design freeboard (m)	Performance grade	Average condition		Grade	Cross section area (m ²)			Average condition	Grade	Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity	Actual capacity	Approx actual ARI (yrs)
Churchill east	731.5	4811	10	0.61	2.0	1	0.4	4.0	3	Main pumpstation	859.0	513.0	25.0	12.0	3.20	4.80	28.3	2.0			
										Watts pumpstation	0.0	100.8	25.0	12.0	0.14	0.20	4.7	2.0			
										Secondary pumpstation	0.0	17.8	25.0	12.0	0.02	2.00	> 150	2.0			
Meremere east	506.9	467	100	0.30	2.0	0			1	Main pumpstation	1520.0	500.0	25.0	12.0	5.09	5.10	7.5	2.0			
Meremere west	160.5	4341	10	0.61	2.0	0			2	Henrys pumpstation	60.0	30.0	20.0	10.0	0.17	0.10	1.0	2.0			
										Peters pumpstation	87.0	117.0	20.0	10.0	0.34	0.60	14.9	2.0			
Swan Road	801.7	5453	100	0.61	1.8	1	0.2	2.0	1	Swan Road pumpstation	524.0	526.0	25.0	12.0	2.25	2.30	4.8	2.0			
Vrsaljkos	52.1	2424	100	0.30	3.0	0			1	Vrsaljkos PS/FG	25.0	53.0	25.0	12.0	0.15	0.14	3.0	2.0			
Orchard Road	25.8	424			3.0	0			1	Orchard Road PS	150.0	30.0	20.0	10.0	0.38	0.60	23.7	2.0			
Island block	165.4	1824	100	0.46	2.0	0			2	Island Block south PS	0.0	44.0	25.0	12.0	0.06	0.50	> 150	2.0			
										Island Block north PS	50.0	120.0	25.0	12.0	0.31	0.63	33.3	2.0			
Waller Commins	26.9	493	100	0.46	3.0	0			1	Waller Commins PS/FG	52.8	79.2	38.0	10.0	0.32	0.47	29.5	2.0			
Parish Polder	91.7	3140	100	0.46	3.0	0			1	Parish Polder PS	13.7	123.3				0.57	46.9	4.0			
Bell Road	179.8	1136	100	0.46	3.0	1		3.0	1	Bell Road PS/FG	172.5	402.5	38.0	10.0	1.22	2.00	26.9	2.0			
Locke	21.8	249	100	0.46	2.0	0			1	Locke pumpstation	15.8	142.2				0.20	1.6	5.0			
Whiskey Flats eastern	16.0	1270	100	0.30	3.0	1	0.3	3.0	0												
Whiskey Flats western	14.3	1143	100	0.30	3.0	1	0.2	3.0	0												
Mangatawhiri C 1	181.6	3505	7	0.30	2.0	2	0.3	2.0	0												
Mangatawhiri C 2	189.5	2080	20	0.30	2.0	0			1	Compartment 2 PS	84.0	336.0	38.0	10.0	0.76	2.06	81.7	3.0			
Mangatawhiri C3	519.4	3713	20	0.30	4.0	0			1	Screw & duty pumps	73.9	665.1	38.0	10.0	1.09	2.60	27.5	4.0			
Mangatawhiri C 4	432.3	8546	20	0.30	4.3	0			1	Compartment 4 PS	163.0	652.0	38.0	10.0	1.47	2.06	9.6	2.0			
Mangatawhiri C 5	28.9	545	100	0.30	3.0	0			1	Miller Farlane PS	147.0	63.0	38.0	10.0	0.72	0.52	7.0	4.0			
Tuakau	147.5	7189	10	0.61	2.0	0			1	Tuakau PS/FG	0.0	94.0	38.0	10.0	0.11	0.30	20.3	2.0			
Ohairoa	43.2	2470	10	0.61	3.0	1		2.0	1	Ohairoa pumpstation	70.9	0.1				0.20	11.4	4.0			
Onewhero east	93.8	2635	10	0.46	3.0	1		3.0	1	Onewhero east PS	77.2	115.8				0.40	4.2	2.0			
Onewhero west	161.0	3857	10	0.46	2.0	1		2.0	1	Onewhero west PS	37.8	151.2				0.40	5.1	2.0			
Te Kohanga major-eastern compartment	568.1	6205	100	0.61	2.3	1		2.0	3	Masseys pumpstation	31.6	284.4				0.94	16.1	3.0			
										Muir's pumpstation	40.6	17.4				0.66	> 150	3.0			

Defence Name	Protected area (ha)	Stopbanks					Floodgates			Pumpstations											
		Length (m)	Design information		Actual information		No	Actual information		No	Name	Design information					Actual information				
			Design standard (ARI)	Design freeboard (m)	Performance grade	Average condition		Grade	Cross section area (m ²)			Average condition	Grade	Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity	Actual capacity	Approx actual ARI (yrs)
Te Kohanga major-western	29.9	1672	100	0.61	2.0	0				1	Sharpes pumpstation		34.7	312.3					0.94	12.1	3.0
Te Kohanga minor (Aireys)	107.3	2494	10	0.30	2.0	0				1	Johansens pumpstation		73.6	110.4					0.20	1.0	4.0
Horseshoe	99.2	767	100	0.30	2.0	0				1	Aireys pumpstation		40.2	160.8					0.42	4.9	4.0
Tickles	23.1	1616	100	0.30	2.0	1	0.1	3.0		1	Horseshoe pumpstation		54.3	126.7					0.40	5.6	3.0
Aka Aka Otaua	5244.4	14349	100	0.30	2.5	29	64.6	2.1		4	Tickles pumpstation		19.5	19.5					0.13	23.4	2.0
											Sandy Muirs pumpstation		8.4	75.6					0.18	5.6	2.0
											Hoods Landing PS		0.0	217.0					0.15	1.0	2.0
											Eastern drain PS		469.5	1095.5					2.06	1.4	2.0
											Mangawhero pumpstation		18.0	162.0					1.80	> 150	2.0
Total or average	28290	246940			2.3	245	156.0	2.2		60			8976	13351				60		2.4	

Waihou

Defence Name	Protected area (ha)	Stopbanks			Floodgates		Pumpstations															
		Length (m)	Design information		No	Actual information		No	Name	Design information					Actual information							
			Design standard (ARI)	Design freeboard (m)		Cross section area (m ²)	Average condition			Grade	Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity	Actual capacity	Approx actual ARI (yrs)	Average condition			
Mouth to Huirau Rd- Left			1%	0.5																		
Huirau Rd to Ohinemuri confluence - Left			1%	0.9																		
Mouth to Puriri River - Right			1%	0.5																		
Puriri River to Ohinemuri Confluence - Right			1%	0.9																		
Wiahou confluence to Karangahake gorge - left			1%	0.9																		

Defence Name	Protected area (ha)	Stopbanks		Floodgates		Pumpstations		Design information							Actual information			
		Length (m)	Design information		No	Actual information		No	Name	Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity	Actual capacity	Approx actual ARI (yrs)	Average condition
			Design standard (ARI)	Design freeboard (m)		Cross section area (m ²)	Average condition Grade											
Wiahou confluence to Karangahake gorge - left			1%	0.9														

Piako

Defence Name	Protected area (ha)	Stopbanks		Floodgates		Pumpstations		Design information							Actual information			
		Length (m)	Design information		No	Actual information		No	Name	Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity	Actual capacity	Approx actual ARI (yrs)	Average condition
			Design standard (ARI)	Design freeboard (m)		Cross section area (m ²)	Average condition Grade											
Foreshore			1%															
Piako River – Mouth to Kaihere Left			1%	0.5														
Piako River Mouth to Kaihere Right			1%	0.5														
Kerepehi Loop			1%	0.5														
Awaiti Canal LB			1%	0.5														
Awaiti Canal RB			1%	0.5														
Elstow Canal RB			1%	0.5														
Kerepehi Block No 2 / Northern Canal			2%	0														
Carters Block Cutoff / Northern Canal			2%	0														
Piako River Upstream of SH27			2%	0														
Waitoa River Upstream Paeroa Tahuna Rd			2%	0														
Other (Maukoro Canal Right SB & Pitts Road Stopbank)			1% & 2%	0.5 & 0														

Defence Name	Protected area (ha)	Stopbanks			Floodgates			Pumpstations											
		Length (m)	Design information		No	Actual information		No	Name	Design information						Actual information			
			Design standard (ARI)	Design freeboard (m)		Cross section area (m ²)	Average condition			Grade	Approx design AEP	Hill catchment (ha)	Flat catchment (ha)	Design hill runoff (mm)	Design flat runoff (mm)	Design capacity	Actual capacity	Approx actual ARI (yrs)	Average condition
1 st Emergency Ponding Zone EP1			10%	0															
2 nd Emergency Ponding Zone EP2A			5%	0															
2 nd Emergency Ponding Zone EP2B			5%	0															
2 nd Emergency Ponding Zone EP2C			5%	0															
2 nd Emergency Ponding Zone EP2D			5%	0															

A4.7 Measuring condition of assets

Asset condition data supports the prediction of remaining asset lives, compliance with regulations and allows the development of projections of long-term asset renewal requirements. Asset condition is assessed on a five point scale in accordance with the WRC Condition Manual (Doc#2023359), generally as set out in the following table.

Table 44: General condition rating model

Condition Grade	Condition Rating	Description of condition	Approx remaining life (% of base life)
1	Very Good	New condition or cosmetic defects that will have no effect on performance.	80% to 100%
2	Good	Normal weathering / deterioration that will not reduce overall performance of the asset.	60% to 80%
3	Fair	Minor defects and normal weathering / deterioration that will have minimal effect on the overall performance of the asset.	20% to 60%
4	Poor	Defects that cause a reduction in the performance of the asset or could do in the near future.	2 years to 20%
5	Very poor	Defects that significantly reduce the performance of the asset (assets may be described as barely serviceable) or severe defects resulting in complete performance failure. Structural failure is imminent, or a significant safety risk exists.	<2 years

The WRC Condition Manual also provides more detailed descriptions for different key asset types.

Specific Asset Condition Measurement:

Equipment Type:	Asset Condition				
	1	2	3	4	5
Civil Equipment					
Buildings	No evidence of Building Integrity Issues or prior repairs	Evidence of previous repairs. Minor Building Integrity issues not creating a hazard for building purpose	Significant measurable wear but in specification. Significant indication of hazards created for building purpose	Building Integrity issues are creating hazards that are compromising the building meeting its purpose	Building integrity issues are resulting in the building being unfit for purpose
Canal – Lined	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>
Canal - Unlined	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>
Culverts / Pipes	No measurable deterioration	Evidence of previous repairs	Cracking & seepage through pipe walls identified, but in specification	Up to 20% of system needs repairs	More than 20% of system needs repairs
Culvert inlet	No measurable/visible deterioration.	Visible cracking around pipe inlet, upper slats of retaining structure come lose without compromising wall	measurable deterioration of pipe inlet (chunks missing, edges starting to buckle or be deformed) or significant buckling of entire retaining structure.	cracking/buckling of inlet, Retaining structure has serious buckling and or deterioration.	Inlet stoved in, or complete failure of retaining structure resulting in loss of culvert function
Drains	No measurable deterioration	Evidence of previous repairs	Significant measurable wear but in specification	Up to 20% of system needs repairs	More than 20% of system needs repairs

Equipment Type:	Asset Condition				
	1	2	3	4	5
Embankments	No visible degradation.	Some minor superficial degradation to batters, caused by animal or vehicle movement. Tracking lines visible.	Degradation to stopbank shape (erosion or slipped) over 10% of bank length, damage no more than 50cm deep, which can be repaired now.	Slip / failure of river facing side of bank less than 20m in total length. Degradation needing repair, medium risk to operation.	Structural integrity compromised, high risk to operation. Areas below designed flood level height. Loss of revetment.
Fencing	No visible damage to wiring, battens, posts	some batten damage, minor fence wire corrosion, but less than 10% of total fence affected.	post or wire broken, multiple battens broken, gate distorted but still functioning	Localised areas where stock may penetrate fence	Fence distorted, and serious and widespread openings causing animal management issues.
Lagoons	no visible degradation, no trees on banks,	Some minor superficial degradation	Degradation which can be repaired now or next major shut	Degradation needing repair, medium risk to operation	Degradation needing repair, high risk to operation. Repairs on previously well repaired sections
Land	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>
Pasteur Coverage	No trees or pest plants visible on bank batters or within 5m of embankment	Pest plant growth totalling less than 10m ² along embankment length.	Declared Pest plants identified on stopbank, growth totalling less than 20m ² Isolated bare patches without grass coverage totalling less than 10%.	Declared Pest plants identified in several areas along stopbank, growth totalling less than 50m ² Tree sapling in stopbank batter, or tree within 5m of stopbank.	Declared Pest plants identified along over 50% of stopbank. Tree over 2m in height within 5m of stopbank. No vegetative cover over 20% of bank.
Riparian Plantings	No deterioration visible	no measurable deterioration	Deterioration measurable in one non critical area	Deterioration outside recommended levels on non-critical area.	Deterioration outside recommended levels in critical area
River Berm	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>
River Channels	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>
River Training Structures (Rockwork, Groynes)	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>	<i>Yet to be developed</i>
Roads & Access ways	No degradation practically detectable	Some minor superficial surface degradation. Minor cracks, settlement and no significant hazards.	Degradation which can be repaired now or next major shut. Some cracking, settlement and minor hazards. No significant structural damage	Degradation needing repair, medium risk to operation and safety hazard. Systemic cracking, settlement or potholing with structural damage to road.	Degradation needing repair, high risk to operation and significant safety hazard. Significant structural damage to road.
Electrical Equipment					

Equipment Type:	Asset Condition				
	1	2	3	4	5
Cables	No overloading AND condition monitoring indicates no issues AND no deterioration	No overloading AND condition monitoring indicates no issues. Some minor deterioration	Minor periodic overloading AND/OR repairable deterioration. Condition monitoring indicates no issues	Minor continuous or periodic overloading AND/OR extensive repairable deterioration AND/OR condition monitoring indicates minor issues	Continuous overloading or periodic heavy overloading AND/OR extensive deterioration, cracked insulation AND/OR condition monitoring indicates critical issues
Electric Panels (MCCs)	Good condition. No degradation practically detectable	Some minor superficial degradation	Degradation which can be repaired now or next major shut	Degradation needing repair, medium risk to operation	Degradation needing repair, high risk to operation
Motors	No visible defects / wear identified through condition monitoring.	Minor increase in power usage, visible surface wear. Condition monitoring identified low level issues.	Conditioning monitoring with measurable deterioration within specifications, but risk is low.	Conditioning monitoring with measurable deterioration within specifications, but risk is High	Requires rewinding, Outside manufacturers specifications in several critical areas
Power Poles					
Mechanical Equipment					
Pumps	No visible or audible defects / wear	Minor polishing of impellor	Cavitation Audible. Measurable deterioration within specifications. Erosion less than 3 mm	Outside manufacturers specifications in 1 critical area. Components can be economically replaced	Outside manufacturers specifications in several critical areas
Pipe work & Valves	No visible deterioration	Insulation or surface coating damage (less than 2% by area)	Pipe has been repaired before, or sections replaced. More than 5% by area damage to surface coating or insulation.	One leak or more than 10% area corroded. Pipe previously damaged from water hammer, and issue not resolved.	Corroded pipe work & leaks
Controls & Monitoring	Best available industry proven technology	Still manufactured but generally style is being superseded	Spare parts still provided by OEM. Control system language still industry supported	Spare parts can manufactured or sourced. Some control systems language support	Spare parts not available, no control systems language support
Safety Systems					
Safety Barriers	New, no defects, damage to paint or bumps noted	Minor paint damage. Scratches.	Has been knocked / hit. Loose bolt, but not damaged. Safety Barrier - less than 1m total needing replacing	Barrier or Bollard Bent. Bolt has been stretched or pulled out of the ground	Broken through safety barrier. Bollard severely damaged or missing
Ladders & Platforms	Well maintained, secure and clear of obstruction	Operational and functional. Minor wear and tear. Clear of obstructions	Operational and functional. Localised damage in high use areas. Flaking, peeling, or wear of paint. Temporary obstructions exist that can be removed	Flaking, peeling, wear or oxidation apparent in 3 or more areas. Between 5% and 10% by area damage. Obstructions creating a hazard	Serious flaking, peeling, wear or oxidation apparent in structure and finishes. More than 10% by area damaged. Obstructions creating a major hazard

Equipment Type:	Asset Condition				
	1	2	3	4	5
Consents	Just Renewed	More than 5 years to run. No variation required	Less than 5 years to run, minor variation required	Some compliance issues to allow renewal	Major compliance issues to allow renewal

A4.8 Measuring operability of assets

Operations checks to ensure the operability and safety of assets, are a key mitigation strategy to ensure assets can be safely operated in various weather conditions. They also allow other factors not directly related to condition and level of service to be assessed. These insights help inform the zone maintenance plans, and the scope of any capital renewal work for the asset.

Equipment Type:	Asset Condition				
	1	2	3	4	5
Health and Safety	Asset components can be accessed safely during storm or emergency events. No trip, slip, fall, or electrical hazards	Asset components can be accessed safely for routine tasks. No trip, slip, fall, or electrical hazards	A Trip, slip, fall, or electrical hazards identified, but easily visible and able to navigate & complete work while not accessing that area	Multiple Trip, slip, fall, or electrical hazards identified, with no mitigation plans in place to rectify or reduce risk	Multiple Trip, slip, fall, or electrical hazards identified, not easily seen when entering site.
Water passage	Culvert /pipes free of any debris, sediment build up or vegetation blockages	Debris, sediment and/or vegetation blockage restricts opening reduces asset operating time by approximately 25%	Debris, sediment and/or vegetation blockage restricts asset opening or reduces asset operating time by approximately 50%. Re-blocked within month of cleaning.	Debris, sediment and/or vegetation blockage restricts asset operating time by approximately 75%. Re-blocked within 7 days of cleaning	Debris, sediment and/or vegetation blockage completely or nearly completely restricts culvert opening. Re-blocked within 24 hours of cleaning
Asset operable	Clear SOPs, clear signage in place,	Labels damaged, but still readable. Instructions in place for minor tasks.	Components / gear / handles etc. showing corrosion, but still functioning		Gear needed to operate asset missing / unavailable
Fish passage	None or minimal obstruction to fish passage when asset operating	Barrier at high flows (where velocity of structure is likely to increase and become unnavigable by the majority of the fish in the stream during high flows, typically where the structure is over half full at normal flows).	Barrier at low flows (due to lack of water coverage, box culverts).	Barrier at most flows (highly perched, concrete apron).	
Site Access	Easily accessible at all times, off tar sealed road	Off gravel road, or farm track where there is permission to use from the landowner	Not accessible from well formed track, requires access via stopbank or paddock	Unable to enter site during a storm or flood event (e.g. flooding of road or track)	Unable to enter site under normal weather conditions

A4.9 Asset Performance Measurement

Specific Asset Performance Measurement: Stopbanks

The performance of earthen structures (Stopbanks and detention dams) is assessed by comparing the current crest level against the design crest level (DCL). The assessment is done at every 100m length or link of stopbank, where the calculated current lowest crest level is compared to DCL.

Each link is assessed and graded applying the criteria set out in the Table 45. The worst grade of any link of the stopbank represents the overall performance grade of the stopbank.

Condition Grade	Crest Level Measure
1	Actual crest level > design crest level @100%
2	Actual crest level > target level @100%
3	Actual crest level < target level at any point
4	Actual crest level < half (target level + design flood level) at any point
5	Actual crest level < design flood level at any point

Table 45: Stopbank Performance Assessment

DFL = Designed Flood Level

DCL = Designed Crest Level = DFL + Freeboard

Target = DFL + ½ Freeboard

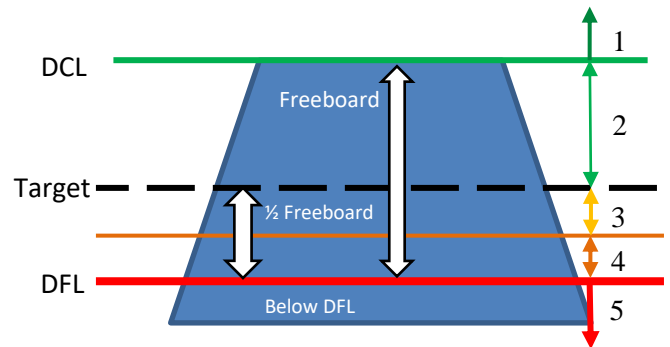


Figure 25: Performance Assessments for Stopbanks

Specific Asset Performance Measurement: Spillways

The performance of earthen spillways is assessed by comparing the current crest level against the design crest level (DCL). While a stopbank can be too high without significant consequences, it is extremely important that the spillway height is not too high or too low, ensuring it activates only under the correct conditions.

The assessment is done at every 100m length or link of spillway, where the calculated current highest and lowest crest level is compared to DCL.

Each link is assessed and graded applying the criteria set out in the Table 45. The worst grade of any link of the spillway represents the overall performance grade of the spillway.

Performance Grade	Activation criteria A = Min (ACL – DCL)	Capacity criteria R = Average (ACL / DCL)
1	$A \geq -0.050\text{m}$	$R \geq 1$
2	$-0.050\text{m} > A \geq -0.100\text{m}$	$0.90 \leq R < 1$
3	$-0.100\text{m} > A \geq -0.150\text{m}$	$0.50 \leq R < 0.9$
4	$-0.150\text{m} > A \geq -0.200\text{m}$	$0.25 \leq R < 0.5$
5	$0.200\text{m} > A$	$0.25 > R$

Table 46: Spillway performance Assessment

ACL = Actual Crest Level

DCL = Designed Crest Level

A4.10 Asset Inspection Regime

Flood Protection Schemes

Waikato Regional Council (the Council) has the management responsibility for flood protection schemes in the region, which includes yearly assessment of schemes' assets conditions and the overall evaluation of schemes' performance. Condition and performance analysis supports decision making and is critical to the management of assets.

The monitoring activities for all assets include:

- Annual inspections and grading assessment of the condition of all stopbanks, pumps, floodgates and other structures
- 3 yearly asset valuations and
- Performance assessments following flood events.
- 10 yearly stopbank and spillway height surveys to complete performance assessments.

For other assets, predominantly floodgates and pumpstations, monitoring includes:

- Structural Audits / CCTV inspection of pipelines – Council undertakes these on a prioritized basis dependant on asset age, condition, criticality and time since last audit.
- 2-yearly electrical compliance inspection.

For the main rivers channels:

- 10-yearly cross section surveys and
- 10-yearly design reviews and floodway performance.

In relation to the services provided, a small asset failure (namely in the stopbanks or erosion protection asset groups) can lead to inundation of a large area of the flood plain resulting in disproportionate damage to the initial failure.

The erosion protection assets can also be subject to substantial damage themselves from flows less than design level.

Reactive maintenance is expended on repairing flood damage resulting from moderate sized floods.

Preventative maintenance, regular inspection, monitoring and hydraulic modelling all contribute to ensuring service reliability standards are met.

On average, the Rivers and Catchment Asset portfolio is in good condition, although as would be expected with such a large asset portfolio, there are some individual assets which are close to the end of their useful lives. Assets which can no longer reliably deliver an acceptable level of service are replaced as part of the asset replacement programme in this asset management plan.

Drainage Networks

Waikato Regional Council has management responsibility for only some of drainage networks within the region.

Monitoring activities for the drains includes inspecting them for damage or defects annually. Inspections are also performed when an adjacent landowner, or member of the public raise an issue with the drainage of their area.

In relation to the services provided, a small asset failure (namely the blocking of a drain) can lead to inundation of an area.

A5 Risk Management

A5.1 WRC Risk Management key elements

The council policy covering a framework for risk management was reviewed and adopted in November 2020. (Doc#15339333)

The risk register below is used to assess the risk of activities and that assets pose to the communities they protect.

A5.2 Initial likelihood and consequence

The tables below demonstrate the scales used to determine the likelihood and consequence levels, which are input into the risk calculation to consider the effect of a risk event. When assessing the likelihood of occurrence and severity of consequences, as much real data as possible is used to ascertain the correct levels.

The likelihood scales identify how likely, or often, a particular event is expected to occur, these are shown in the table below:

Table 47 Likelihood / probability ratings table

Likelihood	Descriptor	Probability
Rare	May occur only in exceptional circumstances e.g. once in 10 years	1
Unlikely	Could occur only very occasionally e.g. 2-3 out of every 10 years	2
Moderate	Might occur from time to time e.g. 5 out of every 10 years	3
Likely	Will probably occur often e.g. 7 out of every 10 years	4
Almost certain	Is expected to occur in almost all circumstances e.g. 9 out of every 10 years	5

The consequence descriptors in Table 48 indicate the level of possible consequences for a risk.

Table 48: Consequence ratings table

Factor	Catastrophic	Major	Moderate	Minor	Insignificant
Score	5	4	3	2	1
Financial	Loss of \$10 million or greater	Loss between \$250,000 and \$10 million	Loss between \$100,000 and \$250,000	Loss between \$20,000 to \$100,000	Loss less than \$20,000
Public and staff	Loss of life or Permanent staff turnover exceeds 30% p.a.	Injury with 3+ months' time-off or Permanent staff turnover 20% to 30% p.a.	Injury with 2 weeks to 3 months' time-off or Permanent staff turnover 15% to 20% p.a.	Injury with less than 2 weeks' time-off or Permanent staff turnover 10% to 15% p.a.	Nil or Permanent staff turnover 0% to 10% p.a.
Legal	Litigation / significant prosecution	Minor Litigation	Enforcement Notice	Non compliance	Minor issues with non-compliance
Political	Nation-wide one week adverse political comment	Nation-wide several days adverse political comment	Regional several days adverse political comment	Local 1 week adverse political comment	Local one day adverse political comment
Image	Negative multi-media nation-wide coverage for 2 weeks +	Negative multi-media nation-wide coverage for up to 2 weeks	Negative multi-media nation-wide coverage for several days	Negative multi-media nation-wide coverage for 2 days	Negative regional multi-media coverage for up to 2 days
Operational	Serious loss of operational capability for over	Serious loss of operational capability for	Serious loss of operational capability for over 1	Loss of operational capability in some areas and some	No loss of operational capability or

Factor	Catastrophic	Major	Moderate	Minor	Insignificant
Score	5	4	3	2	1
	4 weeks and serious disruption to service levels	over 2 weeks and major disruption to service levels	week and disruption to service levels	disruption to service levels	negative disruption to service levels

A5.3 Initial risk assessment

From the likelihood and consequence factors, the level of risk is calculated by multiplying the Likelihood of Occurrence and Consequence Rating together. Risk = the likelihood of an event occurring X the consequence of such an event.

The final outcome is a risk rating. The risk rating enables definition between those risks that are significant and those that are of a lesser nature. Having established the comparative risk level applicable to individual risks, it is possible to rank those risks. Five risk categories have been used: catastrophic, major, moderate, minor and insignificant.

Table 49: Risk assessment matrix

		Consequence				
		Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Likelihood	Rare (1)	I	I	L	L	M
	Unlikely (2)	I	L	M	M	M
	Moderate (3)	L	M	M	H	H
	Likely (4)	L	M	H	H	E
	Almost Certain (5)	M	M	H	E	E

Once the risk has been ranked, it is possible to target the treatment of the risk exposure, by beginning with the highest risks and identifying the potential mitigation measures.

Table 50: Comparative levels of risk

Risk Rating		Action
I	Insignificant risk	Examine where un-needed action can be reduced
L	Low risk	Managed by routine procedures
M	Medium risk	Management responsibility must be specified and risk controls reviewed through AMP
H	High risk	Senior management attention to manage risk
E	Extreme risk	Immediate action required to reduce risk

Essentially the Initial risk assessment is an exercise to determine “What is the worst that could happen?”

A5.4 Analysis to determine Critical Assets

Floodgate and Pump Station criticality

The criticality framework and scoring matrix was used to assess Floodgate and Pump Station asset criticality. The resulting asset criticality ranged between High, Medium and Low based on the criticality scores. The factors included when assessing the overall consequence of failure were:

- Health and Safety
- Business
- Finance
- Asset Functionality
- Reputation / Image
- Resourcing

Criticality	Score Range
High	> 600
Medium	250 – 600
Low	< 250

Table 51: Alignment of score to criticality rating

The results of applying this framework to pump stations and floodgates are shown below:

Criticality	No Assets	% Assets
High	29	6%
Medium	347	71%
Low	113	23%

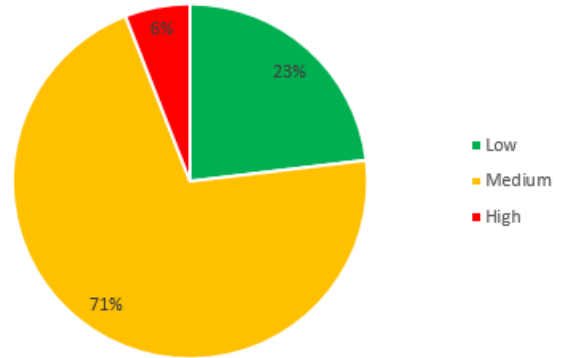


Figure 232: Overall criticality split of ICM assets

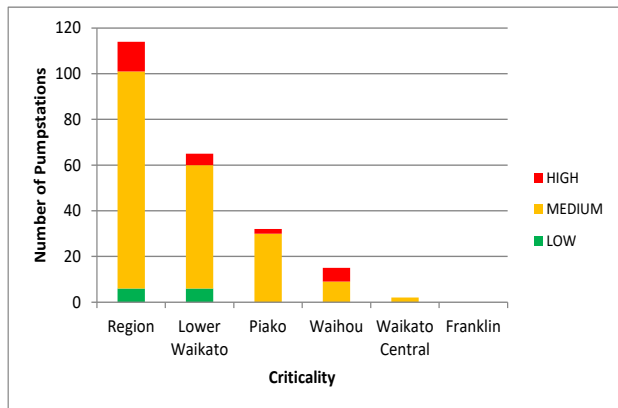


Figure 23: Pump station criticality by zone

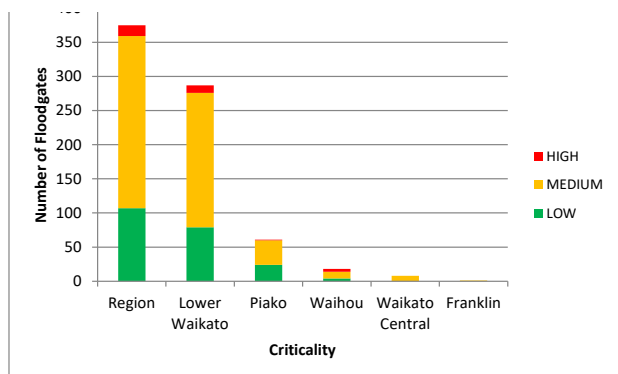


Figure 2424: Floodgate criticality by zone

Stopbank criticality

A comprehensive analysis to quantify the consequence of stopbank overtopping was undertaken as part of a stopbank investment prioritisation process based on risk. This analysis concentrated on the Lower Waikato and Waihou/Piako management zones, which contain more than 90 percent of the stopbanks owned by WRC. The resulting level of consequence provides an indication of the relative criticality of the stopbank.

Estimating the economic cost of overtopping

The economic cost of the consequences of stopbank overtopping was estimated based on the capital value of land inundated by overtopping, a damage ratio based on the land use subject to inundation, and an adjustment factor to account for critical infrastructure that may be subject to inundation by overtopping.

It was assumed that the entire area protected by a stopbank would be flooded during an overtopping event. This assumption was conservative, because in reality the amount of land flooded behind a stopbank is a function of several factors which were not included in the analysis such as:

- Length of stopbank which overtops
- Depth of overtopping
- Duration of overtopping
- Volume of overtopping
- Topography of the flooded compartment
- Depth, extent and duration of ponding in the area

Consequences of a stopbank overtopping will result in inundation of land, leading to direct damages such as:

- Damage to Council's physical assets
- Loss of production on inundated farmland
- Damage to other infrastructure (e.g. transport, telecommunications) and housing potential loss of human life.

In addition, the inundation of land due to stopbank overtopping can lead to indirect damages such as:

- business disruption loss of telecommunications and transport routes
- lost wages of employees unable to attend work
- adverse social consequences (emotional and health impacts), including lessening quality of life due to stress

The direct financial costs of a stopbank failure were easier to measure than indirect damages. The consequences assessment therefore generally considered only direct damages. Indirect damages were assumed to be proportional to direct damages.

It was also assumed that the potential for loss of human life would be mitigated on the basis that an impending risk of overtopping can be forecast, and emergency management procedures would ensure that any population at risk would be evacuated prior to any overtopping event.

The scale of financial losses were estimated by applying a damage ratio to the capital value of the assets in the protected area. Damage ratios varied depending on land-use. The damage ratio's adopted for different land uses in this study are very approximate. It was not however required that the dollar value estimates of damage were highly accurate, rather the relativities in damage between different stopbanks are accurate so that the resulting relativity in asset criticality are accurate enough.

A damage ratio analysis was undertaken using information available on GIS. The basic steps were:

- Define the protected areas for each separate compartment or defence on the GIS
- Council's corporate CRS-GIS layer contains information on individual properties, within the region including their capital value, land area, and land use type. This was spatially combined with the flood defence GIS layer

Damage ratios for rural land uses were estimated based on information obtained from a report titled "Waitohu Stream Study – Potential Flood Damages", prepared by Phil Wallace of the Greater Wellington Regional Council in 2004. These values which are in \$ per hectare were updated using the CPI and converted to a damage ratio using average capital values and land areas for the protected areas in the Lower Waikato zone.

A residential damage ratio was estimated based on a fragility function displayed on the “Riskscape” website (<https://riskscape.niwa.co.nz/features/vulnerabilitymodule>) for a single storey timber/weatherboard house.

It showed that approximately 30% of damage (in terms of replacement value) occurred when floodwaters inundate to a depth 0.5 metres above floor level. The damage ratio estimated to be 2/3 of the capital value of the property.

A lack of current information meant damage ratios for industrial and commercial were guessed. Damage ratios adopted for all land uses are shown in Table 52.

No	Land use category	Damage \$/ha	Damage ratio
1	Dairying	\$1,875.00	0.12
2	Grazing beef and sheep	\$836.25	0.13
3	Market gardens and horticulture	\$22,500.00	1.07
4	Cropping	\$22,500.00	0.58
5	Forestry	\$0.00	0.00
6	Utilities	N/A	0.10
7	Storage	N/A	0.20
8	Recreational	N/A	0.10
9	Industrial and transport	N/A	0.10
10	Commercial	N/A	0.25
11	Residential and community	N/A	0.20
12	Multi use	N/A	0.15
13	Other	N/A	0.10

Table 52: Land use categories and damage ratios

Critical infrastructure protected factor

Table 53: Critical infrastructure protected factor

Critical Infrastructure protected description	Critical Infrastructure factor
State highways and main rail lines	2.0
Arterial roads and local rail lines	1.7
Strategic telecommunications or energy corridor	1.5
Locally significant telecommunications or energy corridor	1.3
Other (as identified for a specific stopbank compartment)	1.2

Critical infrastructure included anything that could severely affect day to day operations of people and organisations outside of the immediate area protected by the stopbank. The factors for various types of critical infrastructure considered the vulnerability of the specific infrastructure to a flood (e.g. damage to the infrastructure that could be expected), as well as intangible consequences (e.g. disruption of service) if the infrastructure is flooded. The estimated factors used are as shown in Table 53.

Criticality Range	Adjusted Direct Damage Cost
High	>\$15 Million
Medium	\$2 million - \$15 million
Low	< \$2 million

The critical infrastructure factors were multiplied by the estimated cost of consequences for each stopbank. The overall result was used to identify the stopbank criticality, based on the total cost consequence of failure.

The Adjusted Direct Damages costs ranged from \$80.5 million down to \$27,300. The results of applying this framework to the stopbanks in the Lower Waikato and Waihou/Piako zones are shown below.

The High Criticality stopbanks represent 18% of the total length but protect 40.8% of the land area and 61% of the consequential damage should they fail

Criticality Range	Adjusted Direct Damage Cost	Lgth stopbank (km)	Protected Area (Ha)	Total Damages \$M
High	>\$15 Million	105	89,936	1,316,084
Medium	\$2 million - \$15 million	274.5	105,281	717,878
Low	< \$2 million	205	25,205	116,022
		584.5	220,422	2,149,984

A5.5 Effectiveness of current systems & processes

Once the Initial risk is determined, investigate the effectiveness of the current systems and processes in place to manage, mitigate or transfer the identified risks and to identify the Residual risk. Effectiveness is expressed in the following categories:

Measure	Description
Excellent	Fulfils requirements thoroughly, very robust and positive measurable effects
Very good	Fulfils requirements, robust and measurable, room for improvement
Good	Barely fulfils requirements, effects hard to measure (or haven't been audited or measured), improvement required
Inadequate	Not fulfilling requirements, little measurement or effect on overall risk
Unsatisfactory	Totally ineffective in avoiding or mitigating associated risk events

A5.6 Residual risk

The Residual risk is the actual risk that exists considering the effective measures implemented. The measures in place reduce either, or both, the consequence and the likelihood of a risk occurrence. The revised factors are input into the same risk matrix to obtain the Residual Risk Factor.

A5.7 Risk register

An ICM risk register has been developed containing the risks identified for the current and future ICM activities. The register is used to record and summarise each risk and to outline current mitigation measures and potential future management options.

A5.8 Risk action plan

The most suitable actions are determined considering available options and resources. The costs and benefits of these actions are analysed.

- A high risk may have to remain due to the inhibitive costs associated with avoidance or mitigation.
- A medium risk event could be easily and cost-effectively avoided within resources available.

The options for mitigating risks considered to reduce the cause, probability or impact of failure, are typically:

Option	Description
Do nothing	Accept the risk
Management strategies	Implement enhanced strategies for demand management, contingency planning, quality processes, staff training, data analysis and reporting, reduce the target service standard, etc.

Operational strategies	Actions to reduce peak demand or stresses on the asset, operator training, documentation of operational procedures, etc.
Maintenance strategies	Modify the maintenance regime to make the asset more reliable or to extend its life
Asset renewal strategies	Rehabilitation or replace assets to maintain service levels
Development strategies	Investment to create a new asset or augment an existing asset
Asset disposal/rationalisation	Divestment of assets surplus to needs because a service is determined to be a non-core activity or assets can be reconfigured to better meet needs

A person is nominated to each risk and is responsible for ensuring the risks are managed and improvements carried out in accordance with the action plan.

A5.9 Monitor and review

Implementation of the action plan is monitored, reported on and reviewed regularly.

In addition, management options are ranked via benefit / cost analysis.

All capital development projects are ranked for inclusion in the LTP/ Annual Plan process using benefit / cost analysis plus the following additional criteria:

- Contribution to the WRC's LTP community outcomes
- Contribution to the WRC's business objectives.
- Level of project commitment (contractual and legal issues).

A5.10 Review risks

Most of the time, the risks identified will remain the same and reviews will occur in the context of these risks. However, it will be important to recognise when a new risk arises, or an existing risk changes in nature. In the latter case, the Initial risk also needs to be re-evaluated.

A5.11 Risk to forecasting assumptions

Forecasting assumption	Risk	Likelihood of occurrence	Financial materiality	Reasons and financial effect of uncertainty
Useful lives of significant assets The useful lives of WRC's significant assets are as disclosed in the notes to the accounts.	The actual life of an asset is shorter than that assumed. This may be the result of a significant weather event.	Low	Low	The WRC's most significant assets are its infrastructural assets comprising of flood protection works. The useful lives of these assets have been assessed by engineers and valuers.
Emission Trading Scheme Due to the high level of uncertainty, no provision has been made for the cost of the government's Emission Trading Scheme (ETS).	That the implementation of this scheme impacts on the costs of WRC undertaking its business.	Medium	Low	The WRC expects that there will be rising costs through the ETS but that these costs cannot yet be quantified or budgeted for. The WRC believes that these cost increases will not be significant and are not expected to be material.
Regional growth Council has estimated that the change in the capital value of the region through new property development will be 1.5 percent for year one of the LTP and is used for the outer years as well.	That growth will not be sustained at the level anticipated.	Low	Low	This growth assumption has only been used to project likely future revenue for those rates set on a per property charge, and in the calculation of rating impacts to existing ratepayers. This growth estimate has been assessed based on actual growth across the region over the last three years. This is considered to be low risk for River and Flood management activities because targeted rates make up a high percentage of the funding required.

A5.12 Asset Related Risks

Figure 25 below shows the components of asset risk and their relationship with the monitoring tools and frameworks currently in place.

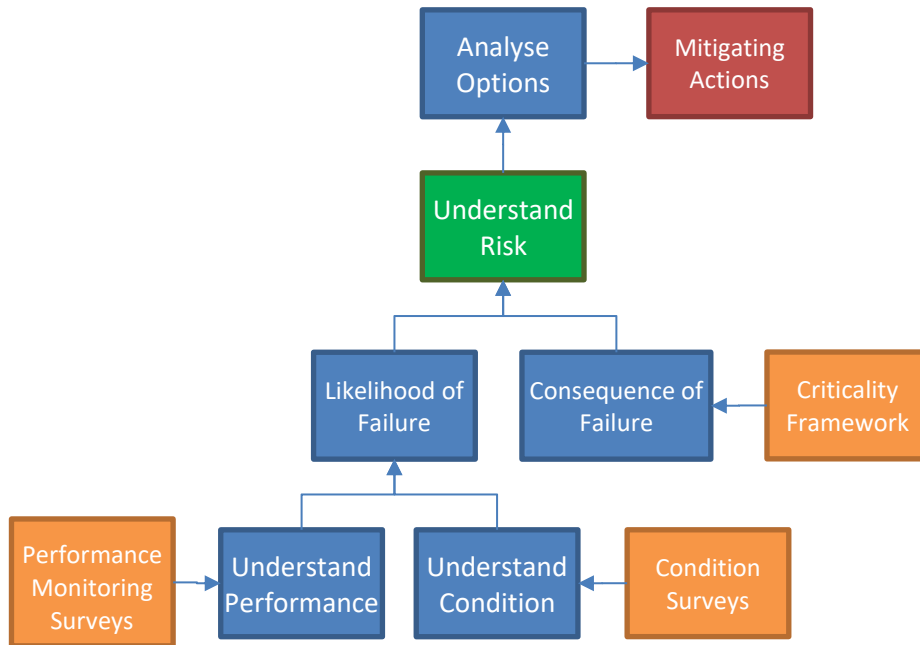


Figure 25: Components of Asset Risk

A6 Lifecycle Management Details

A6.1 Scheme Reviews

Process followed

Using surveys of the actual heights of the stopbanks and spillways, river cross section surveys, extreme weather information from the ministry for the environment and NIWA scheme reviews look first at whether the integrated flood protection scheme meets the existing performance levels of service. It then reviews how the existing scheme would perform with future projected weather extremes caused by climate change.

Results usually state the % of scheme that is designed to meet the performance requirements, and where areas will need redesigning to meet the new height requirements. See the “scheme reviews – how they work graphic” (Doc #11726510).

Scheme Review Timing

The up to date copy of the scheme review programme, including projected external costs is found in “Scheme Review Programme Outline” (Doc #10318391)

Area	Scheme	Typical Review Frequency	Next scheduled Review	Doc Number
Lower Waikato	Motokoraka	10 years	2017/18	(under development)
	Lower Waikato Catchments	10 years (different section every 2 years)	2018/19	(under development)
	Mangawara – Tauhei	10 years	2018/19	(under development)
	Mangatawhiri	10 years	2020/21	
	Lower Waikato Main Channel	10 years	2023/24	
Waihou	Tararu	10 years	2021/22	
	Moanatairi	10 years	2021/22	
	Karaka (Thames)			
	Waihou River including Ohinemuri	10 years	2022/23	
	Komata	10 years	2023/24	
	Puriri	10 years	2023/24	
	Kauaeranga	10 years	2023/24	
	Hape	10 years	2025/26	
	Hikutaia	10 years	2026/27	
Piako	Piako River including Waitoa	10 years	2027/28	Doc #11846571
Waipa	Waipa	10 years	2026/27	
Coromandel	Karaka (Coromandel)	10 years	2027/28	Doc #12609352
	Coromandel Town	10 years	2029/30	Doc #12609352
	Te Puru	10 years	2028/29	Doc #13147968
	Pohue	10 years	2029/30	Doc #13244979
	Waiomu	10 years	2029/30	Doc #13244770
	Tapu	10 years	2031/32	Doc #13245564
	Grahams Creek	10 years	2035/36	Doc #12305172
Taupo	Tongariro	5 years	2022/23	Doc #11250663
	Tauranga Taupo	5 years	2023/24	Doc #12964289

A6.2 Operations and Maintenance

Operations and Maintenance Strategies

The WRC's maintenance strategies cover the policies that will determine how the ICM assets will be operated and maintained on a day-to-day basis to consistently deliver the required levels of service while achieving the optimum use of the asset. The work categories are defined as follows:

- Routine maintenance
 - Planned (proactive) – fix / replace assets components before they fully fail
 - Reactive – fix / replace asset components that have failed

While the short-term maintenance strategy is intended to maintain the current levels of service, the long-term maintenance strategy will be modified to reflect the following:

- Risk of failure associated with critical assets.
- Changes in the agreed level of service.
- Asset condition assessments.
- Extensions to the life of the assets through the asset improvement and development programme.
- Changes in legislative requirements.

Flood Protection Maintenance Programme

The annual maintenance programme includes provision for:

- The 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 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 is work identified during routine inspections, or through customer feedback. These are investigated and assessed, and if the risks of failure warrant it, the works are added to the current annual maintenance programme.

Mandatory Actions Programme

The frequency of the mandatory routine monitoring and maintenance actions, to meet legislative and Level of Service requirements are:

Action	Action Description	Frequency
Pumpstations		
Monitoring	Diesel Generator Plant and Machinery Maintenance - Routine Inspection	1 Monthly
	Pumpstation Maintenance - 3 Monthly Inspection (<i>Operation, condition, weed growth, fish passage etc. where applicable</i>)	3 Monthly
	Diesel Storage Tank and Systems Maintenance - Check for water and leaks in Tank	6 Monthly
	Pumpstation Monitoring - Condition Survey	Annually
	Switchboard and Controls Monitoring - Switchboard IR	Annually
	Pumpstation Maintenance - Electrical Compliance Inspection	2 Yearly
	Pumpstation Monitoring - Structural Survey	10 Yearly
Fixed Time Maintenance	Fuel testing	6 Monthly
	Diesel Generator Plant and Machinery Maintenance - Full Service	Annually
	Telemetry/Scada Maintenance - Replace Battery	3 Yearly
	Diesel Storage Tank and Systems Maintenance - Ten Year Certification	3 Yearly
Floodgates		
Monitoring	Floodgate Maintenance - Routine Inspection (<i>lifting gear, function, weed growth, condition, fish passage etc.</i>)	3 Monthly (Exception: Mangawara flood gates - require a post and pre winter inspection)
	Floodgate Monitoring - Condition Survey	Annually

Action	Action Description	Frequency
	Floodwall Monitoring - Condition Survey	Annually
	Floodgate Monitoring - Structural Survey	5 Yearly, 10 Yearly
Channels		
Monitoring	Canal Monitoring - Condition Survey	Annually
	Canal Monitoring - Cross Section Survey	Variable
	Channel Monitoring - Condition Survey	Variable
	Channel Monitoring - Cross Section Survey	Variable
	Lined Chanel Monitoring - Condition Survey	Annually
Bridges		
	Bridge Monitoring - Condition Survey	Annually
	Bridge Monitoring - 2 Yearly General Inspection	2 Yearly
	Bridge Monitoring - Structural Survey	6 Yearly
Control Gates		
Monitoring	Control Gate Maintenance - Inspection (<i>function, condition, weed growth, etc. - Steve to formulate</i>)	4 Monthly
	Control Gate Monitoring - Condition Survey	Annually
	Control Gate Maintenance - Electrical Compliance Inspection	2 Yearly
	Control Gate Monitoring - Structural Survey	3 Yearly
Stopbanks		
Monitoring	Embankment Monitoring - Condition Survey	Annually
	Embankment Monitoring - Crest Level Survey	5 Yearly, 10 Yearly
Detention Assets		
Monitoring	Detention Dam Maintenance - Routine Inspection	3 Monthly
	Embankment Monitoring - Condition Survey	Annually
	Culvert Monitoring - Condition Survey	Annually
	Embankment Monitoring - Crest Level Survey	10 Yearly
Other Assets		
Monitoring	Fish Pass Maintenance - Inspection Weed Growth, etc.	4 Monthly
	Erosion Control Structure Monitoring - Condition Survey	Annually
	River and Channel Structure Monitoring - Condition Survey	Annually
	Culvert Monitoring - Condition Survey	Yearly (Critical Ones Only)
	***NEW Culvert Maintenance – Routine Inspection_(Operation, condition, weed growth, fish passage etc where applicable	6 Monthly
	Debris Trap Inspection	Annually
	Drain Inspection	Annually
	Culvert Monitoring - Structural Survey	10 Yearly (Critical Ones Only)

Specific mandatory actions are also required for assets where a resource consent is held to meet the resource consent requirements.

Corrective Maintenance Programme

Based on the inspection programme various defects or issues are identified. Depending on what is identified either the leading hand, work supervisor, maintenance planner, or engineer will formulate the best plan to rectify the issue.

Where it may be something simple, it may be fixed immediately (e.g. spot spraying a thistle). Where something serious is identified (e.g. pump noisy, stopbank seeping) it may require external support to develop the correct remediation plan.

Capturing and Prioritising works

To ensure there is visibility that mandatory inspection tasks and planned corrective maintenance actions are being completed, this information is collected in the WRC maintenance system.

A quarterly review of completed inspections and corrective actions is done to check if the work has taken place as planned.

Scheme Land Maintenance Programme

There are areas across the Lower Waikato and Hauraki plains where the WRC owns land with flood protection assets (stopbanks & pumpstations) on it.

Where this land is leased to the local adjoining landowner the scheme land management team work with the local operations work supervisor to ensure the condition of the flood protection assets is assessed annually, and where needed work with the leaseholder to rectify any issues with pest vegetation, fencing, stock damage etc.

Pumpstation Maintenance Programme

Health and safety

Pumpstations contain many hazards, with trip hazards, electricity, and drowning being the top potential issues faced by the operations teams, farmers, and volunteers who operate near or in the pumpstations.

Every pumpstation has a hazards register, and it is expected this is reviewed by anyone who is visiting or working at a pumpstation.

Pump Overhauls

To ensure the flood pumps can operate when a flooding event is occurring (where water levels are causing water to pool on pasture) the pumps, motors, and associated electrical equipment is periodically replaced. This may be triggered either by a failure of a component, the identification of an imminent failure is about to occur through condition monitoring, or for some of the smaller pumpstations on a time based frequency.

Drainage Maintenance Programme

Health and safety

Waikato Regional Council is committed to providing a safe and healthy work environment for its employees, contractors and any others affected by the activities we carry out.

Some landowners through which the drainage network flows have their own health and safety systems. However, given that there are some 8000 property owners across the drainage network WRC maintain, we do not notify individual landowners before carrying out inspections or drain spraying activities.

The local works supervisor will work with the land owner if a specific hazards has been identified by either party. For example, an unsafe bridge or culvert, unguarded power cables or tomos, or aggressive animals. This information is passed onto our contractors by the works supervisor so they are aware of all potential dangers.

Drain spraying

Removing vegetation growing in drains so it doesn't block channels is an ongoing maintenance challenge. Regular spraying of drain beds and better control of weeds leads to less obstructions in drains. This means any silt that is flowing through the drainage network has less physical structures to build up against, thus reducing the frequency of machine cleaning.

Spraying of drains is a routine annual maintenance task, and is the preferred method of cleaning drains as it:

- Is cost effective (up to 10 times cheaper than mechanical cleaning)
- Can be carried out quickly by a small team of people, meaning we can service a bigger area
- Reduces mess left on the landowner's property
- Minimises the need for mechanical cleaning which can often enlarge or deepen drains, making them too big.

Spray programmes are generally undertaken from October to April each year, when the weather is more settled, and mostly completed by trained contractors. However, council field staff also undertake spraying where required.

As a general rule, only the bottom of the drain is sprayed. This is so the vegetation on the edges of the drain remains undisturbed to keep the drain banks stable and filter nutrients and sediment from water entering the drain. The sides of a drain are only sprayed if there is a particular need to do so. A common side effect of excessive spraying is significant slumping of the drain.

Vegetation clearance (including spraying) within drains that located within or within 10m of a natural wetland are regulated by the NES-FW. Vegetation clearance permitted activity is limited to 500m² or 10% of the natural wetland, whichever is smaller.

Fencing

Fencing drains to exclude stock continues to be encouraged. The cost of maintaining a fenced drain is significantly less than that of an unfenced channel. By fencing and then spraying weeds, drains should only need to be cleaned of silt every five to ten years instead of every year or two.

Culverts repairs

The maintenance and replacement of private culverts and bridges is the responsibility of landowners. However, if damage occurs as a direct result of WRC maintenance works, the regional council will repair (where possible) or replace private culverts or bridges.

Where WRC is upgrading a drainage network and a culvert needs to be lowered or enlarged as part of the upgrade, the WRC will fund the required works and comply with the NES-FW regulations for culverts and fish passage. In these cases, existing culverts will be reused where possible but if that isn't a reasonable option, new culverts or structures will be provided at the council's cost. Upon satisfactory completion of any repair, installation or modification of a private culvert or bridge, the landowner will assume ongoing responsibility for future maintenance.

Removal of blockages and obstructions

The council needs to provide clear access way for water through floodgates at the end of drainage networks, but is not responsible for ensuring water reaches those structures.

Removal of blockages and obstructions in drains is usually performed by the local landowners or district council. In a few agreed instances this work is conducted by the regional council.

A6.3 Asset Renewal

Renewal Strategies

Renewal strategies provide for the progressive replacement or rehabilitation of individual assets that have reached the end of their useful life. Ideally, this is managed at a rate that matches the depreciation in the value of the assets as a whole.

The objective is to maintain renewals at adequate levels to maintain current levels of service and the overall quality of infrastructure assets.

Specific strategies have been agreed for a number of asset classes, as follows:

Drainage

The following strategies have been in place for the drainage network since 2006:

- Drains are defined as having an indefinite life. Capital is only spent when a completely new drain is needed. All costs to reshape or deepen a drain are maintenance costs.
- Drainage pumps are installed at the expense of the land owners who require one.
- Council may design, install, and maintain a drainage pump where a formal agreement with a group of landowners who will benefit from the works. It is expected the landowners will pay an agreed percentage (generally minimum of 75%) of the costs of the design and installation, and all of the maintenance, consenting and compliance costs.

Stopbank

In 2015 the following strategy for the renewal of stopbanks was adopted:

- Stopbanks which have Performance Grades 4 and/or 5 will be programmed for renewal.
- All stopbanks with performance grade 4 and/or 5 will be renewed within 5 years of being identified.
- When the renewal backlog is complete, expenditure on stopbank renewal will match depreciation.

Currently the asset criticality of stopbanks does not influence the renewal programme.

Structures

In 2015 the following strategy for the renewal of structures was adopted:

- Identify the projected asset lives for all structures.
- Identify the physical condition of structures
- Programme structures for renewal which are near the end of their asset lives.
- All structures which are near the end of their asset lives will be renewed in 3–4 years (by 2019)

Currently asset criticality does not influence the renewal programme. However as an initial criticality analysis has recently been completed for pump stations and floodgates, these results will be factored into the future programme.

Asset Criticality

The asset criticality for flood gates and pump stations will impact on the renewal strategy as shown in Table 54 below.

Table 54 Criticality Based Renewal Strategy

	Condition Assessment	Renewal Strategy	Risk Assessment
High	Regular condition monitoring of all above ground assets components.	Renew at end of expected asset life or when condition grade reaches 4.	Consider likelihood of failure. Assess potential for: <ul style="list-style-type: none"> ▪ Redesign or modification to, eliminate or reduce asset criticality ▪ Asset duplication ▪ Spares held. ▪ Service provider agreements
Medium	Regular condition monitoring of all above ground assets components. Monitor condition when the asset is at 80% of its expected life and regularly thereafter	Renew when condition grade reaches 4 – Poor or when asset fails.	Consider likelihood of failure. Assess potential for: <ul style="list-style-type: none"> ▪ Redesign or modification to, eliminate or reduce asset criticality ▪ Spares held. ▪ Service provider agreements
Low	Condition monitoring if the asset is not performing as expected.	Renew when asset fails.	Not required

Other factors which are taken into consideration when the renewal programme is developed include:

Asset performance

Assets are often renewed where they fail to meet the required level of service. The monitoring of asset reliability, capacity and efficiency during planned maintenance inspections and operational activities identifies non-performing assets. Indicators of non-performing assets include:

- Structural failure
- Repeated asset failure (breaks, faults)
- Ineffective and/or uneconomic operation
- Unsafe conditions
- Unsatisfactory environmental performance

Legislative requirements

Changes to legislative requirements, especially in the area of Health and Safety can lead to the need to renew assets which no longer conform and therefore pose a specific risk to WRC (see below).

Consent compliance

In many cases the need to comply with the conditions of consents can lead to asset renewal works.

Economics

When it is no longer economic to continue repairing the asset (i.e. the annual cost of repairs exceeds the annualised cost of its renewal). An economic consideration is the co-ordination of renewal works with other planned works such as road reconstruction. WRC actively researches the effectiveness of new technology, which may reduce the direct and social costs of repair works.

Risk

The risk of failure and associated environmental, public health, financial or social impact justifies proactive action (e.g. probable extent of flooding damage, health and safety risk). Where such assets are identified (critical assets), proactive inspection is undertaken to determine asset condition at a frequency appropriate to the risk.

In particular a risk analysis has been undertaken for the prioritisation of investment in stopbank renewals.

Renewal Activities

Renewal works is the replacement of existing assets or facilities with assets or facilities of equivalent capacity or performance capability. These broadly fit into the following work categories as follows:

Rehabilitation (Refurbish)

Works to rebuild or replace parts or components of an asset, to restore it to a required functional condition and extend its life, which may incorporate some modification. Generally involves repairing the asset to deliver its original level of service without resorting to significant upgrade, using available techniques and standards.

Replacement

The complete replacement of an asset that has reached the end of its life, so as to provide a similar or agreed alternative equivalent level of service.

A6.4 Asset Improvement / Acquisition

Asset improvement / acquisition strategies

New capital works involves the creation of new assets, or works, which upgrade or improve an existing asset beyond its current capacity or performance in response to changes in usage or customer expectations

Asset improvement / acquisition activities

Growth

This is investment driven by the need to provide adequate capacity for the asset to deliver the required levels of service for the expected future demand.

Levels of Service

This is capital investment required to enable the asset to deliver the existing service level and includes any future changes to the levels of service which may be driven by changes in legislation, changes in customer service expectations, or environmental influences.

A6.5 Asset Decommissioning / Disposal

As part of the life cycle management of assets it is vital to consider the costs of asset disposal in the long-term financial forecasts for an asset. The cost of asset disposal is incorporated within the capital cost of new works, or asset renewals.

Disposal is the retirement or sale of assets whether surplus or superseded by new or improved systems. Assets may become surplus to requirements for any of the following reasons:

- Under utilisation
- Obsolescence

- Provision exceeds required level of service
- Assets replaced before its predicted economic life
- Uneconomic to upgrade or operate
- Policy changes
- Service provided by other means (e.g. private sector involvement)
- Potential risk of ownership (financial, environmental, legal and social).

Asset decommissioning / disposal strategies

The process for disposal of zone assets is as follows:

- Assets are identified as obsolete due to changes in technology, site conditions and community demand, or failure of the asset to provide the service.
- Disposal options are considered and a cost/benefit analysis carried out. The most cost-effective option to dispose of the asset will be undertaken:
- input sought from catchment committees as appropriate
- the council’s approval sought according to its delegations manual
- Disposal is undertaken including obtaining any consents for disposal works.

Gains and losses on disposals are determined by comparing the proceeds with the carrying amount of the asset and are included in the statement of financial performance. When revalued assets are sold, the amounts included in asset revaluation reserves in respect of those assets are transferred to retained earnings

Asset decommissioning / disposal activities

Currently, there are no plans to dispose of any surplus assets; however planned replacement of some components will be undertaken as per the replacement/renewal plan. Salvage values of replaced assets are unlikely to be significant and are therefore (conservatively) not included in financial forecasts

A6.6 Stopbank Renewal Prioritisation

Stopbanks

In May 2014 it was estimated that raising all of the stopbanks that have crest levels at or below the design flood level (some 90 km) to their required height in the three major flood protection systems would cost approximately \$27 million. This could not be practically achieved during one or two financial years and a scoring matrix for the initial prioritisation of investment on stopbanks was developed.

The matrix was based on a risk assessment methodology, in accordance with Council’s risk management practices in order to:

- allow the systematic identification and classification of overtopping risk,
- enable a better understanding of potential liabilities, and
- provide a clear and auditable process for prioritisation of stopbank renewal works.

The risk tool is used to estimate the annualised monetary risk (in dollar terms) posed by each stopbank from the following equation:

$$Estimated Risk = \left[\begin{array}{c} Probability \\ of \\ design flood \end{array} \right] \times \left[\begin{array}{c} Estimated \\ probability \\ of \\ overtopping \end{array} \right] \times \left[\begin{array}{c} Estimated \\ consequences \\ of \\ overtopping \end{array} \right] \times \left[\begin{array}{c} Critical \\ infrastructure \\ factor \end{array} \right]$$

Where:

“Probability of design flood” is the likelihood of a design flood event occurring in a particular year.

“Estimated probability of overtopping” is the likelihood of a design flood event overtopping a stopbank.

“Estimated consequences of overtopping” is the estimated value of direct, tangible damages related to overtopping of a stopbank. This is the product of a damage ratio based on the land use subject to inundation and the capital value of the land inundated by flooding.

“Critical infrastructure factor” reflects the nature of the critical infrastructure (e.g. state highways, main rail lines, strategic telecommunications, etc.) protected by the stopbank. Together, these two factors were used to identify the criticality of stopbanks (0)

The risk assessment was applied to all stopbanks in the Waihou, Piako and Lower Waikato zones which protect over 220,000 Ha of land.

Risk treatments to be considered are as follows (listed in descending order of priority)

- Implement and/or modify the stopbank monitoring programme
- Raise stopbank to the full height required to provide the current agreed level of service
- Prepare detailed contingency plans in consultation with affected landowners to ensure agreed level of service is met during a flood event
- Agree a reduced level of service with affected landowners and either:
 - raise a stopbank to a level to meet the reduced level of service,
 - do nothing, if the stopbank height meets the reduced level of service, or
 - Prepare detailed contingency plans to provide the reduced level of service.

Development of the stopbank upgrade programme considers the results of the risk analysis tool in light of qualitative information collected during the risk assessment process about the stopbanks and the land they protect, and involves Council staff, zone managers and councillors. Council staff confirm with zone managers the preferred risk treatment method for each stopbank, and the upgrade priorities. These discussions include an assessment of zone-specific considerations, including funding availability and project affordability, legal requirements and/or implications (e.g. consent conditions), and economies of scale and practicalities of construction (particularly with regard to combining renewal projects).

A7 Financial Details

A7.1 Classifying Expenditure Types

Please refer to the Infrastructure assets accounting policy and guidelines (Doc#11074070) for details of Capital and Maintenance expenditure definitions.

A7.2 Asset valuation

Introduction

The WRC values its assets in accordance with the procedures and methods set out in the Public Benefit Entity International Public Sector Accounting Standard 17 Property, Plant and Equipment (PBE IPSAS 17), and New Zealand Infrastructure Valuation and Depreciation Guidelines, issued by the New Zealand Asset Management Support Group (NAMS) of IPWEA.

An asset valuation is undertaken on behalf of the WRC every three years. Key outputs from the valuation are:

- Optimised replacement cost (ORC)
- Optimised depreciated replacement cost (ODRC)
- Assessment of standard asset lives and remaining economic life (REL).

Note:

- All asset values are subject to “straight-line” depreciation.
- All new and/or fully rehabilitated/renewed assets are assigned full standard lives.
- No residual value is assigned to assets – any remaining value of assets which are de-commissioned are written off and the asset derecognised.
- Resource Consents are not valued or depreciated.
- Land is separately valued, but not depreciated, as it is assumed to have infinite life.
- The depreciation of new assets, and assets being constructed as part of work in progress, only starts when the asset has been commissioned.

Valuation methodology

The WRC’s latest revaluation of all infrastructural assets was undertaken in June 2020 to ascertain the value as at 31 Dec 2019.

For the full valuation methodology, including the assessment of base and remaining life, refer to “Infrastructure Asset Valuation – Valuation of Waikato Regional Council Infrastructure Assets as at 31December 2019”, WPC 15 June 2020.

A8 Asset Management Specific Threats / Opportunities

Key issue	Preferred solution
<p>Economic conditions and affordability: Changing economic conditions can hinder the ability to pay for maintenance, capital renewals and new works.</p>	<p>Short to mid-term (1-10 years): A review is to be undertaken assessing the appropriateness of current funding policies across the full range of beneficiaries. Sustainable infrastructure decision-making framework is to be applied once adopted.</p> <p>Central government to be lobbied for additional funding to enable additional project deliverables for the WRC.</p> <p>Mid to long-term (5 years +): Discussion is on-going regarding mid to long term options.</p>
<p>Climate change: Sea level rise, increased severity and frequency of storm events as well as increased and prolonged periods of drought.</p>	<p>Short to mid-term (1-5 years): Climate action committee was established in 2020.</p> <p>Climate change guidelines and sustainable decision-making framework to be completed.</p> <p>Future operational, corporate, and resource decisions made by the WRC to consider the implications of climate change.</p> <p>Mid to long-term (5 years +): Increased investment in flood risk forecasting and prediction tools, continued community engagement regarding climate change e.g. TCDC shoreline management projects.</p> <p>Implement monitoring in periods of drought and incorporate feedback into renewals process. Investigate alternative building methodologies to reduce impact of drought on future assets.</p> <p>Long term (10-30 years): An 'adaptive management approach' to account for uncertainty will be applied. Sustainable decision-making framework will be consistently applied with emphasis on consultation with affected communities</p>
<p>Environmental and regulatory performance expectations: Introduction of new legislation and subsequent changes in land use.</p>	<p>Continue to self-fund or seek community funding to develop new innovative methods to adapt current infrastructure to meet the new requirements. E.g. The Pathways to the Sea project has been set up to directly address barriers to downstream fish passage in line with the Freshwater Management Statement.</p> <p>Establishing a long term (intergenerational) vision for the water that is informed by aspirations of Tangata whenua and communities for what waterbodies should look like in the future. Develop a greater understanding of current pressures to waterbodies and an understanding of the waterbodies' history, and to investigate options for Tangata whenua involvement.</p>
<p>Natural disasters</p>	<p>Continue to maintain regional recovery funds, for when a significant event does occur.</p> <p>Continue to improve data and monitoring to enhance flood warning and monitoring outcomes as well as our response capabilities following natural disasters. E.g. by developing flood forecasting models in partnership with stakeholders.</p> <p>The Regional Asset Management Plan will continue to incorporate residual risk from natural disasters and discuss</p>

Key issue	Preferred solution
	how they are included into the regional asset management planning.
Land use change: Land use intensification	<p>Short to mid-term (1-10 years): Allocate new capital outside of current renewal or operational funding for new land use requirements.</p> <p>Continue collaboration with territorial authorities regarding growth and demand and provide information with respect to natural hazard management and assessment of required service levels.</p> <p>Broaden hydraulic modelling service level reviews to better inform communities and ensure sustainable development.</p> <p>Develop a business case on peat and carbon settlement to better understand the rates and potential impacts within the Waikato.</p> <p>Mid to long-term (5 years +): Develop land use projections and mapping that incorporates climate adaptation and greenhouse gas mitigation, increasing environmental aspirations and changing socio-economic drivers to paint a picture of what the Waikato will look like in 50 years (see Futurescapes SOC in LTP).</p>
Business Capability (knowledge fade)	<p>Develop a plan to capture knowledge of council personnel who are approaching retirement and provide these staff the opportunity to mentor and teach others.</p> <p>Undertake a gap analysis of role requirements in the present and future. This will be followed by identifying training and development solutions and monitoring the implementation of solutions. Future technology and role changes will be considered throughout this process.</p>
Changes in technology	<p>Align with council policy for information management:</p> <p>Information is to be stored in one place and accessed from other interfaces. We will not develop</p> <p>We want to pursue technology that supports delivery of business processes.</p> <p>We will pursue cloud based systems</p> <p>Use technologies that have been proven within another council managing similar assets</p>
Requirement for more immediate data, to better predict and manage flood response	<p>Increase technology take up through:</p> <p>Remote sensing of land and/or water related data. For example the use of LIDAR and drones to obtain detailed ground level and other operational information.</p> <p>Greater coverage of rainfall gauges or use of radar rainfall and improved flow information as measurement technology becomes cheaper Use of computerised data loggers/ and or telemetry for collecting monitoring information.</p> <p>Electronic equipment and telemetry for pump stations and floodgate monitoring, allowing improved responsiveness and efficiency of maintenance procedures.</p>
Legislation, policy and strategy changes, whether health and safety, environmentally, or fiscally	Levels of Service will be reviewed and specific asset management plans and designs for assets in areas where

Key issue	Preferred solution
impacting ability to deliver work plans at previously agreed cost through LTP	<p>policy and strategies have changed. Options will be developed showing cost to implement strategy or policy, so ICM committee can determine timeframe over which strategy or policy will be deployed.</p> <p>Engage with District council and WRC Policy and Strategy groups, to constructively be involved with conversations on topics such as land use, and embankment use to ensure current LOS requirements are considered.</p>

A9 Development of the asset management improvement plan

The framework used to identify current and appropriate practice was based on the IIMM maturity index. Asset management practice was assessed over the following categories:

- AM Policy
- Asset Register
- Demand Forecasting
- Information Systems
- Quality Management
- Zone Management Plans
- AM Teams
- Capital Works
- Financial Strategies
- Levels of Service
- Risk Management
- Asset Condition
- Decision Making
- Improvement Planning
- Operations & Maintenance
- Service Delivery Mechanism

A number of elements were scored under each category using the scoring criteria used for assessing both current and appropriate practice shown in Table 55 below:

Table 55 Assessment Scoring Criteria

Rating	%	Description	Process	Information Systems	Asset Knowledge (Data & Plans)
1	0	Innocence	No process exists Never do this	No system exists	No results seen No confidence in information. Planning based on very large unsupported assumptions
2	25	Awareness	Minimal documentation Ad-hoc procedures Occasionally do this	Manual system exists or plans for automated systems are in place. Some very basic user needs met.	Minimal results, long way to go. Very low data confidence
3	45	Systematic Approach	Semi-formal process. Completed on an as-needed basis for critical programs and activities.	Automated system exists. Basic user needs met.	Some results, still below expectations. Low data confidence
4	70	Competence	Formal process exists and documented but still evolving. Often do this on many programs.	Good system in place. Widely available. All key user needs met.	Good results, getting there. Reasonable data confidence.
5	85	Excellence	Formal documented process, well tested and followed. Usually do this, omitted only in exceptional circumstances	Strong system in place. Nearly all user needs met.	Excellent results, still some room to improve. Good level of data confidence.
6	100	Best Possible	Strictly formal process. Always do this, standard operating procedure. Process heavily emphasised, not deviated from	State-of-the-art system in place. All user needs met.	Unparalleled results; a total success. Very high level of data confidence

A10 Data Confidence and Completeness

Both the quality and quantity of information has improved significantly since 1997 and is still undergoing further improvement. The inventory of assets identifies most of the significant assets. The weakest area of information currently is historic maintenance costs. While gross maintenance costs are recorded in the Financial System, the degree of breakdown for different activities and different types of assets is insufficient to allow accurate identification of historic activity/asset unit costs at this stage.

A drive to improve on the historical asset data has been underway since 2012. The objective is to improve on the asset data completeness and asset condition and performance information. The following reviews have been completed:

- A review of the pumpstation and floodgate attributes
- Verification of license land assets (e.g. fence ownership)
- A review of the electrical ownership and responsibilities.
- A stopbank crest-level design data review.
- A condition inspection guidance manual is in place and an audit of the stopbank condition assessment was completed in 2012.

Table 56 below provides the confidence framework from the 2006 version of the National Asset Management Group's International Infrastructure Management Manual (NAMS IIMM) used to determine the confidence in the asset data used in this Regional AMP.

Table 56: Asset data - confidence grades

Confidence grade	General meaning
Highly reliable	Data based on sound records, procedure, investigations and analysis, documented properly and recognised as the best method of assessment.
Reliable	Data based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example the data is old, some documentation is missing, and reliance is placed on unconfirmed reports or some extrapolation.
Uncertain	Data based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolated from a limited sample for which grade highly reliable or reliable data is available.
Very uncertain	Data based on unconfirmed verbal reports and/or cursory inspection and analysis.

The following table outlines the grading system used to summarise the completeness of the data held in the asset register.

Table 57: Asset data – completeness grades

Data completeness	General meaning
0 – 20%	The asset register contains minimal information about the assets with the majority of assets not listed at all
20 – 40%	About a third of the assets are listed, and/or about a third of the attribute information is listed
40 – 60%	About half of the assets are included in the asset register and/or of the assets included, only half the asset attribute data is included
60 – 80%	Most assets are included on the asset register with most of the relevant asset attributes
80 – 100%	The asset register contains a complete set of data for every known asset

Table 58 reflects the confidence and completeness of data for all assets within the region. . The “material data” refers to the construction material of the asset. “Other attribute data” includes length, height, volume, width, foundation type, design freeboard, transformer rating, power rating etc.

Table 58: Summary of asset data confidence and completeness for critical and non-critical assets (July 2017)

Asset type	Material data (where applicable)	Age	Other attribute data	Overall
Embankments	<i>Confidence</i> - Reliable <i>Completeness</i> - 100% Foundation data	<i>Confidence</i> - Reliable <i>Completeness</i> - 98% however date of last top up needs to be collected	<i>Confidence</i> - Reliable <i>Completeness</i> - 93%	<i>Confidence</i> -Reliable <i>Completeness</i> - 93%
Structures	<i>Confidence</i> - Reliable <i>Completeness</i> - 77%	<i>Confidence</i> - Reliable <i>Completeness</i> - 94%	<i>Confidence</i> - Reliable <i>Completeness</i> - 70%	<i>Confidence</i> - Reliable <i>Completeness</i> – 70%
In river structures	<i>Confidence</i> - Reliable <i>Completeness</i> - 56%	<i>Confidence</i> - Uncertain <i>Completeness</i> - 87%	<i>Confidence</i> - Reliable <i>Completeness</i> - 42%	<i>Confidence</i> - Reliable <i>Completeness</i> - ~55%
Channels	<i>Confidence</i> - Reliable <i>Completeness</i> - 80%	<i>Confidence</i> - Uncertain <i>Completeness</i> - 12%	<i>Confidence</i> - Reliable <i>Completeness</i> - 50%	<i>Confidence</i> - Reliable <i>Completeness</i> - ~50%
Soil conservation / Clean streams	<i>Confidence</i> - Reliable <i>Completeness</i> - 93%	<i>Confidence</i> - Very Uncertain <i>Completeness</i> - 21%	<i>Confidence</i> - Uncertain <i>Completeness</i> - 60%	<i>Confidence</i> - Uncertain <i>Completeness</i> - ~50%

The following table provides an initial assessment of the level of completeness and data accuracy WRC wants to achieve for each asset type.

Table 59: Target level of asset data confidence and completeness

Asset type	Confidence	Completeness
Embankments	Highly Reliable	100%
Structures	Highly Reliable	100%
In river structures	Reliable	80%
Channels	Reliable	60-70%
Soil conservation/Clean streams	Reliable	60-70%

When comparing target levels for data confidence and completeness vs actuals the Embankments asset type compares most favourably, particularly in terms of data completeness. However due to the critical nature of this asset type and the impact of missing or less reliable data on the ability to accurately determine Embankment performance and Valuation it remains a high priority item.

Structures are a focus for improving data completeness, particularly relating to attributes that impact on asset valuation. This aspect and data confidence is continually improved through verification during structural audits and annual condition inspection.

In river structures and soil conservation assets are less significant in terms of asset value and this is reflected by the lower targets for data confidence and completeness. Current data completion ratings are a reflection of the difficulty in finding as built information for historically constructed assets.

The assessment completeness of age information for channels excludes natural channels but does include artificial waterways such as canals and drains. Drains make up the bulk of these assets and collection of age information is considered low priority as these assets are not depreciated and are not subject to renewal.

APPENDIX B – ZONE SPECIFIC SUMMARIES

Drainage Networks Summaries

1. Franklin Waikato Land Drainage Network
2. Thames Valley Land Drainage Network
3. Waikato Central Land Drainage Network
4. Aka Aka/Otaua Land Drainage Network

Catchment Management Zone Summaries

1. Coromandel zone
2. Waihou-Piako zone
3. Lake Taupo zone
4. Waipa zone
5. Upper Waikato zone
6. Central Waikato zone
7. Lower Waikato zone
8. West Coast zone

B1 Drainage Network Summaries

Common issues across all drainage networks

Issue 1: What is and isn't included in our drainage network

Not all drains within the Waikato and Hauraki areas are managed by the Waikato Regional Council. Where an agreement is in place, an established network is maintained to provide a drainage outlet to each property. The effectiveness of the drainage networks is regularly reviewed, and as a result of this process, where agreed existing private drains or new drains may be added to the council maintained network.

For example, there may be a subdivision where newly created lots require drainage and the council drainage network needs extending to provide that service. Alternatively, the council maintained network may be reduced by the removal of drains or portions of drains. Such instances could include the amalgamation of properties where a current council maintained drain would end within a property and it would be appropriate to shorten the drain to the new property boundary.

The developer of the new subdivision is responsible for the drainage areas in the area they are developing. Through the resource consent process they are usually also responsible for ensuring any additional storm water requirements caused by the change in land use.

To ensure there is detailed community input into the land drainage programmes for each drainage area, WRC works closely the advisory subcommittees comprised mainly of landowner representatives.

Issue 2: Excessive peat drainage

Peat drainage has become a major drainage challenge for our council.

As peat land is farmed, the peat oxidises, and shrinks in height. As the land height adjacent to the drain drops the drain becomes too shallow, causing it to not hold enough water during an extreme weather event. To reduce the frequency of needing to re-dig the drain land users have tended to dig the drains deeper than initially needed. Unfortunately deep drains and cropping can accelerate the rate of shrinkage, making these areas more expensive to maintain. This has been especially seen in the Hauraki area over the last 40 years, where the farming practises employed have meant ground water levels have not been maintained causing further accelerating peat shrinkage.

Issue 3: Stock access to drains

Most of the silt that needs to be removed from drains comes from erosion of drain banks caused by stock damage. This damage also results in higher costs to ratepayers as subsidence and slumping of drain banks due to stock pressure often means channels have to be regularly machine cleaned – a method that is expensive, creates more disturbance and leaves more mess on the landowner's paddock. In general drains that are not fenced require cleaning every one or two years while drains that are fenced require cleaning every five or seven years.

Issue 4: Access along drains

To enable the drain maintenance work to be completed for as little cost to ratepayers as possible, good access along drains is essential. Within each property it is the land owner's responsibility to provide access along the community drains. Providing access includes:

- Gateways adjacent to drains in lateral fences.
- Culverts for access over side drains.
- No trees or hedges along the drains to allow machines to reach into the drain. (Permission can be granted in some cases)
- Restrictions relating to structures or ponds adjacent to community drains.

The cost difference between areas with good access and those with poor access is significant.

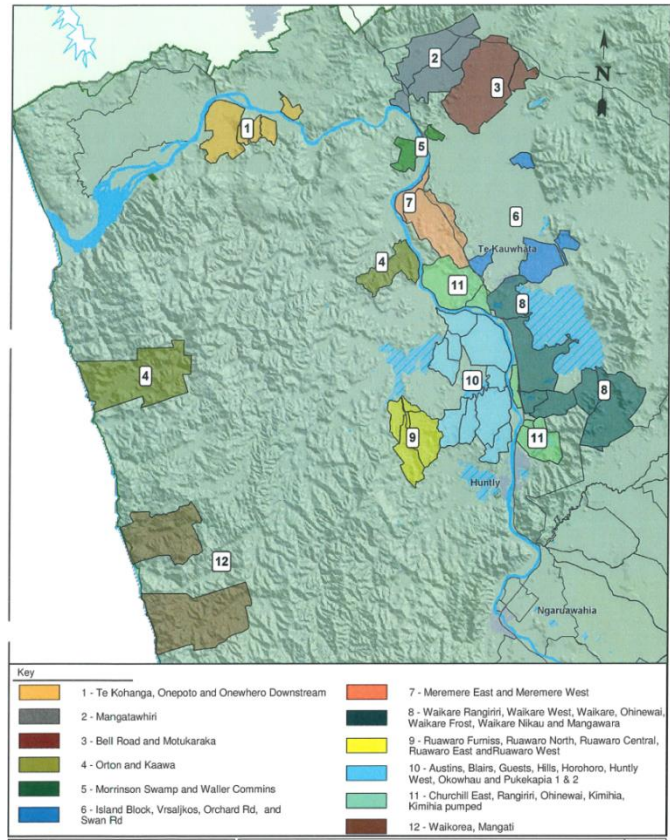
Franklin Waikato Land Drainage Network

The Franklin Waikato Land Drainage Network is made up of 49 individual subdivisions totalling approx. 42,000 hectares.

This Scheme includes 266km of drain as well as a small amount of stopbank associated with the Kaawa subdivision.

Key issues

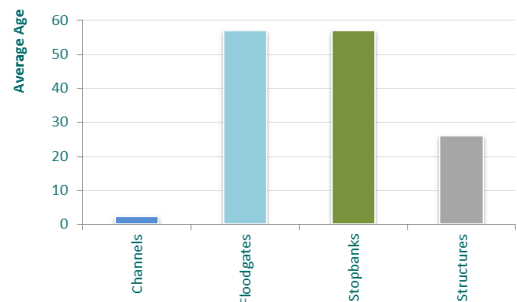
- Land use changes resulting in more surface water runoff into the land drainage network. These changes can also alter the level of service expectations particularly where subdivision results in the creation of smaller rural residential lots.
- Vegetation management – including pest plants such as alligator weed
- Roding network upgrades impact on drainage areas e.g. Waikato Expressway / SH2 realignment.
- Environmental Management – rules relating to work in Artificial channels vs modified natural
- Peat Settlement
- Presence of services such as power cables, water pipes, gas mains etc.
- Numerous small drainage areas. Efficiencies may be gained by amalgamation of some these into larger areas.



Assets summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Franklin Waikato	\$4,822,766	\$4,300,562	\$9,680

Average asset age

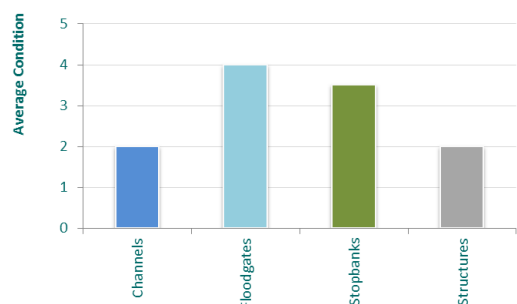


Asset Current Condition

Overall, the Kaawa main right bank stopbank is in fair condition (grade 3), with some surface damages and multiple low spots. The Kaawa main left bank was rated poor (grade 4) due to various defects predominantly stock damage and human activities.

The Kaawa twin box floodgate, only floodgate within the drainage area, was removed by the farmer and replaced with culvert and new headwalls.

Average asset condition



Drainage area	Drainage subdivision	No Drains	Drain Length (m)	Additional Assets	Depth of Runoff per day	10% AEP V/d
Bell Road	none	2	2.98		Various but eventually 19mm from flat land and 38mm from hill land.	
Churchill East	none	6	9.67		Various but eventually 19mm from flat land and 38mm from hill land.	
Huntly West	Austins	4	5.16		Various but eventually 19mm from flat land and 38mm from hill land.	
Huntly West	Blairs	3	4.01		Various but eventually 19mm from flat land and 38mm from hill land.	
Huntly West	Golf Course	7	10.2		Various but eventually 19mm from flat land and 38mm from hill land.	
Huntly West	Guests	6	4.09		Various but eventually 19mm from flat land and 38mm from hill land.	
Huntly West	Hills	1	0.49		Various but eventually 19mm from flat land and 38mm from hill land.	
Huntly West	Horahora (Patterson's)	11	16.34		Various but eventually 19mm from flat land and 38mm from hill land.	
Huntly West	Okowhau	8	6.73		Various but eventually 19mm from flat land and 38mm from hill land.	
Island Block	none	5	3.7		Various but eventually 19mm from flat land and 38mm from hill land.	
Kaawa	none	7	8.44	+4.38km stopbanks + 1 floodgate	Various but eventually 19mm from flat land and 38mm from hill land.	
Kimihia	Kimihia drainage	2	3.61		Various but eventually 19mm from flat land and 38mm from hill land.	
Kimihia	Kimihia pumped	1	0.27		Various but eventually 19mm from flat land and 38mm from hill land.	
Mangatawhiri	Mangatawhiri C1	2	2.42		Various but eventually 19mm from flat land and 38mm from hill land.	
Mangatawhiri	Mangatawhiri C2	4	5.12		Various but eventually 19mm from flat land and 38mm from hill land.	
Mangatawhiri	Mangatawhiri C3	3	4.12		Various but eventually 19mm from flat land and 38mm from hill land.	
Mangatawhiri	Mangatawhiri C4	6	11.98		Various but eventually 19mm from flat land and 38mm from hill land.	
Mangatawhiri	Mangatawhiri C5	1	0.72		Various but eventually 19mm from flat land and 38mm from hill land.	
Mangati	none	1	13.03		Various but eventually 19mm from flat land and 38mm from hill land.	
Mangawara	none	6	8.55		Various but eventually 19mm from flat land and 38mm from hill land.	
Meremere East	none	6	9.67		Various but eventually 19mm from flat land and 38mm from hill land.	
Meremere West	none	none	none		Various but eventually 19mm from flat land and 38mm from hill land.	
Morrison Swamp	none	2	2.51		Various but eventually 19mm from flat land and 38mm from hill land.	
Motukaraka	none	13	22.8		Various but eventually 19mm from flat land and 38mm from hill land.	
Ohinewai	none	2	2.22		Various but eventually 19mm from flat land and 38mm from hill land.	
Onepoto	none	2	3.7		Various but eventually 19mm from flat land and 38mm from hill land.	
Onewhero Downstream	none	2	1.25		Various but eventually 19mm from flat land and 38mm from hill land.	
Orchard Road	none	2	1.53		Various but eventually 19mm from flat land and 38mm from hill land.	
Orton	none	5	7.48		Various but eventually 19mm from flat land and 38mm from hill land.	
Pukekapia	Pukekapia 1	4	5.95		Various but eventually 19mm from flat land and 38mm from hill land.	

Drainage area	Drainage subdivision	No Drains	Drain Length (m)	Additional Assets	Depth of Runoff per day	10% AEP V/d
Pukekapia	Pukekapia 2	3	3.68		Various but eventually 19mm from flat land and 38mm from hill land.	
Rangiriri North	none	4	4.49		Various but eventually 19mm from flat land and 38mm from hill land.	
Ruawaro	Ruawaro East	1	3.84		Various but eventually 19mm from flat land and 38mm from hill land.	
Ruawaro	Ruawaro No1, Central	1	0.72		Various but eventually 19mm from flat land and 38mm from hill land.	
Ruawaro	Ruawaro No1, Furniss	2	2.28		Various but eventually 19mm from flat land and 38mm from hill land.	
Ruawaro	Ruawaro North	2	2.84		Various but eventually 19mm from flat land and 38mm from hill land.	
Ruawaro	Ruawaro West	2	5.07		Various but eventually 19mm from flat land and 38mm from hill land.	
Swan Road	none	6	10.94		Various but eventually 19mm from flat land and 38mm from hill land.	
Te Kohanga	none	5	5.06		Various but eventually 19mm from flat land and 38mm from hill land.	
Tickles	none	none	none		Various but eventually 19mm from flat land and 38mm from hill land.	
Tuakau	none	3	3.04		Various but eventually 19mm from flat land and 38mm from hill land.	
Vrsaljkos Road	none	2	1.96		Various but eventually 19mm from flat land and 38mm from hill land.	
Waikare	Waikare Frost	2	2.97		Various but eventually 19mm from flat land and 38mm from hill land.	
Waikare	Waikare Nikau	1	1.97		Various but eventually 19mm from flat land and 38mm from hill land.	
Waikare	Waikare Ohinewai	4	2.31		Various but eventually 19mm from flat land and 38mm from hill land.	
Waikare	Waikare Rangiriri	3	5.23		Various but eventually 19mm from flat land and 38mm from hill land.	
Waikare	Waikare West	10	13.28		Various but eventually 19mm from flat land and 38mm from hill land.	
Waikorea	none	2	6.64		Various but eventually 19mm from flat land and 38mm from hill land.	
Waller Commins	none	1	0.66		Various but eventually 19mm from flat land and 38mm from hill land.	

Drainage area	Drainage subdivision	No Drains	Drain Length (m)	Additional Assets	Depth of Runoff per day	10% AEP Volume per day
Thames Valley	Ahikope SRA				38 mm. (1 1/2 ")	
Thames Valley	Bancrofts SRA				38 mm. (1 1/2 ")	
Thames Valley	Elstow	37	84.9		38 mm. (1 1/2 ")	
Thames Valley	Hungahunga	60	83.6		38 mm. (1 1/2 ")	
Thames Valley	Manawaru	59	121.5		38 mm. (1 1/2 ")	
Thames Valley	Matamata Urban				38 mm. (1 1/2 ")	
Thames Valley	Rowes East SRA				38 mm. (1 1/2 ")	
Thames Valley	Tahuna	29	36.5		38 mm. (1 1/2 ")	
Thames Valley	Tahuna SRA				38 mm. (1 1/2 ")	
Thames Valley	Tatuanui	64	94.8		38 mm. (1 1/2 ")	
Thames Valley	Waiheka	96	122.1		38 mm. (1 1/2 ")	
Thames Valley	Waihou	51	50.1		38 mm. (1 1/2 ")	
Thames Valley	Waitoa	51	71.5		38 mm. (1 1/2 ")	
Thames Valley	Whakahoro	58	93.3		38 mm. (1 1/2 ")	

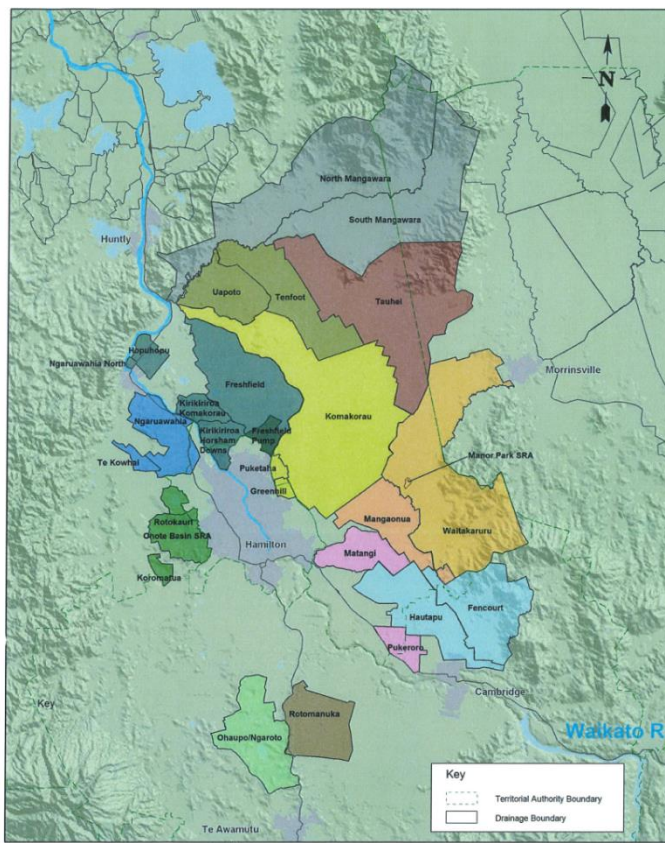
Waikato Central Land Drainage Network

The Waikato Central Land Drainage Network is made up of 28 individual subdivisions totalling approx. 103,000 hectares.

The Scheme includes 952km of drains.

Key issues

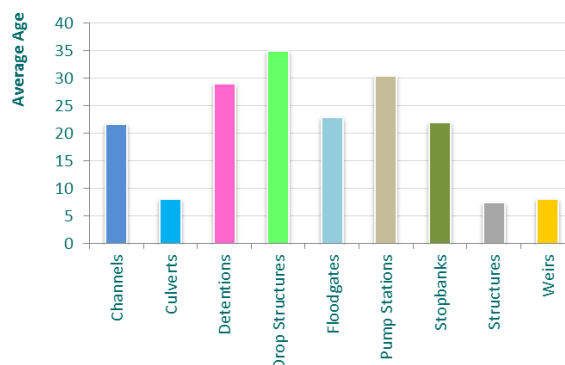
- Land use changes resulting in more surface water runoff into the land drainage network. These changes can also alter the level of service expectations particularly where subdivision results in the creation of smaller rural residential lots.
- Vegetation management – including pest plants such as alligator weed
- Roding network upgrades impact on drainage areas e.g. Waikato Expressway.
- Environmental Management – rules relating to work in Artificial channels vs modified natural
- Peat Settlement
- Presence of services such as power cables, water pipes, gas mains etc.



Assets summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Waikato central	\$15,000,951	\$13,621,957	\$50,625

Average asset age



Asset Current Condition

Generally, the twenty drainage network's assets that were inspected and assessed this year are in fair to good condition. No asset was assessed to be in poor or very poor condition.

The Ohote stopbank is in fair condition (grade 3) with some defects such as rutting and some undesirable vegetation. Assets that are in good condition included 8 floodgates, 2 pumpstations and 9 other in-river structures.

Drainage area	Drainage subdivision	No Drains	Drain Length (m)	Additional Assets	Depth of Runoff per day	10% AEP Volume per day
Eureka	Mangaonua	54	47.9		38 mm. (1 1/2 ")	
Eureka	Manor Park	2	1.3		38 mm. (1 1/2 ")	
Eureka	Waitakaruru	100	113.8		38 mm. (1 1/2 ")	

Drainage area	Drainage subdivision	No Drains	Drain Length (m)	Additional Assets	Depth of Runoff per day	10% AEP Volume per day
Fencourt	none	47	49.7		25 mm. (1")	
Waikato District	Greenhill	6	2.5		Various but generally 20mm	Needs handing over to HCC
Hautapu	none	84	79.8	+ 1 floodgate	25 mm. (1")	
Waikato District	Hopu	10	9		Various but generally 20mm	
Waikato District	Kirikiroa Horsham Downs	6	7.3		Various but generally 20mm	
Waikato District	Kirikiroa Komakorau	3	4.7		Various but generally 20mm	
Waikato District	Koromatua	1	3.1		Various but generally 20mm	
Waikato District	Matangi	33	31.2		Various but generally 20mm	
Waikato District	Ngaruawahia North	5	2.2		Various but generally 20mm	
Ohaupo/Ngaroto	none	16	23.6		25 mm. (1")	
Waikato District	Pukeroro	3	4.4		Various but generally 20mm	
Waikato District	Puketaha	9	6.7		Various but generally 20mm	
Rotomanuka	none	14	27.8		25 mm. (1")	
Taupiri	Freshfield	40	59.2		38 mm. (1 1/2 ")	
Taupiri	Freshfield Pump	4	5.2		38 mm. (1 1/2 ")	
Taupiri	Komakorau	87	175.4		38 mm. (1 1/2 ")	
Taupiri	North Mangawara	16	13.8		38 mm. (1 1/2 ")	
Taupiri	South Mangawara	25	33.2		38 mm. (1 1/2 ")	
Taupiri	Tauhei	36	81.3		38 mm. (1 1/2 ")	
Taupiri	Tenfoot	27	48.1		38 mm. (1 1/2 ")	
Taupiri	Uapoto	16	23.8		38 mm. (1 1/2 ")	
Waikato District	Te Kowhai	4	7.7		Various but generally 20mm	
Te Rapa	Ngaruawahia	59	50.6		38 mm. (1 1/2 ")	
Te Rapa	Ohote Basin	4	9	+ ohote stopbank and 7 floodgates	38 mm. (1 1/2 ")	
Te Rapa	Rotokauri	56	41.4		38 mm. (1 1/2 ")	

Aka Aka/Otaua Land Drainage Network

The Aka Aka/Otaua Land Drainage Network is made up of 1 subdivision totalling approx. 6,600 hectares.

The Aka Aka/Otaua drainage subcommittee carries out the day to day management of the 86km of drain on a largely voluntary basis. This committee liaises with Council staff on a regular basis.



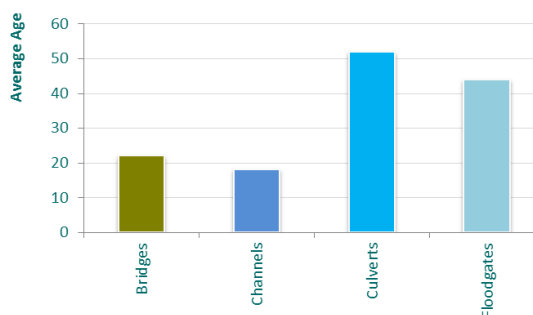
Key issues

- Vegetation management – including pest plants such as alligator weed
- Environmental Management – rules relating to work in artificial channels vs modified natural channels
- Peat Settlement
- Presence of services such as power cables, water pipes, gas mains etc.

Assets summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Aka aka / Otaua	\$1,598,397	\$1,335,536	\$7,309

Average asset age



Technical Details

Drainage area	Drainage subdivision	No Drains	Drain Length (m)	Additional Assets	Depth of Runoff per day	10% AEP Volume per day
Aka Aka Otaua	none	46	83	+ 9 floodgates, 1 bridge, 13 culverts	10 mm. (3/8 ")	

B2 Catchment Management Zones

The Waikato region has four major river catchments, spanning eleven District and City Councils. The day to day management is split into 8 management zones, who work with the various councils on the management on the flood, river, and drainage assets. The map below shows which District councils are interacting with each zone.

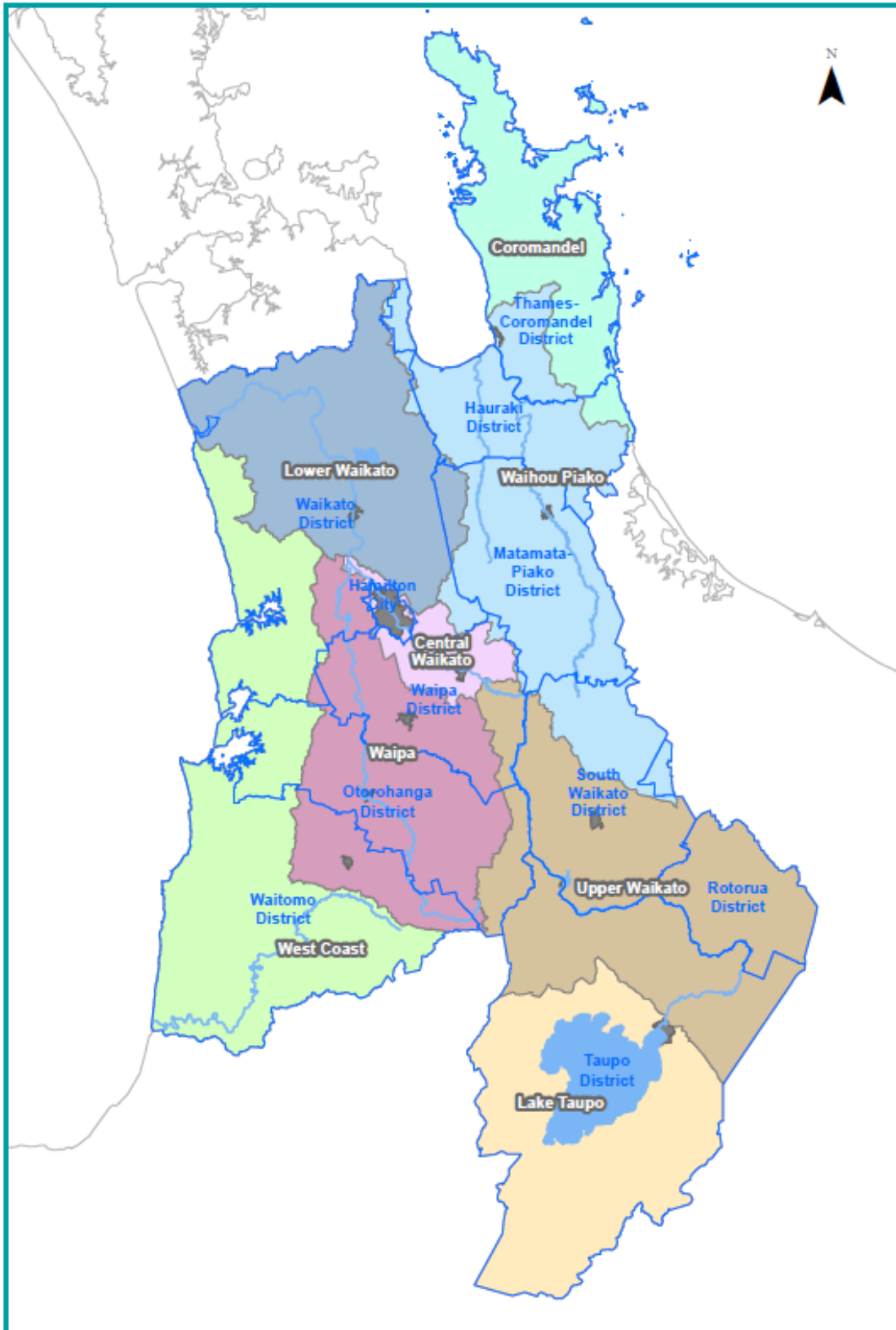


Figure 26: District and ICM Zone management boundaries

COROMANDEL ZONE

Zone Overview

The Coromandel zone has an approximate total area of 193,000ha, and covers most of the Coromandel Peninsula. The zone has an estimated 3,900km of rivers and streams. (Coromandel Zone Management Plan (Doc# 1897959 – Coromandel Zone Management Plan).

The total resident population within the zone is estimated at 19,000, while the total number of ratepayers is around 23,000, of which 51 percent are permanently occupied.

Zone Features

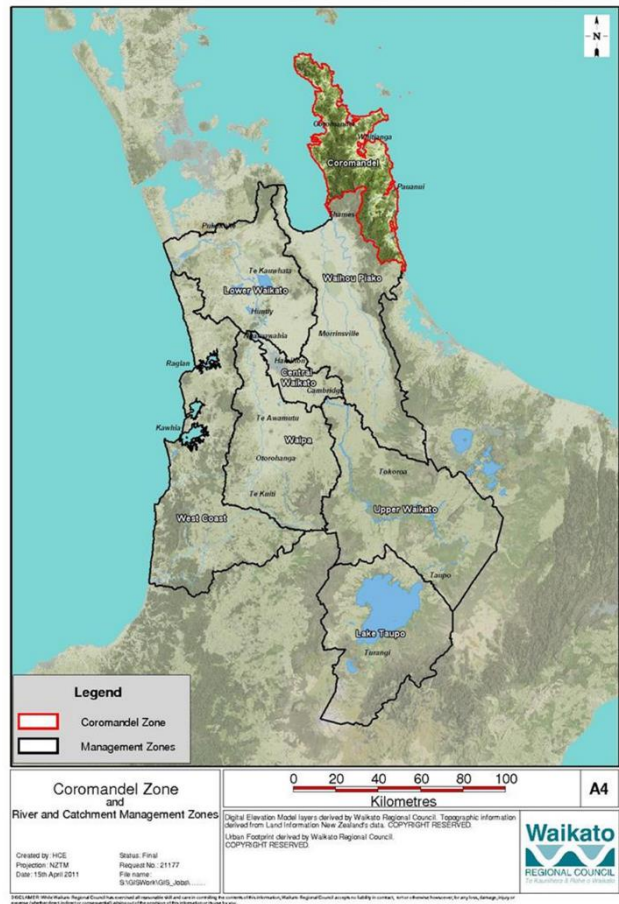
The dominant feature of the Coromandel zone are:

- Coromandel Range, Kaimai and Mamaku ranges
- Indigenous and threatened native flora and fauna

65 percent of the zone area is covered by indigenous vegetation, 22 percent by pasture and 12 percent by production forestry.

The majority of pasture land is used for dry stock, with a small percentage used for dairy and horticulture.

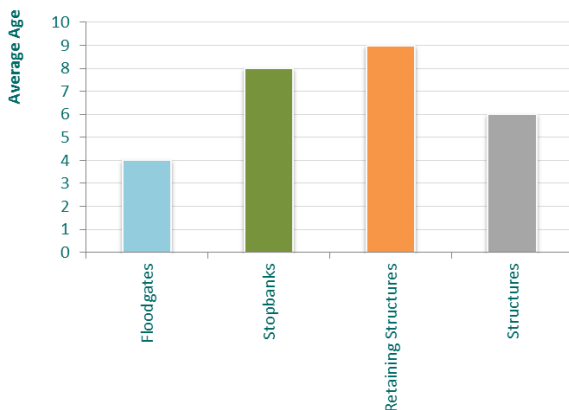
The main economic activities are primary production (farming, fishing and forestry) and tourism.



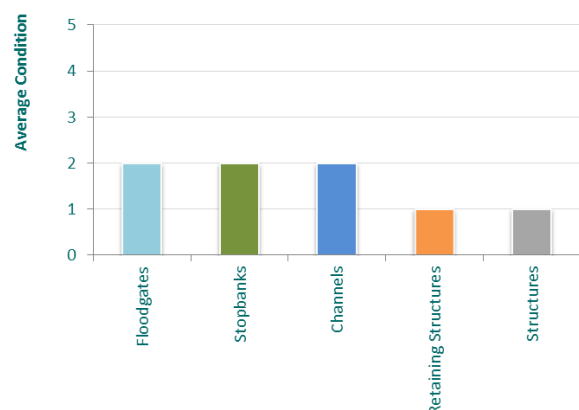
Coromandel River and Flood Protection Assets Summary

Assets

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Coromandel	\$3,109,747	\$2,255,939	\$99,795



Average Asset Age



Average Asset Condition

Asset Condition

Overall the flood protection assets are in good to excellent condition which is a reflection of the fact that the various flood protection schemes have been recently constructed between 2005 and 2016.

River and stream condition in the Coromandel is subject to significant impact from storm and flood events. This is due to the steep nature of the catchments and dynamic river systems. Inspections are carried out post event and repairs agreed on a prioritised basis.

WAIHOU PIAKO ZONE

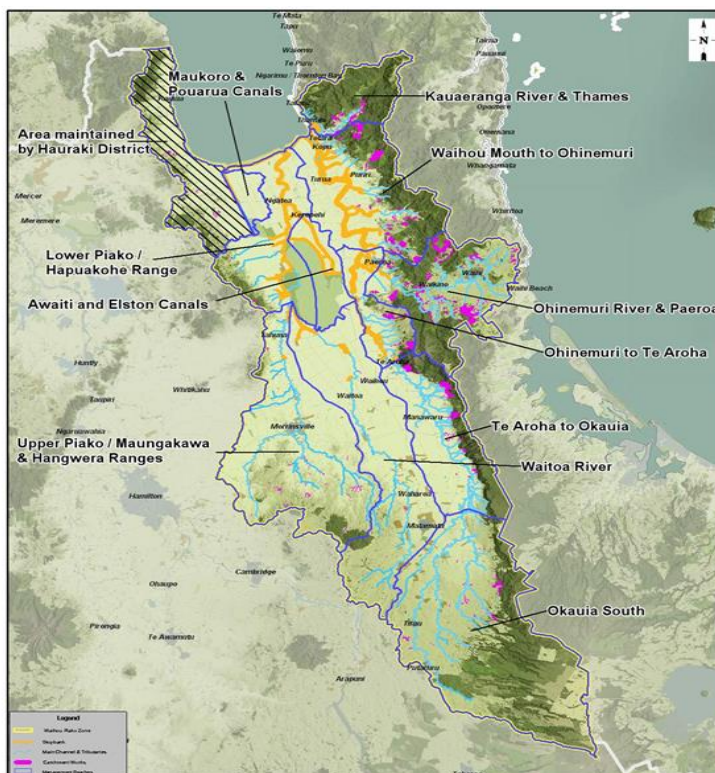
Zone Overview

The Waihou Piako zone covers an area of approximately 3,734 km², and is dominated by the Waihou and Piako river systems. The total number of individual rate payers within the zone is 28,500.

Zone features include:

- Waihou & Piako River systems
- Native forests of the Coromandel, Kaimai and Mamaku ranges
- Kopuatai Peat Dome and Torehape wetland
- Firth of Thames foreshore
- Indigenous vegetation in the Kaimai and Mamaku ranges
- Tangata whenua areas of special significance.

The main economic drivers are primary production (farming, forestry) and tourism.



Waihou Piako Zone River and Flood Protection Assets

The two largest rivers systems that the majority of River and Flood Protection assets are associated with are the Waihou and Piako Rivers.

On the Piako River the majority of scheme works are located within the lower reaches, between the mouth of the Piako River near Pipiroa to the confluence of the Piako and Waitoa Rivers. The Piako River experiences tidal influence from the Firth of Thames and stopbanks as far upstream as Kaihere on the Piako River and the Awaiti Canal are designed to protect against a tidal flood event.

Throughout the middle reaches there are a series of stopbanks and designated ponding zones. These are stopbanks designed to be overtopped at certain flood levels allowing larger flood events to be managed in a predictable way by the scheme.

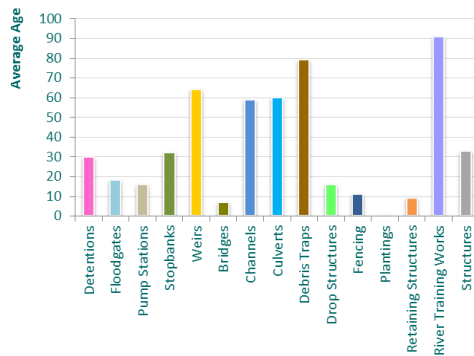
The Waihou River has a long narrow catchment bounded on the eastern side by the Coromandel, Kaimai and Mamaku Ranges. Many of the significant tributaries extend into these ranges so are susceptible to high intensity rainfall events from the north east. Upper tributaries respond quickly to rainfall due to the steep catchments. As with the Piako River the lower reaches of the Waihou River experience tidal influence.

A significant area of the Waihou Piako zone is low lying, with some areas being up to 2m below sea level. If sea level rise occurs as predicted, there is an increased risk of flood infrastructure failure and potential for widespread inundation which may impact on fresh water wetland systems, and the farming and urban communities.

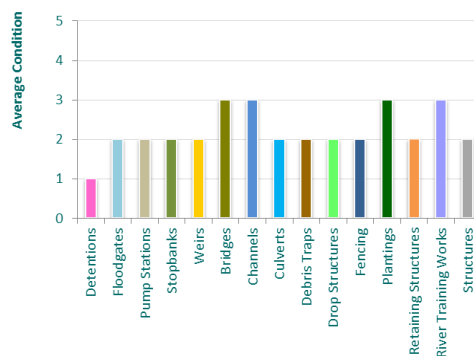
Critical flood protection assets within the zone include those protecting the urban areas of Te Aroha, Paeroa, Turua, Kopu and Thames.

Assets Summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Waihou Piako	\$404,677,832	\$288,784,670	\$4,261,266



Average Asset Age



Average Asset Condition

Key issues

- Assets within Tidal area experience higher utilization, floodgates may be submerged daily.
- Accelerated asset deterioration due to saline conditions
- Sedimentation of floodgate outlets
- Marine Mud foundations. Leads to settlement of Stopbanks and associated Floodgates and Pumpstations which can result in performance issues.
- Stopbank stability particularly on the left bank of the Piako River between Pipiroa and Ngatea due to narrow berms. Extensive berm stabilisation and widening work has been carried out over the past 10 years.

LAKE TAUPŌ ZONE

Zone Overview

The Lake Taupō zone comprises of the catchments discharging into Lake Taupō. It covers approximately 3,500 square kilometres.

The population of the Taupō district is approximately 35,850 people.

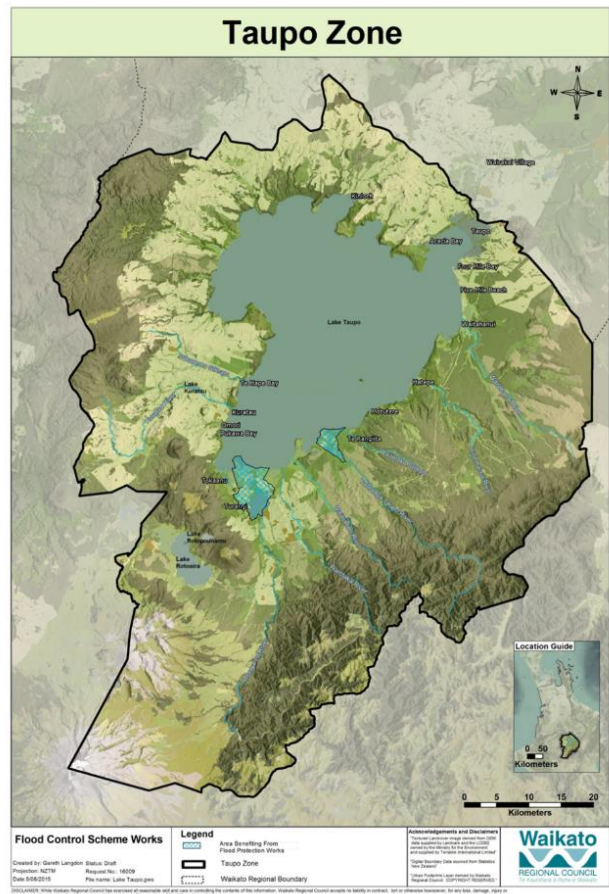
Key Features

The area includes the township of Taupō and is recognised as a tourist destination.

WRC has long-standing relationships with primary hydro generators Mercury Energy and Genesis Energy.

Mercury own and operate the Taupō control gates. Genesis Energy owns and operates the Tongariro power scheme. Flood management of the hydro system is achieved through consultation and agreement between Mercury and WRC as provided for within the high flow management plan. We work closely on implementing a high flow management plan during times of flooding

State Highway 1 also runs adjacent to Lake Taupō and crosses both the Tongariro and Tauranga Taupō rivers.



Lake Taupō Zone River and Flood Protection Assets

The Tongariro and Tauranga Taupō rivers have a recent history of flooding events resulting in inundation of land within the lower reaches of both rivers. Specifically, the township of Turangi and the communities of Oruatua and Te Rangiita are identified as being at risk of inundation from certain flooding events.

To provide the township of Turangi and the communities of Oruatua and Te Rangiita with an agreed level of protection from certain flooding events, WRC operates and manages two flood protection schemes:

- Tongariro flood protection scheme
- Tauranga Taupō flood protection scheme

WRC also undertakes works on rivers within the Lake Taupō catchment directed at controlling bank erosion, channel instability, riparian vegetation and the aggregation of riverbed sediments.

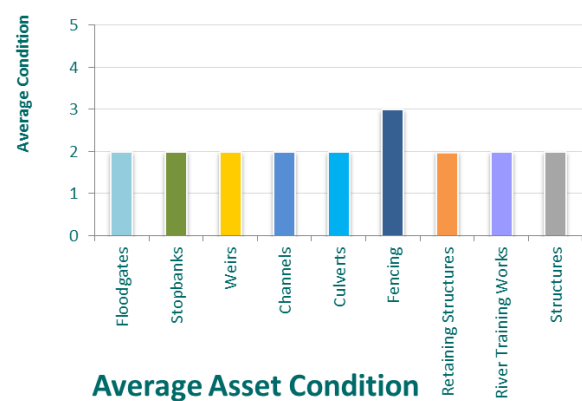
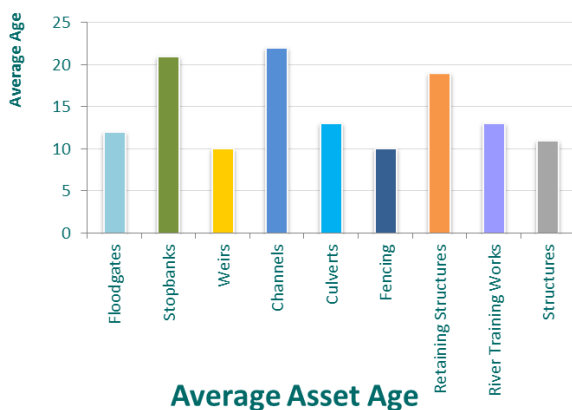
Taupō Specific Level of Service

Alignment	Requirement	Measure
Tongariro Flood Protection Scheme		
Level of Service	Design Discharge requirements met	1,500m ³ /sec with varying freeboard
Performance measure	100% compliance with resource consents	121305, 121306, 104532, 104807, 110223, 110224 and 030640.
Tauranga Taupō Flood Protection Scheme		

Alignment	Requirement	Measure
Level of Service	Design requirements met Discharge	Protection for the design discharge of 318m ³ /s.
Performance measure	100% compliance with resource consents	108324, 108325, 108326, 108697, 109978, 111087, 111088 and 117974.
River Management Services		
Performance measure	100% compliance with resource consents	107283, 107284 and 107285.

Assets Summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Taupo	\$8,316,186	\$5,750,321	\$120,812



Key issues

- Both Tongariro and Tauranga Taupo Rivers are 'Flashy' in nature and produce high velocity flood waters that can be damaging to river and flood management infrastructure.
- Gravel movement and aggradation are an issue on the Tongariro River
- Both Tongariro and Tauranga Taupo Rivers are susceptible to channel breakouts which can lead to the rivers changing course.
- Rivers in the zone have high recreational value and activities need to balance this against the desired river management outcomes.

WAIPA ZONE

Zone Overview

The Waipa zone covers an area of 306,569 hectares.

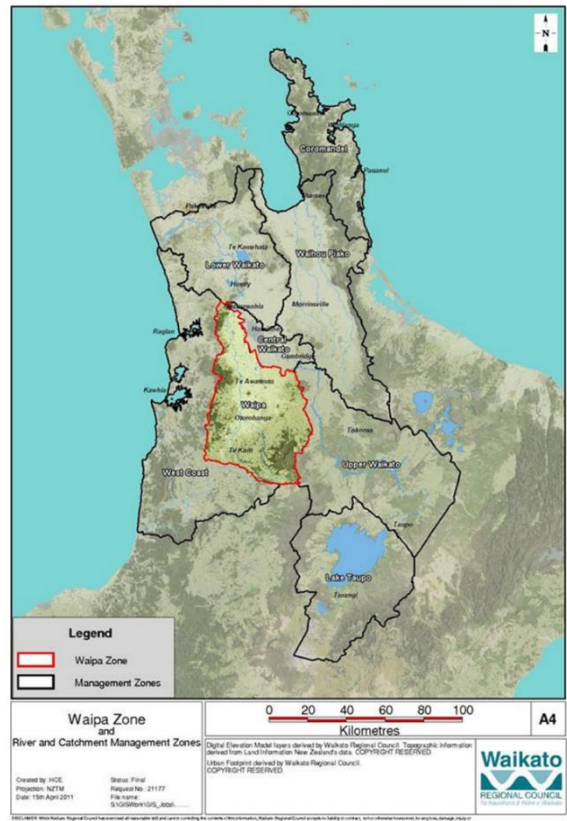
The Waipa River is the single largest tributary to the Waikato River, and is the largest part of the Waikato catchment area that is not affected by hydro-electric power generation activities.

Key Features

The Hakarimata ranges define the northern boundary of the zone. The volcanic cones of Pirongia and Maungatautari dominate the landscape from west to east.

The Waipa zone covers an area bordered by the catchment divides with the:

- Upper Waikato, West Coast, Central Waikato, and Lower Waikato.



Waipa Zone River and Flood Protection Assets

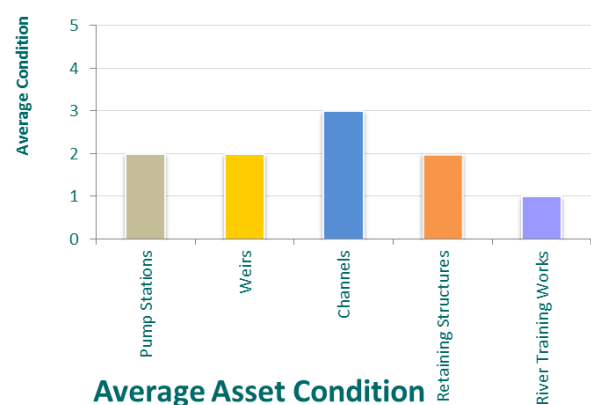
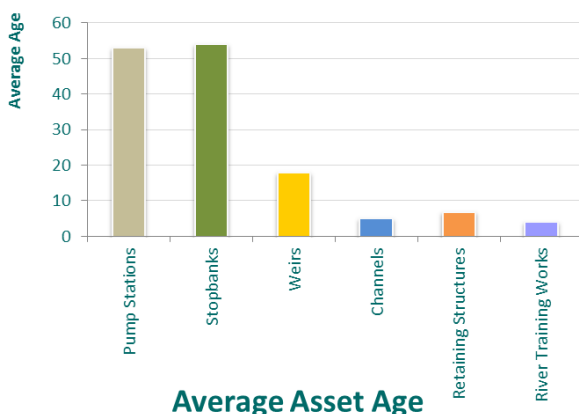
The Waipa Zone contains the Waipa River, the major tributary of the Waikato River. There have been flood protection works carried out to protect the townships of Te Kuiti and Otorohanga. The stopbanks and three pumpstations associated with the Otorohanga scheme are owned by the Otorohanga District Council and Waikato Regional Council assists with the management via a service level agreement.

The main river management activity challenges are maintaining channel capacity whilst managing bank erosion. This is achieved through vegetation management including removal of Crack Willows, removal of blockages and channel bank protection works.

River Management activities are generally undertaken in partnership with landowners on a cost share basis.

Assets Summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Waipa	\$1,397,869	\$1,203,072	\$26,859



Key issues

- Channel capacity – impacted by blockages and undesirable vegetation
- Bank erosion
- Vegetation management

UPPER WAIKATO ZONE

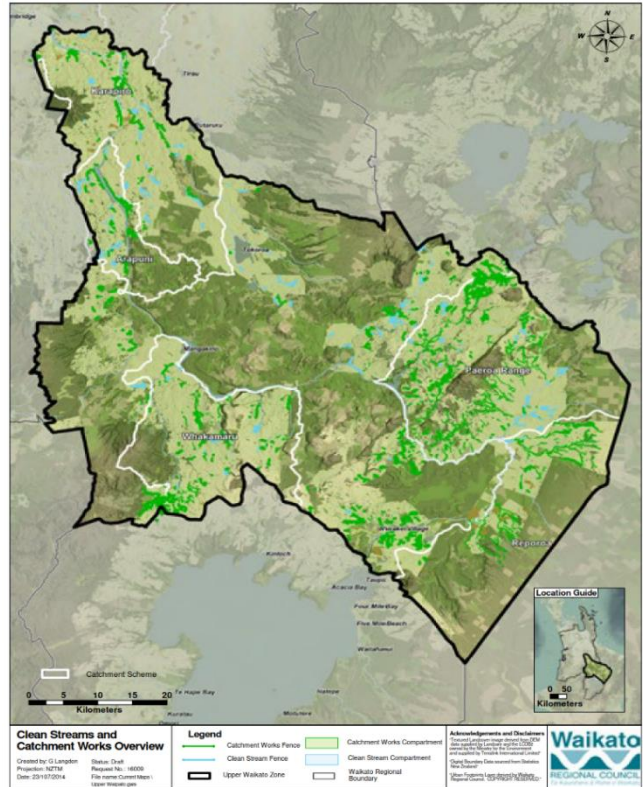
Zone Overview

The upper Waikato zone covers 436,000 hectares. Economic drivers for the zone are forestry, agriculture, energy production (hydroelectricity and geothermal) and tourism.

Zone Features

The area includes the hydro lakes of Aratiatia, Ohakuri, Atiamuri, Whakamaru, Maraetai, Waipapa, Arapuni and Karapiro

Geologically the zone is volcanic in nature with 68 per cent being comprised of Taupō pumice. The remainder is made up of other volcanic materials, including tephra and muds from the Rotorua Volcanic Centre. Much of the zone is characterised by young, soft and loose materials prone to erosion.

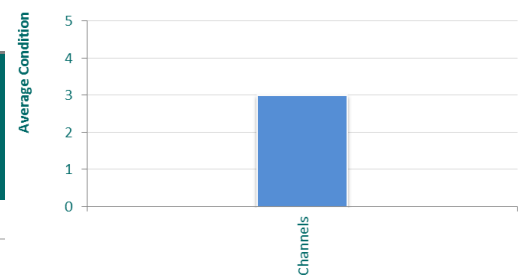


Upper Waikato Zone River and Flood Protection Assets

Forestry and pastoral farming are the predominant land uses but in recent years there has been a marked increase in dairy conversions and intensification.

Assets Summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Upper Waikato	\$265,193	\$123,757	\$8,835



Average Asset Condition

Key issues

The following issues have been identified as being particularly relevant to the Upper Waikato Zone:

- Declining water quality
- Erosion and changes in land use
- Loss of indigenous biodiversity
- Co-management
- Scheme management.

CENTRAL WAIKATO ZONE

Zone Overview

Waikato River has an area of 64,000 hectares. And contains the major population centre for the region (Hamilton city). The total number of rateable properties within the Central Waikato zone is 67,795.

Agriculture (dairy, dry stock farming) is the dominant economic activity. There is significant industrial activities including power generation, coal mining and quarrying.

Zone Features

The Central Waikato zone contains two dominant features,

- Waikato river and associate tributaries
- Urban areas of Hamilton, Cambridge, and Ngaruawahia

A number of elements of nationally important infrastructure traverse through the zone including:

- State Highway 1, 1B, 3, 26 and 39
- North Island Main Trunk Railway
- National electricity grid transmission lines.

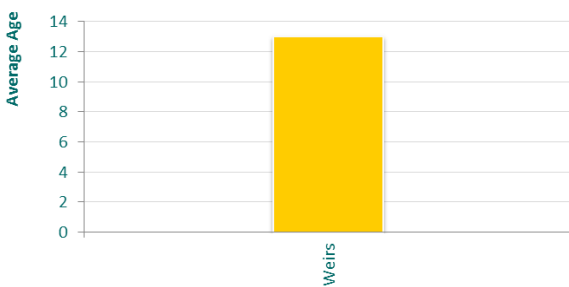
Central Waikato River and Flood Protection Assets

Assets Summary

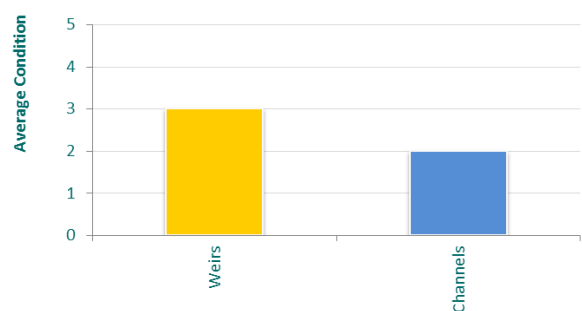
The Central Waikato is unique in that it is significantly more urbanised than other catchment zones within the region. In recognition of this the river management works programme within the Hamilton City boundary is carried out by Hamilton City Council under a Services Agreement with Waikato Regional Council.

There are no flood protection assets owned or management by the Waikato Regional Council

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Central Waikato	\$46,544	\$38,942	\$465



Average Asset Age



Average Asset Condition

LOWER WAIKATO ZONE

Zone Overview

The Lower Waikato zone covers an area of 283,757 hectares. It occupies a position at the lower end of the Waikato River catchment, and is the destination of all waters flowing into the Waikato River catchment, thus is heavily influenced by activities that occur higher in the catchment within each of the other four zones – Lake Taupō, Upper Waikato, Waipa and Central Waikato.

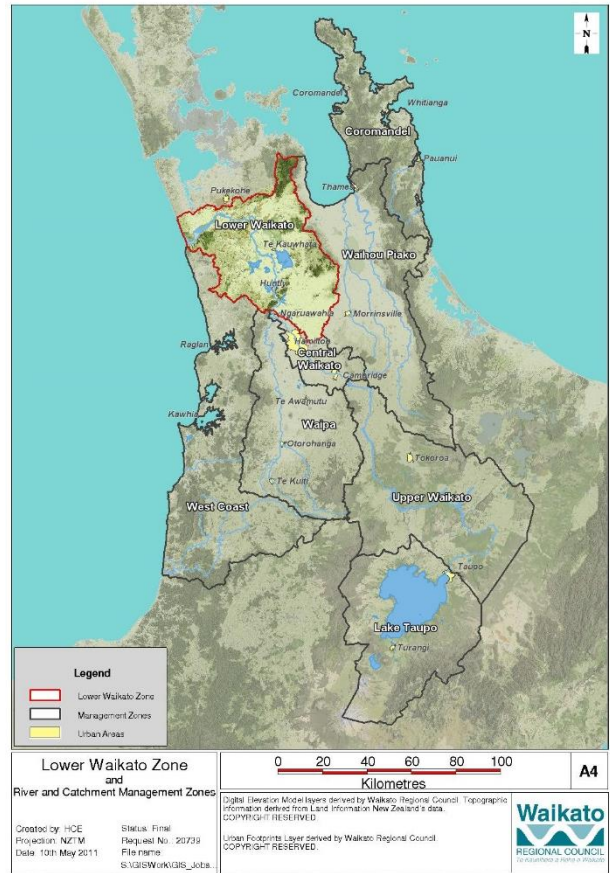
Zone Features

- Lower Waikato Flood Protection Scheme
- Lakes and wetlands.

The total number of individual rate payers within the Lower Waikato Zone is 15,970.

Agriculture (dairy and dry stock farming) are the dominant economic activities. There are also significant industrial activities including power generation, coal mining, quarrying and sand mining.

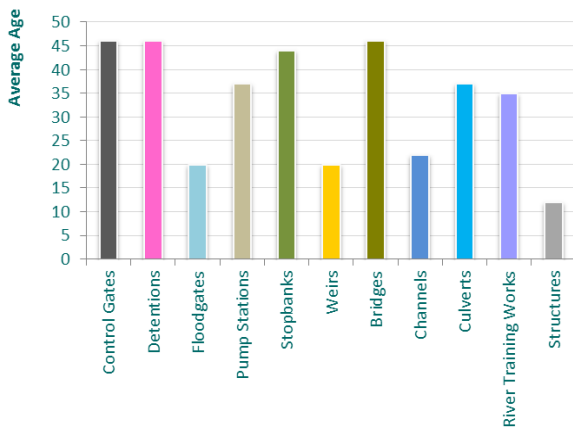
Nationally important infrastructure traverses through the zone, including State Highway 1, 1B, 2, 22 and 39, the North Island Main Trunk Railway, the national electricity grid transmission lines and the main natural gas pipeline to Auckland



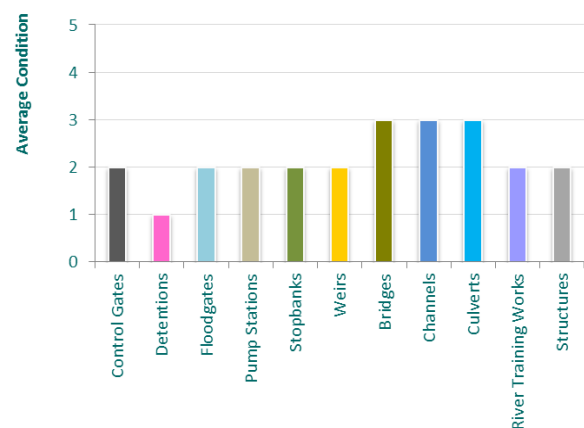
Lower Waikato River and Flood Protection Assets

Assets Summary

Catchment	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019	Annual Depreciation
Lower Waikato	\$191,695,067	\$133,753,261	\$1,848,112



Average Asset Age



Average Asset Condition

Key issues

- Environmental management
- Peat settlement

WEST COAST ZONE

Zone Overview

The West Coast zone covers a large geographic area of 425,835 hectares, and overall has a low population base of less than 3 per cent of the region’s population.

The West Coast zone is very sparsely populated and this is in part as a result of its rugged hill country and harbour topography. Agricultural land use on the West Coast generally remains of low intensity, and sheep and beef farming predominates.

Some isolated rural areas are experiencing population decline which may threaten the viability of some communities.

Zone Features

The zone contains a range of high value natural habitats, landscapes and ecosystems that make the West Coast unique, and highlight the importance of on-going initiatives to maintain and enhance the environment of the West Coast zone. These include the following:

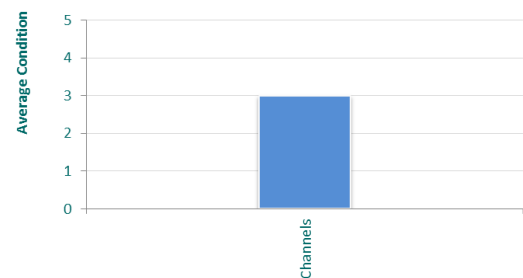
- Coastal landforms
- Harbours and major river mouths
- Dune lakes
- Considerable areas native bush.
- Karst landscapes
- A range of threatened plants and animals
- A rich cultural heritage
- Extensive areas of erosion prone (Class VI and VII) hill country



West Coast River and Land Assets

Assets Summary

Asset Category	Quantity	Optimised Replacement Cost @ 31/12/2019	Optimised Depreciated Replacement Cost @ 31/12/2019
Channels	254,825 m	N/A	N/A



Average Asset Condition

Key Issues

The key issues relating to the management of the West Coast zone are as follows:

- Stock access to waterways.
- Hill country management.
- Nutrient management.
- Increased stocking rates versus the capability of the land and soil.
- Loss of seeps and wet areas adjacent to streams.
- Riparian management.
- Impacts on water quality.
- Impacts on the habitats of taonga species.
- Negative effects on indigenous biodiversity, aquatic recreation and flood risks, as well as future pastoral productivity and community prosperity.

APPENDIX C – 50 YEAR BUDGET DETAIL BY ZONE

C1 50 Year Budget Details

50-Year Operations and Maintenance Budgets (000's) (includes inflation)

Service	Zone / Scheme	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Yr. 11-20	Yr. 21-30	Yr. 31-40	Yr. 41-50
River Management	Central Waikato	\$895	\$974	\$1,051	\$1,131	\$1,216	\$1,303	\$1,395	\$1,493	\$1,597	\$1,702	\$1,965	\$2,540	\$3,283	\$4,244
	Coromandel	\$591	\$641	\$680	\$726	\$745	\$762	\$781	\$802	\$825	\$847	\$978	\$1,264	\$1,634	\$2,112
	Lower Waikato	\$455	\$471	\$483	\$495	\$509	\$521	\$534	\$549	\$564	\$580	\$669	\$865	\$1,118	\$1,446
	Piako	\$527	\$563	\$584	\$598	\$619	\$629	\$640	\$661	\$674	\$688	\$794	\$1,026	\$1,327	\$1,715
	Taupō	\$382	\$369	\$373	\$378	\$387	\$392	\$397	\$407	\$414	\$389	\$449	\$581	\$751	\$971
	Upper Waikato	\$80	\$100	\$102	\$105	\$107	\$110	\$112	\$115	\$119	\$122	\$140	\$181	\$235	\$303
	Waihou	\$1,383	\$1,447	\$1,481	\$1,574	\$1,624	\$1,651	\$1,677	\$1,731	\$1,772	\$1,809	\$2,089	\$2,700	\$3,490	\$4,512
	Waipa	\$713	\$766	\$811	\$837	\$875	\$905	\$932	\$967	\$997	\$1,027	\$1,186	\$1,534	\$1,982	\$2,562
	West Coast	\$257	\$266	\$273	\$280	\$287	\$294	\$302	\$310	\$319	\$328	\$378	\$489	\$632	\$817
	TOTAL	\$5,282	\$5,598	\$5,839	\$6,123	\$6,369	\$6,567	\$6,770	\$7,036	\$7,280	\$7,490	\$8,650	\$11,181	\$14,452	\$18,682
Flood Protection	Coromandel	\$324	\$333	\$338	\$345	\$356	\$361	\$368	\$377	\$383	\$393	\$454	\$586	\$758	\$980
	Lower Waikato	\$5,144	\$5,828	\$5,977	\$6,108	\$6,375	\$6,456	\$6,603	\$6,894	\$6,981	\$7,079	\$8,175	\$10,567	\$13,659	\$17,656
	Piako	\$3,068	\$3,415	\$3,609	\$3,647	\$3,845	\$3,868	\$3,915	\$4,174	\$4,097	\$4,107	\$4,742	\$6,130	\$7,924	\$10,243
	Taupō	\$242	\$250	\$253	\$258	\$264	\$268	\$273	\$280	\$286	\$292	\$337	\$436	\$563	\$728
	Waihou	\$3,838	\$4,011	\$4,069	\$4,118	\$4,257	\$4,311	\$4,305	\$4,574	\$4,627	\$4,603	\$5,315	\$6,870	\$8,881	\$11,480
	Waipa	\$243	\$250	\$256	\$263	\$270	\$276	\$283	\$291	\$299	\$307	\$355	\$458	\$593	\$766
		TOTAL	\$12,859	\$14,086	\$14,503	\$14,738	\$15,367	\$15,540	\$15,748	\$16,590	\$16,674	\$16,781	\$19,378	\$25,048	\$32,378
Land Drainage	Aka Aka / Otaaua	\$323	\$333	\$341	\$348	\$358	\$365	\$373	\$383	\$393	\$403	\$465	\$601	\$777	\$1,004
	Franklin Waikato	\$569	\$588	\$603	\$616	\$635	\$648	\$663	\$682	\$701	\$725	\$837	\$1,082	\$1,398	\$1,808
	Thames Valley	\$811	\$831	\$850	\$853	\$878	\$896	\$915	\$940	\$966	\$991	\$1,144	\$1,479	\$1,912	\$2,471
	Waikato Central	\$1,385	\$1,434	\$1,465	\$1,478	\$1,514	\$1,551	\$1,582	\$1,628	\$1,667	\$1,713	\$1,978	\$2,557	\$3,305	\$4,272
		TOTAL	\$3,087	\$3,186	\$3,258	\$3,296	\$3,385	\$3,459	\$3,533	\$3,633	\$3,726	\$3,831	\$4,424	\$5,719	\$7,392
OVERALL TOTAL		\$21,228	\$22,870	\$23,600	\$24,157	\$25,121	\$25,567	\$26,051	\$27,260	\$27,680	\$28,102	\$32,451	\$41,947	\$54,222	\$70,089

See [Doc#17591626](#) for further details.

50-Year Capital Renewals Budgets (000's)

Years 11 through 50 are an average spend each year for each 10 year period

Service	Zone Scheme /	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11 - 20	Year 21 - 30	Year 31 - 40	Year 41 - 50
River Management	Central Waikato	\$35	\$36	\$42	\$43	\$44	\$45	\$47	\$48	\$49	\$51	\$58	\$75	\$98	\$126
	Lower Waikato	\$153	\$87	\$105	\$108	\$111	\$114	\$117	\$120	\$123	\$126	\$146	\$189	\$244	\$315
	Waipa	\$390	\$401	\$411	\$422	\$433	\$443	\$455	\$467	\$480	\$493	\$569	\$736	\$951	\$1,229
	West Coast	\$40	\$46	\$58	\$59	\$61	\$63	\$ 64	\$66	\$68	\$69	\$80	\$104	\$134	\$173
	TOTAL	\$618	\$571	\$617	\$632	\$649	\$665	\$682	\$701	\$720	\$739	\$854	\$1,103	\$1,426	\$1,844
Flood Protection	Central Waikato				\$640	\$3	\$3	\$3	\$3	\$3	\$3	\$4	\$5	\$26	\$8
	Coromandel	\$10			\$1	\$1	\$1	\$1	\$1	\$1	\$1	\$5	\$3	\$11	\$94
	Taupō		\$36		\$66	\$13	\$14	\$14	\$14	\$15	\$15	\$25	\$52	\$109	\$68
	Lower Waikato	\$10,578	\$8,261	\$7,351	\$4,813	\$5,222	\$6,914	\$6,020	\$2,979	\$4,239	\$4,091	\$4,511	\$8,607	\$9,369	\$7,564
	Piako	\$8,590	\$9,416	\$4,324	\$3,534	\$2,936	\$3,043	\$4,309	\$1,321	\$2,481	\$4,918	\$4,664	\$4,764	\$5,157	\$7,780
	Waihou	\$5,197	\$6,103	\$1,936	\$1,588	\$1,625	\$1,612	\$900	\$5,782	\$2,246	\$2,711	\$3,005	\$3,254	\$6,946	\$12,787
	Waipa				\$70	\$228							\$80		\$7
TOTAL	\$24,375	\$23,816	\$13,611	\$10,712	\$10,028	\$11,587	\$11,247	\$10,101	\$8,986	\$11,740	\$12,215	\$16,765	\$21,618	\$28,307	
Land Drainage	Aka Aka / Otaua				\$75	\$77			\$84	\$86	\$44	\$159	\$8		
	Franklin Waikato										\$62	\$10	\$586		
	Thames Valley				\$106					\$94	\$1,531	\$1,263	\$2	\$44	\$16
	Waikato Central			\$4	\$4		\$ 37				\$1,805	\$1,438	\$183		
	TOTAL			\$4	\$185	\$77	\$37		\$84	\$180	\$3,442	\$2,870	\$780	\$44	\$16
OVERALL TOTAL		\$24,993	\$24,387	\$14,232	\$11,529	\$10,754	\$12,289	\$11,930	\$10,885	\$9,887	\$15,921	\$15,938	\$18,649	\$23,088	\$30,167

50-Year New Capital Programme (000's) Figures are the total expected expenditure for each time frame. Inflation NOT included.

Service	Zone / Scheme	Year 1 - 3	Year 4 - 10	Year 11 - 20	Year 21 - 30	Year 31 - 40	Year 41 - 50
Flood Protection & River Management	Coromandel		7	12	16	21	24
	Waihou	200	342	351			
	Piako	2,472	2,819	5,025	6,496	8,397	9,639
	Taupō		98	176	227	294	337
	Waipa	1,202	3,192	5,690	7,355	9,508	12,290
	Upper Waikato						
	Central Waikato	113	898	623	805	1,041	1,336
	Lower Waikato	2,374	4,997	8,907	11,513	14,883	17,437
	West Coast	144	450	802	1,037	1,340	1,733
	TOTAL						
Land Drainage	Franklin Waikato		34	5	5,857	1,834	
	Thames Valley		1,329	11,976	24		
	Waikato Central		1,789	13,370			
	Aka Aka / Otaua				1,545	8	
		TOTAL					
Overall							

Planned new works:

- Lower Waikato: Canal improvement works
- Piako: Mugeridge's Pump station, if central government funding is approved.
- Waihou: land purchase to increase stopbank size at Kirikiri bridge

Expected future new works:

- Aka aka / Otaua: expectation is in 30 – 40 years, due to climate change, and land sinkage additional drainage will be required.
- Coromandel: expectation is due to increased storm sizes, and changes in river morphology, additional stone works / groynes may need to be built to protect the stopbanks.
- Central Waikato: expectation is river edge stability will be required.

- Franklin Waikato: population increased in the area are likely to precipitate the need for additions to the drainage network.
- Lower Waikato: river stability works (none have been programmed since the late 1990's) and stopbank height adjustments due to changing weather patterns.
- Piako: expectation is in 30 – 40 years, due to climate change, and land sinkage (peat soil collapse), stopbanks will need to be made higher.
- Thames Valley: expectation is in 10 – 20 years, due to climate change, and land sinkage additional drainage will be required
- Waikato Central: expectation is in 10 – 20 years, due to climate change, and increases in subdivisions in the area, additional drainage will be required
- Waipa: this river provides much of the soil into the Waikato river, works are expected for river edge stabilisation.
- Waihou: expectation is in 10 – 20 years, due to climate change, and land sinkage (peat soil collapse), stopbanks will need to be made higher.
- West Coast: river works to provide bank stability & enable National Environmental Standards to be achieved.