Implementation Committee Agenda - 10 March 2021

Meeting is held in the Council Chamber, Level 2, Philip Laing House
144 Rattray Street, Dunedin

Members:

Cr Bryan Scott, Co-Chair	Cr Gary Kelliher
Cr Carmen Hope, Co-Chair	Cr Michael Laws
Cr Hilary Calvert	Cr Kevin Malcolm
Cr Michael Deaker	Cr Andrew Noone
Cr Alexa Forbes	Cr Gretchen Robertson
Hon Cr Marian Hobbs	Cr Kate Wilson

Senior Officer: Sarah Gardner, Chief Executive

Meeting Support: Liz Spector, Committee Secretary

10 March 2021 09:00 AM

Agenda Topic — Page

Minutes of a meeting of the Implementation Committee held in the Council Chamber on Wednesday 14 October 2020, commencing at 9:00 am

Membership

Cr Carmen Hope	*(Co-Chair)*
Cr Bryan Scott	*(Co-Chair)*
Cr Hilary Calvert	
Cr Michael Deaker	
Cr Alexa Forbes	
Hon Cr Marian Hobbs	
Cr Gary Kelliher	
Cr Michael Laws	
Cr Kevin Malcolm	
Cr Andrew Noone	
Cr Gretchen Robertson	
Cr Kate Wilson	

Welcome

Co-Chair Scott welcomed Councillors, members of the public and staff to the meeting at 9:00 a.m.

Staff present included: Sarah Gardner (Chief Executive), Nick Donnelly (GM Corporate Services), Gavin Palmer (GM Operations), Amanda Vercoe (Executive Advisor), Richard Saunders (GM Regulatory), Ryan Tippet (Media Communications Lead), Liz Spector (Committee Secretary), Andrea Howard (Manager Biosecurity and Rural Liaison) and Richard Lord (Team Leader Biosecurity and Biodiversity).

1. APOLOGIES

Resolution

That the apologies for Cr Laws be accepted.

Moved: Cr Hope
Seconded: Cr Wilson
CARRIED

2. CONFIRMATION OF AGENDA

The agenda was confirmed as published.

3. CONFLICT OF INTEREST

No conflicts of interest were advised.

4. PUBLIC FORUM

There were no requests to address the Committee.

5. CONFIRMATION OF MINUTES

There are no previous minutes of the Implementation Committee.

6. ACTIONS

There are no outstanding actions of the Implementation Committee.

7. MATTERS FOR COUNCIL DECISION

7.1. Biosecurity Implementation Improvement Update - Pest Management

Cr Calvert left the meeting at 09:52 am.
Cr Calvert returned to the meeting at 9:55 am.

This report was provided to update the Committee on the programme of change underway for the ORC's biosecurity function through a range of business improvement initiatives. Progress in implementing new rabbit management initiatives under the Regional Pest Management Plan 2019-2029 includes better engagement with specific communities, tangible solutions to facilitate rabbit control in problematic peri-urban areas and stepped up monitoring and compliance programmes.

A decision was also sought on future ownership and use of ORC's rabbit control assets. The ORC owns rabbit control assets retained from its former Regional Services function which ended in 2015. Public input was sought on what do with the idle equipment and the site in which it is stored. A survey was added to the ORC website and 160 submissions were received. Submitters were overwhelmingly in favour (71% for each question) of Council retaining the rabbit control assets and the building in which they are housed.

Gavin Palmer (GM Operations), Andrea Howard (Manager Biosecurity and Rural Liaison) and Richard Lord (Team Leader Biosecurity and Biodiversity) were present to speak to the report and respond to questions. Co-Chair Scott summarised the paper and indicated that he wanted to consider options for the future of the ORC rabbit control assets in a separate motion.

After a lengthy discussion, Cr Wilson moved:

Resolution

That the Committee:

1) ***Receives** this report.*
2) ***Notes** the recent development and implementation of a programme of work to deliver on Council's feral rabbit responsibilities under the previously approved Regional Pest Management Plan, Operational Plan.*
3) ***Notes** progress made in developing a revised inspection and compliance approach.*
4) ***Notes** increased operational focus on land occupier compliance including land owned or controlled by the Crown, Crown agencies and local authorities.*
5) ***Notes** progress made by the Otago Regional Council to establish and implement a model to support small-scale landowner led rabbit control operations.*
6) ***Notes** the range of business improvements made to the rabbit programme, and wider Biosecurity function, to order to achieve the objectives of the Regional Pest Management Plan, Operational Plan and better meet community expectations.*
7) ***Notes** the planned recruitment of three additional fixed-term positions within the Biosecurity team, two of which will focus exclusively on ORC's Regional Pest Management Plan - Rabbit Programme.*
8) ***Notes** that detailed resourcing required to better deliver a comprehensive rabbit management programme aligned to Council's responsibilities under the Regional Pest Management Plan and communities' expectations will be presented as part of the forthcoming Long-Term Plan 2021-2031 development process.*

Moved: Cr Wilson
Seconded: Cr Noone
CARRIED

A discussion was then conducted about which option was preferred to deal with the idle rabbit control assets. After a debate, it was determined to eliminate staff option 1, which was to dispose of all the assets via tender because it did not account for the views received in the survey submissions. After debate, the group suggested staff come back with a paper detailing pros and cons of Option 2, to rationalise and retain the assets, and Option 3, to rationalise and lease the assets for further determination.

Resolution

That the Committee:

1) ***Affirms** options 2 or 3 when considering the future use of ORC rabbit control assets.*

Moved: Cr Calvert
Seconded: Cr Forbes
CARRIED

8. MATTERS FOR NOTING

8.1. Catchment Support Advisory Group Report Back

The report was provided to the Committee to update on activities of the Catchment Support Advisory Group. This Group was established to provide advice to Council on the best way for ORC to support the ongoing work of catchment groups to maintain and improve water quality in Otago. The Advisory Group met four times since July 2020, developing a set of working principles and an approach to allocate the funding set aside in this year's budget to support local groups to improve water quality.

Co-Chair Carmen Hope took over chairing duties for the remainder of the meeting. Gavin Palmer (GM Operations) and Andrea Howard (Manager Biosecurity and Rural Liaison) were present to speak to the report and respond to questions.

After questions and discussion on the report, Cr Wilson moved:

Resolution

That the Committee:

1) ***Receives** this report.*
2) ***Notes** the previously approved allocation of $200,000 in the 2020/2021 financial year to fund the development of an umbrella entity and to support co-ordination and administrative roles that facilitate 'on the ground' action to improve water quality in the region's water bodies.*
3) ***Notes, with thanks,** that the Catchment Support Advisory Group has completed its work and has now disbanded.*
4) ***Notes** that Council will be asked to nominate representatives for the new Otago Catchment Communities governance board.*
5) ***Endorses** establishing a Memorandum of Understanding between the Otago Regional Council and the umbrella entity, once formed, detailing ongoing partnership and collaboration roles and responsibilities.*
6) ***Notes** that, once formed, a funding agreement will be established with the umbrella entity detailing payments, deliverables and reporting requirements.*
7) ***Notes** that a longer-term budget for supporting the region's Catchment Groups will be presented as part of the forthcoming Long-Term Plan 2021-2031 development process.*

Moved: Cr Wilson
Seconded: Cr Malcolm
CARRIED

9. CLOSURE

There was no further business and Co-Chair Hope declared the meeting closed at 10:15 a.m.

_____ _____

Co-Chairperson Date

7.1. Infrastructure Strategy for LTP 2021-31

Prepared for:	Implementation Committee
Report No.	ENG2101
Activity:	Flood Protection & Flood Control Works
Author:	Michelle Mifflin, Manager Engineering Pam Wilson, Engineering Infrastructure Lead
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	1 March 2021

PURPOSE

[1] To seek Committee approval of the draft 2021-2051 Flood Protection, Land Drainage and River Assets Infrastructure Strategy which will form part of the Draft 2021-31 Long Term Plan (LTP).

EXECUTIVE SUMMARY

[2] Otago Regional Council (ORC) provides flood protection and land drainage to approximately 21,000ha of rural and urban land in Otago. This is achieved through infrastructural assets that include 218km of floodbanks, 12 pumping stations, 55 bridges and culverts and various river assets (e.g., Shotover delta training line, Albert Town riverbank rockwork).

[3] The community is dependent on the effective performance of this infrastructure for their safety and economic wellbeing. This includes parts of the Dunedin Central Business District, University of Otago city campus, Dunedin International Airport and the townships of Balclutha, Alexandra and Mosgiel. Approximately 7,462ha of land that relies on ORC's flood protection and land drainage infrastructure is less than one metre above current mean sea level.

[4] The Local Government Act 2002 requires an infrastructure strategy to be developed which sets out the management and future considerations of flood protection and flood control works. A strategy has been prepared for the period 2021 to 2051 (attachment 2).

[5] The purpose of this strategy is to:

a. identify any significant issues the Council is likely to face during the thirty-year period; and

b. identify the principal options for managing decisions around those issues (and the implications of those mechanisms) along with the timing of when key decisions are required.

[6] The strategy identifies the existing infrastructure in place, noting that no new infrastructure is planned in the short term. The focus is on maintaining the current flood

protection, land drainage and river assets and how we continue to achieve the current levels of service.

[7] Sustainability of the existing infrastructure and current levels of service are a key focus in the strategy as we plan for the effects of climate change, changing land use and increased weather events, increasing pressure on current asset performance.

[8] The pressure on our asset performance will also in the long-term require an assessment on the effectiveness of the current funding model for flood protection, land drainage and river assets regarding cost / benefit ratios considered and affordability across communities. Many assets were constructed with central government funding contributions. Government funding for construction and renewal ceased in the 1980s but community dependency on those assets has endured. Non-rateable Crown-owned or controlled entities rely on these same assets.

[9] The draft 2021-2051 Infrastructure Strategy is an update on the previous 2018 – 2028 Long Term Plan Infrastructure Strategy.

RECOMMENDATION

That the Committee:

1) ***Receives*** *this report.*

2) ***Approves*** *the draft 2021-2051 Infrastructure Strategy to be included in the information available for community consultation in the Long-Term Plan 2021-31 process, subject to any minor editorial changes made by staff.*

3) ***Notes*** *that the Infrastructure Strategy is to provide the framework (direction) for managing current assets and making future decisions that are identified by the significant issues.*

BACKGROUND

[10] ORC provides flood protection and land drainage to approximately 43,000ha of rural and urban land in Otago. This is achieved through infrastructural assets that include 218km of floodbank, 12 pumping stations, 55 bridges and culverts and various river assets (e.g. Shotover delta training line, Albert Town riverbank rockwork). Table 1 provides a summary of the key flood protection and drainage infrastructural assets of ORC.

Table 1 Asset portfolio summary for ORC flood protection and land drainage schemes

Scheme	Catchment Area (,000 ha)	Area Protected (,000 ha)	Assets
Alexandra Flood Protection	1,511	0.01	1 - 3 - -
Leith Flood Protection	4	0.2	- - - - -
Lower Clutha Flood Protection and Drainage	2,110	9.3	110 153 5 189 5
Lower Taieri Flood Protection	565	13	107 - - - -
West Taieri Drainage	8	8.1	- 144 3 22 20
East Taieri Drainage	17	4.8	- 128 3 84 1
Tokomairiro Drainage	40	7.7	- 110 - 74 19
Total	**4,256**	**43**	218 535 14 369 55

Key

- Length of floodbanks (km)
- Length of drains (km)
- No. of pump stations
- No. of culverts
- No. of bridges

[11] The community is dependent on the effective performance of this infrastructure for their safety and economic wellbeing. This includes parts of the Dunedin Central Business District, University of Otago city campus, Dunedin International Airport and the townships of Balclutha, Alexandra and Mosgiel. Approximately 7,462ha of land that relies on ORC's flood protection and land drainage infrastructure is less than one metre above current mean sea level.

[12] Some of these assets were initially constructed in the late nineteenth century whereas others, such as parts of the Leith Flood Protection Scheme, were constructed in the last three years (Figures 1 and 2). These assets are typically arranged into "schemes" so that they function as an integrated system (Figure 3).

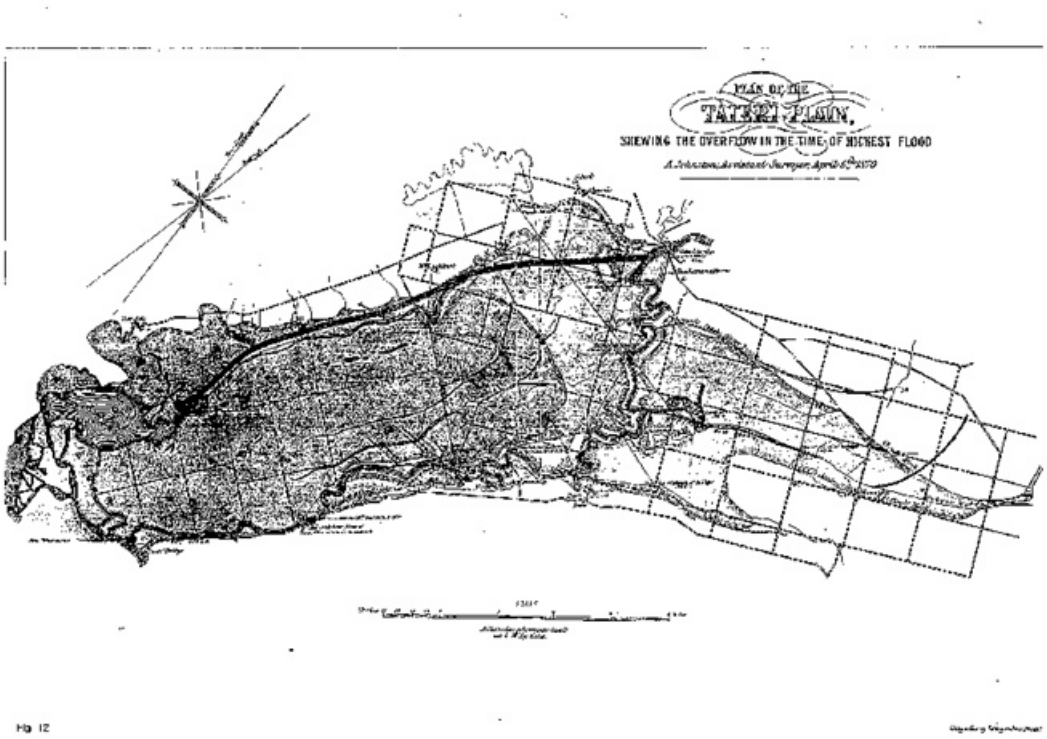

Figure 1: Early plan of Lower Taieri flood works development

Figure 2: Leith Flood Protection Scheme at University of Otago Registry building

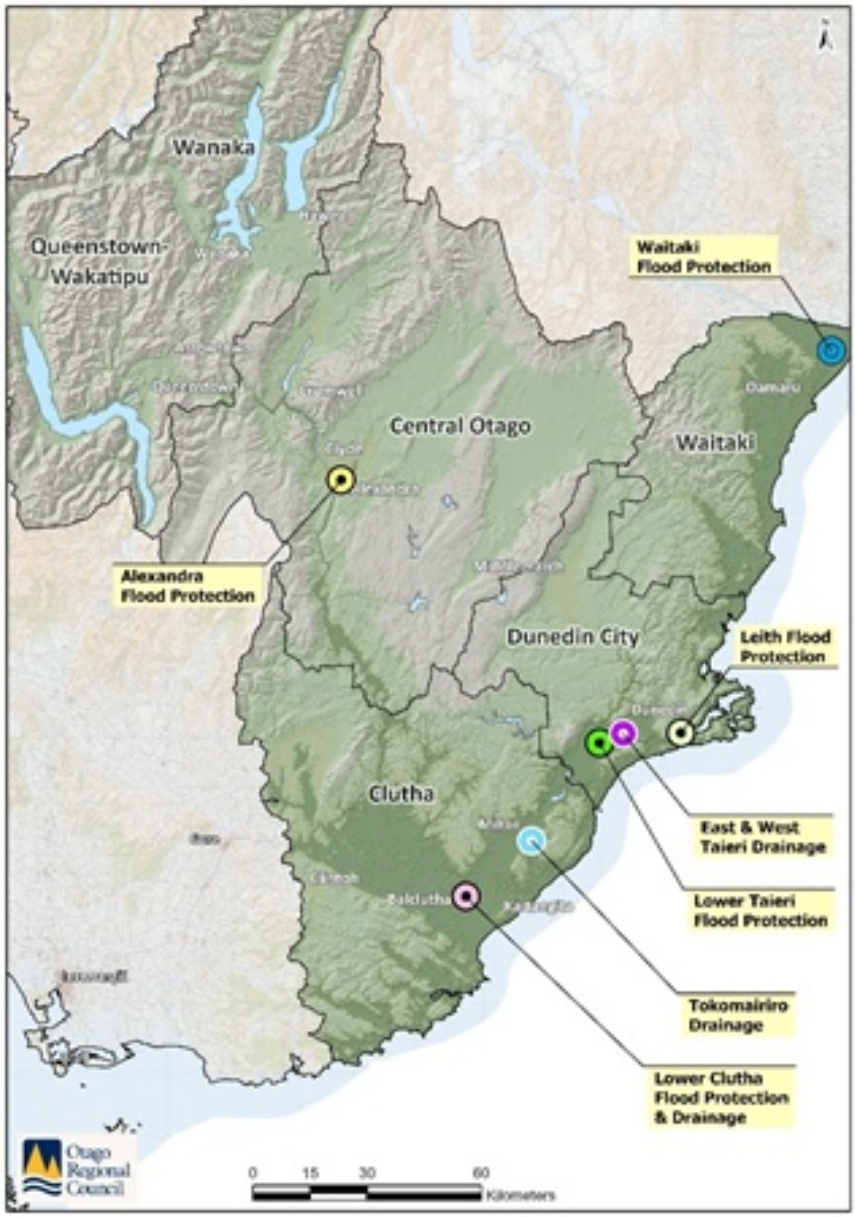

Figure 3: Otago Regional Council flood protection and drainage schemes.

[13] The Local Government Act 2002 ("LGA 2002") requires a 30-year strategy to be prepared for particular types of infrastructure assets managed by territorial authorities and regional councils.

[14] This Strategy has been prepared for flood protection, land drainage, and river asset infrastructure as required under section 101B of the LGA 2002. It covers the types of infrastructural assets of ORC described in Figure 4.

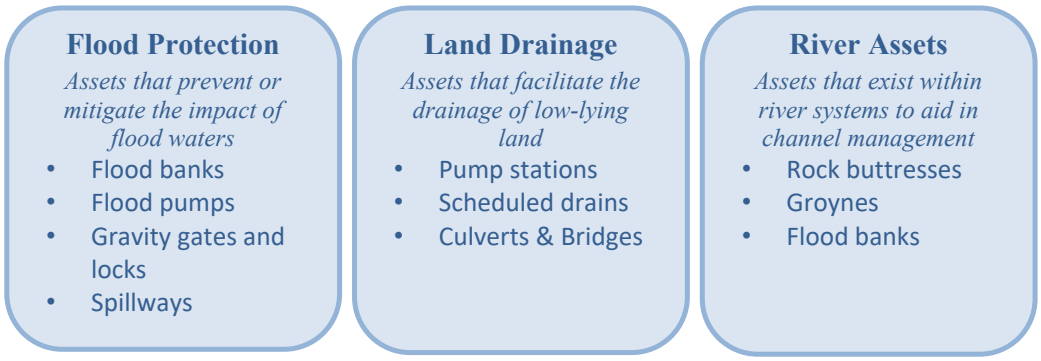

Figure 4: Otago Regional Council infrastructural assets by type.

[15] The year 2021 marks the Council's third Infrastructure Strategy since the inaugural strategies were developed in 2015. Throughout this time, various reviews and reports, outlined below, have disseminated best practice in infrastructure management in the Local Government Sector. As well as these reports, best practice has been pulled from other Local Authorities who have set great examples in developing their infrastructure strategies.

[16] The main updates from Council's previous strategies include:

a. Incorporating appropriate recommendations and learnings from Audit NZ's report "*Asset management and long-term planning: Learnings from audit findings 2015 to 2017*";
b. Incorporating appropriate recommendations and learnings from the Office of the Auditor General's reports "*Matters arising from the 2015-25 local authority long term plans*" and "*Matters arising from the 2018-28 local authority long term plans*";
c. Major structural changes and development to the overall strategy document;
d. Addition of asset information and current state of the flood and drainage infrastructure;
e. Updates to asset and demographic data to reflect the most recent information available; and
f. Addition of significant infrastructure issues, principal options, and their implications.

[17] Council understands that providing and maintaining its infrastructure requires good asset management practices and strategic thinking. In response to this Council have also:

a. Updated the Flood Protection and Drainage Asset Management Plans (previously completed in 2014).
b. Carried out an asset management maturity assessment of flood protection and drainage activities.
c. Developed a three-year asset management improvement plan that sets out improvement items over eight overarching improvement projects.

DISCUSSION

[18] This Strategy outlines the key issues, implications, and most likely scenarios for how Council intends to manage its flood protection, land drainage and asset infrastructure over the next 30 years.

[19] This Strategy has a 30-year planning horizon and will be reviewed every three (3) years to align with Long Term Plan cycles. The planning horizon extends well beyond the more detailed planning included in the LTP as a longer time horizon is required to consider the whole life cycle of the infrastructural assets. This helps the Council and the community to see the longer-term approaches planned and what can be expected for Otago up to 2051.

[20] The long planning horizon also recognises that some issues require long lead times. For example, addressing the effects that retreat of the Clutha delta shoreline and sea level rise induced rise in groundwater will have on the Lower Clutha Flood Protection and Land Drainage Scheme.

[21] The Infrastructure Strategy fits within a decision-making and operational framework that ultimately provides direction for the LTP. This is depicted in Figure 5.

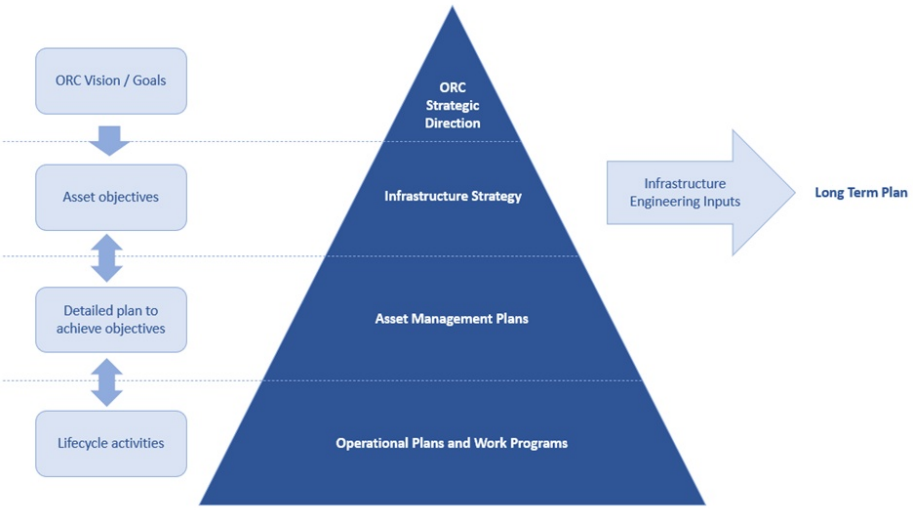

Figure 5: Linkages between the Infrastructure Strategy and other key Council documents.

[22] The significant issues facing flood protection, river assets and drainage activities for the Otago Regional Council are presented diagrammatically in Figure 6. All significant issues are inextricably linked to one another, with one common denominator being 'Scheme Performance'.

Figure 6: Significant issues and association with each other

[23] The Infrastructure Strategy presents why these significant issues have been identified, the options for managing these issues, and a suggested preferred approach to aid in decision making that will be required over the term of the 30-year strategy.

[24] The decision between the *preferred approach* and *alternative scenarios* will depend on the strategic direction of the Otago Regional Council and community consultation undertaken on the significant change, outcome, and associated effects[1].

[25] The Council will need to respond to some significant challenges, where the status quo will not deliver the future the Otago region and communities are striving towards.

[26] During the lifetime of the strategy, decision making may also be influenced by unforeseen events, such as the examples of Covid19 and increased weather events. The strategy allows us to adapt our management and decision making in response to these events.

[27] It is noted that ORC manages flood hazard risks and land drainage through a range of methods not limited to infrastructure. The methods include collaboration with territorial authorities on District Plans, the development of policies through the Regional Policy Statement, provision of information through the Otago Natural Hazards Database and participation in the Otago Civil Defence and Emergency Management Group.

OPTIONS

[28] Council has two options in relation to the proposed strategy. It can approve it in its current form, or it can direct changes.

[1] Associated effects could include, but not limited to; environmental effects, affordability etc

[29] Changes to the strategy may have an impact on the financial strategy including the proposed expenditure forecast and subsequent work programmes set in the long-term plan.

CONSIDERATIONS

Financial Considerations

[30] The financial considerations are detailed as part of the Financial Strategy and long-term planning process.

Significance and Engagement

[31] The proposal triggers Council's Significance and Engagement Policy. Under section 93C of the LGA 2002, the LTP consultation document must include the Council's proposed Infrastructure Strategy.

Legislative and Policy Considerations

[32] The Infrastructure Strategy is required to be prepared in accordance with the LGA 2002.

[33] Council has statutory functions and powers under the Soil Conservation and Rivers Control Act 1941 for river management, flood protection and soil conservation within Otago.

Risk Considerations

[34] The 30-year infrastructure strategy is required for updating the issues and evolution in thinking and public perception that has occurred over the last three years of the current long-term plan.

[35] It has been updated to reflect this including all known and available information sources being drawn on and updated where relevant. The forecast expenditure reflects those stated in the draft LTP budget previously received by Council.

[36] The Council must provide an Infrastructure Strategy as part of its obligations under the Local Government Act 2002.

NEXT STEPS

[37] Finalise the Infrastructure Strategy as part of the consultation for the LTP.

[38] Complete the supporting LTP documentation to this Infrastructure Strategy which details scheme and river expenditure including key projects included.

[39] Commence the development of asset management plans, operational plans and work programs which will proceed under the long-term plan 2021 – 2051 and this overarching infrastructure strategy.

ATTACHMENTS

1. Current Infrastructure Strategy 2018 2028 [**7.1.1** - 4 pages]
2. Otago Regional Council Infrastructure Strategy 2021 2051 [**7.1.2** - 55 pages]

Infrastructure Strategy

Council owns a wide range of assets, including land and buildings, motor vehicles and plant. Infrastructure assets held by council include flood and drainage scheme assets. Their book value is around $81 million. This strategy focuses on our infrastructure assets, which are made up primarily of over 200km of floodbanks, over 250km of open channel drains, 14 pump stations, and culverts.

Flood protection and drainage assets are grouped into "schemes". All our schemes have agreed levels of service that they provide to the community. The infrastructure to achieve this level of service is in place, and this strategy ensures that the infrastructure will continue to provide to the community the agreed levels of service.

Construction of the last two stages of the Leith Flood Protection Scheme has not yet been completed. We plan to complete the flood protection stages of this scheme by 2019/20.

The purpose of this strategy is to identify how we will manage our infrastructure assets, identify significant issues around our flood protection and drainage schemes over the next 30 years, and investigate how to mitigate any issues and optimise the performance of the existing assets. We have made assumptions in determining our strategic direction for the 30 year period and these are also discussed in this strategy.

Geographical context

Large developed areas of Otago are in low lying river flats, often close to sea level. Many people live in those areas, and farming is a key use of the land. The continued safe occupation and use of these areas is important to the wellbeing of our communities, and so protection from flooding is important. Our flood protection schemes aim to protect people and property from flooding. Our drainage schemes assist maintaining the productive capability of the land.

We manage eight flood and drainage schemes, protecting both the urban and rural sectors within Otago. Those schemes are as follows:

- Alexandra flood protection scheme;
- Leith flood protection scheme (under construction);
- Lower Clutha flood and drainage scheme;
- Lower Taieri flood protection scheme;
- East Taieri drainage scheme;
- West Taieri drainage scheme;
- Tokomairiro drainage scheme;
- Shotover Delta flood protection;
- Lower Waitaki Scheme; and
- Non-scheme flood assets.

Capital Expenditure

There are four drivers for making capital investment in our flood and drainage schemes and they are:

- The need to renew/replace existing assets;
- The need to adapt to changing environment to maintain the level of service that the schemes currently provide;
- The need for an increase in the level of service that the schemes currently provide; and
- The requirement to meet a new need or demand for flood or drainage scheme protection.

Renew/replace

All assets are appropriately maintained. However, some assets will still need to be renewed/replaced at the end of their useful lives. The types of assets that have a programme of renewal/replacement include:

- Assets associated with pump stations; and
- Bridges, culverts, pipes and other structures.

Floodbanks are maintained in as-new condition to meet service needs (they are not depreciated), some older floodbanks are reconstructed to improve their resilience by use of modern design and construction methods.

The renewals/replacement programme for each of the schemes is based on the assumptions that:

- there will be no deferred maintenance during the 30 year period; and
- there will be no events (flood, earthquake etc.) of a magnitude that will damage the assets.

The majority of the capital work expected to be undertaken by council over the next 30 years will be the renewal/replacement of assets as the schemes are well established.

Increase levels of service

We define levels of service as the level of protection our flood and drainage schemes provide. These may be expressed in terms of the return period of a flood, e.g., the 1 in 100 year flood, in terms of a water level, or in terms of the ability of our pumps to remove water from the catchment. Council may decide to increase the level of service for the following reasons:

- the community may demand a greater level of flood protection or drainage, than is currently being provided; and
- a need for a greater level of environmental protection.

Except for the new Leith Flood Protection Scheme, the current levels of service for all flood and drainage schemes relating to flood protection and drainage standards have not been revisited by Council or the relevant communities of interest for a number of years. Council will consult these communities over the next three years to discuss current levels of service, and to discuss whether there is a desire to increase those levels of service, and if so, the possible options for doing so.

Studies have shown that there will be a possible sea level rise of between 0.3 and 0.5 metres over the next 30 years. Sea level rise may generate additional flooding and drainage risks, particularly for the Taieri and Lower Clutha flood and drainage schemes, which are close to sea level. Council will investigate the effects of sea level rise on agreed levels of service. We believe capital works may be required to mitigate that risk, so that we continue to maintain and provide the agreed levels of service. Investigation works have been budgeted for, capital budgets have been estimated in the latter years of this plan. These budgets will be refined after investigations and community consultation.

As we cannot predict if or when flood or earthquake events may occur, or that they might result in damage to scheme assets, the capital level of service programmes for each of the schemes in this strategy do not include such events taking place. However, the likelihood of such an event occurring during the 30 year period is high.

While our schemes are designed to deal with flood events, we are not prepared for events that will be greater than the levels of service provided. For example, the Leith scheme is being designed to provide protection for a 1 in 100 year flood; we will not be prepared for a flood event of a greater magnitude than this.

New need or demand

There is a possibility that new schemes may need to be developed in areas where currently no flood protection or drainage services are provided. This demand may be triggered by a flood event or an increase in activity in a flood prone area. Council may undertake investigations to determine the feasibility during the 30 year period, if there is a demand.

Demand is managed through working collaboratively with territorial authorities to manage land use activities in flood prone areas.

Capital estimates assume however, that there will be no new schemes developed over the next 30 years.

Operational Expenditure

Operational expenditure covers the maintenance and operation works associated with each scheme and includes depreciation and the day to day running costs.

In the first three years of this plan Council will be reviewing its asset management and operational and maintenance plans for each type of asset.

Our Priorities

Council's priorities for our future flood and drainage scheme activities include the following:

- Provide agreed level of service (LoS);
- Review scheme performance and consult with the communities on acceptable levels of risk;
- Align schemes with land use changes and population growth;
- Develop/refine asset management plans and Planned Preventative Maintenance (PPM) for each scheme, including determine assets remaining useful life and plan for disposal or renewal at end of life; and
- Strategy includes targets to understand effects of climate change, how we adapt as a community and what will be required of flood and drainage schemes to meet new demand. It considers changes to precipitation Intensity, sea-level rise, and coastal erosion.

These priorities will assist our future planning and decision-making processes.

Assumptions

Future population

We do not expect that there will be any significant increase in the demand on our flood protection and drainage scheme assets because of population growth. These assets are not directly impacted by the population levels within the scheme areas. Further, we assume that our population growth in the whole of the region will not be significant over the next 30 years based on previous years.

Inflation

The financial forecasts for the forecasts for the first 10 years of this strategy are adjusted for projected inflation based on the BERL local government cost index. The forecasts for year 11 to 30 have been inflated to year 10 costs, that is, no further inflation allowance has been added.

Useful lives

The renewal/replacement programme is based on the useful life of each asset. Useful lives are assumed to be in accordance with Council's accounting policies and equipment manufacturers guidelines.

Levels of Service

We are assuming that there will be no changes to the levels of service for each of our flood and drainage schemes, except for the completion of the Leith scheme.

Other assumptions

Other assumptions made in preparing this strategy are as follows:

- There will be no new schemes developed over the 30 year period;
- There will be no deferred maintenance during the 30 year period;
- Floodbanks are maintained in as-new condition to meet service needs;
- It is expected the works programmed in years 1-3 of the LTP will progress. These works are focused on understanding, quantifying and optimising performance; and
- No allowance has been made for repairs to scheme assets resulting from flood events or other natural disasters.

Most Likely Scenarios and their cost

The following sections outline the most likely scenarios for council infrastructure investment in our scheme areas. The scenarios are based around the expected useful lives of the assets, and when they will require replacement.

The significant investment is driven by our priority to provide agreed levels of service throughout the 30 year period of this strategy.

The total projected operating expenditure over the next 30 years is $153,365,000.

The total projected capital expenditure over the next 30 years is $61,805,000.

Otago Regional Council

INFRASTRUCTURE STRATEGY 2021 - 2051

Flood Protection, Land Drainage and River Assets

Contributors

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For Otago Regional Council

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February 2021

Document ID: Obj.: A1449917

Contents

Terms and Definitions

The following terms and definitions are used in this document

Asset Management Plan (AMP)	A written representation of the intended asset management programmes over the whole life of the assets, to ensure that Council's infrastructure assets are maintained to provide a specific level of service in the most cost-effective manner.
Community Outcomes	Community outcomes represent councils' contribution to community well-being (economic, social, cultural and environmental). They articulate ORC's "value proposition"; and provide a foundation to ORC's funding and planning decisions.
Financial Strategy	The Council's agreed long term approach to financial management as contained within the Long Term Plan.
Financial Year	The Council's financial year runs from 1 July to 30 June. For example, the 2021/22 financial year runs from 1 July 2021 through to 30 June 2022.
Inflation	A rise in the general level of prices of goods and services over a period of time.
Long Term Plan (LTP)	A 10-year plan developed by Council and describing what Council plans to do to contribute to the Otago Region's community outcomes. It shows why the Council does this, how much it will cost, and how success will be judged. A 10-year plan is prepared every three years.
Maintenance Costs	Expenditure in relation to repairs and maintenance of Council's assets.
Operating Expenditure	Expenditure that is necessary for the normal activities of Council, including maintenance costs.
Renewal	A replacement of an existing asset at the end of its useful life.
Level of Service (LoS)	The amount or quality of a service or activity that is provided to the community. Also commonly referred to as 'level of service'.

1. Introduction

Otago is administered by the Otago Regional Council. Situated in the southern half of the South Island, and with an area of approximately 32,000 square kilometres, it is the second largest local government region in the country.

Council provides flood protection and land drainage to approximately 43,000ha of rural and urban land in Otago. This is achieved through managing infrastructural assets that include 218km of floodbanks, 12 pumping stations, 55 bridges, culverts, and various other assets, across the region's rivers and a total of seven flood protection and/or drainage schemes.

Different types of assets are situated within our rivers to maintain river and stream channel capacity, and bank stability in targeted areas, as well as satisfying environmental needs. These assets may include rock buttresses, groynes and floodbanks, outside of those within Council's flood protection and drainage schemes.

Council's flood protection schemes are designed to protect people, property and stock during a flood event. These schemes typically consist of floodbanks, flood pumps, ponding areas, gravity gates and floodways. Council's drainage schemes are designed to drain land so that it remains viable for farming activities. Drainage schemes are located on the low-lying plains in parts of Otago and typically consist of pump stations and a network of open drains.

The context within which Council's infrastructure must operate is ever-changing as influenced by several factors:

- Demographics – The Otago region has been experiencing very high growth and this is projected to remain strong into the future.
- Economy – Different economic structures across the Otago region with the economies of the Clutha and Waitaki districts focussed heavily on the primary sector and bigger manufacturing sector than other districts; Dunedin and Queenstown Lake economies heavily reliant on the tertiary sector (food and accommodation, retail, health and social services); and Central Otago reliant on both the primary and tertiary sectors.
- Physical environment – Management of infrastructure within an ever-changing physical environment brought about by the dynamic geomorphology of the Otago region e.g. over 2,000 alluvial fans across the region.
- Climate – Variable impact of climate change likely across the region, with sea level rise and shoreline retreat near our coasts, and more frequent and high intensity rainfall events across the region.

The community are dependent on the effective performance of Council's infrastructure for their safety and economic wellbeing. This infrastructure has a key role to play in the protection of non-Council assets and businesses, including Dunedin's Central Business District, University of Otago, Dunedin International Airport, Finegand Freezing Works, and the townships of Balclutha, Alexandra and Mosgiel.

Strategic planning positions council to make informed decisions about the management of assets. This enables council to optimise asset performance to meet the level of service to the customer, with consideration and a balance of expenditure and risk in the long term. This document describes that planning process and the resulting approaches that Council intends to pursue in managing its assets. This planning has a 30-year horizon which enables consideration of the entire lifecycle of assets as well as accounting for external factors and changes over time.

1.1 Purpose

The purpose of this Infrastructure Strategy (Strategy) is to provide to Council and the Otago community with information about what significant issues the flood protection and drainage infrastructure face over the next 30 years and beyond, and to identify the principal options for managing those challenges, including the implications of those options, before presenting the most likely scenarios for each issue and when any significant decisions will need to be made.

When setting out how the Otago Regional Council (Council) intends to manage the flood protection, land drainage, and river asset infrastructure in accordance with the requirements of the Local Government Act[1], Council needs to consider how:

- To manage the renewal or replacement of existing assets over their lifetime;
- To respond to growth or decline in demand;
- Increases or decreases in levels of service will be planned for;
- Public health and environmental outcomes will be maintained; and
- Natural hazard risks and resilience will be addressed.

Each of these are discussed and addressed within the Strategy.

The high-level direction presented in this Strategy has formed the basis of infrastructure planning decisions included in the Long Term Plan 2021-2031. In doing so it links with the Council's Financial Strategy to provide an integrated approach to providing value for money for Otago communities.

The Strategy is a statement of current assumptions and thinking on what infrastructure is required to address the major issues facing the flood protection, land drainage and river management activities over the next 30 years. It presents a clear picture of where we are now, where we are going and how we intend to get there.

[1] Local Government Act 2002 Amendment Act 2014

1.2 Statutory Requirements

In August 2014, the Local Government Act introduced a new requirement for infrastructure strategies and asset management planning. Table 1 below sets out the relevant requirements of this Act and outlines the corresponding section of this Strategy where it is addressed.

Table 1. LGA 2002 Amendment Act 2014 requirements for Infrastructure Strategy.

LGA 2002 Section 101B		Strategy Section
1	A local authority must, as part of its long-term plan, prepare and adopt an infrastructure strategy for a period of at least 30 consecutive financial years.	**1.3**
2(a)	The purpose of the infrastructure strategy is to identify significant infrastructure issues for the local authority over the period covered by the strategy.	**5**
2(b)	The purpose of the infrastructure strategy is to identify the principal options for managing those issues and the implications of those options	**5**
3	The infrastructure strategy must outline how the local authority intends to manage its infrastructure assets, considering the need to: a. renew or replace existing assets; b. respond to growth/decline in the demand for services reliant on those assets; c. allow for planned increases or decreases in levels of service provided through those assets; d. maintain or improve public health and environmental outcomes or mitigate adverse effects on them; e. provide for the resilience of infrastructure assets by identifying and managing risks relating to natural hazards and by making appropriate financial provision for those risks.	**5**
4	The infrastructure strategy must outline the most likely scenario for the management of the local authority's infrastructure assets over the period of the strategy and, in that context, must:	**5**
4(a)	show indicative estimates of the projected capital and operating expenditure associated with the management of those assets: i. in each of the first 10 years covered by the strategy; and ii. in each subsequent period of 5 years covered by the strategy	**6.**3
4(b)	identify: i. the significant decisions about capital expenditure the local authority expects it will be required to make; ii. when the local authority expects those decisions will be required; iii. for each decision, the principal options the local authority expects to have to consider; and iv. the approximate scale or extent of the costs associated with each decision	**5**
4(c)	Include the following assumptions on which the scenario is based: i. the assumptions of the local authority about the life cycle of significant infrastructure assets: ii. the assumptions of the local authority about growth or decline in the demand for relevant services: iii. the assumptions of the local authority about increases or decreases in relevant levels of service	**6**.2
4(d)	if assumptions referred to in paragraph (c) involve a high level of uncertainty: i. identify the nature of that uncertainty; and ii. include an outline of the potential effects of that uncertainty	**6**.2

1.3 Strategy Scope

Providing and maintaining infrastructure requires good asset management practices and strategic thinking. This Strategy has been prepared for the flood protection, land drainage, and river asset infrastructure of ORC as required under the LGA 2002 Amendment 101B. It covers the following infrastructural assets:

Flood Protection

Assets that prevent or mitigate the impact of flood waters

- Flood banks
- Flood pumps
- Gravity gates and locks
- Spillways
- Ponding areas and floodways
- Culverts & Bridges

Land Drainage

Assets that facilitate the drainage of low-lying land

- Pump stations
- Scheduled drains
- Culverts & Bridges

River Assets

Assets that exist within river systems to aid in channel management

- Rock buttresses
- Groynes
- Flood banks

This Strategy outlines the key issues, implications and most likely scenarios for how Council intends to manage its flood protection, land drainage and river asset infrastructure over the next 30 years.

The Infrastructure Strategy fits within a decision-making and operational framework that ultimately provides direction for the Long Term Plan (LTP). This is depicted in Figure 1.

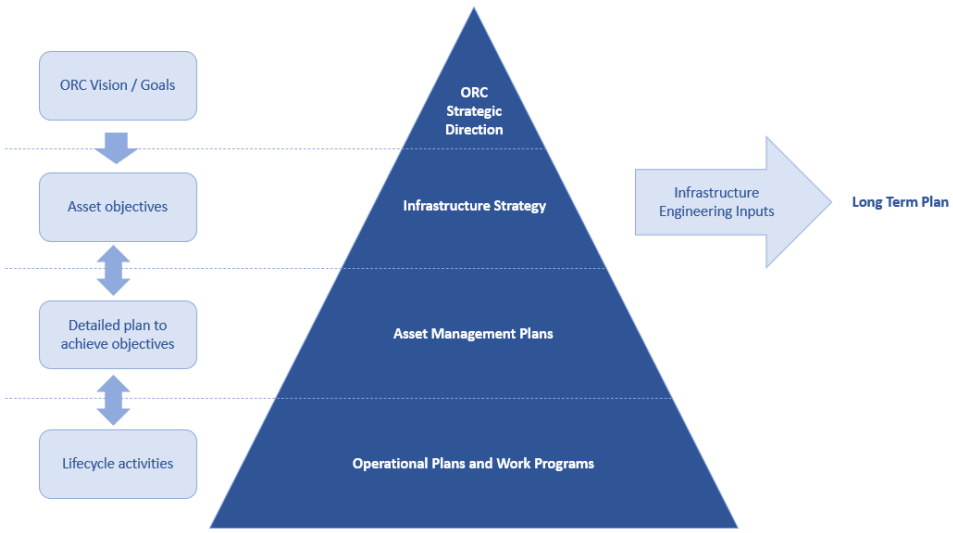


Figure 1 Linkages between the Infrastructure Strategy and other key Council documents.

This Strategy has a 30-year planning horizon and will be reviewed every three (3) years. The planning horizon extends well beyond the more detailed planning included in the Long-Term Plan as a longer time horizon is required to consider the whole life cycle of the infrastructural assets. This helps the Council and the community to see the longer-term approaches planned and what can be expected for Otago up to 2050, and beyond.

The Strategy is structured into the following six sections:

Introduction	This section discusses the purpose of the Infrastructure Strategy, the minimum legislative requirements to meet, how the Infrastructure Strategy links with other key Council documents, and what progress has been made since 2015.
Setting the Context	This section provides the context across the 6 areas: geographic, demographic, economic, strategic, and environmental and climate. Council's purpose, vision, and strategic objectives are presented, along with the various levels of service.
Infrastructure Overview	This section provides a summary of the flood protection and drainage activity and infrastructure asset portfolio including asset condition, performance, and criticality. A summary of data confidence in the asset information is provided.
Infrastructure management Approach	This section outlines Council's approach to managing infrastructure in line with its strategic directions. This sets the scene for how Council applies these principles in response to the significant issues that follow.
Significant Issues & Directions	Key significant issues are highlighted and discussed alongside various options considered to address the issues, the implications of each of those options, the most likely scenarios, and when any key decisions will need to be made.
Infrastructure Investment Programme	Infrastructure priorities and principles are outlined. Key projects are presented including which significant issues will be addressed. The funding and expenditure required for the projects and programmes are presented.

1.4 Progress and milestones between 2015 and 2021

The year 2021 marks the Council's third Infrastructure Strategy since the inaugural strategies were developed in 2015. Throughout this time various reviews and reports, outlined below, have disseminated best practice in infrastructure management in the Local Government Sector. As well as these reports, best practice has been pulled from other Local Authorities who have set great examples in developing their infrastructure strategies.

The main updates from Council's previous strategies include:

- Incorporating appropriate recommendations and learnings from Audit NZ's report "Asset management and long-term planning: Learnings from audit findings 2015 to 2017";
- Incorporating appropriate recommendations and learnings from the Office of the Auditor General's report, "Matters arising from the 2015-25 local authority long term plans"
- Major structural changes and development to the overall strategy document;
- Addition of asset information and current state of the flood and drainage infrastructure;
- Updates to asset and demographic data to reflect the most recent information available; and
- Addition of significant infrastructure issues, principal options, and their implications.

ORC understands that providing and maintaining the Council's infrastructure requires good asset management practices and strategic thinking. In response to this ORC have also:

- Updated the Flood Protection and Drainage Asset Management Plans (previously completed in 2014).
- Carried out an asset management maturity assessment of flood protection and drainage assets.

Figure 2 River channel asset, Albert Town (Clutha River/ Mata-Au) Rock Buttress flood repair works completed in February 2021.

2. Setting the Context

2.1 Geographic Context

The Otago region is located in the southern half of the South Island (Figure 3) and is the second largest region in New Zealand by land area; covering approximately 32,000 km^2. The region incorporates the full extent of the coastline stretching approximately 470 km from the Waitaki River in the north to Wallace Beach in the south; the coastal marine area extends 22.2 km out to sea. To the west the region is largely bounded by the high alpine mountains and catchment watersheds of the Clutha/Mata-Au River and its tributaries, and also the Taieri River which rises in the Lammerlaw Ranges.

The Otago region is made up of five territorial authorities:

- Queenstown Lakes District Council
- Central Otago District Council
- Clutha District Council
- Waitaki District Council
- Dunedin City Council

It should be noted that while Waitaki District lies across both the Otago and Canterbury regions (predominant river catchment area), around 90% of its population live within the Otago region.

Major centres include Dunedin, Oamaru, Balclutha, Alexandra, Cromwell, Wanaka and Queenstown.

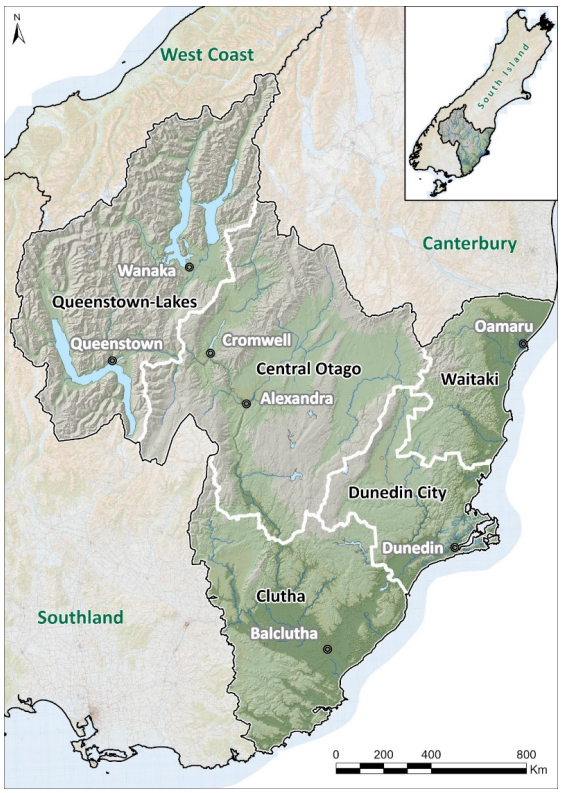


Figure 3 Map of the Otago Region and territorial authorities

2.2 Demographic Context

The population of Otago is 245,300[2] is approximately 4.8% of New Zealand's total population. The Otago region has been experiencing very high growth and this is projected to remain strong into the future (Figure 4).

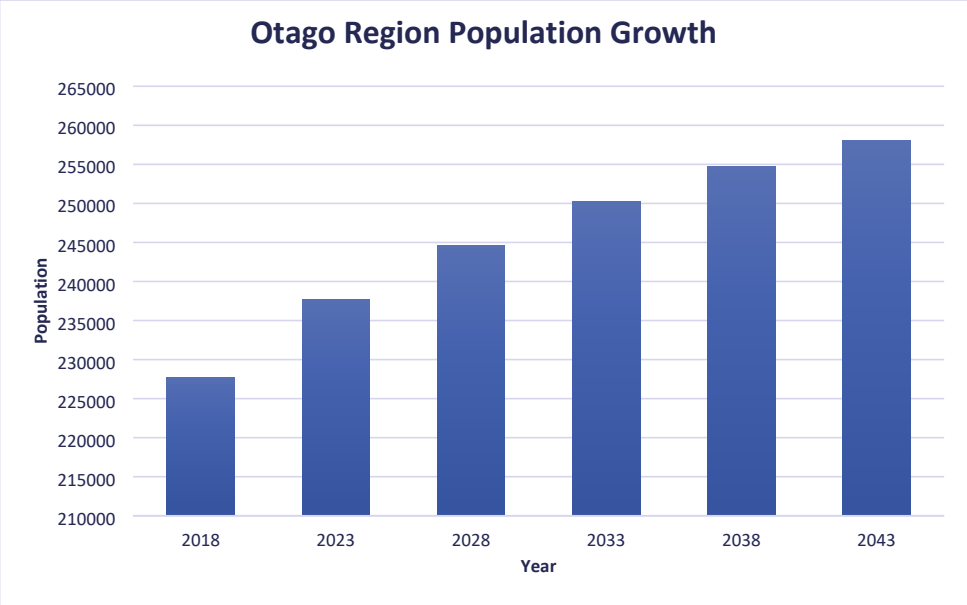


Figure 4 Projected population growth in Otago from 2018-2043 .n.b. figures not projected beyond 2043 not avaliblehttps://www.stats.govt.nz/assets/Uploads/Subnational-population-projections/Download-data/subnational-pop-projections-2013-43-update.xlsx

Dunedin City (including Taieri) and Clutha districts contain the majority of flood protection and drainage schemes that the ORC manages and maintains. Changes in population are projected to differ in both areas as follows:

- Dunedin City – Population numbers are projected to increase from 2018 to 2028 by 6% and to 2048 by 10%, however the rate of change is projected to decrease[3].
- Clutha District – Population numbers are projected to increase from 2021 to 2031 by 3% and to 2051 with no change of population[4].

The Otago region also has an ageing population. In 2020 around 16.5% of the region's population was aged 65 and over; this is above the national average of 15.6%[5]. This population trend is projected to continue with the number of people aged 65 and over expected to more than double from 32,400 in

[2] https://www.stats.govt.nz/information-releases/subnational-population-estimates-at-30-june-2019-provisional
[3] Dunedin City Council statistics
[4] Clutha District Council statistics
[5] https://www.stats.govt.nz/assets/Uploads/Subnational-population-estimates/Subnational-population-estimates-At-30-June-2020/Download-data/subnational-population-estimates-at-30-june-2020.xlsx

2013, to 65,800 in 2043. This projected figure will account for more than a quarter of the Otago population (25.7%) in 2043, which will remain higher than the national average of around 23%.

In developing this Strategy, it is important to consider population and demographic projections as they give insight into the future challenges, community drivers and desires that will influence the flood protection, drainage and river services provided.

2.3 Economic Context

While Otago region comprises the sixth largest regional economy in New Zealand, with the latest official estimates from Statistics New Zealand showing a regional gross domestic product (GDP) of approximately $13.6 billion in the year to March 2019[6], which is 4.5% of New Zealand's national GDP, overall the income of residents across the Otago region is lower than for New Zealand. Otago's regional GDP per capita was estimated at $57,974, which is $4,195 below the national average of $62,165 per capita.

Otago districts have different economic structures. Clutha and Waitaki's economies are focused heavily on the primary sector and bigger manufacturing sector than other districts; Dunedin's economy is relatively concentrated on tertiary sectors (e.g., food and accommodation, retail and health and social services); Central Otago's economy relies more on both the primary and the tertiary sector; and Queenstown-lake's economy has the highest tertiary sector concentration in the region. This makes up for a diverse range of economies across the district, as demonstrated in Figure 5 below.

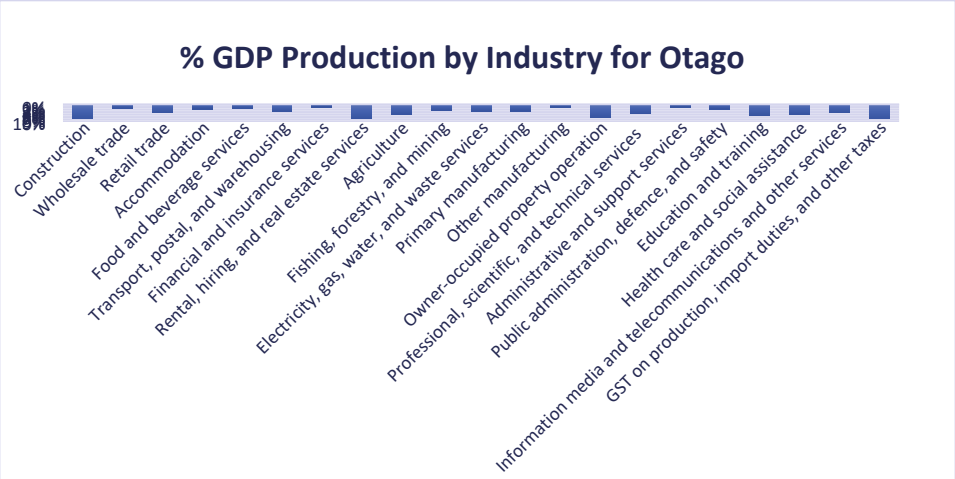


Figure 5 2018 percentage contribution to Otago GDP by Industry (Source: Statistics NZ 2019)

Whilst agriculture is one of the main sectors that benefits, the services provided by the flood protection and land drainage schemes have a variety of other quantifiable benefits which enables further contribution to the region's economy, including but not limited to:

- Protection of land/property, which reduces potential damage and increases the productive value of the land;
- Protection of regionally and nationally important infrastructure associated with activities such as transport (e.g. roads including state highways) and Dunedin International Airport;

[6] Regional gross domestic product: Year ended March 2019. Statistics NZ

- Avoided costs from flood damage that would otherwise result if the schemes were not in place (or maintained to the necessary standard).

2.4 Climate Context

The effects of climate change will impact the environment regionally, nationally, and globally. There will be changes in sea level rise, wind and weather patterns, and the frequency of extreme weather events are anticipated to increase. Furthermore, these changes will occur to differing extents in different places. Significant upgrades of infrastructure are expected as a result, to maintain the current and future level of security from flooding.

In October 2019, the ORC commissioned the National Institute of Water and Atmospheric Research (NIWA) to undertake a review of climate change projections for the Otago region over the 21st Century[7]. The study states that changes to Otago's future climate are likely to be significant, with the key messages from this report being:

- Annual rainfall is projected to increase by between 0-10% for most of the region by 2040.
- Increases in winter and spring rainfall of between 5-20% are projected for many western and inland parts of Otago by 2040.
- Annual rainfall increases of 10-20% are projected for the majority of Otago by 2090 with smallest increases expected near Ranfurly (0-5%).
- Winter rainfall is projected to increase considerably by 2090, with 20-40% more rainfall projected for many parts of the region.
- Decreases in summer rainfall of 5-10% are projected around Ranfurly and Middlemarch by 2090.
- Mean annual flood is expected to become larger everywhere, with increases up to 100% in some locations by the end of the century.
- Extreme, rare rainfall events are likely to increase in intensity in Otago because a warmer atmosphere can hold more moisture.
- Short duration rainfall events have the largest relative increases.

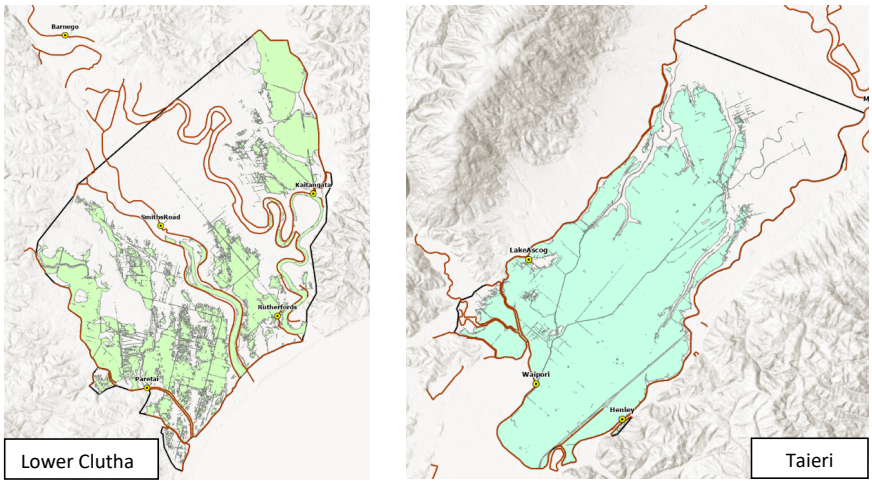


Figure 6 Lower Clutha & Taieri catchments, highlighting land areas less than 1 metre above mean sea level

[7] https://www.orc.govt.nz/media/7591/niwa_climatechangereport_2019_final.pdf

Furthermore, other climate change studies and reports have indicated that New Zealand can expect sea levels to rise over the 21st Century. From 1899-2015 the annual mean sea level rise for Dunedin was 1.42mm (Ministry for the Environment, 2017), and this is predicted to not only continue throughout this century, but also increase.

Sea level rise has the potential to have a significant impact on the flood and drainage schemes. With 45,462 Ha of the land that relies on ORC's flood protection and land drainage infrastructure less than one metre above current mean sea level. This is demonstrated in Figure 6 above.

Whilst the changes in climate are predicted to increase rainfall amounts/frequencies, coincided with sea level rise, this does not directly result in proportional increases in the peak flood flows. Relationships within and across catchments are complex, thus regular hydrodynamic modelling is required to assess changes in the performance of infrastructure and flood risk.

2.5 Environmental Context

Whilst there are a number of significant, positive contributions to social and economic outcomes from the flood protection and drainage activity, there are also a number of other consequences, such as:

- The construction of infrastructure assets, particularly flood banks and modified river channels, permanently alters the natural character and behaviour of a river, and may have adverse effects for the long-term character and quality of instream and riparian ecology and biodiversity;
- The provision of river infrastructure assets imposes on-going channel management works which have the potential to periodically disrupt recreational use, as well as instream and riparian ecology on an on-going basis; and
- The provision and management of river infrastructure assets has the potential to conflict with the traditional use of rivers and river margins by Mana Whenua.

Over recent times there has been a paradigm shift that has occurred in response to environmental regulation, community expectations, and an increasing awareness of the interrelationships between land use and water quality. Legislation such as the Resource Management Act (RMA) 1991 requires that any adverse effects of future modifications to the natural environment are avoided or mitigated, are pivotal elements of law driving parts of this change. The Local Government Amendment Act (May 2019) also reinstated the four aspects of community well-being – social, environmental, economic and environmental.

Figure 7 River Channel Tree defence assets, Lower Clutha River, February 2021

The National Policy Statement for Freshwater Management (2014) that came into effect in September 2020, provides local authorities with updated direction on how they should manage freshwater under the RMA 1991, including requirements such as:

- managing fresh water in a way that gives effect to the principles of Te Mana o te Wai;
- improving degraded water bodies, and maintaining or improving all others using minimum baselines; and
- working towards target outcomes for fish abundance, diversity and passage.

Otago's Regional Policy Statement (RPS) also sets the direction for future management of Otago's natural and physical resources. It provides the foundation for the development of regional plans and district plans. It also gives an overview of the significant resource management issues facing the region, sets out objectives, policies and methods to resolve those issues, and aims to achieve the integrated management of the natural and physical resources of Otago.

3. Infrastructure Overview

3.1 Existing Flood Protection and Drainage Schemes

Council owns and manages three flood protection schemes and three drainage schemes as well as a combined flood protection and drainage scheme. They are the Alexandra Flood Protection Scheme, the Leith Flood Protection Scheme, the Lower Clutha Flood Protection and Drainage Scheme, the Lower Taieri Flood Protection Scheme, the West Taieri Drainage Scheme, the East Taieri Drainage Scheme and the Tokomairiro Drainage Scheme. The council also owns but commissions external management for parts of the Lower Waitaki River Control Scheme.

The majority of the schemes were initially built to provide protection to local communities and agriculture on the adjacent floodplains. These benefits include access to key transport infrastructure such as Dunedin Airport and State Highways, and protection of critical lifeline networks such as electricity substations. The schemes are essential to managing risks to communities associated with natural hazards, empowering economic prosperity and contributing to community resilience and well-being.

Central Government investment into flood protection and drainage projects ceased after the 1989 local government reforms, leaving it up to local ratepayers to develop and maintain the schemes. The schemes developed and constructed prior to this were largely funded by central government. There remains an ongoing need to operate and maintain these assets, ensuring the benefits they provide remain to be utilised.

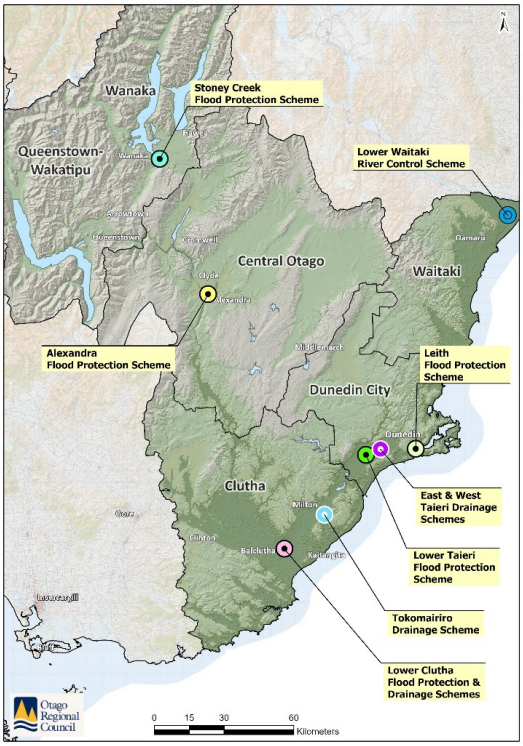


Figure 8 Location of Otago flood protection schemes.

3.1.1 Alexandra Flood Protection Scheme

The Alexandra Flood Protection Scheme was built in 2001 to protect Alexandra's central business area against flooding from the Clutha and Manuherikia Rivers. Stormwater drainage systems owned by the Central Otago District Council normally drain into the river by gravity, but in some events high river levels prevent the drains from discharging into the river. This is where the pumps in the flood protection scheme serve. The total length of floodbanks in this scheme is just over 1 km. Two roads penetrate the floodbanks, so the roads must be closed, and stoplogs installed, during severe floods.

3.1.2 Leith Flood Protection Scheme

The Water of Leith catchment is located to the north of (and includes) the Dunedin Central Business District (CBD), and has a catchment area of approximately 42 square kilometres. This scheme protects the area from the risk of steep headwaters overwhelming the shallower grade channels through the North Dunedin floodplain. Key Dunedin infrastructure such as the hospital, Otago University, Otago Polytechnic and stadium are protected by the scheme. Flood mitigation measures in the Water of the Leith include:

- Substantial lengths of concrete and stone wall to prevent bank erosion and facilitate urban development of the floodplain (e.g. University Campus);
- A boulder trap upstream of George Street (constructed in the 1950s) and a debris/boulder trap upstream of the Lower Malvern Street Bridge (constructed in 1963);
- Straightened channels including a high-velocity channel between George Street and Cumberland Street;
- Grade control weirs of varying heights along the Water of Leith;
- A double concrete-lined channel between Clyde Street and the Otago Harbour; and
- Channel enhancements downstream of Dundas St, constructed progressively since 2013.

3.1.3 Lower Clutha Flood Protection and Drainage Scheme

This scheme combines both flood protection and drainage works. Construction of this scheme started in 1960 and was completed in 1991. The area protected by the flood protection component is the Clutha Delta, which extends from 4km north of Balclutha to the sea. The Clutha is the second longest river in New Zealand, and the largest by mean flow. The Clutha's headwaters are in the Southern Alps above lakes Wakatipu, Wanaka, and Hawea. The Clutha River bifurcates (splits into two) just downstream of Balclutha. Between 60% and 70% of the flow goes down the Koau Branch and 30% to 40% down the Matau Branch. The island formed between the branches is called Inch Clutha. There is a floodway (area designed to carry floodwaters when the river level rises) at the top of Inch Clutha. As well as the Clutha River, water flows into the delta from several other sources including Lovells Stream and Lake Tuakitoto; Waitepeka River; Puerua River and Barrata Creek. Land drainage is provided by a network of 153 km of drains in four regions: Barnego; Stirling/Kaitangata; Inch Clutha; and Otanomomo/Paretai. Drainage in Balclutha and Finegand is not ORC's responsibility.

3.1.4 Tokomairiro Drainage Scheme

The Tokomairiro Drainage Scheme is located in the flat basin surrounding Milton, surrounded on three sides by inland hills, and by coastal hills to the southeast. It has no pumps or control structures. Many of the drains were originally creeks that have been realigned.

3.1.5 Lower Waitaki River Control Scheme

Some flood protection assets on the Waitaki river are owned by the council. This includes small floodways and river groynes within the Otago portion of the river. The management of these is contracted to Environment Canterbury as they manage other river assets in the area.

3.1.6 Lower Taieri Flood Protection Scheme

The Lower Taieri Flood Protection Scheme protects the Taieri Plain during flood events. It was the first to be developed, alongside the East and West Taieri Drainage Schemes, when works commence in 1870 (Figure 9). It is complex, with multiple rivers affecting the scheme. This means flows can increase dramatically in widespread and prolonged rainfall events. The Silver Stream is also a significant river in the scheme. It flows out of the Silverpeaks area and has a far quicker response time than the Taieri River. Other rivers managed in this scheme are Waipori River and Owhiro Stream.

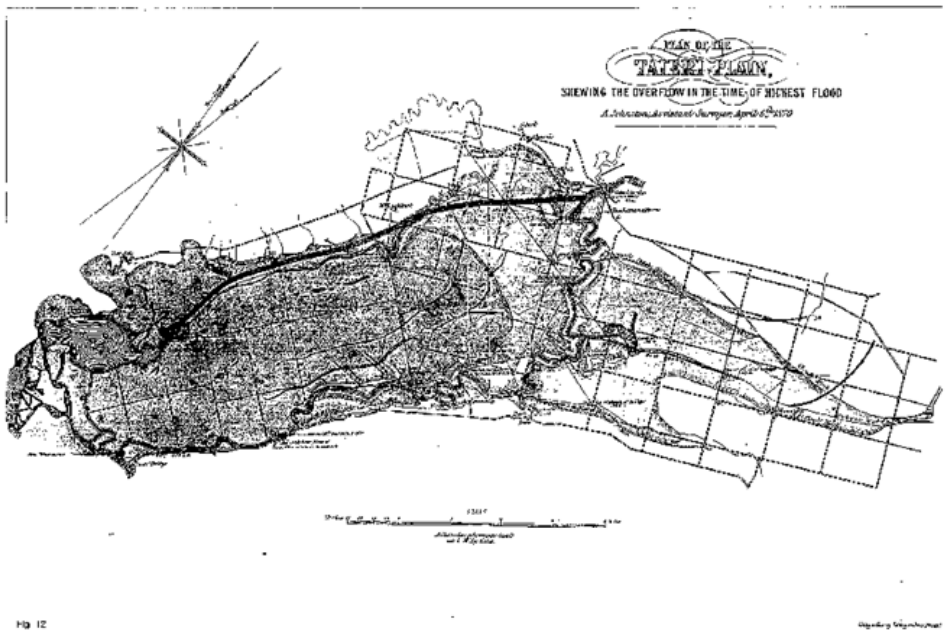


Figure 9 Early development of the Lower Taieri Flood Protection Scheme, showing the extent of a flood event in the late nineteenth century.

3.1.7 West Taieri Drainage Scheme

The West Taieri Drainage Scheme covers the area bounded by the Taieri River, Lake Waipori, and the West Taieri Contour Channel. A small part of the scheme lies in the Henley Floodway. The West Taieri area differs from the other drainage schemes in that water cannot drain out of the scheme under gravity: it must be pumped out. There are three pump stations in the West Taieri Drainage Scheme: Waipori; Henley; and Lake Ascog.

3.1.8 East Taieri Drainage Scheme

The East Taieri Drainage Scheme is physically divided into two areas by the Silver Stream, which flows across the Taieri Plain in a south-westerly direction. Drains on the northern side of the Silver Stream generally flow toward what is called the Upper Pond area. Drains on the Southern side of the Silver Stream flow toward the Lower Pond area. When the Taieri river is at low flow these drains flow out to the river by gravity, whereas when the Taieri is at high flows, gravity gates close and pumps must be used.

3.2 Asset Summary by Scheme

The flood protection, river and drainage assets, and the schemes they make up, primarily consist of floodbanks, pump stations, floodgates and culverts. Table 2 provides a summary of the key flood protection and drainage infrastructural assets that are included within this strategy.

Table 2 Asset portfolio summary for flood and drainage protection schemes across Otago.

Scheme	Catchment Area (,000 ha)	Area Protected (,000 ha)	Assets
Alexandra Flood Protection	1,511	0.01	1 - 3 - -
Leith Flood Protection	4	0.2	- - - - -
Lower Clutha Flood Protection and Drainage	2,110	9.3	110 153 5 189 5
Lower Taieri Flood Protection	565	13	107 - - - -
West Taieri Drainage	8	8.1	- 144 3 22 20
East Taieri Drainage	17	4.8	- 128 3 84 1
Tokomairiro Drainage	40	7.7	- 110 - 74 19
Total	**4,256**	**43**	218 535 14 369 55

Key

- Length of floodbanks (km)
- Length of drains (km)
- No. of pump stations
- No. of culverts
- No. of bridges

In addition to the assets in the above there are other assets that form part of Councils infrastructure including:

- The training line that guides the river and sediment in the Shotover River.
- Smaller floodways and river groynes that make up the Lower Waitaki River Control Scheme.
- Trees and vegetation which is planted and maintained along river channels and margins are a defence asset which reduce erosion to river channels and adjacent floodbanks.
- Rock buttress and placed rock within rivers and flood protection schemes, such as Albert Town rock buttress.

3.3 Asset Infrastructure Condition

The assessment of asset condition is an essential part of infrastructure management, where primarily the collection of data is used to support and inform:

- Scheme and asset performance assessments.
- Annual maintenance work programmes; and
- Asset renewals/replacement programmes.

Asset condition is determined by undertaking a site visit and visually inspecting each asset, and then grading the physical condition using a 1-5 rating system as detailed in Table 3.

Table 3. Asset condition grading scale.

Condition Grading	Condition	Description for Floodbank
1	**Very Good**	Only planned maintenance required
2	**Good**	Minor maintenance required plus planned maintenance
3	**Average**	Significant maintenance required
4	**Poor**	Significant renewal/rehabilitation required
5	**Very Poor**	Physically unsound and/or beyond rehabilitation

In 2007 and 2017 an asset condition programme was undertaken across all floodbanks in the Lower Taieri, Lower Clutha, and Alexandra flood protection schemes. Historical and ongoing problems include stock damage, trees and features located in or adjacent to floodbanks, as well as minor erosion around culverts, and slumping on the outside of river bends. Of these, stock damage is considered to be the most common factor affecting condition of floodbanks, along with the quality of the initial construction.

A summary of floodbank condition is presented in Figure 10 below. There were 1288 floodbank inspections, 85% of those were in an Average to Very Good condition. A summary of floodbank condition is presented below.

Asset Condition	No. of Inspections	%	%
1 – Very Good	227	17.7	85
2- Good	511	39.8	
3- Average	354	27.5	
4 - Poor	125	9.7	15
5 – very Poor	68	5.3	
Total	**1288**	**100**	**100**

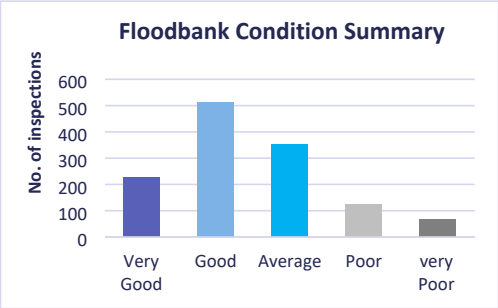


Figure 10 Summary of floodbank condition by grade. Source T+T, 2018. N.b. Inspection frequency varies, average is one inspection every 170 metres of floodbank.

3.4 Data Confidence

The foundation of all asset management activities is asset data information. Knowing exactly what assets exist, where they are, and in what physical condition they are in is fundamental to infrastructure planning. Good quality asset data is required to achieve good quality asset management. This in turn provides clarity over the robustness of plans and provides decision-makers with confidence.

ORCs current data reliability has been scored in Table *4* based on data confidence and reliability gradings adapted from the International Infrastructure Management Manual (Table 5).

Table 4. Data confidence and reliability across various asset management criteria in 2021.

Data	Unknown	Very Uncertain	Uncertain	Reliable	Highly reliable
Asset Inventory:					
Location				✓	
Quantity				✓	
Value[8]		✓			
Condition:					
Flood protection schemes				✓	
Drainage schemes				✓	
River Assets		✓			
Performance:					
Flood protection schemes				✓	
Drainage schemes				✓	
Criticality:					
Asset Criticality				✓	

Table 5. Data confidence and reliability gradings and descriptions.

Confidence Grade	Description
Highly reliable	Data based on sound records, procedures, investigations and analysis, documented properly and agreed as the best method of assessment. Dataset is complete and estimated to be accurate ± 2%
Reliable	Data based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example some of the data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation. Dataset is complete and estimated to be accurate ± 10%
Uncertain	Data based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolated from a limited sample for which grade A or B data are available. Dataset is substantially complete but up to 50% is extrapolated data and accuracy estimated ± 25%
Very Uncertain	Data is based on unconfirmed verbal reports and/or cursory inspections and analysis. Dataset may not be fully complete and most data is estimated or extrapolated. Accuracy ± 40%
Unknown	None or very little data held.

In general, Council has a reliable understanding of its flood protection and drainage infrastructure, and regularly undertakes asset condition and performance monitoring, which in combination with modelling and other investigative activities, informs asset maintenance, renewal and replacement.

ORC is committed to working towards having a “highly reliable” asset management system in the next three years. Council acknowledges that it needs to make better use of asset management information

[8] The ORC uses depreciated value.

systems and tools for managing its assets and in order to effectively deal with the extent of analysis required to support the size and complexity of its flood protection and drainage network and asset infrastructure. Furthermore, by better utilising information systems and tools, Council can make improvements to the optimised decision-making of asset renewals, maintenance and capital works programmes. As technology continues to advance, Council will need to be agile with changes but also be able to forecast when and how changes may impact on the way flood and drainage services are delivered, or any technology-related effects, positive or negative.

3.5 Asset Criticality

Central to managing risks, hazards and resilience is the criticality of assets. Critical assets are identified as those which have a high consequence of failure, such as a more significant financial, environmental and social cost to communities.

With regards to the flood protection and drainage schemes, critical assets are those that protect urban or high value areas or areas critical to effective operations of the schemes. The critical assets as identified in the asset management plans are:

- Flood banks that protect the towns and industrial areas of Outram, Mosgiel, Balclutha, Alexandra, the Silver Fern Farms Finegand Plant, and the Dunedin International Airport.

- The Waipori Pump Station - drains 95% of the West Taieri Drainage Scheme.

- In the Leith Flood Protection Scheme, the protection works through the university area (Dundas St to Forth St). Failures to these assets would result in flooding of much of the Dunedin CBD, including State Highway 1.

- The Shotover Training Line - critical to the performance of the Shotover Delta Infrastructure. If this did not function correctly then there would effects on to Lake Wakatipu and therefore flooding to the surrounding townships, including the Queesntown CBD.

3.6 Levels of Service

3.6.1 Overview

This section details the existing levels of service across Otago's flood protection schemes, drainage schemes, and rivers. The existing levels of service for Flood Protection, Drainage and River assets are defined in Table 6.

Table 6 Flood Protection and River Management Levels of service.

Levels of Service	Performance Measures
Provide the standard of flood protection and control agreed with communities.	Major flood protection and control works are maintained, repaired, and renewed to the key standards defined in relevant planning documents.
Respond promptly and effectively to damage from natural hazard events.	Damage identified, prioritised and a repair programme communicated with affected communities in a timely manner.
Maintain channel capacity and stability, while balancing environmental outcomes and recognising mana whenua values in rivers.	Percentage of identified and reported issues that have been investigated and appropriate action determined and communicated to affected landholders within 20 working days.
	Percentage of planned maintenance actions achieved each year.

Council will be looking to develop a strong line of sight from the corporate strategy, into asset management objectives, into level of service statements, into customer performance measures (customer experience based), into technical performance measures (asset based). These performance measures will then inform lifecycle decision making which will encompass capital, operating and maintenance works.

3.6.2 Scheme Performance Issues

ORC currently has the below known issues specific to a particular scheme and/or rivers that need decisions made in order to find a resolution. All of them are a consequence of one or more of the significant issues described in section 5.1.

Scheme/Location	Issue
Clutha Delta	Flood protection and drainage schemes are in place. Natural Hazards are undertaking a risk assessment of climate change impacts to the Clutha Delta including consequences for levels of service. A Scheme performance review will follow the risk assessment which will assist in future infrastructure requirements of the flood and drainage schemes. This will help us to determine how, and when, to adapt the Lower Clutha Flood Protection and Drainage Scheme.
Dart/Rees Rivers	A collaborative project with QLDC, the current objective is to provide a framework to actively manage the risks associated with natural hazards for the long-term development of the area located at the head of Lake Wakatipu, including Glenorchy and Kinloch. This is in its early stages but will help determine whether and what form infrastructure is part of the adaptation options.
Roxburgh	Adequacy of the existing limited infrastructure on Reservoir Creek.
Lindsay Creek	Sections of the Lindsay Creek still have insufficient channel capacity to convey flood flows. A higher and more uniform standard of flood protection for these areas, to provide a standard of flood protection that is consistent with comparable urban areas across New Zealand, will need to be considered, again. The renewal of existing assets is necessary regardless of any enhanced standard of protection.
Water of Leith/Leith Flood Protection Scheme	Renewal of pre-existing assets (e.g. concrete-lined channel), completion of enhancement works downstream of Forth Street.
Taieri Plains	Flood protection and drainage schemes are in place. Undertaking a risk assessment of climate change impacts to the Taieri Plain including consequences for levels of service and future infrastructure requirements of the flood and drainage schemes. The expansion of Mosgiel and Wingatui within the boundaries of the Taieri Scheme will result in a need to address and manage the stormwater/land drainage interface.
Lower Waitaki River Control Scheme	Repeat floods. Very dynamic river. Managing funding of unplanned works.

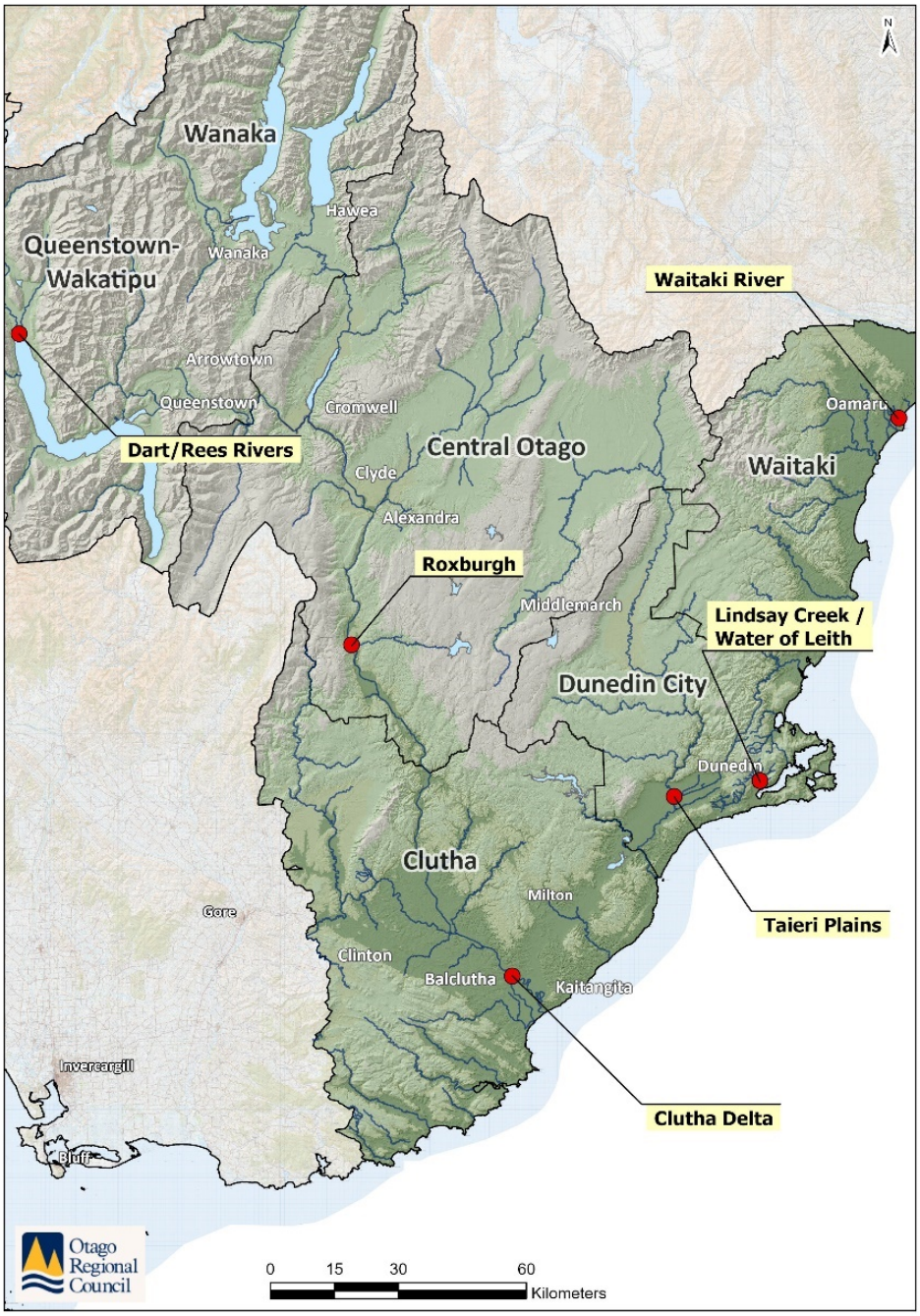


Figure 11 Location of known scheme performance issues.

4. Infrastructure Management Approach

While ORC's purpose, vision and strategic priorities provide an overarching framework to ensure Council are working on the things that matter, the following principles form how ORC manage infrastructural assets:

1. Decisions are aligned with the Council's strategic direction and priorities.
2. Partnership with Iwi.
3. Improving asset inventory data and information.
4. Maintaining existing and fit-for-purpose infrastructure.
5. Optimised decision-making on renewal and replacement of existing infrastructure.
6. Proactively monitoring the ever-changing physical environment and its consequential effects on levels of service.
7. Legislative requirements and consents.

The application of these principles helps guide the infrastructural decisions, and ensures assets are managed in a consistent manner.

4.1 ORC Strategic Direction

ORCs Vision for Otago sets the direction for improving the social, economic, environmental and cultural wellbeing for the Otago communities now and into the future, through six community outcomes:

- Communities that connect with, and care for, Otago's environment.
- An environment that supports healthy people and ecosystems.
- Communities that are resilient in the face of natural hazards and climate change and other risks.
- A sustainable way of life for everyone in Otago.
- Te Ao Māori and Mātauranga Kāi Tahu are embedded in Otago communities.
- Sustainable, safe and inclusive transport.

Council seeks to meet the needs of the community and support the delivery of the flood protection, drainage and river services set out in the Council's Long-Term Plan. ORC will ensure that infrastructural services are managed in alignment with Council's strategic direction.

4.2 Iwi Partnership

Part of the ORCs vision is that Otago mana whenua have a strong voice in shaping Otago. ORC acknowledge the special position of tangata whenua within the region. Te Rūnanga o Ngāi Tahu is the tribal representative body for the entire area of the Otago Region. There are four Papatipu Rūnanga; Te Rūnanga o Moeraki; Kati Huirapa Rūnanga ki Puketeraki; Te Rūnanga o Ōtākou; and Hokonui Rūnaka. Otago's environment holds many values for Aukaha and Kāi Tahu, ranging from the spiritual to the practical. Its place-names are a record of the history, traditions, and customs. The region's coast is still a major source of food, livelihood, and recreation for many.

A 'Memorandum of Understanding and Protocol' is in place between Otago Regional Council and local iwi - Kāi Tahu and Aukaha. ORC are committed to the continuing process of consultation with Māori in the region, to try to achieve mutual understanding and agreement on those issues that concern us all.

4.3 Data and Information

Knowing exactly what assets exist, where they are, and in what physical condition they are in is fundamental to all asset management activities, and sound decisions are dependent upon the ongoing collection and management of appropriate information. Asset information will be improved across all schemes through field-based data collection and office-based data analysis and processing. Council places high importance on regular river surveys, condition and performance assessments and modelling investigations to inform work programmes and associated activities. This also enables us to identify and ensure appropriate management of the most critical assets. Continuously improving the quality and accuracy of data is an ongoing activity Council is committed to.

4.4 Maintaining Infrastructure

The existing flood protection and land drainage infrastructure has largely been developed over the last century and has contributed to regional economic growth and community wellbeing since 1870. This infrastructure underpins the regional economy by providing a level of protection from natural events. The operations and maintenance of infrastructure will continue throughout the lifetime of this Strategy.

The age of the flood banks means that in some areas there is some uncertainty associated with the risk posed by the construction methods that may have been employed at the time, the materials used, and the quality and availability of the documentation provided. This highlights the need for an ongoing improvement of ORC's data and information management capabilities, as well as continuous monitoring, maintenance and potential upgrade of this infrastructure as knowledge improves.

4.5 Renewal of Infrastructure

Some assets will require renewal during the 30 year duration of this Strategy. These assets include:

- Pump stations, including ancillary plant and equipment.
- Gravity gates and locks.
- Culverts.
- Bridges.
- Concrete flood walls and retaining walls.

Operating these assets beyond the end of their useful lives can result in a reduction in performance of the asset or overall scheme, and increased risk of failure, and/or increased maintenance requirements. Undertaking asset renewals is an appropriate way to extend an asset's working life, and these are planned to deliver the most efficient use of expenditure. Improvements in the data is managed and information pertaining to these assets will also improve the way ORC plan and budget for this expenditure over time.

4.6 Changing Physical Environment

Managing infrastructure within an ever-changing physical environment will continue to pose challenges and opportunities throughout the lifetime of this Strategy. ORC will proactively monitor the physical environment in order to adapt to the challenges and opportunities posed by:

- The dynamic geomorphology of the Otago region that contributes to the behaviour of the river catchments and ultimately how the flood and drainage schemes perform.
- The changing climate in Otago and the variable impact of climate change across the region, such as sea level rise, and more frequent and higher intensity rainfall events.

These changes and their consequences have the potential to compromise levels of service and will need to be understood and actively managed. The forward work programmes will therefore include monitoring and analysis to understand the impacts of the ever-changing physical environment on the infrastructure, including ongoing surveys to monitor channel morphology and participation in sea level rise studies to understand regional estimates and impacts. ORC will also continue the development of well-informed communication and adopt a consultative approach with the community as to the areas of natural risk and the measures in place to manage these risks.

Figure 12 Flood Protection asset, Waitepeka Floodbank during the February 2020 flood event

5. Significant Issues and Directions

This section summarises the significant issues facing the flood protection, river assets and drainage activities for the Otago Regional Council and the corresponding actions that are in place over the next 30 years and beyond. These issues are presented diagrammatically in Figure 13. All significant issues are inextricably linked to one another, with one common denominator being 'Scheme Performance'.

Figure 13 Significant issues and associated links.

The following pages in this section provide detail on why each issue has been identified, Council's preferred approach to managing the issue and the alternative scenarios identified. While Council has a preferred approach to managing the issues, the alternative scenarios are sometimes dependent on external factors outside of Council's control. Factors in the environment or economy can have unforeseen effects, such as Covid-19. However, the decision between the preferred approach and alternative scenarios often depends on the strategic direction the Otago Regional Council is heading. The Council needs to respond to some significant challenges, the status quo will not deliver the future the Otago region and communities are striving towards.

Significant Issue No.1: Infrastructure Condition

Why is it an issue?

ORC's infrastructure assets were constructed over a period of 150 years. As infrastructure ages the condition can degrade (flood banks), need replacement or the technology used become redundant. This signals a bow wave of asset renewals/repair/upgrade that will require investment, and funding of such, within the next 30 years.

Continuing to maintain assets beyond their intended life increases the risk of failure and will also increase the frequency and cost of operations and maintenance activities. Factors such as installation, operational environment and manufacturing defects can also reduce the useful lives of assets.

Council has good institutional knowledge of its assets, however, does rely on asset management systems and processes that are in some cases dated. This may reduce confidence in the data that informs operational and maintenance decisions, and the timing of renewal.

The age of an asset is only one indication of an asset's renewals and maintenance needs. Key to smart asset management is a sound understanding of asset condition, with regular and structured condition assessments of all assets. This allows asset renewals to be driven by the condition of the asset, not only its age.

It is imperative that Council has the confidence in its infrastructure to perform as designed. Allowing assets to decline would lead to reduced levels of service and increase the risk associated with their functioning as required.

Council's preferred approach to manage this issue

The preferred approach is to **adopt a risk management approach to prioritise and schedule asset renewals to proactively manage this program of renewals and investment over the lifetime of this Strategy**.

It is understood that improved asset management systems and processes, as well as undertaking effective planning to avoid/mitigate the effects of natural hazards, are necessary to understand risk and increase confidence in the decisions that are made in relation to operations, maintenance and renewal.

The implications of taking this approach are:

- Deferred renewals/maintenance.
- Decision making can be based on both asset condition and age
- Critical assets are maintained.
- Reduced level of service in low criticality areas.
- Short-term affordability.

The following option was considered as an alternative to the preferred approach identified above.

Renew assets at point of failure

Assets would be renewed before the end of their useful life.

The implications of this option are:

- Reduction of risk associated with continuing to operate assets beyond the end of their useful life.
- Level of service maintained.
- Increased capital costs as bow wave of asset renewals is struck within the period covered by this strategy.

Significant Issue No.2: Funding

Why is it an issue?

The Otago region's economic conditions have an impact on the ability of communities to pay for the services provided. There are increasing pressures on the current level of funding to deliver more. Furthermore, the affordability of levels of service are already being impacted by a number of the significant issues discussed earlier, such as changes to and effects of climate change, growth (or decline) of populations and development in surrounding floodplains, and increasing regulatory performance requiring higher operational and maintenance costs. Alternative funding mechanisms will need to be considered otherwise trade-offs in levels of service and risk will be necessary, the consequential effects of such being increased risk and reduced economic prosperity.

The flood protection and drainage infrastructure is fundamental to the continuing economic prosperity of the Otago region as it provides protection to a significant number of residential, commercial, and agricultural assets, including lifeline utilities, the Dunedin International Airport and state highways. Significant investment is needed to maintain infrastructure networks with consideration for the other significant issues raised previously.

Council's preferred approach to manage this issue

The preferred approach is to **maintain current practice while continuing to review and improve funding strategies**. Council will continue to engage through the Regional Council infrastructure sector to source Central Government funding.

The implications of this approach are:

- Risk that funding strategies do not come to fruition and there is a reduction in maintenance and decrease in level of service over time.
- Impact on property valuations.
- Increase in insurance costs.

The following option was considered as an alternative to the preferred approach identified above.

Reduced maintenance and decreased levels of service

Maintenance would be reduced and there would be a corresponding decrease in the level of service achieved by Council's flood and drainage infrastructure.

The implications of this option are:

- Reduced level of service.
- Increased risk and damage costs.
- Reduced short-term costs.
- Poor reputation.

Significant Issue No.3: Climate Change

Why is it an issue?

If current and improved levels of service are to be delivered, significant investment is required to address climate change impacts on scheme infrastructure.

In October 2019, the ORC commissioned NIWA to undertake a review of climate change projections for the Otago region over the 21st Century. The study concluded that changes to Otago's future climate are likely to be significant with increases in rainfall across the region, with subsequent increases in the scale of annual floods, means:

- The changes challenge the ability to achieve Levels of Service over time
- Changing climate in Otago
- Sea level rise in Otago
- Clutha shoreline retreat

The effects of climate change will impact the environment regionally and nationally. There will be changes in sea level rise, wind and weather patterns, higher water tables, and the frequency of extreme weather events. These climatic changes will put increased pressure on the schemes and challenge the Levels of service provided. Furthermore, climate change is likely to impact on the health and distribution of species, and pests will spread to new areas, habitats will change, and indigenous species may need to migrate.

Council's preferred approach to manage this issue

The preferred approach is to **adopt a more planned and integrated approach** by:

- Making provision for the efficient installation of increased flood capacity.
- Incorporating resilience into future designs of new infrastructure or renewals.
- Invest in improved understanding of future climate change effects.

How Council responds operationally and strategically to climate change will continue to evolve in parallel with climate science and policy. Climate change is currently being factored into the design of schemes through scheme reviews and design decisions. The actual costs related to climate change will be subject to decisions made by individual communities when considering their appetite for risk, costs of risk mitigation, and the timing of interventions as risks increase gradually over time.

The implications of taking this approach are:

- More planned and substantial provision for climate change, and reduction in risk as a result.
- Improved understanding of climate change in Otago.
- Opportunity for environmental enhancement.
- Improved reputation.

The following options were also considered as an alternative to the preferred approach identified above.

Maintain current design flow (flood) standards	Increase design standards
Maintain scheme levels of service to original design standards. The implications of this option are: • Avoiding increased costs in the short-term. • Accumulation of infrastructure debt. • Increased risks and costs to future generations. • Increased frequency of flood response and recovery.	Incrementally increase the capacity of floodbanks and pump stations to meet current climate change projections. The implications of this option are: • Reduced risks with some residual risks. • Increased costs and debt. • Land purchase may be required.

Significant Issue No.4: Legislation/Regulatory

Why is it an issue?

The flood protection and drainage schemes were designed and built at various times over the past 150 years and reflect the values, knowledge and understanding of that time. The majority of these schemes were developed and constructed in an era when economic growth and development were the primary focus of the time. Flood protection and land clearance for drainage enabled farmland and agricultural initiatives to develop and prosper.

Community values and Central Government expectations in relation to environmental outcomes have changed and continue to change at a significant rate. The following are examples of such changes that will impact the schemes:

- Freshwater improvement programme
- Fish passage requirements
- Biodiversity opportunities
- Tracks and trails on/around assets
- Co-benefits

Public perceptions now seek multiple values in addition to the original purpose from the time most schemes were established: flood protection/drainage. Flood protection infrastructure is often located in areas of high environmental, recreational or conservational value and these values may be impacted by, or maintenance of, that infrastructure.

Council's preferred approach to manage this issue

The preferred approach is to seek **improved environmental performance & integrate asset diversification** by achieving multiple outcomes wherever possible. Adopting a more natural and adaptable approach by integrating environmental enhancement wherever possible. This will be progressed by continuing to actively manage scheme effects and working with local landowners, to achieve full regulatory outcomes across a range of outcomes, including those associated with biodiversity and recreational opportunities.

There are a wide range of management options available for environmental enhancement. These include riparian planting, fish passage, and giving rivers and the ocean more room to behave naturally. The ORC will continue to endorse increased community and iwi engagement in improvement initiatives, as well as other stakeholder collaboration and partnership funding opportunities, wherever possible. There will inevitably be trade-offs between costs, risks and environmental performance.

The implications of taking this approach are:

- Sustainable long-term outcomes.
- Enhanced environment.
- Increased costs to meet standards.
- Improved reputation.

The following option was considered as an alternative to the preferred approach identified above.

Maintain current practice

Maintain current practice through the operation and maintenance of existing infrastructure while continuing to mitigate any adverse environmental effects of this infrastructure. There would be little to no improvement in environmental performance and outcomes.

The implications of this option are:

- Failure to meet public expectations.
- Declining environmental outcomes.
- Risk to reputation.

Significant Issue No.5: Natural Hazards

Why is it an issue?

The Otago region comprises a diverse landscape ranging from flat coastal lowlands and intensively used alluvial floodplains, to large sparsely populated and steep mountainous areas. Otago is exposed to a broad range of natural hazards such as:

- Flooding.
- Landslides.
- Seismic activity.
- Coastal erosion.
- Tsunami.
- Storm surge.

These all present major hazards to flood protection and drainage infrastructure. For example, major earthquakes could result in cracking, slumping and/or settlement of flood banks.

The potential effect of a natural disaster (including flood events) on the ORC's financial position is dependent upon the scale, duration and location of the event. Recovery/response reserves are being built up over time and (self) insurance cover is in place to fund up to 40% of qualifying expenditure in the event of a natural disaster/event, noting that the remaining 60% of funding is provided by the National Emergency management Agency (NEMA). Current LTP has no allowance for repairs to scheme assets resulting from flood events/natural disaster forecast in expenditure.

Council's preferred approach to manage this issue

The preferred approach is to **maintain and improve current practice around hazard readiness, response and recovery** throughout the lifetime of this Strategy as Council continues to learn from past events across the region and New Zealand. This will include increased efforts to raise awareness and educate communities around natural hazards they may be at risk from. Council will continue to undertake investigations to help understand and plan for risks related to natural hazards.

Council aims to minimise damage to flood protection and drainage infrastructure and will continue to develop plans and processes that will:

- Take a risk management approach.
- Incorporate climate change impacts into asset management.
- Seek to reduce the damage potential on the flood and drainage infrastructure.
- Develop strategies to enable timely response following a natural disaster.
- Ensure funding policies are robust and appropriate.
- Integrate with Civil Defence and Emergency Management (CDEM) readiness and response planning.

The following options were considered in relation to this significant issue. It is noted that Council's preferred approach is to adopt a combination of these options.

Maintain current practice	Build resilient infrastructure
Maintain current practice by undertaking natural hazards investigations and carrying out effective planning to avoid/mitigate effects of natural hazards on flood and drainage infrastructure. The implications of this option are: • Localised damage and disruption. • Pressure on flood response plans to be effective. • Multi-agency collaboration. • Reserve funding reliance.	Design and upgrade infrastructure to be more resilient to natural hazards. This may include strengthening infrastructure, or in some cases designing for failure at suitable locations to mitigate the impact of the event on critical infrastructure. The implications of this option are: • Decreased risk. • Increased costs.

Significant Issue No.6: Growth and Development

Why is it an issue?

In April 2017 changes were made to the RMA (Section 6) highlighting the increasing level of natural hazard risk and the need to ensure growth and development does not increase these risks and associated costs. While household projections for Dunedin City are estimated to decelerate, some growth is proposed in areas of high or increasing natural risk, and there is a need for information to be available to assist in decision-making and managing community expectations. For example, intensification of urban development along the right bank of the Silver Stream and some sections of the Owhiro Stream are likely to affect the runoff to, and consequently design capacity of East Taieri and Lower Taieri Schemes. Furthermore, this rising urban development is changing the public's expectations on the levels of service that should be provided.

Over the longer term there is potential to see some acceleration of land use change outside of urban areas, placing additional pressures on the flood protection and drainage services to provide protection. A better understanding is needed of the likely distribution of this growth and what additional demands this will likely place on flood management services.

Council's preferred approach to manage this issue

The preferred approach is to **maintain current practice but consider innovative approaches to addressing population growth/decline and manage demand through land use controls**. Collaboration with territorial authorities will need to continue to effectively mitigate the impact of increased runoff through land use change and development. This will include identifying areas of potential risk and may also include opportunities for innovative approaches to managing the impacts of development. There is an ongoing need to ensure sufficient information is available to assist in informing where there may be risks associated with development. Subject to further discussion and agreement with the relevant territorial authorities, the ORC aspires to take an integrated, multi-agency approach to land use planning.

In addition to this ORC will look to better understand what impact a failure of its assets and levels of service will have on other key infrastructure in the immediate and wider region. While ORC understands what other infrastructure surrounds its own assets, work is required to develop a sound understanding of the strategic importance that these hold socially and economically and how the performance of ORC schemes/assets may directly or indirectly affect their function.

The following options were considered in relation to this significant issue. It is noted that Council's preferred approach is to adopt a combination of these options.

Maintain current practice	Reactive response to demand as a result of development	Integrated multi-agency approach
Utilise existing planning controls to mitigate impact of development. Growth and development trends are monitored and forecasts incorporated into forward work programmes. The implications of this option are: • Similar levels of expenditure. • Some reduced risks.	Levels of service will be increased to the current 100-year design level of protection (or standard otherwise agreed with the community). Climate change will not be allowed for. The implications of this option are: • Increased capital/operational costs. • Difficult to forecast costs. • Increased risks.	Work with territorial authorities to take an integrated and multi-agency approach to land use planning and District Plan review. The implications of this option are: • Multi-agency collaboration. • Financial sustainability for schemes.

Significant Issue No.7: Scheme Performance

Why is it an issue?

Scheme performance is at the centre of all other significant issues. Each issue will ultimately have a flow on effect to the overall scheme performance parameters.

Levels of service are currently based on the existing design standards for each scheme. These design standards are most commonly based on an historical flood event. For example, the design standard for the Lower Taieri scheme is based on the 100-year flood (1% Annual Exceedance Probability) event as determined in 1980, with a set flow rate (measured in cumecs) and drainage moduli (measured in mm/day) being used to define the level of service provided by the infrastructure (pump stations, flood banks and spillways) that makes up the scheme.

Over time several factors may affect the ability of a scheme to meet the standards that it was designed to, including:

- Changes in the climate that impact on the intensity of rainfall events and their duration.
- Changes in community tolerance and vulnerability.
- Changes in the geomorphology of the landscape within river catchments that prompts changes in river behaviour, such as increased build-up of sediment in the lower lying reaches of the schemes, that in turn leads to a reduction in capacity of a flood protection scheme during a flood event.
- Improved hydrological analyses and understanding of the behaviour of the natural environment in response to the environmental and geomorphological changes outlined above.

Council's preferred approach to manage this issue

The preferred approach is to **maintain levels of service to current standards whilst noting there will be instances where intervention will be required, and standards will need to be increased**. There are a number of options for improvement to levels of service and consideration will need to be given to other significant issues that are inextricably linked to the issue of scheme performance.

Scheme performance reviews of the Lower Taieri and Lower Clutha, which will include consultation with benefiting communities, landowners and other affected stakeholders, are due to commence within the first five years of this strategy. Options will look at increasing the level of service whilst providing allowance for climate change either now or in the future. Increasing levels of service, with or without climate change adaption, will result in increased costs for the beneficiaries and wider communities.

The following options were considered in relation to this significant issue. It is noted that Council's preferred approach is to adopt a combination of these options.

Maintain current scheme performance	Increase scheme performance (no climate change allowance)	Increase scheme performance (with climate change allowance)
Schemes will be maintained to current design standards/performance. The implications of this option are: • Reduced expected levels of service. • Similar levels of current expenditure. • Increased risk from flood events.	Scheme performance increased to provide a greater level of protection (Climate change will not be allowed for. The implications of this option are: • Increased cost to implement. • Meet expected levels of service. • Reduced risks. • Reduced level of service over time.	Scheme performance increased to provide a greater level of protection (Climate change will not be allowed for. The implications of this option are: • Increased cost to implemented. • Meet expected levels of service. • Greater reduction in risk.

6. Infrastructure Investment Programme

Key projects and programmes are presented including the significant issues that will be addressed, accompanied by estimated expenditure over the next 30 years to deliver these programmes and how they relate to significant issues and drivers for change.

While the major projects and programmes identified in this 30-year investment programme reflect current assumptions and uncertainties, there is a higher degree of certainty about the investment forecast for the first 10 years. Projects and programmes identified in the subsequent two decades (years 11-30) are likely to change in response to new information, change in demand, and future needs.

A summary of the key projects and programmes that address some of the specific significant issues addressed in this Strategy is provided in Figure 14.

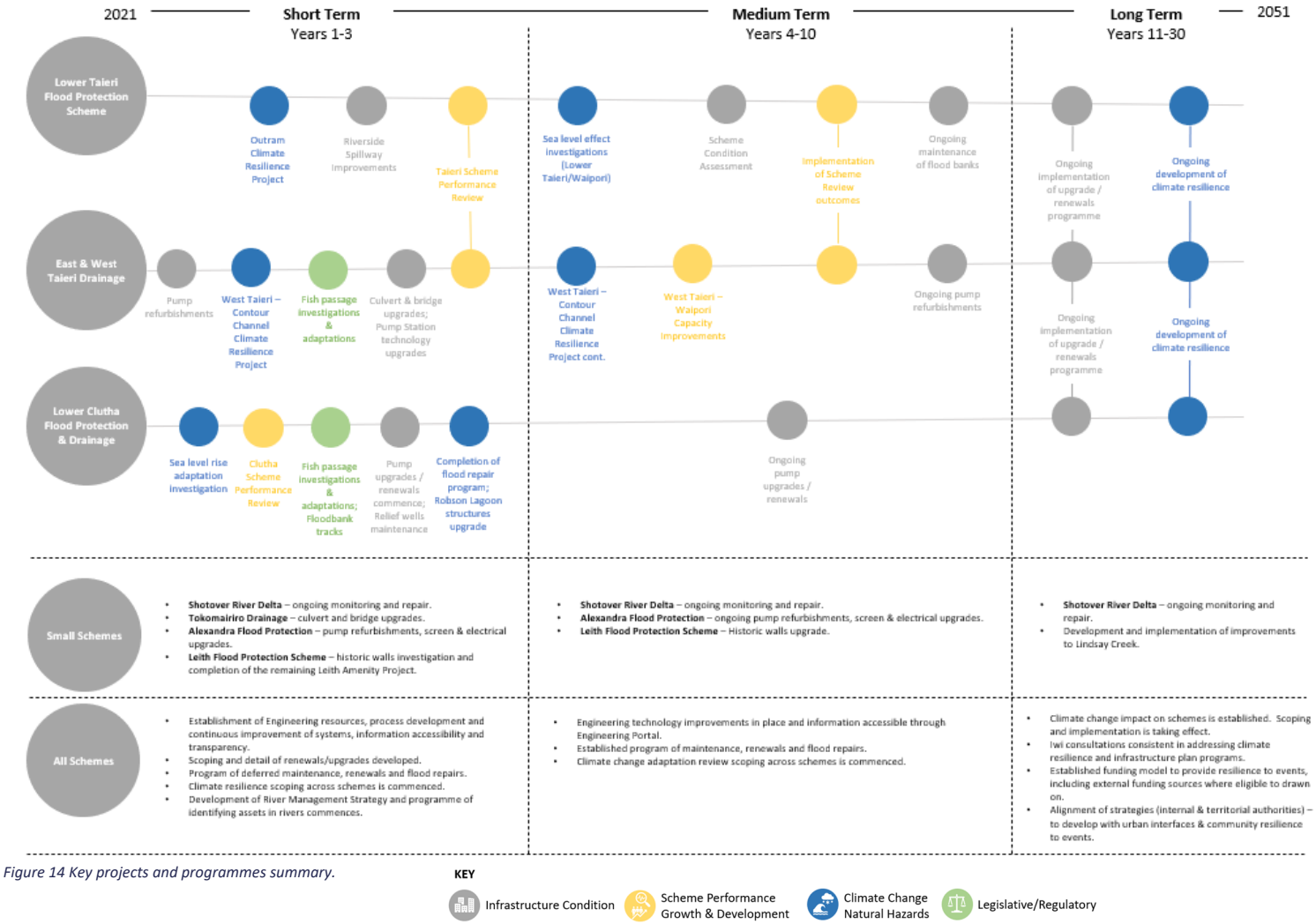


Figure 14 Key projects and programmes summary.

6.1 Planning asset renewals

Council carries out routinely through its operations and maintenance program, cyclic inspections of all above ground assets, annually and as otherwise required. These inspections are required to ensure the resilience and performance of these assets are confirmed and not compromised with the assigned remaining life of the asset (asset lives are recorded in the management plans and in Councils information system, Conquest).

In addition to visual inspections Council undertakes a programme of structural audits which commenced in 2012. These structural audits provide the Council with a detailed condition assessment of the above ground assets and contribute to setting asset renewals and risk management.

6.2 Infrastructure expenditure assumptions and uncertainty

The Council's Infrastructure expenditure programme is based on the following key assumptions and basis of assumption:

Infrastructure Category/Timeline	Key Assumption	Basis of Assumption
General	• Asset valuation is based on a combination of depreciation value, and subject to impairment losses as well in some cases. The Financial Strategy will detail this. • Structures, and bridges are depreciated. • Floodbanks, drains and culverts are not depreciated. • Legislation changes may have an impact on the level of service, where changes in rules and requirements have an impact on planned expenditure programme. • Insured assets are limited to pump station infrastructure only. • Council does not self-insure all other above ground assets. • No allowance has been made in expenditure for repairs to scheme assets resulting from flood events or other natural disasters. • Responding to major weather events or other natural disasters is funded through insurance (where insurable) and scheme reserves in response to events. • Increased renewals or maintenance due to natural disasters will be funded through scheme reserves and Councils ability to raise debt. • Information contained in this Infrastructure Strategy is based on current known information which has been used to determine issues and understand the asset management requirement for a 30-year horizon. • Asset lifecycle costs are based on useful remaining lives, condition assessments and replacement values as at 31st December 2020, which has been drawn from known information[9] in Councils current systems. • All capital renewal expenditure is based on current levels of service. • Global crisis or pandemic, the Council has systems and procedures in please for staff to work remotely. The council may be required to drop many of its BAU activities to focus resources on essential services and any major civil defence response across the region	• **Existing schemes remain economic at current level of service.** • **Management, systems, and processes are fit for purpose** • **Flood protection schemes have been designed and constructed to provide a level of protection accepted by communities which is supported by relevant funding models.** • **There is a possibility that new schemes may need to be developed in areas where currently no flood protection or drainage services are provided. This demand may be triggered by a flood event or an increase in activity in a flood prone area. Council may undertake investigations to determine the feasibility during the 30 year period, if there is a demand.**

[9] "known information" is drawn from Councils databases which record; inventory of assets, assessments, inspections, reports pertaining to assets. Council uses a computerised maintenance management system, Conquest along with other databases of source information relating to the operation and maintenance of schemes.

Infrastructure Category/Timeline	Key Assumption	Basis of Assumption
Years 1 to 10	• There is not expected to be an increase in demand that will significantly change the current level of design and service, as the overall projected population growth is not expected to exceed the scheme functionality. • There are no planned increases or changes to level of service in Years 1 through to 10.[10] • The continued development of robust asset management systems including forecasting and modelling tools in Years 1 to 3 will provide Council an improved basis of determining capital renewals costs. • No new schemes are provisioned for in Years 1 through to 10. • Demand and vulnerability to managed through District Plan. • Known asset performance deficiencies are addressed to provide scheme resilience. • All future projects have been investigated, scoped and programmed into future LTPs (where projects exceed $100,000 of renewal or replacement). • All asset gradings of 'very unreliable' are transitioned into 'reliable' grading. • Any health and safety deficiencies with operating infrastructure are identified by and addressed. • Scheme Performance reviews for Taieri and Lower Clutha have been completed, investigated, scoped and programmed into proceeding LTPs. • River channel assets are identified and updated on asset management system. • Completion of flood repair program of works and climate resilience (MBIE funded) program of works.	• **No significant new schemes, investigations, scoping only.** • **Major upgrades only if affordable and agreed with communities.** • **Resilience restored in flood protection schemes through flood repair programs and climate resilience programs**

[10] The Scheme Performance reviews completed in Years 1 to 3 will provide an indication of any changes to levels of service which may be identified as a future requirement. This has been indicated in forecast expenditure in Years 4 to 10 as potential 'increased levels of service' resulting from scheme modifications, improvements and/or capacity increase.

Infrastructure Category/Timeline	Key Assumption	Basis of Assumption
Years 10 - 20	• Years 11 onwards show an indicative increase in levels of service required (land drainage New East Taieri Pump Station) and new works (Lindsay Creek). • There is an anticipation for an increase on our flood protection and drainage scheme assets due to the increase of urban development on existing rural locations where the schemes are located. Consequently, a review of rating and development contribution may occur to contribute to the maintenance expenditure, and investigations around capacity of storm drainage impacts on existing land drainage infrastructure. • Climate adaptation programmes developed and consulted with community.	• **Climate change impacts will become increasingly important over the 20 - 30-year period.** • **Increase in cost and/or risk will become key consultation on resilience of existing schemes and/or new schemes.**
Years 20 -30	• Climate adaptation programmes scoped, designed and implemented per community consultation. • Lindsay Creek upgrades proceed with community approval and appropriate funding.	• **Unqualified estimates have been indicated relating to climate resilience, assuming that the increased risks due to climate adaptation are not accepted and community requires investigation and/or adaption.**

Further details on the key assumptions, associated uncertainty and the potential implications are shown below in Table 7:

Table 7 Infrastructure assumptions and uncertainty

Key Assumption	Risk	Level of uncertainty	Expenditure implication	Reasons and expenditure effect of uncertainty
Growth and Demand				
There is expected to be a marginal increase in demand on the use of the flood protection and drainage scheme assets to convey stormwater drainage from urban development. This is predominately in the Taieri (Mosgiel and Outram) areas where urban development interfaces existing rural locations where the schemes are located.	The increase in demand may significantly change the current level of design and service. The overall projected population growth in the Taieri areas exceeds the projected scheme functionality and capacity.	Low	Low	The scheme performance and capacity of existing flood protection and drainage assets will be assessed in the Taieri Scheme Review during Years 1 to 3. The current special rating districts do not include urban growth areas in the Taieri as rated areas that contribute the flood protection and drainage schemes. Options to provide for urban development and reliance on Councils existing flood protection and drainage assets will be determined during Years 1 to 3 which may result in infrastructural changes to cater for increased capacity. This may result in an increase of special rating districts to cater for an increased level of service and flood protection in the Taieri growth areas of Mosgiel and Outram.
Asset Lifecycle				
Sources of funds for future replacement of critical and significant assets are secure.	The Council has insufficient funds to replace significant assets at the end of their useful lives	Low	Low	

Key Assumption	Risk	Level of uncertainty	Expenditure implication	Reasons and expenditure effect of uncertainty
Information contained in this Infrastructure Strategy is based on current known information which has been used to determine issues and understand the asset management requirement for a 30-year horizon. The continued development of asset management systems including forecasting and modelling tools will continue through Years 1 to 3. It is expected that maturity in asset management systems and consolidation of known information will provide Council an improved basis of determining capital renewals costs. Asset lifecycle costs are based on useful remaining lives, condition assessments and replacement values as at 31st December 2020, which has been drawn from known information in Councils current systems.	The Council has insufficient known information to support its asset lifecycle costs.	Low	Low	
Climate & Hazards				
Increased significant weather events, or other natural hazard emergencies will occur. Infrastructure Strategy assumes there will be an average of (1) significant event[11] per financial year.	Council cannot accurately predict when and where large flood events will occur, or the damage that may result from any flood event. here will be increased frequency of weather events that cause damage to infrastructure assets.	Medium	Medium	The effects of increased weather events that cause damage and potential other natural hazard events, on Councils financial position is dependent on the scale, duration and location of the event.

[11] Significant event is defined as flood protection trigger levels are reached in a scheme and the event reaches repair cost threshold in accordance with NEMA guidelines

Key Assumption	Risk	Level of uncertainty	Expenditure implication	Reasons and expenditure effect of uncertainty
				The Council will manage the effect through its reserves to repair or replace infrastructural assets that are damaged and/or destroyed. The infrastructure strategy will focus on self-insurance reserves that are built up over time to ensure funding up to 40% of the expenditure is available across the schemes.[12]
Climate change will be consistent with current national and regional projections. Future sea level rise does not exceed that projected by current climate science.	If climate change effects occur more quickly than expected, the adaption and response to climate change will change cost response.	Medium	Medium	Potential climate change impacts are being considered through scheme performance and detailed investigation as prediction and adaptation information becomes available. The infrastructure considers climate change and provides to investigate the impact on the management of flood protection and land drainage scheme assets.
Legislation/Regulatory				
Resource Consents	The necessary resource consents for infrastructural activities, including capital renewals/repairs, operations and maintenance will be obtained (and granted) as they are due or required.	Medium	Medium	
Land acquisition – land can be purchased when and where needed.	If land cannot be purchased as and when planned, projects would need to be deferred until land could be acquired. This may result in additional expenditure from damage prior to land acquisition.	Medium	Medium	

[12] The Council has access to the National Emergency Management Agency (NEMA) which provides 60% funding of expenditure required to repair assets damage. This is dependent on the Council reaching its threshold which is 0.002% of the Rateable Value of Council infrastructure in the financial year in which the damage occurred.

Key Assumption	Risk	Level of uncertainty	Expenditure implication	Reasons and expenditure effect of uncertainty
Legislative changes will change marginally, however current forecast allows for adaptation.	There will be no major changes to key legislation that effects the ORC's strategy or has funding implications. Key legislation under this Infrastructure Strategy includes, Local Government Act 2002, Resource Management Act, and Soil Conservation and River Control Act 1941.	High	High	There is a high level of uncertainty because legislative change is likely over the next 30 years. The potential effect of any new changes environmental or resource management will be determined on the response required, and the timing to effect such changes. Legislative changes may result in additional required expenditure to comply with new standards.
Cultural & Community Values				
Iwi and Maori expectations	Expectations and management of how infrastructural assets are managed in conjunction with Iwi and Maori values may require adjustment and implementation of key projects and programme.	Low	Low	
Community expectations	Level of community engagement and evolving expectations on current levels of service as urban and rural demographic's merge may cause for key projects and programmes of work to be adjusted.	Low – Short term (1 – 5 years) Medium – Longer term (6 – 20 years)	Low – Short term (1 – 5 years) Medium – Longer term (6 – 20 years)	Expectations and addressing outcomes into implementation plans, are largely included in the Short term. Long term as detailed investigations around scheme performance and climate resilience / adaptions progresses may result in forecast adjustment to reflect community consultation and request for levels of service.
Level of Service				

Key Assumption	Risk	Level of uncertainty	Expenditure implication	Reasons and expenditure effect of uncertainty
All capital renewal expenditure is based on current levels of service.[13] No new schemes are provisioned for in Years 1 through to 5. [14] Years 11 onwards indicate an increase in levels of service (land drainage) and new a scheme (Lindsay Creek).	Levels of service are not adequate	Low	Low	
Weather events and Natural disasters				
No allowance has been made in expenditure for repairs to scheme assets resulting from flood events or other natural disasters.	Multiple weather event and natural disasters occur and exceeds forecast expenditure.	Medium	Low	Responding to major weather events or other natural disasters is funded through insurance (where insurable) and scheme reserves in response to events. Increased renewals or maintenance due to natural disasters will be funded through reserves. Council also has the ability to raise funding for the cost of unexpected works in response to weather events and natural disasters such as floods or earthquakes.

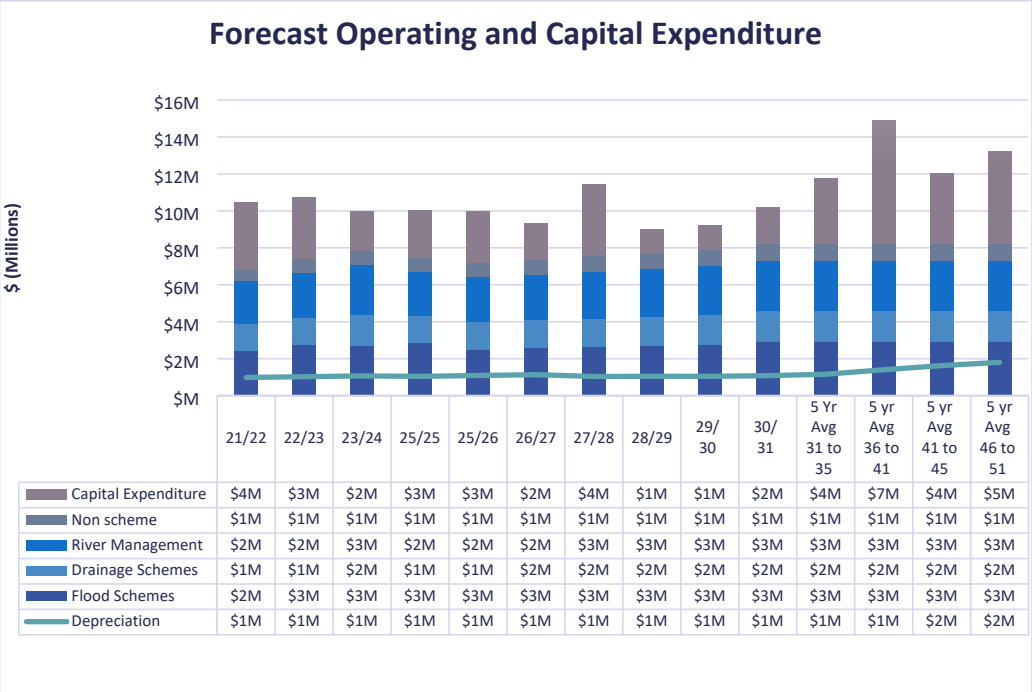
[13] Current levels of service are based on agreed flood management and land drainage infrastructure that has been developed and agreed to specifically with local communities when constructed (>50 years ago) as a defence. These levels of service remain relevant.
[14] Additional new schemes will likely to be identified over the next 30 years, they will be developed and included in revisions of this strategy.

6.3 Total expenditure

Over the next 30 year period Council has forecast to spend a total of $392 million. $281 million will be invested in ongoing maintenance and operations of schemes, including an asset depreciation allowance. Capital investment will be $111 million, this expenditure will enable periodic replacement of existing assets and provide asset upgrades or additions to address significant issues. Forecast expenditure by scheme/area is shown in Table 8. This is depicted graphically in Figure 15.

Table 8 Capital and operational expenditure by scheme area for the 30-year period 2021 - 2051

Scheme/Area	Capital Expenditure	Operational Expenditure	Total Expenditure
F 1 Alexandra Flood Protection Scheme	$5M	$9M	$14M
F 2 Leith Flood Protection Scheme	$33M	$23M	$53M
F 3 Lower Clutha Flood Protection and Drainage Scheme	$17M	$46M	$62M
F 4 Lower Taieri Flood Protection Scheme	$18M	$29M	$45M
F 5 West Taieri Drainage Scheme	$33M	$31M	$62M
F 6 East Taieri Drainage Scheme	$5M	$25M	$29M
F 7 Tokomairiro Drainage Scheme	$1M	$5M	$6M
F 8 Shotover River SRA	-		-
F 9 Scheme Oversight & Bylaws	-	$26M	$26M
M 1 River Management - Dunedin	-	$14M	$14M
M 2 River Management - Clutha	-	$15M	$15M
M 3 River Management - Central	-	$14M	$14M
M 4 River Management - Wakatipu	-	$13M	$13M
M 5 River Management - Wanaka	$0.105M	$11M	$11M
M 6 River Management - Waitaki	-	$13M	$13M
M 7 Lower Waitaki Flood Protection Scheme	-	$7M	$7M
M 8 Non Scheme Management	-	$1M	$1M
Total	**$111M**	**$281M**	**$392M**



	21/22	22/23	23/24	25/25	25/26	26/27	27/28	28/29	29/30	30/31	5 Yr Avg 31 to 35	5 yr Avg 36 to 41	5 yr Avg 41 to 45	5 yr Avg 46 to 51
Capital Expenditure	$4M	$3M	$2M	$3M	$3M	$2M	$4M	$1M	$1M	$2M	$4M	$7M	$4M	$5M
Non scheme	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M
River Management	$2M	$2M	$3M	$2M	$2M	$2M	$3M	$3M	$3M	$3M	$3M	$3M	$3M	$3M
Drainage Schemes	$1M	$1M	$2M	$1M	$1M	$2M	$2M	$2M	$2M	$2M	$2M	$2M	$2M	$2M
Flood Schemes	$2M	$3M	$3M	$3M	$3M	$3M	$3M	$3M	$3M	$3M	$3M	$3M	$3M	$3M
Depreciation	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$1M	$2M	$2M

Figure 15 Forecasted operational and capital expenditure 30-year period 2021 – 2051. N.b units in table are rounded to the nearest million dollars.

6.3.1 Capital expenditure

The most significant driver of capital expenditure is the infrastructure renewals and replacement.

The four key drivers for making capital investment across the flood and drainage schemes are:

1. The need to renew/replace existing assets;
2. The need to adapt to changing environment to maintain (as a minimum) the level of service that the schemes currently provide;
3. The need to increase a level of service that the schemes currently provide in the areas required; and
4. The requirement to meet a new need or demand for flood or drainage scheme protection.

There will be an on-going requirement to make decisions including through consultation on renewals expenditure on a cyclical basis as part of the processes associated with the Councils LTP and Annual Plan processes.

Figure 16 shows the forecast renewal expenditure profile for the infrastructure assets associated with flood protection and land drainage. The expenditure forecast has been developed in line with the assumptions detailed in section 6.2.

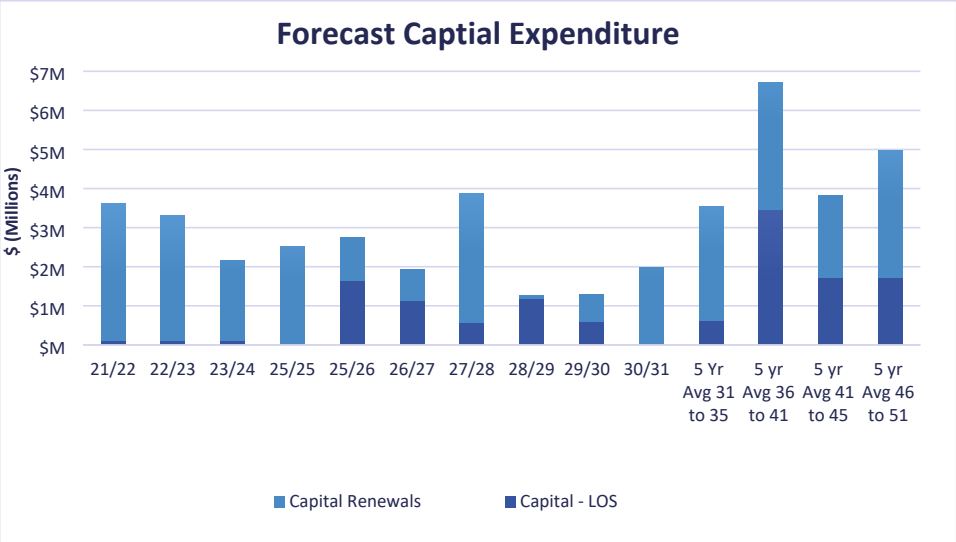


Figure 16 Forecast capital expenditure 2021 – 2051.

6.4 Operational expenditure

Operation expenditure provides for the maintenance and operations works associated with each scheme and includes depreciations and other running costs.

In years 1 to 4 a number of scheme reviews will be undertaken, otherwise operational expenditure remains relatively consistent with some increases for inflation accounted for. It is not anticipated that scheme reviews would have a significant impact on future operational costs/needs.

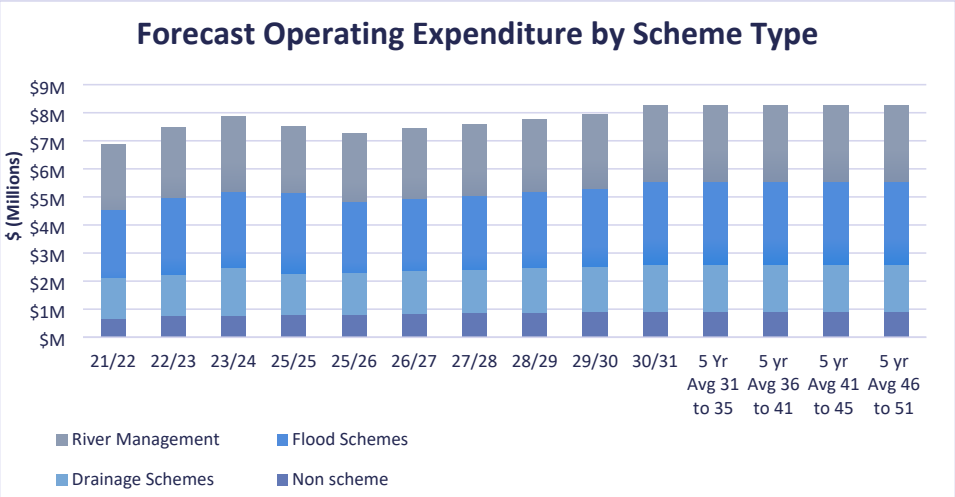


Figure 17 Forecast operating expenditure split by scheme

6.5 Key projects and programmes

A summary of the key projects and programmes that are planned over the next 3 years are presented in Table 9 below. A description for each is provided including the significant issues that will be addressed, the estimated expenditure required, and the timing for delivery. Key projects are defined where the project or programme of works exceeds $100,000 in a financial year cycle.

Table 9 Key projects and programmes for flood protection and drainage services 2021 – 2051

Project/ Programme	Description	Addresses Significant Issue(s)	Timing
Taieri Scheme Performance Review	Assessment of performance and engineering options considered for scheme.		2021 -2024
Clutha Scheme Performance Review	Assessment of performance and engineering options considered for scheme.		2021 - 2022
Climate Change Adaptation investigation	Engineering options and resilience options developed.		2021 - 2023
Drainage Capacity investigations	Detailed assessment of drainage capacity, pump stations and drains.		2021 - 2022
Storm drainage assessment and principles	Development of storm drainage principles and effect of urban approach on rural land drainage assets.		2021 - 2022
Fish Passage adaptation investigations	Research and development for implementation of fit for purpose fish passage across pumping/outflow structures.		2021 - 2024
Asset Management improvements	System and technology assessment and implementation to coordinate critical assets data .		2021 - 2024
Investigation of use of ORC assets for trails	Investigation and development of design and standards to be constructed on ORC floodbanks.		2021 - 2022
Weed management of pump station inlets	Research and development of techniques to manage and remove weed blockages at pump stations.		2021 – 2023
Leith Historic Wall investigation	Detailed design and option for replacement program of historic channel walls.		2022 - 2024

The key used to represent the significant issues in this section is depicted below:

The following key projects (Table 10) are detailed in the long-term plan and reflect continued programs of work and projects resulting from key programmes of investigation and detailed design set out in this infrastructure strategy. The projects reflect the focus on on-going repairs to critical assets and the development of infrastructural renewals or upgrades because of identified issues for detailed design for solutions. Projects will be subject to community consultation and funding models where significant expenditure is signalled.

Table 10 Key projects, including capital renewals/repairs 2021 - 2051

Project/ Programme	Description	Addresses Significant Issue(s)	Timing
Flood Repair programs: February 2020 event and January 2021 event	Completion of flood damage repair programs		2021 onwards
Climate Resilience Program: Outram	Ministry (64%) funded resilience renewal of flood protection assets		2021 - 2023
Climate Resilience Program: Contour Channel	Ministry (64%) funded resilience renewal of flood protection assets		2021 -2024
Climate Resilience Program: Riverbank Road	Ministry (64%) funded resilience renewal of flood protection assets		2021 - 2022
Climate Resilience Program: Robson Lagoon	Ministry (64%) funded resilience renewal of flood protection assets		2021 - 2023
Leith Amenity Project	Completion of the remaining Leith Amenity Project		2021 - 2022
Construction of a Shared Use Path (SUP) on Lower Clutha Foodbank	Construction of a SUP on ORC asset to provide an amenity use for community		2022 - 2024
Gordon Road and Silverstream improvements	Channel improvements in Silverstream		2022 - 2024
Riverside Spillway improvement	Spillway upgrade / improvement		2021 - 2022
Pump Station Technology improvements	Implementation of SCADA and link to asset management data portals		2022 - 2025
Asset Management improvements through technology system improvements	System implementation of data and metric monitoring of critical assets		2022 - 2025
Stoney Creek Debris Flow development of options	Upgrade of Stoney Creek to provide debris flow		2022 - 2025
Installation of increased monitoring for flows and levels across schemes and coastal mouths	Installation of monitors and link to asset management		2022 - 2025

Project/ Programme	Description	Addresses Significant Issue(s)	Timing
Pump stations infrastructure upgrade	To meet safety, compliance and fit for purpose standards, including fish passage considerations and weed management		2023 - 2026

There are only three significant projects that are signalled in the Long Term Plan that are categorised as new capital expenditure.

These projects are signalled to support investigations in preceding years that address climate adaptation, levels of service and growth and development. Additional projects may result as the definition of the renewals are developed over the next 30 years.

These will be developed and included during respective infrastructure strategy and long term plan revisions and other relevant planning documents.

Table 11 Key renewals/repairs 2021 - 2051

Project/ Programme[1]	Description	Addresses Significant Issue(s)	Timing
Lindsay Creek	Development, consultation and implementation[15] of the Lindsay Creek Scheme		2031 onwards
Climate Adaptation infrastructure transition Lower Clutha	Development and preparation of infrastructure options for climate adaption analysis		2025 onwards
Climate Adaptation infrastructure transition Lower Clutha	Development and preparation of infrastructure options for climate adaption analysis		2025 onwards

[1] These projects and expenditure assume community support through consultation and adoption of a funding policy to enable them to proceed.

6.6 Expenditure Forecasts

It is expected that with each review of the; Infrastructure Strategy (every 3 years), Asset Management, Long Term Plan, and Annual Plans, the cost estimates will be updated, particularly at the three year review of the Infrastructure Strategy and Long Term Plan. This will enable the forecast to be updated to reflect more detailed design and understanding of costs associated with key projects and programmes of work along with community consultation and expectation.

[15] The viability of the Lindsay Creek Scheme will be determinate on Council and Community consultation.

7.2. Environmental Implementation Update

Prepared for:	Implementation Committee
Report No.	BIO2103
Activity:	Environmental: Land Environmental: Water
Author:	Andrea Howard, Manager Biosecurity and Rural Liaison
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	3 March 2021

PURPOSE

[1] To provide a quarterly summary of operational implementation activities being undertaken in the areas of freshwater, biosecurity, and biodiversity. This report complements the Annual Plan quarterly reporting. It includes details of projects underway, and improvements being made to processes and systems that support delivery of these activities.

RECOMMENDATION

That the Committee:

1) ***Receives*** *this report.*

2) ***Notes*** *the range of standard business and transformational activities being undertaken to maintain and improve Otago Regional Council's delivery of environmental implementation activities.*

EXECUTIVE SUMMARY

[2] The Biosecurity and Rural Liaison function of Otago Regional Council (ORC) has expanded its skillset and capacity over the past six months, with an additional four permanent and two fixed-term staff commencing work. The business improvement focus continues to be a mix of re-engineering core delivery, developing and enhancing current systems and processes and exercising a greater degree of regional leadership on matters pertaining to freshwater, biosecurity, and biodiversity.

[3] Work is well underway on several projects focused on achieving improved water quality outcomes. These include initiatives occurring in conjunction with the communities of Lake Hayes, South Otago and Upper Lakes, alongside planned projects for the Tomahawk and Owhiro catchment areas.

[4] Staff have assisted a range of organisations with funding proposals to the Ministry for the Environment's Freshwater Improvement Fund and submitted two expressions of interests for ORC-led projects. The first proposal is a revised submission from an earlier unsuccessful bid, focused on implementing interventions to reduce sediment and nutrient inputs in the Pleasant River Catchment. The second proposal aims to protect

non-migratory galaxiids across the region from extinction and further decline by building and enhancing barriers to protect them from predation.

[5] To complement work underway in the wider ORC to support the new National Policy Statement for Freshwater Management's (NPSFM) regulatory requirements, operations staff are developing options for implementing non-regulatory approaches to best practice land management. This involves a mix of passive educational information and active one-on-one/group engagement and advice with landowners on good management practices on areas such as nutrient management, soil health, land drainage, greenhouse gas emissions and more.

[6] Biosecurity activities have been focused on the local implementation of national wallaby and wilding conifer programmes and ORC's Regional Pest Management Plan compliance inspections. Regional Co-ordination Groups for Wallaby and Wilding Conifer pest management will be established by the end of March 2021. These groups will focus on collaborative planning with key stakeholders and co-ordinating work across the region for the greatest gain. Two further community-led rabbit management projects are underway in Lake Hayes and Albert Town, with more commencing later in the month.

[7] Biodiversity work has been focused on finalising the new biodiversity mapping and ecological prioritisation data for internal and external use. This data will inform evidenced-based and landscape-scale investment decisions by ORC and its partners for active management of indigenous biodiversity values. The regional biodiversity partnership group met at the end of 2020. A key focus of coming months for this group will be the development of prioritisation criteria to guide the partnership's decision-making on where to collaborate and invest resources.

[8] ORC led submission of an application in partnership with QEII National Trust and Aukaha, representing the runaka of Otago, to the Jobs for Nature Private Land Biodiversity Fund. The application proposed a three-year project to create jobs to protect covenanted sites across the Otago within areas of high biodiversity value.

DISCUSSION

1. Business Transformation

[9] As reported to Council in October 2020[1], increased resourcing and the establishment of new roles has allowed operational activities under the Biosecurity and Rural Liaison function (freshwater, biosecurity and biodiversity) to be refined with a renewed focus on implementation. To date, efforts have been concentrated on increased regional leadership, improved delivery of core business, targeted action, and general business improvement (Figure 1).

Figure 1: Business Improvement Framework

[10] To support this work, over the past four months there has been an increase in staff and skillsets within the team. Two fixed-term appointments have been made in biosecurity, focused on supporting compliance in the rabbit programme and surveillance and monitoring activities in the wallaby programme.

[11] Expert assistance has been secured to ensure ORC successfully delivers on its obligations under the Ministry for Primary Industries Wallaby ($380k) and Wilding Conifer ($5.9m) contracts with the aim of creating the necessary internal processes and regional governance structures to effectively deliver the outcomes sought.

[12] A new 'Partnership Lead – Biodiversity' role was established within the function in September 2020. This role is responsible for developing partnerships with a range of organisations (governmental and community) to drive collective progress on initiatives that contribute to improved biodiversity outcomes in Otago.

[13] Several new roles have also been created to support biosecurity compliance (Compliance Support Coordinator), operational readiness and delivery excellence (Performance and Development Specialist), and better delivery of 'on the ground' projects (Project Delivery Specialist). These roles work alongside the previously created Procurement and Contractor Coordinator role and now provide a core resource to support ongoing business improvements and activity.

[1] See 14 October 2020 paper to the Implementation Committee (https://www.orc.govt.nz/media/9217/agenda-implementation-committee-20201014.pdf)

2. Freshwater Implementation

Government Funding to Accelerate Action

[14] Staff have been working with a range of organisations applying for funding in the February 2021 round of the Ministry of Environment's Freshwater Improvement Fund. We provided letters of support to six external led projects, alongside a peer review of some applications and technical input from the Science team. Staff also looked for opportunities to align existing work programmes with proposals, where possible, to provide some level of in-kind support.

[15] ORC directly submitted two expressions of interest to the February 2021 round of the Freshwater Improvement Fund:

A. A project to implement effective interventions to reduce sediment and nutrient inputs and better safeguard the water resources from ki uta ki tai in the **Pleasant River Catchment** (joint proposal with Science team) (Figure 2).

   If successful, issues to be addressed include wetland removal and degradation, improving the quality of water to the estuary and coastal environments, actions to address sediment and nutrient laden water, working with the forestry sector to reduce impacts on stream health and biodiversity and fish passage remediation.

   The expression of interest is a re-packaging of a previously submitted application. ORC's proposal has the support of the East Otago Catchment Group.

Figure 2: Pleasant River catchment

B. Led by Science, a proposal to protect populations of non-migratory galaxiids in perpetuity from extinction and further decline by building and enhancing barriers to protect them from predation. If successful, this project will create built barriers and maintain known fish passage barriers to ensure that predatory species are excluded from native fish populations, enabling these to thrive.

Delivering Annual Plan Programmes

Catchment Groups

[16] Staff and elected members have been working with a number of Catchment Groups to support local responses to improving water quality and biodiversity. The Otago Catchment Communities (OCC) continues to evolve. The entity is now an incorporated society, a final funding agreement is in place, and staff have been employed by OCC to support the sustainability of existing groups and nurture new groups. Staff have assisted OCC with these matters. Councillor Scott represents the ORC on OCC.

Lake Hayes Water Quality Project

[17] Work on delivering Council's Lake Hayes programme has continued (Figure 3). Staff met with members of the Lake Hayes community in December 2020. The purpose of the meeting was to provide an opportunity for all parties to update on progress with initiatives and to further understand issues within the catchment from community members.

[18] As a result of this meeting, ORC has assisted in drafting terms of reference for a proposed newly established 'Lake Hayes Strategy Group'. This community/multi-agency group will focus on coordinating existing policy and actions to improve water quality in Lake Hayes and oversee the development of the new 2021 – 2026 Lake Hayes Management Plan/Lake Hayes Strategy, an activity in our current Annual Plan.

Figure 3: Lake Hayes Catchment

[19] The 2021 – 2026 Lake Hayes Strategy, a revision of the original 1995 document, is underway with a first draft on track to be discussed with Friends of Lake Hayes in March.

[20] Staff are liaising with Waka Kotahi/New Zealand Transport Agency regarding the site-occupation approval process that would be followed if Council is to construct a new culvert in Hayes Creek at State Highway 6.

Robson Lagoon (South Otago)

[21] Staff are assisting with delivery of ORC's Robson Lagoon flood protection and environmental project (Figure 4). The lagoon lies at the north end of Lake Tuakitoto and is part of the Lower Clutha Flood Protection and Drainage Scheme. The project involves improvements to the way water is managed within the lagoon, to enhance ecological values whilst managing drainage and flooding of adjacent farmland. The project is one of ORC's four Climate Resilience projects that are receiving a total of $5.4M in grant funding from government's Provincial Development Unit.

Figure 4: Robson Lagoon

Good Water Programme Management

[22] ORC continues to operate a structured framework to co-ordinate, direct and oversee the implementation of a set of related actions focused on delivering the Council's good water objectives. A formal programme management approach has been implemented, comprising a Good Water Programme Steering Committee, a Good Water Programme Delivery Team and underpinning project management systems and processes.

[23] Council has previously approved[2] an 'Implementation Plan - Action for Health Waterways' and an 'Implementation Plan for PC8 and PC1'. All applicable actions were progressed prior to the planning process being passed to the Environmental Protection Authority. At the conclusion of this process, all remaining actions will be implemented.

[24] The Good Water programme has created a schedule of cross-organisational projects (some of which are outlined in this report) and will be responsible for ensuring efficient and effective delivery of these projects for Council.

Upper Lakes Good Water Project

[25] ORC's 'Good Water' project in the Wanaka region has been underway for 18 months and covers four catchment areas in the Upper Lakes Rohe (Figure 5). The project involves three local community catchment groups, providing members with detailed water quality information on their waterways. The groups are, the Friends of Bullock Creek (FOBC), Wanaka Catchment Group (WCG) and Luggate Action Group. All groups report benefits from more advanced knowledge of water quality in their catchments.

[26] The WCG has used the water quality data from 46 sites distributed throughout the catchment to support the selection of mitigation sites on farms. These sites have been identified through farm plans developed over the past three years. The partnership with ORC has provided further evidence of the need for improvements in farm management activities that affect water quality.

[27] The WCG has recently obtained over $1M from MfE's Freshwater Improvement Fund to fence streams and restore wetlands at 29 sites in the catchment, on 16 properties. The data collected through ORC's project provides base information for on the ground mitigation action and will be used to evaluate the effectiveness of Freshwater Improvement Fund interventions.

[28] FOBC are interested in the effects of stormwater losses to Bullock Creek. Data collected in the ORC project is enabling the provision of baseline information for community engagement activities.

[29] The Luggate Action Group is considering on the ground actions in response to monitoring that indicates elevated E.coli, etc. The group has decided to investigate enhancing the biodiversity of Luggate Creek by re-introducing eels to the catchment. Some further rainfall runoff sampling may also occur at sites in the catchment.

[2] See 8 July 2020 paper to the Strategy and Planning Committee (https://www.orc.govt.nz/news-and-events/events/2020/july/strategy-and-planning-committee-8-july)

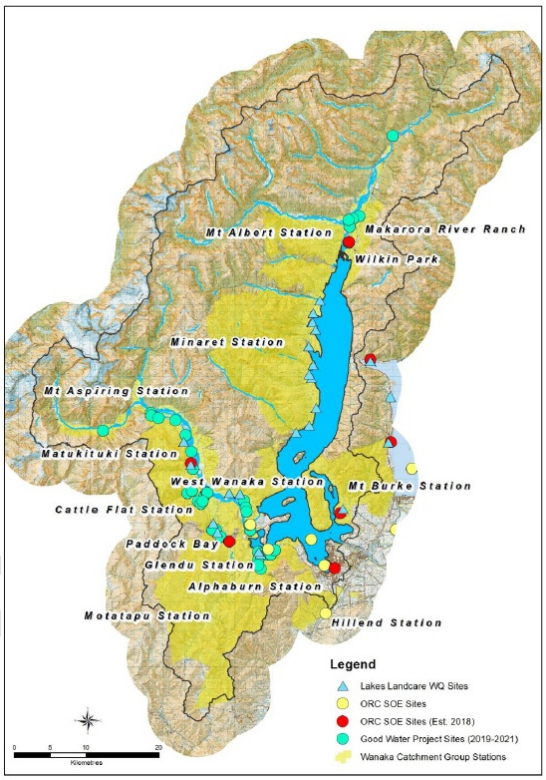


Figure 5: Upper Lakes Good Water Project Area

[30] The Upper Lakes Good Water project has undergone its second review to refine the monitoring needs for community information and groups have asked to move focus to biological monitoring at a limited set of sites. The project will continue to be supported by a mix of ORC staff and locally based experts and will be fully transferred to ORC management at the end of the financial year.

Jobs for Nature – Wanaka Basin

[31] In the wider Wanaka catchment, ORC is represented on the steering group for Wai Wanaka's $3M Jobs for Nature project. This project is focused on planting and plant maintenance delivering measurable benefits for the environment alongside providing much-needed local employment. Jobs have been created to undertake activities such as weed control, pest management, biodiversity monitoring and carbon planning on properties in the Wanaka basin. Biosecurity staff have been supporting the project with technical expertise, training of staff and aligning work programmes with Regional Pest Management Plan (RPMP) objectives.

Owhiro Small Block Owner Pilot Project

[32] The Owhiro catchment has been identified as a pilot site for on the ground action due to evidence of degraded water quality in the catchment (Figure 6). The area faces further challenges through ongoing development pressures. The lower part of the catchment

lies within the East Taieri Drainage Scheme and the Lower Taieri Flood Protection Scheme. State of Environment Monitoring for 2014-2019 identified that there are high levels of sediment, ammonia, E. coli, phosphorus and nitrogen found within Owhiro Stream.

Figure 6: Owhiro Catchment

[33] The objectives of this pilot are:

- To work with small block landowners within the Owhiro to ensure best practice land management is implemented to reduce sediment, improve water quality and biodiversity within the catchment.
- To increase community education and awareness around the environmental issues and pressures that the Owhiro catchment is facing.
- To assist landholders to complete a basic Farm Environment Plan for their property.
- To pilot a successful project with small block landowners to potentially roll out into other catchments within Otago.
- To provide an opportunity for ORC to lead on the ground non-regulatory actions for improving water quality.
- To test the effectiveness of the approach and its applicability for use elsewhere in the region.

[34] Working in partnership with NZ Landcare Trust, ORC will run two workshops for small block owners (2-20 hectares land parcels) to assist in the development of a plan for their property. The workshops will cover topics including good land management practices, biosecurity on small blocks, and planting for biodiversity or riparian management. Staff would follow up periodically with landowners to identify the effectiveness of any

mitigation measures and to support them with any future land management issues or opportunities.

Implementation Development - Fresh Water

Non-Regulatory Land Management Approach

[35] To complement the NPSFM regulatory requirements, staff are developing options for ORC's role to better facilitate non-regulatory approaches to best practice land management.

[36] Consideration is focused on which properties to target first, the environmental issues to be included and how best ORC can add value in this space. This process aims to ensure ORC is playing a proactive role, offering something tangible to landholders but not duplicating effort that is provided elsewhere.

[37] As part of ORC's non-regulatory approach, an environmental incentives policy is being drafted for future consideration by Council. In the work to date on the Draft 2021-31 Long-Term Plan, a number of incentives have been proposed for landowners to support freshwater, biodiversity and biosecurity outcomes so an overarching policy is required to ensure effective, efficient and transparent use of public funding.

[38] In addition to 'on the ground' activities, staff have been creating additional content on good management practices for Council's website. This includes new information on:

- What is Good Management Practice (GMP)
- Wintering well
- Nutrient Management
- Critical Source Areas (CSA) management
- Riparian Management
- Soil Health
- Paddock cultivation GMP
- Land drainage
- Irrigation GMP
- Stream health monitoring
- Hotspot management (offal pits, silage pits etc)
- Greenhouse Gases GMP
- Land management for mahinga kai/cultural values

Implementation Capabilities

[39] Staff are due to participate in specialist training including:

- Land resource inventory - Inventory of physical factors (e.g. rock, soil, slope, erosion type and severity, and vegetation). The inventory is the basis of assessing land resources.
- Land use capability (suitability for productive use or uses after considering the physical limitations of the land) to inform catchment and farm scale planning.

- Sustainable nutrient management (assessment of nutrient requirements of a range of agricultural systems, including a consideration of best practices) for environmental protection.

[40] These expertise development opportunities will enable the team to provide landowners with specific expertise and advice and a wider range of options when consider land use capabilities and best practice land management. This supports the deliberate shift to ORC staff taking a more proactive approach to providing advice on intervention methods.

3. Biodiversity Implementation

[41] Biodiversity mapping and ecological prioritisation were undertaken for ORC in 2020. This work was commissioned to meet Action 3.1 of the ORC Biodiversity Action Plan. Dr John Leathwick was subsequently commissioned to produce an ecological prioritisation model. This work was presented to Council on 14 October 2020 and finalised in November 2020. The output ranks all indigenous-dominated terrestrial sites and all freshwater sites on their ability to contribute to the representation of a full range of the indigenous ecosystems found within Otago. The ranking was completed using conservation planning software (called 'Zonation') that analyses spatial data describing the ecosystems.

[42] The mapping and ecological prioritisation will be used for several purposes:

1. It provides ORC with an 'ecological baseline' against which to monitor (required by the National Policy Statement for Indigenous Biodiversity).
2. It will be used to help inform evidenced-based and landscape-scale investment decisions by ORC and its partners for active management of indigenous biodiversity values.
3. It will be a 'living database' that we engage key partners with to generate additional data that builds on the technical work to more fully capture the value of indigenous biodiversity across Otago.

[43] The second and third uses above are examples of how the ORC is moving towards an implementation through partnership model. This partnership model is key to the ORC realising the guiding principle of taking a coordinated and collaborative approach to implementation of its 2018 Biodiversity Strategy.

[44] A meeting with Aukaha and Edward Ellison, representing Ōtākou Runaka, was held on 2 February 2021. The purpose of the meeting was to discuss how ORC partners with iwi to capture Maori priorities for indigenous biodiversity in the mapping and ranking work. We are awaiting advice on how best to proceed. Similar approaches will be used with key stakeholders across Otago to ensure that the mapping and ranking work provides the information needed for holistic decision-making.

[45] Biodiversity mapping data is available to other central and local government agencies via a data sharing agreement and will be made more publicly available shortly following the conclusion of our discussions with iwi partners. It is hoped this information will be available on Council's website by the end of April 2021.

[46] ORC's Biodiversity Action Plan 2019-24 commits the Council to taking a regional leadership role in managing indigenous biodiversity. It recognises the clear need for partnerships between iwi, Government agencies, councils, landowners and communities to enable regional biodiversity restoration projects. To help provide this leadership for Otago, ORC has initiated a regional partnership with Kai Tahu and public sector agencies to advance indigenous biodiversity outcomes across the region. The Partnership includes ORC, DOC, all Territorial Authorities in Otago, and Kai Tahu through representation by Aukaha.

[47] A review of the current partnership model was undertaken by current members of the group in December 2020 with feedback indicating a need to further explore models of governance, membership, and collaboration. Staff are reviewing various biodiversity partnership models across New Zealand to inform these meetings and developing prioritisation criteria to guide the partnership's decision-making on where to collaborate and invest resources.

[48] Commitment to and enthusiasm for the partnership is high. It will be critical for progressing biodiversity outcomes across the region. For example, if the National Policy Statement on Indigenous Biodiversity (NPS-IB) is gazetted as drafted, the Partnership will be the lead vehicle for co-development of a multi-agency regional biodiversity strategy.

Preparations for the National Policy Statement on Indigenous Biodiversity

[49] A draft NPS-IB was released by the Ministry for Environment (MfE) late 2019. An internal biodiversity working group has been established and convened. This group will act as a virtual team across ORC directorates to coordinate deliver of biodiversity services. Coordinating the Council's implementation of the NPS-IB will be a key focus of this group for 2021 and beyond.

Application to the Jobs for Nature Private Land Biodiversity Fund

[50] ORC led submission of an application in partnership with QEII National Trust and Aukaha, representing the runaka of Otago, to the Jobs for Nature Private Land Biodiversity Fund. This was a quick turnaround, one-off funding round to assist with COVID-19 recovery.

[51] The application proposed a three-year project to create jobs that protect covenanted sites across the Otago within areas of high biodiversity value. The project will be on private land protected under legal protection and aims to protect high value biodiversity sites by managing pest plants. The project would enable private land holders to meet the significant time and resourcing gap that is a barrier to successfully maintaining covenanted land.

4. Biosecurity Implementation

Operational Planning

[52] An annual operational plan is required under the Biosecurity Act 1993 to implement the RPMP. The Biosecurity Operational Plan (Operational Plan) details the scope of activities

the Council intends to implement to progressively achieve the RPMP. The Operational Plan for 2020-21 was approved by Council in April 2020[3]. As required by the Act, the Operational Plan is to be reviewed annually. However, any revision of the Operational Plan is optional, dependent on findings of the review.

[53] Staff are currently reviewing the 2020-2021 Operational Plan and any amendments in style or substance will be captured in the 2021-2022 Plan. This will be brought to Council for approval prior to 30 June 2021, once 2021-31 Long Term Plan activities and budgets have been confirmed.

[54] A report on the current Plan and its implementation will be provided by September 2021. A copy of this report will also be sent to the Minister for Biosecurity as required by the Act. Implementation of the Operational Plan has been progressing well, although issues of present capability and capacity will impact on overall delivery. Where possible, solutions to these barriers are being progressed immediately and further support required has been identified and incorporated into the 2021-2031 Long-Term Plan process.

National Programme – Wilding Conifer

[55] The National Wilding Conifer Programme was established by the Ministry of Primary Industries (MPI) in 2016 and aims to prevent the spread of wilding conifers and progressively remove these pest species from vulnerable landscapes within New Zealand.

[56] Council is the ‘‘Recipient” for the National Programme in the Otago region and works collectively with the Wakatipu Wilding Conifer group and the Central Otago Wilding Conifer Control Group on operational plans and management for the control of wilding conifers throughout Otago.

[57] The region received $5.9M for the 2020-2021 operational year, with most of the funding ($5.2M) being distributed within the Wakatipu Management Unit (Figure 7). This accelerated investment was focused on the creation and support of post COVID-19 pandemic jobs in the Queenstown-Lakes District area.

[58] The funding agreement commenced in late 2020 and so far, 21,817 hectares have been controlled in the Wakatipu management units and 13,445 hectares in the Central Otago units. There is still a large amount of funding to be spent (approximately $3m). While COVID-19 facilitated additional funding, it has also proven to be a barrier to participation in the programme which requires a landholder contribution.

[3] See 22 April 2020 paper to Council (https://www.orc.govt.nz/media/8399/council-agenda-20200422.pdf)

Figure 7: Map of the Otago Region divided into Management Units, highlighting newly 'activated' areas for the 2020-2024 National Wilding Conifer Programme and infestation data of wilding spread.

[59] ORC recently attended an aerial mulching trial with Environment Canterbury (Figure 8). This tool is for wilding conifers within native bush and areas where ground tools and spraying herbicides are not appropriate (e.g., disturbance to historic sites).

Figure 8: Aerial Mulching Demonstration

[60] Staff are in the process of establishing a Regional Co-ordination Group (RCG) for Wilding Conifer management. The RCG will be established by the end of March 2021 and will focus on matters such as ensuring:

a. That operational activities are planned in a cohesive and coordinated way.

b. That operational activities achieve national strategy objectives.

c. Risks are identified and managed appropriately.

d. Progress towards operational plans is reported and accountabilities are understood.

[61] ORC will lead this newly established group and use this group to work effectively with key stakeholders, to deliver on government expectations and to pursue longer term strategic goals with respect to more holistic wilding conifer management across the entire region.

[62] ORC is planning to directly manage a newly created wilding conifer management unit (Luggate) in the next financial year. ORC will provide project management expertise and contract out the service delivery. This will be the first time ORC has played a 'hands on role' and will result in control occurring in currently unmanaged areas across Otago. We also hope to increase our share of the national funding pool as a result of broadening our areas of operation (e.g. outside of the existing Central Otago and Wakatipu Trusts work boundaries).

National Programme – Wallabies

[63] The National Wallaby Programme was established by MPI in 2020 and aims to prevent the spread of wallabies and to progressively contain and eradicate these pest species from vulnerable landscapes within New Zealand.

[64] Council approved ORC entering a funding agreement with MPI on 28 October 2020. For the 2020-2021 operational year, Otago has received $382,000, with the majority of funding being allocated to surveillance and control activities within the Hawea, Hawkdun and North Otago Management Units (Figure 9).

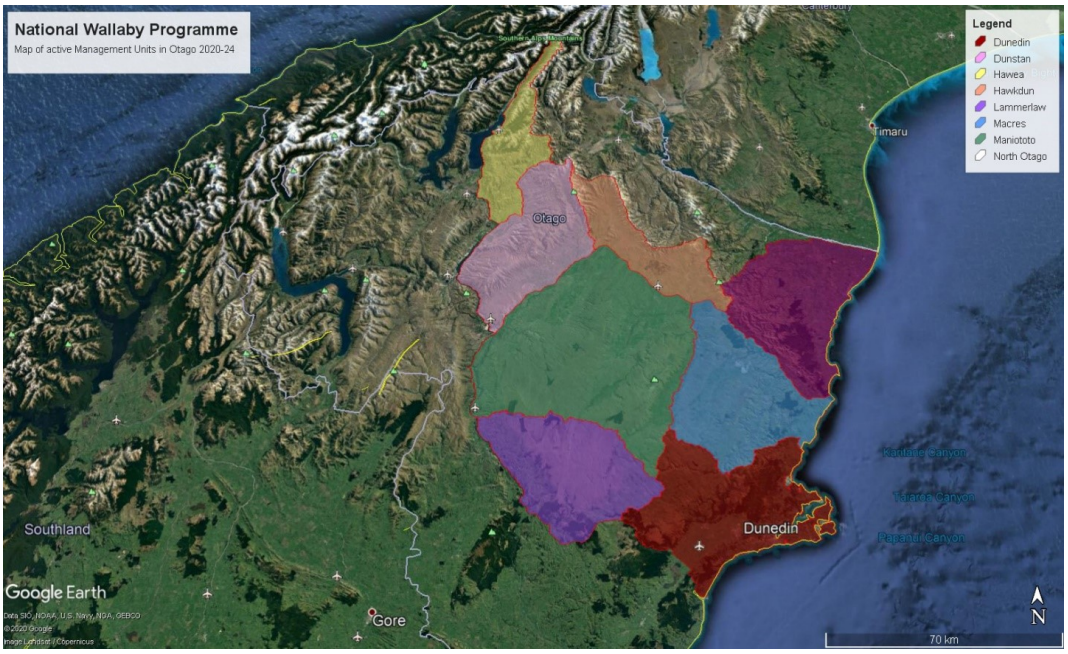


Figure 9: Map of the Otago Region divided into Management Units, highlighting newly 'activated' areas for the 2020-2024 National Wallaby Programme

[65] Staff have undertaken two procurement processes to engage (i) contractors for Wallaby Surveillance and Control and (ii) project management expertise to support ORC's delivery of its part of the National Wallaby Programme. Contracts are expected to be in place by mid-March, dependent on the negotiation process with successful parties.

[66] As part of normal ORC wallaby activities, ten additional trail cameras have been installed to provide a greater range for remote monitoring. These support eleven existing cameras already installed in the Little Mount Ida/Wether Burn areas in the Maniototo and the Livingston area in North Otago (although they are moved around in response to sightings) (Figure 10). Evidence from the cameras will be used to guide control (poison) operations.

Figure 10: Current locations of trail cameras for detection of wallabies

[67] Figure 11 below shows two wallabies that were captured on 28 February 2021 by the Livingston cameras. The animals have been consuming bait laid, and more intensive

follow-up control work is being undertaken in the immediate area as a result of visual confirmation.

Figure 11: Two wallabies captured by Livingston cameras (28 February 2021)

[68] A thermal camera is continuing to be trialed on the Aviemore dam (Figure 12) to observe and classify any wallaby movement. Thermal cameras are much faster and accurate at detecting animals in field situations. An auto notification system for this camera to alert when a wallaby has been recorded has just been implemented. As yet, no wallabies have been captured by the camera. The installation coincided with the busy summer period in terms of traffic and activity and extended daylight hours. If wallabies are crossing over the dam, this should become evident as human activity in the immediate area reduces.

Figure 12: Aviemore Dam

[69] Bay of Plenty Regional Council have recently conducted a drone trial for pest control using technology initially developed to survey large areas for 'hotspots' in rural/forest fires[4]. A South Island trial of this technology is currently being discussed with respective agencies including ORC. Under ideal conditions these drones can cover 28 km2/hour and offer a cost effective ($162 per hour) and efficient surveillance tool compared to land based activities and helicopter work[5].

[70] Staff are in the process of establishing a Regional Co-ordination Group (RCG) for Wallaby Surveillance and Control. The group will be established before the end of March, with a similar remit to that outlined above in relation to the Regional Co-ordination Group for Wilding Conifer control.

Compliance

[71] Pest plant inspections have continued to check for compliance with the Regional Pest Management Plan (RPMP). A total of 3,177 pest plants have been observed via 2,494 individual property inspections since July 2020. The dominant plant pest observed during inspections was Old Man's Beard with 2,707 cases observed. This exceeds the Biosecurity Operational Plan target of 2,500 property inspections for Old Man's Beard in this financial year. Overall, there is a compliance rate of around 52.3% for properties inspected (Table 1).

[72] Follow-up inspections occur for non-compliant properties. Our process is focused on achieving voluntary compliance through education and enabling property owners to control their pest plants. However, enforcement options exist and will be used when required.

[4] https://interpine.nz/thermal-infrared-pest-monitoring-and-detection-using-drones/
[5] www.ectech.co.nz

Table 1: Compliance and Non-compliance for Plant Pests

Plant Species	Compliant	Non-compliant	Total	Compliance Rate
Old Man's Beard	1,495	1,212	2,707	55.2%
Bomarea	135	102	237	57.0%
Cape Ivy	18	67	85	21.2%
Wilding Pines*	0	71	71	0.0%
Broom	2	30	32	6.2%
Gorse	1	17	18	5.6%
Other	10	17	27	37.0%
	1,661	**1,516**	**3,177**	**52.3%**

* This has since been controlled by contractors through the National Wilding Conifer Programme but will require reinspection.

[73] Rabbit inspections continue with progress to date outlined in Table 2. A target of 130 rabbit inspections was set in the Biosecurity Operational Plan for the 2020/21 annual period. This has been exceeded with 180 inspections being completed so far.

Table 2: Compliance from rabbit inspections by properties and area

Management Unit	Properties	Compliant	Non-compliant	% Compliance
East Ida Valley	13	11	2	84.6%
Hyde	10	7	3	70.0%
Cardrona	14	12	2	85.7%
Dukes Road	12	7	5	58.3%
Otago Peninsula	45	7	38	15.6%
Waihola/Taieri	15	4	11	26.7%
Wanaka	5	0	5	0.0%
Alexandra	2	0	2	0.0%
Ettrick and Moa Flat	48	43	5	89.6%
Clutha	5	3	2	60.0%
Alexandra	2	0	2	0.0%
Lindis	9	9	0	100.0%
	180	**103**	**77**	**57.2%**

[74] Of the inspections completed, 57% were compliant. A large percentage of non-compliant properties were in the Waihola/Taieri and Otago Peninsula areas. However, there are still large areas of the region that require inspection.

[75] Non-compliant properties have been issued with a 'request to act', requiring the landowner to undertake control measures to ensure that feral rabbit densities are at or below Level 3 on the Modified McLean Scale. Re-inspections will occur at the end of the required work completion date. Failing to meet the rule requirements on the specific date will result in progression of the compliance/enforcement pathway.

[76] We hope to secure external resources within this financial year to allow additional rabbit inspections to occur in areas such as North Otago, Wanaka and Queenstown.

[77] All biosecurity staff undertook and passed an external Biosecurity Act 1993 authorised persons training exercise in February 2021. The opportunity was also used to review progress towards achieving the targets established in the first Operational Plan and to identify areas of current operations that were working well, or that could be improved. As a result, a key focus over the next four months will be on improving internal systems and processes to support delivery.

Education

[78] Otago's annual 'Check Clean Dry' advocacy work took place in December 2020, and January and February 2021. The programme is a national freshwater campaign led by MPI to stop the spread of freshwater pests like Lagarosiphon, Lindavia and Didymo. Supporting ORC staff, two students were recruited over the summer to assist with work. As well as providing general education, the students conducted 858 surveys (more than any other region) to better understand community knowledge of freshwater pests (Figure 13).

[79] The survey data collected will illustrate knowledge of freshwater pests, knowledge of Check Clean Dry best practice, freshwater user activity, waterways visited by survey participants in last two weeks and the home location of water users. Information gathered is used to inform local and national future strategies to direct education campaigns and facilitate behavioural change by water users. A summary of results and subsequent actions will be included in the next quarterly report to committee.

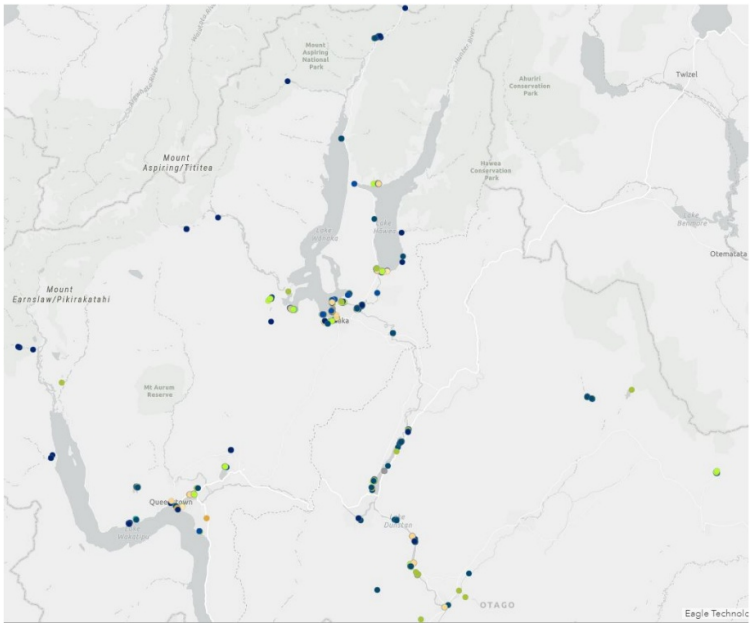


Figure 13: Locations where water user surveys were undertaken, December 2020 to February 2021

Facilitation/Collaboration

[80] In addition to standard compliance work within our rabbit programme, ORC has committed to facilitating a number of community-led responses to better rabbit

management in semi-rural and peri-urban environments. The ORC Biosecurity Operational Plan 2020-2021 has the target "*establish at least one central and one coastal Otago new landowner-led rabbit control group by December 2021*". We anticipate exceeding this target.

[81] Given the community demand, internal resourcing constraints, and recognising the need for a specific skillset for dealing with many landowners, Ahikā Consulting has been contracted to manage the community engagement for the first two pilot projects in Lake Hayes and Albert Town. Their brief includes supporting staff with the development and implementation of a community engagement approach, project management of the initiatives, co-ordination of stakeholders, community and contractors and development of an evaluation framework.

[82] Working closely with internal communication and engagement staff, a range of supporting educational material is being produced for different types of landholders (rural and urban, large and small) to support ongoing engagement and activity focused on reducing rabbit populations in the region.

[83] A procurement request was advertised for the Community Engagement Facilitation and Programme Design and Management Services for Community-led Pest Control (Rabbits) in Otago. This covers next year one areas – Hidden Hills; Queensberry; Lowburn/Pisa Moorings; Moeraki; Otago Peninsula and Gibbston Valley – as shown in Figure 14. The evaluations of the tenders have been completed with an expected commencement date in mid-March, depending on the negotiation process with preferred candidate.

[84] A detailed business case on the future use of ORC owned rabbit poison assets (carrot cutters and an Oat cooker) will be presented to Council in late March 2021. A condition assessment of all equipment owned by the ORC has been completed and a cost benefit analysis of two options previously endorsed for further exploration[6] is currently being prepared to support final Council decision-making.

[85] Biosecurity staff will be attending the Wanaka Show in mid-March and will focus on the provision of information and advice for rabbit control in rural, semi-rural and peri-urban areas. This will support and raise awareness of our forthcoming community-led rabbit facilitation projects, inform community of the RPMP rabbit rules and their responsibilities, explain control options and presents an opportunity for the community to provide feedback on any issues or barriers managing rabbits.

[86] Biosecurity staff will also focus on the freshwater pest, lagarosiphon, highlighting the environmental damage caused by the weed, RPMP rules and how community can assist with stopping its spread. Key findings from the summer Clean Check Dry user surveys will be incorporated into the educational programme.

[6] See 14 October 2020 paper to the Implementation Committee (https://www.orc.govt.nz/media/9217/agenda-implementation-committee-20201014.pdf)

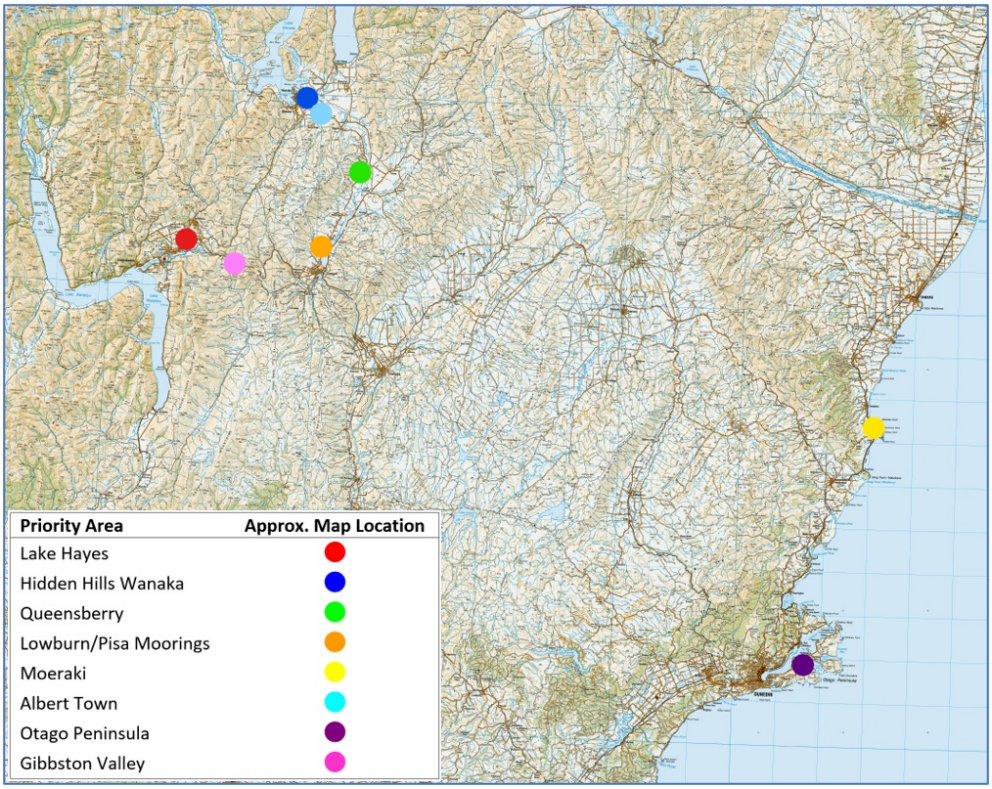


Figure 14: Year 1 – Planned Facilitated Community-Led Rabbit Projects

[87] A formalised plan for a contractor workshop has been developed, provisionally scheduled for mid-April 2021. The purpose of this workshop is an engagement exercise with pest control contractors to socialise work programmes coming up. This will help understand the skills and expertise of contractors in Otago and surrounding areas. This also provides an opportunity to cover questions regarding the RPMP with contractors and to understand any barriers or constraints they face in delivering work for private landowners.

Research and Development to Support Delivery and Impact Evaluation

[88] Staff have commenced the process of working with Manaaki Whenua (Landcare Research) on the following science and research issues:

Pest Trends, Pest Plan Effectiveness and Emerging Issues:
The development of a fit for purpose monitoring framework for pest plants and pest animals in Otago.

Rabbit Management, Control and Regulation:
Better understanding rabbit populations, including:

- proactive approaches and methodologies for monitoring feral rabbits
- review of ORC's existing current rabbit monitoring approaches and methodologies against best practice
- alternative regulatory compliance and control tools for semi-rural and peri-urban environments

- establishment plan for a comprehensive virus monitoring programme across the region including fly trap monitoring and rabbit liver sampling
- Other recommendations for science-based interventions (biological and non-biological) that may assist the region and its communities to reduce rabbit numbers.

[89] This work will be completed within the next six months, with the results of the advice being used to inform the design and delivery of work programmes and monitoring frameworks in year one and two of the 2021-31 Long Term Plan, where budget allows.

CONSIDERATIONS

Policy Considerations

[90] No considerations arising from this paper.

Financial Considerations

[91] As noted in the quarterly report to Finance Committee on 24 February 2021, expenditure on biosecurity for 2020/21 will exceed the Annual Plan budget.

Significance and Engagement

[92] No considerations arising from this paper.

Legislative Considerations

[93] No considerations arising from this paper.

Risk Considerations

[94] The new directions for biosecurity and rural liaison present some risk as capabilities and capacity is tested but ultimately represents a positive step forward for these functions and the ORC. The risks are offset, to some extent, by increased staff and expertise in the newly established business improvement, compliance and project management support functions.

ATTACHMENTS

Nil

7.3. Tomahawk Lagoon Enhancement Project Update

Prepared for:	Implementation Committee
Report No.	OPS1027
Activity:	Environmental - Rural Water Quality; Environmental - Biodiversity
Author:	Andrea Howard, Manager Biosecurity and Rural Liaison Libby Caldwell, Project Delivery Specialist
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	3 March 2021

PURPOSE

[1] This report provides an update on proposed activities for the Tomahawk Lagoon catchment over the coming years. It signals that engagement will occur to prioritise projects to be implemented which aim to enhance biodiversity, water quality and recreational values within Tomahawk Lagoon and its surrounding catchment. A draft outline management plan has been prepared by staff to support that engagement.

EXECUTIVE SUMMARY

[2] The 2017/18 Annual Plan included working with the local community to scope lake restoration works for Tomahawk Lagoon.

[3] Engagement with the local community around Tomahawk Lagoon was initiated as water quality was found to be degrading. It has been identified that there are elevated levels of sediment, E. coli, nitrates and phosphates found within the lagoon and Lagoon Creek (contributing waterway). Cyanobacteria is found within the lagoon regularly in the summer months.

[4] Goals, values and potential projects were identified through this process. Further engagement with key stakeholders is required to prioritise the projects to implement these and enhance biodiversity and water quality within the catchment.

RECOMMENDATION

That the Committee:

1) ***Receives*** *this report.*

2) ***Approves*** *that the draft outline management plan is the basis of further community consultation and the prioritisation of projects, in 2022/23, subject to Long Term Plan decisions.*

3) ***Approves*** *commencing the immediate actions that have been identified, in the current financial year.*

BACKGROUND

[5] Tomahawk Lagoon (Figure 1) is located at the southern end of the Otago Peninsula. It consists of two shallow brackish water lagoons which are joined by a narrow channel and weir/gate structure and share a common sea outlet. Tomahawk Lagoon is a wildlife refuge of 33 hectares that is managed by the Department of Conservation which contains the threatened plant species *Isolepis basilaris* on the margin of the lagoon. The area is important ecologically as it is defined as a marsh and less than 15% of original marshes remain in Otago.

Figure 1: Tomahawk Lagoon

[6] The lagoon is a regionally significant wetland habitat for waterfowl and waders with a variety of bird species present and is part of a chain of feeding habitats along the coast used by migrating birds. Tomahawk Lagoon is also important habitat for native fish and eels. Citizen Science water quality monitoring is undertaken by ECOtago monthly. Their results indicate that turbidity, E. coli, nitrates and phosphate levels are all exceeding national guidelines. Cyanobacteria is also regularly found within the lagoon over the summer months which is a toxic bacterium which can be harmful to humans and animals.

[7] The 2017/2018 annual plan included 'to work with local communities to scope lake restoration works for Tomahawk Lagoon'.

[8] In February 2018, a workshop was held with the community which identified community goals and values for the Tomahawk Lagoon catchment. In May 2018, a second workshop was held with the community where potential projects were identified following on from the first workshop.

[9] A submission was received from the Otago Peninsula Community Board on the Otago Regional Council Annual Plan 2020 highlighting that sufficient funding should be allocated to ensure:

i. Appropriate management of the weir
ii. Management of the waterway in times of high rainfall and flooding
iii. Joint approach to management of the channel affecting flooding with ORC and DoC.
iv. Implementation of the management plan. And objectives to improve water quality, biodiversity, recreation, accessibility, and cultural matters.
v. A continued programme of monitoring, reporting and liaison that informs the community about the health of the lagoon.

[10] On 3 June 2020, a resolution made by the Finance Committee requested a staff report by February 2021 to inform cost considerations of including a Tomahawk Management Plan in the 2021-31 Long Term Plan.

[11] Staff have prepared a draft outline management plan based on the feedback received during consultation (attached).

ISSUES

[12] Citizen Science water quality monitoring is undertaken by ECOtago monthly. Their results indicate that turbidity, E. coli, nitrates and phosphate levels are all exceeding national guidelines.

[13] Contact recreation monitoring is undertaken within Tomahawk Lagoon for the summer months to monitor for cyanobacteria (blue/green algae) by ORC. This monitoring has been undertaken since summer 2016/2017, and each year except for 2019/2020, cyanobacteria has been found within the lagoon.

[14] Cyanobacteria produce toxins which affect humans and animals. It is found within the lagoon due to warm weather and a build-up of nutrients, namely phosphates within the lagoon.

DISCUSSION

[15] Potential projects have been identified in consultation with the community through workshops 1 and 2 within the Tomahawk Lagoon catchment which include:

i. Ecological Assessment
ii. Water Quality Monitoring
iii. Sediment management at bridge
iv. Citizen Science
v. Education and Awareness
vi. Pest and weed programme
vii. Stock exclusion through fencing
viii. Native plant restoration
ix. Native plant effectiveness research
x. Community planting events

xi. Catchment group formed and supported
xii. Recreation and public access
xiii. Nursery
xiv. Flora and Fauna study
xv. Algae removal
xvi. Sediment removal around the weir
xvii. Stormwater awareness

[16] These projects have been assembled into a draft outline management plan, for the purposes of seeking final community feedback on priorities and to enable costs to be prepared (Appendix 1).

[17] Some straightforward projects can be delivered quickly at a low cost, with some projects potentially able to be accommodated within existing budgets in the current financial year. Initiatives include:

i. Support of citizen science that ECOtago are undertaking.
ii. Facilitation of the creation of a catchment group to be formed if there is community desire.
iii. Formation of a partnership with Dunedin City Council and University of Otago Marine Studies Centre *Signs of the Sea Project.*
iv. Further investigation of setting up a permanent ORC monitoring site within the lagoon.
v. Provision of a grant of $10,000 to ECOtago to support planting native plants in the upper catchment (Lagoon Creek).

CONSIDERATIONS

Policy Considerations

[18] This paper does not trigger policy considerations.

Financial Considerations

[19] The sum of $100,000 has been proposed as part of the current 2021-31 Long Term Plan process for the 2022/23 Financial Year for projects to improve biodiversity and water quality within the Tomahawk Lagoon catchment. The sum of $80,000 has been provided in each of the 2023/24 and 2024/25 budget years. These amounts and timing are subject to Council decision making on the Long-Term Plan.

Significance and Engagement

[20] The recommendations of this report are consistent with the council's Significance and Engagement Policy.

Legislative Considerations

[21] This paper does not trigger legislative considerations.

NEXT STEPS

[22] Following a final Council decision on proceeding with the prioritisation of projects within the Tomahawk Lagoon catchment and subject to confirmation of LTP funding, staff will arrange to meet with key stakeholders to work to prioritise actions and projects.

[23] Following the completion of prioritisation ORC staff will complete a costing analysis of the highest priority projects.

[24] Subject to confirmation of LTP funding, the development of a catchment management plan for Tomahawk Lagoon.

ATTACHMENTS

1. Draft Tomahawk Lagoon Outline Management Plan [8FGZ] [**7.3.1** - 3 pages]

Draft Tomahawk Lagoon Outline Management Plan

Vision

To contribute to a thriving Tomahawk Lagoon, where water quality and biodiversity are enhanced through community action to contribute to a healthy ecosystem for all to enjoy.

Values

- The natural environment of Tomahawk Lagoon and the ecosystem is to be protected and enhanced
    - Land use within the catchment has been altered over time with the removal of native vegetation with associated increased sedimentation and contamination within the catchment. There are both historic and current causes to these issues and finding a balanced solution in some cases will be complex. The health of the catchment as a whole is important and links to how it is functioning and enjoyed. Tomahawk Lagoon is a significant ecological area.

- Appropriate recreational uses of Tomahawk Lagoon are to be protected and enhanced
    - Tomahawk Lagoon has many recreational assets such as fishing, walking, kayaking. By improving public access the recreational capacity and ability of people to enjoy the lagoon is enhanced. It is important that the impacts that recreation has on the environment, the values of mana whenua and property rights need to be managed carefully. A connection between the environment, the local community and visitors to the area is important. Opportunity for community to contribute to the enhancement of the Lagoon.

Issues

- Algal Blooms
- Water Quality Data
- Swimmable Water
- Pest management (animals and weeds)
- Weir
- Flooding
- Sedimentation

Objectives

- To maintain **and improve the water quality in** Tomahawk Lagoon and the catchment which feeds this for environmental, mana whenua, and recreational uses
- Working with mana whenua to identify projects of significance to collaborate on and bring to fruition.
- To meet the National Freshwater standards
- Support a healthy ecosystem which sustains and enables mahika kai and improves biodiversity

- To preserve and protect the wetlands, rivers and streams, their margins and the saline environment so that there is no further loss or degradation within the catchment
- To encourage soil conservation to minimise sedimentation
- To maintain and improve public access around Tomahawk Lagoon
- To ensure there is no toxic algae present in the water and that the water is swimmable year-round.
- Collation of existing data and define future research direction

Potential Projects

- **Ecological Assessment**
  Investigate the balance between the needs of human interaction with the lagoon and wildlife (hydrological function, ecology, wildlife, walking tracks, flood hazard).
- **Water Quality Data**
  Have a permanent water quality monitoring site installed to establish baseline data and ensure mahika kai safety.
- **Outlet**
  Sediment management around the outlet to ensure that there is flushing and better flow of water in and out of the lagoon.
- **Citizen science**
  Support ongoing water quality monitoring programme as a way to generate data for the catchment and as an important community engagement tool.
- **Education and awareness**
  Engaging, educating and inspiring the local community to support this action plan. This area is to be a source of learning for local schools. Development of resources to assist with this engagement and education
- **Pest and weed programme**
  Support an provide resources to assist neighbours to form groups to tackle weed and pest species in a combined and aligned effort. The aim is to control predators of birds and to minimise impacts on the native forest in the area and to control weeds where fast growing exotic species out compete natives.
- **Fencing project to exclude stock from waterways**
  Support for landowners to exclude stock from waterways
- **Native plant restoration**
  Support, advice and resources provided to aid landowners with riparian planting projects to restore the ecosystem (planting plans provided? Plants provided/co funded)
- **Research which riparian plants will be most effective** – leverage off relationships with university/schools
- **Community Planting Events**
  Community planting days and events where people can come together to help restore the lagoon and its catchment.
- **Catchment group formed and supported**
  Joining of agencies and the community. Establish a ‘Friends of Tomahawk Lagoon’ with members of the community and stakeholder representatives
- **Recreation (boardwalk, walkway, boat ramps)**
  Identify opportunities with DoC and private landowners for sections surrounding the lagoon to be restored and developed for public access.
- **Nursery? Support YEPT or Tomahawk Smaills Beach Care Trust**

To provide locally grown plants for planting within the catchment

- **Study of flora and fauna** present in this area as an engagement and education tool. A reason why we should protect the area. (DoC may have this already? Leverage University)
- **Algae Removal**
  Use technology to reduce the frequency of algal blooms in the lagoon and enhance mahika kai and recreational opportunities.
  Investigate floating wetlands Algae Removal and Wildlife Habitat Using Floating Treatment Wetland Technology | Case Study | Aquabio Environmental Technologies, Inc.
- **Sediment Removal around Weir (top lagoon)**
  Remove sediment from around weir to improve water quality by increasing the turnover of water between upper and lower lagoons. Upgrade weir.
- **Stormwater from urban area**
  Knowledge lacking in the public – education – stormwater drains to sea. Developers, and general public. Improve general water literacy levels.

Indicators of success

- Number and size (area) of riparian enhancement projects completed each year.
- Metres of riparian margin fenced each year
- Metres of riparian margin planted each year
- Water quality indicators (macro-invertebrates, Nitrate and Phosphate levels etc)
- Number of and quality of public access points
- Number of community members engaged in work/workshops in the area
- Number of hours doing pest control, types of pests removed.
- Number of community members undertaking citizen science and how often this is done

Opportunities

The restoration of Tomahawk Lagoon will require the collaboration of partners and stakeholders working together.

- Collaboration with neighbouring catchment groups
- Biosecurity programmes incorporated
- Community planting programmes
- Million Metres crowd funding campaign
- Walkway
- Motivated property owners