Strategy and Planning Committee Agenda
1 December 2020

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

Members:

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

Senior Officer: Sarah Gardner, Chief Executive

Meeting Support: Liz Spector, Committee Secretary

01 December 2020 02:00 PM

Agenda Topic — Page

Minutes of a meeting of the Strategy and Planning Committee held in the Council Chamber on 11 November 2020 at 1PM

DRAFT MINUTES

Membership

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

Welcome

Co-Chair Kate Wilson welcomed Councillors, members of the public and staff to the meeting at 1 p.m.

Staff present included: Sarah Gardner (Chief Executive), Nick Donnelly (GM Corporate Services), Gwyneth Elsum (GM Strategy, Policy and Science), Gavin Palmer (GM Operations), Amanda Vercoe (Executive Advisor), Liz Spector (Committee Secretary, minutes), Anita Dawe (Manager Policy and Planning), Anne Duncan (Manager Strategy), Julie Everett-Hincks (Manager Science), and Jason Augspurger (Environmental Resource Scientist – Freshwater).

1. APOLOGIES

Resolution

That the apologies for Cr Hope, Cr Malcolm be accepted.

Moved: Cr Wilson
Seconded: Cr Calvert
CARRIED

Cr Laws joined the meeting at 1:10 p.m.

2. CONFIRMATION OF AGENDA

The agenda was confirmed as published.

3. CONFLICT OF INTEREST

No conflicts of interest were advised.

4. PUBLIC FORUM

No public forum was held.

5. PRESENTATIONS

Crs Noone and Robertson updated the meeting on recent activities of the Land and Water Regional Plan Governance Group (LWRPGG).

Cr Wilson moved that the presentation be accepted and this was seconded by Mr Ellison.

Moved: Cr Wilson
Seconded: Mr Ellison
CARRIED

6. CONFIRMATION OF MINUTES

Resolution

That the minutes of the meeting held on 9 September 2020 be received and confirmed as a true and accurate record.

Moved: Cr Hobbs
Seconded: Cr Noone
CARRIED

7. ACTIONS

The Actions Register was reviewed. GM Strategy, Policy and Science Gwyneth Elsum noted that initial work had commenced on Thomsons Creek, in alignment with the resolution, however she noted the work may merge in with other work due to the announcement from Central Government that the Manuherekia will be the third exemplar catchment to be targeted as part of the Government's plan to clean up waterways by supporting community-led programmes. She suggested work on this issue would best be directed through that government group and the outstanding action item be closed off. The Councillors agreed to this suggestion.

DRAFT MINUTES

8. MATTERS FOR NOTING

8.1. ORC's Science Approach for the Land and Water Regional Plan

The Otago Regional Council must notify a new, NPSFM compliant, Land and Water Regional Plan (LWRP) by 31 December 2023 upon recommendation of the Minister for the Environment. This report provided an overview on the proposed science approach to inform the work on the LWRP.

Jason Augspurger (Environmental Resource Scientist - Freshwater), Julie Everett-Hinks (Manager Science) and Gwyneth Elsum (GM Strategy, Policy and Science) were present to respond to questions about the report. Several Councillors had questions, noting specific interest in the community engagement process to seek formal feedback during drafting of the final Land and Water Regional Plan.

After an in depth discussion, Cr Noone said the overall report was a sound building block to work towards the 2023 due date target for the LWRP and he was encouraged by staff's openness to all approaches. He then asked for a motion to receive the report.

Resolution

That the Committee:

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

2) ***Notes*** *the* proposed science approach for the LWRP outlined in this paper.

Moved: Cr Hobbs
Seconded: Cr Noone
CARRIED

8.2. Overall Implications of Essential Freshwater Reforms

A suite of regulatory reforms, including a National Policy Statement for Freshwater Management 2020, a National Environmental Standard for Freshwater, and Section 360 Resource Management Act regulations, was released in August this year, taking effect from 3 September 2020. This report was provided to inform Councillors of implications on work programmes and budgets for the current financial year as a result of the National Policy Statement for Freshwater Management 2020 (NPSFM).

Anita Dawe (Manager Policy and Planning) and Gwyneth Elsum (GM Strategy, Policy and Science) were available to speak to the report and respond to questions. After a brief discussion of the paper, Cr Calvert moved:

Resolution

That the Committee:

1) ***Receives*** *this report.*
2) ***Notes*** *the additional resources required to start implementing the NPS FM.*
3) ***Notes*** *the additional expenditure required for the 2020/21 financial year.*
4) ***Notes*** *that any additional resource implications will be addressed as part of the Long Term Plan.*

DRAFT MINUTES

Moved: Cr Calvert
Seconded: Cr Hobbs
CARRIED

8.3. Otago Greenhouse Gas Emission Inventory by District

This report was provided to update the Committee on work being undertaken towards ORC's commitment to do a regional emissions assessment in 2020/21. Anne Duncan (Manager Strategy) and Gwyneth Elsum (GM Strategy, Policy and Science) were present to speak to the report and respond to questions. After a general discussion of the report, Cr Calvert moved:

Resolution

That the Committee:

1) ***Receives** this report.*
2) ***Notes** that a draft report is expected to be completed by March 2021 and the final report is expected to be completed by April 2021.*

Moved: Cr Calvert
Seconded: Cr Deaker
CARRIED

8.4. Avenues for Investment in COVID-19 Recovery

This report was provided to assist the Otago Regional Council with responses to COVID-19 recovery proposals. Sarah Gardner (Chief Executive) was present to speak to the report and respond to questions. She noted a question for the working group was whether the ORC should be involved in job creation or whether its role should be as facilitator. She said it was a challenging question and will be for Council to determine how it should proceed, taking into account budgeting for the Long Term Plan.

Cr Robertson asked whether this should go to the Finance Committee for input into budget impacts. Mrs Gardner noted that there was no Finance Committee meeting scheduled before the Christmas break and if Councillors want to discuss this prior to then, the report should go directly to Council. The Councillors agreed to invite chairs of Committees to the Working Group's next meeting to discuss finances. Cr Laws mentioned the notable labour shortages for seasonal work in Central Otago and asked that the group take this into account when they met.

After further general discussion, Cr Hobbs moved:

Resolution

That the Committee:

1) ***Receives** this report.*
2) ***Notes** the potential for Council to need to make decisions on proposals for funding related to Kaimahi for Nature and other Central Government grants for COVID-19 recovery.*

DRAFT MINUTES

3) ***Approves*** *the proposed decision tree to evaluate funding applications or proposals made to or by ORC against Council's Strategic Directions.*

4) ***Approves*** *the COVID-19/Jobs for Nature Working Group of Council as the evaluator of proposals for funding received by ORC*

5) ***Invites*** *the COVID-19/Jobs for Nature Working Group to devise a funding process and funding envelope for consideration by Council in late 2020, ensuring a financial lens is considered by inviting Chairs of Committees and GM Corporate Services to participate in the meeting with the Working Group.*

6) ***Requests*** *that the Working Group will take note of seasonal labour shortages in Central Otago*.

Moved: Cr Hobbs
Seconded: Cr Robertson
CARRIED

9. CLOSURE

There was no further business and Co-Chair Wilson declared the meeting closed at 02:40 pm.

_____ _____
Chairperson Date

DRAFT MINUTES

Action Register – Strategy and Planning Committee at 25 Nov 2020

Meeting Date	Document	Item	Status	Action Required	Assignee/s	Action Taken	Due Date	Completed (Overdue)
22/01/2020	Strategy and Planning Committee 2020.01.22	P&S1812 Manuherekia River Resource Assessment report	Completed	Report back on options for potential remedial actions from the Chief Executive, e.g. Thomsons Creek (E. coli), where appropriate as significant diversions or risks were revealed in the current report. UPDATE: Action will now be delivered through: - Manuherekia as an "at risk" catchment programme announcement from Minister which is proposing to deliver an integrated Catchment Plan and projects to address water quality in Manuherekia, and; - New Requirement for "action plans" for various attributes in the NPSFM that was gazette in early August.	Gwyneth Elsum	**30/07/2020** Stage 1 - propose framework prioritisation of remedial actions - due November 2020 **30/07/2020** Stage 2 - Apply framework to the Manuherekia - due January/February 2021. **2/11/2020** Report on framework for prioritisation of resources for Manuherekia/Thomsons Creek Action will be presented to Council at its 9 December 2020 meeting. **12/11/2020** Update provided to Councillors.	28/02/2021	12/11/2020
12/11/2020	Strategy and Planning Committee 2020.11.12	P&S1880 Otago Greenhouse Gas Emission Inventory by District	In Progress	Complete Draft Emission Inventory by March 2021 and present final report to the Committee by May 2021.	Ann Yang, Anne Duncan, Gwyneth Elsum		14/04/2021	
12/11/2020	Strategy and Planning Committee 2020.11.12	GOV1953 Avenues for Investment in COVID-19 Recovery	Assigned	Request the Working Group to devise a funding process and funding envelope for consideration by Council in late 2020, ensuring a financial lens is considered by inviting Chairs of committees and the GM Corporate Services to participate in the meeting with the Working Group and request the Working Group to take note of seasonal labour shortages in Central Otago during this work.	Cr Scott, Nick Donnelly		31/12/2020	

7.1. LTP Consultation Proposal - Integrated Environmental Management

Prepared for:	Strategy and Planning Committee
Report No.	P&S1889
Activity:	Internal Projects: Corporate
Author:	Sylvie Leduc, Senior Strategic Analyst; Anne Duncan, Manager, Strategy
Endorsed by:	Gwyneth Elsum, General Manager Strategy, Policy and Science
Date:	1 December 2020

PURPOSE

[1] To approve the options to be presented to the public regarding ORC's approach to achieving integrated catchment management as part of public consultation on the Long-Term Plan (2021-2031).

EXECUTIVE SUMMARY

[2] Integrated catchment management has long been recognised as good practice in natural resource management. Its principles are supported in the *Resource Management Act (1991)* and are fully aligned with the ORC's draft Strategic Directions commitments to achieving integrated environmental management and collaborating to deliver.

[3] The preparation of ORC's Long-Term Plan (2021-2031) is a good opportunity for ORC to consider its approach to achieve integrated catchment management, as described in paragraph [14] of this report.

[4] ORC's development of an approach to integrated catchment management can be considered an issue of significance under the current Significance and Engagement Policy as it is likely to be of high interest to the public and to agencies/groups involved in natural resource management in the region.

[5] This paper describes options for ORC to achieve integrated catchment management in the region; and the implications (including financial implications) of these options. This will form the basis for the preparation of the LTP consultation document, providing Council adopts the recommendation below.

RECOMMENDATION

That the Committee:

1) ***Agrees*** *that the statement of proposal "integrated catchment management" is a matter of significance as assessed in this report*

2) ***Approves*** *the statement of proposal "integrated catchment management" for inclusion in the Long-Term Plan 2021-2031*

3) ***Approves*** *the following options to be presented to the public as part of LTP consultation:*

    a) *Option 1: ORC supports and enables integrated environmental management in all the region's catchments.*

b) Option 2: ORC leads, facilitates and coordinates integrated environmental management in all the region's catchments.

i) Option 2a: and implements this approach at a moderate pace (over 5 years).

ii) Option 2b: and implements this approach at a slow pace (over 10 years).

BACKGROUND

[6] Integrated natural resource management, and, in particular, integrated catchment management, has long been recognised as good or best practice:

a. It ensures that natural resource management objectives for catchments are mutually compatible and that they recognise the interconnectedness of the environment, people, and ecosystems.
b. It allows the development of work programmes that seek to achieve a holistic set of objectives and avoid unintended consequences.

[7] In New Zealand, regional councils are uniquely positioned to achieve integrated catchment management:

a. They monitor environmental health in catchments, including catchment hydrology, water quality, ecosystem health and other key catchment values.
b. They have a wide range of regulatory functions under the *Resource Management Act (1991)* to protect ecosystems, freshwater bodies, coastal and soil values in their region's catchments.
c. They have powers to do works to manage drains and watercourses under the *Soil Conservation and Rivers Control Act (1941)* and the *Land Drainage Act (1908)*; and to enforce the *Hazardous Substances and New Organisms Act (1996)*.

[8] Historically, ORC has focused on achieving integrated management through the Regional Policy Statement and underpinning plans as part of its RMA functions. It has been less active in:

a. Undertaking/coordinating non-regulatory activities/programmes generally;
b. Coordinating activities across functions in the same catchment;
c. Facilitating and coordinating initiatives across agencies at a catchment scale; or
d. Providing a holistic overview of catchments' natural resources health, trends, and risks, to enable informed engagement and integrated decision-making.

[9] With ORC's functions not being managed at the same geographic scale, or following a consistent community focused planning process, objectives that span all relevant environmental domains (water, land and soil, biodiversity, climate change impacts etc.) at a catchment scale have not been set. Similarly, apart from community or catchment group initiatives, there has been little coordination of environmental activities across agencies and groups.

[10] Moreover, because of not having a clear overview of objectives, issues and existing initiatives, ORC's decisions to support, participate in, or lead environmental initiatives have mostly been ad-hoc driven by community advocacy, rather than objective priorities and planning.

[11] The Long-Term Plan (2021-2031) is a good opportunity for ORC to rethink its role and approach in achieving or supporting integrated catchment management in a structured and transparent way.

ISSUES

[12] The *Local Government Act (2002)* requires that public consultation on proposed Long-Term plans be based on a consultation document that:

a. "Identifies and explains to the people of the […] region, significant and other important issues and choices facing the local authority and […] region, and the consequences of those choices" (s93B); and
b. "Describes, for each issue of significance, the principal options for addressing the issue and the implications of each of those options" (s93C).

[13] In advance of the preparation of the LTP consultation document, ORC must consider whether integrated catchment management is an issue of significance which requires consultation, and what options should be put forward in its consultation document.

DISCUSSION

What would integrated catchment management look like?

[14] Integrated catchment management is a broad concept that is operationalised in several ways. In some places in New Zealand, it refers to coordination of water management activities only, often around urban areas. However, in this proposal, a broader definition of the concept is used, one which encompasses integration of all-natural resource management and environmental matters in a catchment. Considering the issues outlined above, it is expected that integrated catchment management for ORC would be a planning and delivery cycle ("plan-do-review") with the following components:

a. **A comprehensive set of mutually compatible objectives**, goals, priorities, and targets across natural resources matters for a catchment area, taking into consideration the inter-connectedness of the catchment's ecosystems, the overall context, and community aspirations as well as regulatory requirements.
b. **A programme of work** linked to the catchment's objectives, goals, priorities, and targets. This would be developed in collaboration with local communities and active agencies and groups in the catchment and could incorporate natural resource management initiatives across agencies/groups.
c. **A monitoring and reporting framework** designed to achieve the relevant catchment objectives which provides a comprehensive overview of catchment natural resource health and risks; and provides a robust foundation to evaluate the progress of activities and interventions and adaptive response in terms of actions, policies, and rules.

[15] There is an opportunity to partner with Otago's mana whenua in integrated catchment management and the nature of that will need to be discussed and agreed as part of implementing the approach. The proposal was signalled as part of ORC's mana to mana in October and it is envisaged that there will be further discussion prior to formal public consultation.

[16] Any process with these three key elements (catchment objectives, collaborative work programme and catchment monitoring framework) will be referred to as Integrated Catchment Action Planning (ICAP) in this report.

What are the benefits of integrated catchment management?

[17] Taking a catchment-scale and integrated approach to natural resource management has many benefits:

a. **More effective management:** It is well established that the natural resources, ecosystems, and communities are closely interconnected. As previously noted, taking those interconnections into consideration is essential to avoid unintended consequences. In addition, all parties, both internal and external, can access common information about the catchment - its natural resources; management activities/action plans underway and progress of management in achieving agreed objectives.

b. **More effective and efficient engagement and communication with Otago communities:** A place-based approach to planning, delivery and engagement better reflects the perspective of the community and facilitates more meaningful engagement with local communities. It does this by facilitating the provision of relevant information at the right scale, increasing understanding of the catchment and its issues, providing the community the opportunity to contribute knowledge and express concerns and aspirations, and be provided with an overview of ORC and other agency projects and activities within their community.

c. **Better coordination across agencies and across ORC functions:** Many parties are involved in natural resource management including district and city councils, DOC, Fish and Game, industry bodies, catchment groups and other community groups. Coordinating and aligning of all actions as well as ORC's activities means that outcomes can be delivered more efficiently and facilitate progress towards objectives and aspirations. Although the value of cross-agency collaboration is well recognised, achieving that coordination is challenging, especially in the absence of a dedicated process that seeks to articulate coherent and shared objectives for a place, and allocate the actions to achieve these objectives to the relevant party. Within ORC, ORC activities across its functions (biosecurity, biodiversity, river management, drainage and flood scheme management, land, and water management etc.) could also be better coordinated and aligned so that synergies between functions could be realised.

d. **Enhanced accountability and reporting:** Clear, place-based planning that provides locally specific objectives, goals, and targets will allow locally based monitoring programmes that provide better insight into natural resource management interventions and their effectiveness in catchments, and any emerging issues that may require further investigation, planning and interventions.

e. **Facilitates adaptive management:** Better structured and locally specific monitoring and investigations, as described above, are essential pre-requisites to adaptive management; and the proposed place-based approach will need to be designed to deliver adaptive management.

f. **Is consistent with Te Ao Māori and condiucive to meaningful engagement with Otago's mana whenua:** Integrated natural resource management which acknowledges and takes into consideration the interconnectedness of the

natural environment and communities, is consistent with Te Ao Māori (the Māori worldview). An approach that fits with Te Ao Māori should enable more meaningful engagement and input from mana whenua.

Is integrated catchment management an issue of significance?

[18] Under S93C of the *Local Government Act (2002)*, the LTP consultation document must describe *"each issue that the local authority determines should be included having regard to (i) the significance and engagement policy adopted under section 76AA; and (ii) the importance of other matters to the district and its communities".*

[19] Under ORC's Significance and Engagement Policy, the degree of significance of an issue is a matter of judgment and must be determined taking into consideration:

a. The extent of any consequences or impact on Otago residents and ratepayers, or stakeholders […].
b. The level of public interest likely to be generated within the region or New Zealand, generally.
c. Any likely effect on the ability of Council to perform its role, carry out is existing activities and meet statutory timeframes.
d. Any financial and other costs or implications.
e. The impacts on people's ability to use property or essential services; and/or
f. If the issue, proposal, decision, or other matter involves a strategic asset.

[20] ORC's role in achieving integrated catchment management does not involve a strategic asset and will not impact on people's ability to use property or essential services.

[21] The main driver is to increase ORC's effectiveness in carrying out its role and activities. Although ORC will continue to perform its role and activities whatever the decision, integrated catchment management will support the development and implementation of the freshwater action plans required by the NPS-FM (2020), and enhance the effectiveness of ORC's activities in land, water, biodiversity, biosecurity, climate change adaptation and natural hazards mitigation.

[22] The health of Otago's rivers, lakes and ecosystems, and climate change, are matters of public concern, as indicated by two public surveys carried out in 2020[1]. The role of ORC in integrated catchment management is likely to impact on how those issues are addressed in the region and is therefore likely to be of high public interest.

[23] It is also likely to generate a high degree of interest among stakeholders who are actively involved in natural resource management and environmental initiatives in the region as it will impact on their relationship with ORC and other stakeholders.

[24] As a result, the issue of ORC's role in achieving, leading, enabling or supporting integrated catchment management can be considered an issue of significance under ORC's Significance and Engagement Policy, and should be included as a matter for consultation in the LTP consultation document.

[1] Regional Policy Statement 2020 Survey (https://www.orc.govt.nz/media/8527/council-agenda-20200527.pdf) and Vision for Otago Survey (https://www.orc.govt.nz/media/9003/agenda-strategy-and-planning-20200909.pdf)

OPTIONS

[25] The *Local Government Act (2002)* requires LTP consultation document to describe, for each of the issues identified for consultation *"the principal options for addressing the issue and the implications of each of those options"* and *"the proposal, if any, for addressing the issues"*.

[26] This section identifies and assesses three options by which ORC can achieve integrated catchment management, as described in paragraph [12]. These options have been identified for the purpose of the LTP consultation. They correspond to varying degrees of ORC involvement in integrated catchment management.

a. In **Option 1**, ORC focuses on enabling integrated catchment management, by ensuring that it provides catchment information in a way which can foster integrated catchment management.
b. In **Option 2,** ORC takes a more active role in catchments, where it facilitates and coordinates the preparation, implementation and review of ICAPs. This can be implemented at a moderate pace (2a) or more slowly (2b).

[27] Table 1 describes in more details these three options, and outlines what activities they entail.

Table 1: Options description

OPTION 1	**Information platform** • Coordinating ORC activities at a catchment level, across functions within ORC • Collecting, reporting and enabling the sharing of all relevant catchment information • Continuing to support catchment and community groups • Participating in integrated catchment planning initiated by third parties.
OPTION 2	**In all catchments** • Coordinating ORC activities at a catchment level, across functions within ORC • Collecting, reporting and enabling the sharing of all relevant catchment information • Facilitating Integrated Catchment Action Planning (as described in paragraph 14); • Co-ordinating the delivery of the action plan across agencies, and reporting on implementation • Facilitating and coordinating ICAP review processes

[28] For clarity of purpose, it is proposed that:

a. Under all options, ORC will better coordinate its activities across functions. This may impact on ORC's performance and environmental reporting systems and processes.
b. Under Option 1, ORC will still develop freshwater action plans, as required by the NPS-FM (2020), participate in developing natural hazard mitigation plans and climate change adaptation plans, and implement its biodiversity and biosecurity work programmes. There is no commitment that those plans will be collaborative or integrated.
c. Under Option 2, ORC will leverage the current review of the Land and Water Plan to identify catchment objectives. This will widen the scope of community

consultation on catchment objectives to natural hazards risks, river forms and functions, biodiversity and biosecurity.

[29] It is proposed that, to enhance the sharing and reporting of catchment information, ORC will develop an online portal that will provide all relevant available information on Otago's catchments, including information on water quality, land use, flows and hydrology, ecosystems, invasive species in the catchment, but also on objectives for the catchment (where identified) and existing and planned initiatives. The portal may include catchment information from third parties providing that information meets ORC's assurance quality expectations. This online portal will also be an invaluable resource, should central government adopt the Resource Management Review Panel's recommendation to require the development of regional spatial strategies setting high level patterns of development and land use change in the region[2].

[30] Table 2 assesses the benefits, disbenefits and risks of each option.

Table 2: Option assessment – ORC's role

OPTION 1
In this option, ORC supports and enables integrated natural resource management in all the region's catchments through providing comprehensive catchment-based information to communities and supporting community initiatives that seek to achieve integrated catchment management.
Implications
• ORC sets up and maintain a new online portal to capture and provides relevant catchment information. • Community engagement on freshwater management, biosecurity, biodiversity, natural hazards risks and climate change is carried out separately as required by each functional team. • Although coordinated, ORC's operational planning is carried out separately across functions.
Benefits
• Option requires the least resources and is the least disruptive to ORC's current way of operating.
Disbenefits
• Option less likely to deliver integrated catchment management as described in paragraph [14], with its associated benefits (outlined in paragraph [17]) • Option does not demonstrate leadership role in delivering 'integrated planning' as required under the RPS. • Option less aligned with ORC's strategic directions and Strategic Directions commitments to: 'deliver integrated environmental management', 'effectively engage communities' and 'collaborate to deliver'. • In the absence of a structured and systematic approach to prioritizing ORC's activities and involvement at across catchments, risk that ORC's operational activities remains reactive rather than proactive, focussing on catchments where a community group has the resources to initiate planning; rather than on those where issues are the most significant.

[2] https://www.mfe.govt.nz/sites/default/files/media/RMA/rm-panel-review-report-web.pdf

Uncertainty & Risks
• This option is essentially reactive in that ORC will participate in, and support, any integrated catchment planning initiated by a third party. The level of participation and support needed is unknown. • The main uncertainty associated with this option is how much community or catchment groups, or other parties, will be willing to initiate and lead collaborative integrated catchment planning. If few parties are willing to lead integrated planning, then this option will not deliver the benefits outlined in paragraph [17].

OPTION 2
In this option, ORC leads, facilitates and coordinates Integrated Catchment Action Planning (planning, delivery and review) in all Otago catchments.
Implications
• ORC sets up and maintains a new online portal to capture and provide relevant catchment information. • Community engagement is integrated across ORC's functions. • ICAP incorporates freshwater action plans as defined in the NPS-FM (2020) and ORC programmes, including natural hazard risks mitigation plans, climate change adaptation plans and biodiversity and biosecurity work programmes.
Benefits
• Likely to deliver all the benefits of integrated catchment management across the region. • Provides a mechanism to achieve leadership in 'integrated planning' as required by the RPS. In addition, this option also provides a mechanism for better alignment of regulatory and non-regulatory approaches in the context of place. • Strong alignment with ORC's draft Strategic Directions and its strategic commitments. • Likely to foster a better understanding of ORC's roles, responsibilities, and activities in the community, across the region. • Supports a more structured and justified prioritization of ORC activities across Otago's catchments.
Disbenefits
• Option is more resource intensive.
Uncertainty & Risks
• The level of commitment ORC will be taking for the delivery of ICAP recommended actions is unknown: catchment work programmes may significantly increase ORC's operational activities over time due to increased expectation of delivery as a result of proactive action planning. • Risk in management of change in how ORC delivers its business while continuing to deliver. The faster the change needs to be delivered the higher the risk. • Risk of aligning work programmes and relationships management with catchment groups or other third parties where catchment planning is already underway at their initiative.

[31] Option 2 brings more benefits than Option 1. It is also the option which brings about the most significant changes in how ORC operates and engages with the region's communities.

[32] In view of that, a further matter for consideration is the pace at which Option 2 is implemented.

a. ORC could either implement Option 2 at a moderate pace **[Option 2a]**, by which Integrated Catchment Action Planning is introduced to catchments across the region between 2023 and 2026-2028.
b. or take a slower pace **[Option 2b]**, where Integrated Catchment Action Planning is introduced to catchments across the region between 2023 and 2033-2035.

[33] Table 3 assesses the respective benefits and disbenefits of Option 2a and Option 2b.

Table 3: Option assessment – Timeframes

	BENEFITS	**DISBENEFITS**
OPTION 2a moderate *(over 5 years)*	• Achieves a coherent, integrated and structured approach to ORC's operational planning faster • Achieves cross-agency coordination faster • Better continuity with FMU processes • More equitable in that all catchments are addressed in a foreseeable timeframe • Greater clarity on the ORC's approach and commitment.	• A sharper increase in staff resources dedicated to integrated catchment management.
OPTION 2b Slow *(over 10 years)*	• Greater ability to learn over time how best to approach Integrated Catchment Action Planning. • More time to achieve change in ORC mode of delivery. • A more gradual increase in staff resources dedicated to integrated catchment management.	• **Having two co-existing operating models for longer** (catchments with or without ICAP) o May create uncertainty over the role of ORC in integrated catchment management and its commitment to it. o Risks internal inefficiencies, and confusion over roles and responsibilities internally • **In catchments which are addressed at a later stage:** o Lack of continuity with the FMU process o Risk of degrading relationships with communities in the interim. o Greater risk of having ad-hoc, uncoordinated, initiatives in the catchments in the interim.

[34] The estimated financial implications of each option are outlined below, along with their underlying assumptions.

	Year 1	Year 2	Year 3	Year 4-10
Option 1				
Resources	1 FTE	1.5 FTE	1 FTE	1 FTE
Assumptions	• One full-time role for 18 months to design and implement the online catchment portal and data quality assurance processes. • One permanent full-time role that supports activity coordination across functions, and ORC performance reporting and communication by catchment, from the middle of Year 2. • Current budgets for supporting catchment groups will cover any support and participation in community-led integrated catchment management programmes. • The volume of ORC's operational activities is not impacted. These estimates do not include the costs associated with the development of the freshwater action plans required by the NPS-FM, participation in natural hazard risk mitigation or climate change adaptation planning, or any other operational planning activity.			
Option 2a				
Resources	2 FTE	1.5 FTE	5 FTE	5 FTE
Assumptions	Assumes: • One full-time role for 18 months to design and implement the online catchment portal and data quality assurance processes; • The establishment of a new team of 4 catchment leads, staged over the next 3 years, to lead Integrated Catchment Action Planning in catchments across the region. • One spatial analyst role to support Integrated Catchment Action Planning; • The volume of ORC's operational activities is not impacted. • Integrated Catchment Action Planning is done based on existing knowledge. These estimates include coordination of Integrated Catchment Action Planning which incorporates freshwater action plans, natural hazard risk mitigation or climate change adaptation plans and other operational activities.			
Option 2b				
Resources	2 FTE	1.5 FTE	2.5 FTE	2.5 - 5 FTE
Assumptions	• One full-time role for 18 months to design and implement the online catchment portal and data quality assurance processes; • Two permanent full-time roles to progressively lead Integrated Catchment Action Planning in catchments across the region, commencing in priority catchments; with one of these positions starting in Year 1 and the other in Year 3. In time, this team would grow to 4 FTEs. • A part-time spatial analyst role (0.5 FTE) to support Integrated Catchment Action Planning, increasing to 1 FTE over time; • The volume of ORC's operational activities is not impacted. • Integrated Catchment Action Planning is done based on existing knowledge.			

	These estimates include coordination of Integrated Catchment Action Planning which incorporates freshwater action plans, natural hazard risk mitigation or climate change adaptation plans and other operational plans.

[35] The table above highlights significant differences in the resourcing required to implement the various options. It must be noted however that those differences assume that contributing to Integrated Catchment Action Planning or preparing separate functional operational plans (including NPS-FM freshwater action plans) requires the same amount of work and resources for ORC's functional teams. This assumption, along with the other assumptions highlighted in this report, will be tested further before consultation on the LTP starts.

CONSIDERATIONS

Policy Considerations

[36] Addressed in the body of the report.

Financial Considerations

[37] Addressed in the body of the report.

Significance and Engagement

[38] Addressed in the body of the report.

Legislative Considerations

[39] Addressed in the body of the report.

Risk Considerations

[40] Addressed in the body of the report.

NEXT STEPS

[41] The next steps are:

a. To further review and test assumptions and budget estimates;
b. Prepare the LTP consultation document for Council approval in February 2021.

ATTACHMENTS

Nil

7.2. Integrated Otago Trail Network Investigation

Prepared for:	Strategy and Planning Committee
Report No.	OPS1016
Activity:	Transport - Unplanned
Author:	Garry Maloney, Manager Transport Michelle Mifflin, Manager Engineering
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	25 November 2020

PURPOSE

[1] To present a report setting out opportunities for Otago Regional Council to consider how to facilitate assistance with continued development of an integrated trail network throughout Otago.

EXECUTIVE SUMMARY

[2] During the development of the 2020/2021 Annual Plan, the Council received a submission regarding regional trails. Arising from this submission, Council directed that it wished to receive advice outlining the potential for development of an integrated trail network throughout Otago, and where there may be an opportunity to assist.

[3] A high-level desk-top investigation has been undertaken to that effect and indicates that while the Council does not have a direct role in providing for cycling and walking, the opportunities for it to be involved include:

a. providing funding for land purchase, planning, construction, consenting, ongoing maintenance or any combination of these;

b. leading/coordinating as a 'regional project';

c. providing specialist subsidised public transport services to fill gaps between trails; and

d. allowing use of Council's land/assets (e.g. floodbanks).

[4] Other potential opportunities include:

e. promoting/ensuring safe cycling and walking connections; and

f. connecting/providing access to areas of high biodiversity and to waterways.

[5] While all the options outlined in the report stated advantages, it also presents challenges, such as;

a. funding - requires (new) Council investment in grants and administration; potentially a reduction in Council revenues (consents) and potentially additional funds to establish link public transport services;

b. changes to Council processes - if providing grants Council may need to set up a new process for that to happen and it may require change to current flood protection asset maintenance arrangements;

c. potential governance tensions given the multiple agencies involved (Otago's regional trail network is predominantly led by groups of community volunteers formed as Trusts) and potentially the goals they are seeking to achieve; and

d. potential difficulty managing public access or community expectations of access to ORC assets.

[6] If the Council were to consider one or more of the options, it would be classified as new business for Council and require consultation with the community, local government partners and other stakeholders to determine an agreed way forward.

RECOMMENDATION

That the Council:

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

2) ***Notes*** *that a Regional Trails Investigation report has been prepared, outlining potential opportunities for the Council to assist development of an integrated trail network throughout the region.*

3) ***Notes*** *that the opportunities identified in the report would be new business for the Council and require additional resources and funding to implement.*

BACKGROUND

[7] During the 2020/2021 Annual Plan process, the Council received a submission seeking that it:

a. endorse the concept of the Southern Gateway Trail linking Dunedin to Waihola;

b. acknowledge a trail leading north from the city is also integral;

c. add both these trails to the Regional Land Transport Plan;

d. work with the Dunedin Tunnels Trail Trust to complete the cycleway from the Octagon to Waihola; and

e. include the cycleway in the Regional Land Transport Plan.

[8] The Council directed that it wished to receive advice outlining opportunities to assist development of an integrated trail network throughout Otago to inform development of the 2021/31 Long Term Plan.

ISSUE

[9] The Council does not have a statutory land transport role to provide for cycling and walking. However, it wished to understand if a potential role may exist.

[10] Proposed use of land/assets and specifically the floodbanks that form Council's Flood Protection and Drainage schemes, had also been the subject of recent public submission and discussions with district councils. The Council also wished to know what opportunities may exist to enable its land/assets to be used for those purposes.

DISCUSSION

[11] The current Regional Land Transport Plan (RLTP) identifies a regional trail network. A new RLTP is being prepared and while a public draft has yet to be released the document in development does contain a section on regional trails. This provides the opportunity for this matter to be developed further and publicly consulted on.

[12] In terms of the Council request for further advice, staff commissioned a high-level desk-top investigation.

[13] The investigation report has been prepared and is appended. In summary, it:

a. provides context for the investigation;

b. describes the Otago trail network including the current network, what's in development, where the gaps are and current network management approaches;

c. describes opportunities to support network development; and

d. discusses opportunities for Council to use flood protection and drainage schemes assets.

[14] Other potential opportunities not identified in the report include:

a. promoting/ensuring safe cycling and walking connections; and

b. connecting/providing access to areas of high biodiversity and to waterways.

OPTIONS

[15] The Council currently identifies the regional trail network in the RLTP, however there are a number of additional ways that it could assist or support development of an integrated regional trail network. These include:

a. providing funding for land purchase, planning, construction, ongoing maintenance or any combination of these;

Advantages	**Disadvantages**
Powerful mechanism through which ORC can influence, facilitate and support trail network development	Requires use of ORC budget and administration to oversee
Likely to enable growth and expansion of regional network development where funding is a constraint	May require ORC to set up new or specific grant scheme

May stimulate new match funding	May reduce funding shortfall causing other funders to redirect contributions elsewhere

b. leading/coordinating as a 'regional project';

Advantages	**Disadvantages**
Creates a single point of contact across the region for trail development	Likely to require additional operational budget
Helps create a shared vision for trails in Otago and strengthen "Brand Otago"	May create tension where governance of trails is established

c. providing specialist subsidised public transport services to fill gaps between trails; and

Advantages	**Disadvantages**
Fills a gap in the network enabling people to continue their journey with relative ease	A service is likely to operate at a loss due to the size of the gaps and relative demand
May create a new service for local community	May create competition with local commercial operators and cause them to cease operating

d. allowing use of Council's land/assets.

Advantages	**Disadvantages**
Enables trail developers to negotiate with a single landowner (ORC)	May present a risk to flood protection asset if access and trail design is not suitable
Promotes access to areas of high community value ie. local waterways	May require change to current maintenance arrangements e.g. livestock grazing
Helps achieve objectives of RTC to grow and expand Otago's trail network	May create community expectation that all flood banks are suitable
Creates opportunity for ORC to raise awareness about regional resources through storytelling/information boards	Likely to require some change in staff responsibilities to deal with new BAU e.g. Managing public access during flood events
Creates opportunity for regional partnerships with ORC partnering with Tas and local stakeholders	May be difficult to manage public access or expectations of public access

[16] While all the options outlined in the report have advantages, they also have a number of shared disadvantages. Those disadvantages include:

a. Funding - requires (new) Council investment in grants and administration and potentially additional funds to establish link public transport services;

b. Council processes – if providing grants Council may need to set up a new process for that to happen and may require change to current flood protection asset maintenance arrangements;

c. Governance – current governance of Otago's regional trail network is predominantly led by groups of community volunteers that have been formed as Trusts. Seeking to establish overarching regional governance may create tensions given the multiple agencies involved and potentially the goals they are seeking to achieve; and

d. Community expectations - may be difficult to manage public access or expectations of access.

[17] If Council were to implement one or more of the options, it would be new business for Council and require consultation with the community, local government partners and other stakeholders to determine an agreed way forward.

Use of Flood Protection and Drainage scheme Assets

[18] There have been two recent approaches to Council to assist trail development using Council's 'flood banks' (Silverstream and Taieri River and Clutha River at Balclutha) which are outlined in the appended report.

[19] It should be noted that most land owned by Council is subject to lease agreements. Within the Flood Protection and Drainage scheme areas, Council uses grazing leases to ensure grass on flood banks and river berms is managed in a way that reduces the need to mow large areas of grass. Changes to lease arrangements that result in the removal of stock would require alternative management methods to be considered to ensure floodbanks were maintained.

[20] In addition, the decision to vary a lease may not rest solely with Council but would depend on respective leases' terms and conditions.

[21] In the Lower Taieri catchment area, the land most likely to benefit the development of Otago's regional trail network are the floodbanks alongside the Silverstream and the Taieri River:

a. Silverstream - there is currently a walkway along the true left bank of the Silverstream, between Wingatui and Gladfield Roads. Ownership of the flood banks along the Silverstream is relatively simple. Most of the land used for the walkway is owned by Council, with some sections nearer to Mosgiel being owned by the Dunedin City Council. Due to operational requirements, the true right bank is not suitable for construction of a public trail due to access constraints.

b. Taieri River - there is currently no public access along the Taieri River flood banks. Ownership of floodbanks on the Taieri River is complex and two sections of the Taieri River flood bank system are not suitable for the construction of a public trail due to access constraints.

[22] The Council's Lower Clutha Flood Protection and Drainage Scheme is primarily designed to provide a level of service, that protects the community from the effects of flooding from the Clutha River.

[23] Flood protection scheme land and the flood banks in the Lower Clutha are a mixed ownership and one section of the Lower Clutha flood protection scheme is not suitable for the construction of a public trail due to restrictive access.

[24] Balclutha communities currently use local and regional flood banks for walking and cycling which is enabled by public access to the floodbanks, which is not restricted currently. The well-established Blair Athol Walkway traverses' sections of flood bank as it follows the Clutha River around the town's perimeter. Less formal trails connect to the Blair Athol Walkway.

CONSIDERATIONS

Policy Considerations

[25] There are no policy considerations associated with receiving this report. However, should the Council resolve to pursue one or more options outlined in this report, it is likely it will have to consider policy implications further.

Financial Considerations

[26] There are no financial considerations associated with receiving this report.

[27] If Council recommend further consideration of one or more options outlined in this report, there will be a financial consideration, and this would need to be considered under separate Council approval.

Significance and Engagement

[28] There are no significant and engagement considerations associated with receiving this report. However, should the Council recommend one or more options outlined in this report, it would constitute new business for Council and require consultation with the community, local government partners and other stakeholders to determine an agreed way forward.

Legislative Considerations

[29] There are no legislative considerations associated with receiving this report. However, the comments above relating to Council recommending one or more of the options outlined in this report, also apply to legislative consideration.

Risk Considerations

[30] There are no risks associated with receiving this report.

NEXT STEPS

[31] The next step is for the Council to consider this report and recommend how it wishes to proceed.

ATTACHMENTS

1. 2020-11-25 ORC Regional Trails Investigation FINAL PDF v 2 [**7.2.1** - 24 pages]


REGIONAL TRAILS INVESTIGATION
PREPARED FOR OTAGO REGIONAL COUNCIL
24 November 2020
Stantec

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QUALITY STATEMENT

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REVISION SCHEDULE

Rev No.	Date	Description	Signature or Typed Name (documentation on file)			
			Prepared by	Checked by	Reviewed by	Approved by
1	27/8/20	Draft for comment	Susan Lilley	Susan Lilley	Sarah Connolly	Susan Lilley
2	24/11/20	Final	Susan Lilley	Susan Lilley	Sarah Connolly	Susan Lilley

Abbreviations

A2O	Alps to Ocean Trail
BDC	Balclutha District Council
cm/s	cubic meter per second
COVID-19	2019 novel coronavirus
DCC	Dunedin City Council
DOC	Department of Conservation
DRL	Dunedin Railways Limited
LGA	Local Government Act
LINZ	Land Information New Zealand
MBIE	Ministry of Business, Innovation and Employment
NZCT	Ngā Haerenga The New Zealand Cycle Trail
ORC	Otago Regional Council
RTC	Regional Transport Committee
RLTP	Regional Land Transport Plan
SH	State Highway
TA	Territorial Authorities
Waka Kotahi	Waka Kotahi NZ Transport Agency

Otago Regional Council

Regional Trails Investigation

CONTENTS

LIST OF TABLES

LIST OF FIGURES

APPENDICES

Executive Summary

There is a resurgence in cycling and trail riding in New Zealand, and Otago is at the forefront. The New Zealand Cycle Trail, made up of the country's most iconic cycle routes, includes six 'Great Rides' within Otago and more Otago trails are in development.

A range of organisations in the Otago/Southland region are already working together to expand cycle tourism and support people travelling by cycle in urban and peri-urban areas. The Otago/Southland Regional Transport Committees' goal of expanding Otago and Southland's network of off-road cycle trails and connecting the regions' Great Rides with the rest of New Zealand, is well on the way to being achieved.

While the Otago Regional Council does not have a direct role in providing for cycling and walking, there are opportunities for the Council to be involved. Otago Regional Council wishes to understand what the opportunities and challenges are to assist with the development of an integrated regional trail network.

This report describes Otago's current trail network, including those sections in development, and the gaps in the regional network that are not funded for planning or construction.

The report then sets out possible mechanisms that ORC could use to assist development of an integrated regional trail network in Otago should it choose to do so, including:

- providing funding for trail development.
- leading/coordinating cycle trail development as a 'regional project'.
- providing specialist public transport services to link cycle trails to each other, and to key transport hubs/towns.
- allowing use of land/assets for trails.

Use of land/assets, and specifically the floodbanks that form ORC's Flood Protection and Drainage schemes, has been the subject of recent public submission and discussion with local Territorial Authorities.

To allow improved understanding of the opportunities and challenges of using ORC's flood banks in the Lower Taieri and Lower Clutha catchments for trail development, the report discusses current public access, operation requirements, land ownership and existing lease arrangements.

1. Introduction

This report has been prepared to provide a high-level desk-top assessment of the trail network in the Otago region. The purpose is to help ORC understand opportunities and challenges it may face if it decides to assist with the development of an integrated regional trail network. The report focuses on trails between urban centres and townships, rather than within them.

The report sets out the national context for trails, the statutory role for the regional council and current regional direction. It then describes the Otago regional trail network, its ongoing development, network gaps, and current governance/management arrangements.

The report provides a high-level assessment of mechanisms ORC could use to assist or support development of an integrated regional trail network, and challenges associated with each. It then expands in more detail on one possible mechanism of interest, using flood protection assets, such as flood banks, for trail purposes.

1.1 Context

New Zealand is an outdoor nation with a long history of tracks and trails for tramping and walking. In 1975, a goal of the then New Zealand Walkways Commission was that a New Zealand-long "scenic" trail be formed. Drawing on New Zealand's extensive walking track system this idea was finally realised in 2011 when the 3,000 km Te Araroa walking route was opened.

The development of New Zealand's long-distance cycle trails began in Otago in 1990 when the Department of Conservation purchased the 150 km stretch of railway from Middlemarch to Clyde, to allow conversion of the corridor to a trail. The Otago Central Rail Trail was opened in 2000 as a recreational trail for cyclists, walkers and horse riders between Middlemarch and Clyde. It is estimated that over 15,000 users completed the trail in 2018/19, with upwards of 80,000 trail users either commuting or using the trail for short rides annually.

The success of this trail inspired the creation of the New Zealand Cycle Trail network (see 1.3 below for more detail) and the Otago Central Rail Trail became New Zealand's first 'Great Ride'. Every two years since 2016, hundreds of cyclists have signed up to ride 'Tour Aotearoa' from Cape Reinga to Bluff via New Zealand's Great Rides, Heartland Rides, and quiet back country roads. The Tour travels down the West Coast, over Haast Pass to Wanaka, then over the Crown Range to Queenstown, before crossing Lake Wakatipu into Southland via Mavora Lakes.

Walking and cycling continue to be popular pursuits in New Zealand. Sports NZ Active New Zealand surveys show that walking and cycling are amongst the most popular recreational activities. The New Zealand Government understands the wide-ranging benefits of tracks and trails and continues to support and invest in walking and cycling through its National Land Transport Plan, Provincial Growth Fund and dedicated conversation, economic development and tourism funds.

1.2 Ngā Haerenga The New Zealand Cycle Trail

The New Zealand Cycle Trail (NZCT) is an initiative to create a series of iconic cycle routes throughout New Zealand. It was started by the New Zealand Government and is managed by Ministry of Business Innovation and Employment (MBIE). NZCT Inc. was established in 2014 for long-term governance and management of NZCT, working with stakeholders and other agencies to maximise the tourism value and economic benefit of the trails.

NZCT is made up of Great Rides and Heartland Rides:

- 'Great Ride': a trail that is predominantly off-road and approved by the Minister of Tourism to use the Great Ride brand. There are 20 Great Rides in New Zealand.
- 'Heartland Rides': a series of on-road cycle touring routes aimed at encouraging cyclists to use scenic back-country roads where they can experience 'heartland New Zealand'. The Heartland Rides link the Great Rides with urban centres, transport hubs and other key tourist attractions.

Trail design and development is guided by a national design guide. The New Zealand Cycle Trail Design Guide (5th edition) was updated in 2019. It was prepared for MBIE, with input and review from staff from Department of Conservation (DOC), Waka Kotahi NZ Transport Agency (Waka Kotahi), MBIE and Kennett Brothers Ltd. The guide establishes a trail grading system, to help guide visitor expectations, and draws on lessons learnt to assist planning, designing and cycle trail construction.

1.3 Regional Council Role

The roles and responsibilities of Regional Council are set out in the Local Government Act (2002) and Resource Management At (1991). The LGA requires all local authorities to prepare a Local Governance Statement.

Under the Local Government Act (2002), ORC has responsibility for regional land transport planning. The ORC's Regional Transport Committee approves the Regional Land Transport Plan. Under the Resource Management Act 1991, ORC is responsible for the integrated management of the physical resources of a region.

A Regional Council does not have a direct role in the provision of cycling and walking. However, there are opportunities for Regional Council involvement (see Section 3), and its statutory role does not preclude it from being involved in the provision of trails. For example, Hawkes Bay Regional Council is a joint landowner, the primary asset holder, provides governance and management, and shares responsible for marketing and promotion of Hawke's Bay Trails - Heretaunga Ararau. The Hawkes Bay Regional Council also shares responsibility for maintenance of those sections of the Hawkes Bay Trails on regional council land. Most regional councils promote their regional cycle trail networks via their websites.

ORC was involved in track and trail development around 2000 as part of millennium commemorations. At this time, the ORC built or contributed to the building of the Arrowtown Millennium Trail, the Millennium track between Wanaka and Glendhu Bay, and the Millennium Trail section of Clutha District's Taieri River Track.

1.4 Otago Region Direction

The Otago/Southland Regional Land Transport Plan (RLTP) was updated in 2018 and sets out the opportunity to create a network of cycle rides in southern New Zealand. Growing the cycle network in Otago and Southland is a key focus for the joint Regional Transport Committees (RTCs). The RTCs see the opportunity to expand cycle tourism and to see much larger numbers of people travelling by cycle in urban and peri-urban areas.

A map showing the existing and potential future network of cycle trails in Otago Southland set out in the RLTP 2018-21 is Appendix A.

The initial priorities identified in the RLTP for expanding the cycle network in Otago and Southland were:

- completing the Around the Mountain trail between Kingston and Walter Peak Station via Mavora Lakes.
- connecting Queenstown and Dunedin with a cycle trail by completing the missing sections including extending the Clutha Gold Trail from Lawrence to Waihola.
- new trails connecting Queenstown, Wanaka and Cromwell with the Central Otago trails network at Clyde.

The majority of these have been achieved, in full or in part with planning or construction currently underway. Future possibilities included:

- Dunedin – Oamaru and north beyond Timaru.
- Balclutha – Invercargill via the Catlins.
- Bluff – Invercargill – Lumsden.
- Invercargill – Manapouri – Te Anau via Tuatapere.
- A loop connecting Queenstown – Cromwell, Cromwell – Clyde, Alexandra and Wanaka.
- Danseys Pass.

The joint RTCs support the long-term objective of connecting the Great Rides with the rest of New Zealand and expanding Otago and Southland's network of off-road cycle trails and Heartland Rides to draw an increasing number of visitors, both domestic and international.

As a means of supporting and enabling tourism and visitor travel, the RLTP includes a policy for the RTCs and/or Approved Organisations to:

> *Operate, maintain and improve the strategic visitor network (including the cycle network) to allow safe, reliable visitor travel.*

2. Otago's Trail Network

This section describes Otago's regional trail network, its development, purpose and management.

2.1 Current Network

Otago's regional trail network can be used for walking, running, cycling and, in some cases, horse riding. However, it is predominantly being established and promoted for cycling.

There are six 'Great Rides' in, or partly within, Otago. Five traverse the countryside between townships. These are the Clutha Gold Trail, Roxburgh Gorge Trail, Otago Central Rail Trail, Alps to Ocean (A2O) and Around the Mountain. The Queenstown Trails connect the residential areas within the Queenstown 'urban' area.

There are also four new trails under development and one trail extension (discussed below).

The map in Figure 1 shows the current and planned trail network in Otago, as well as inter-regional connections and indicative network gaps. The trails are described in Table 2-1.

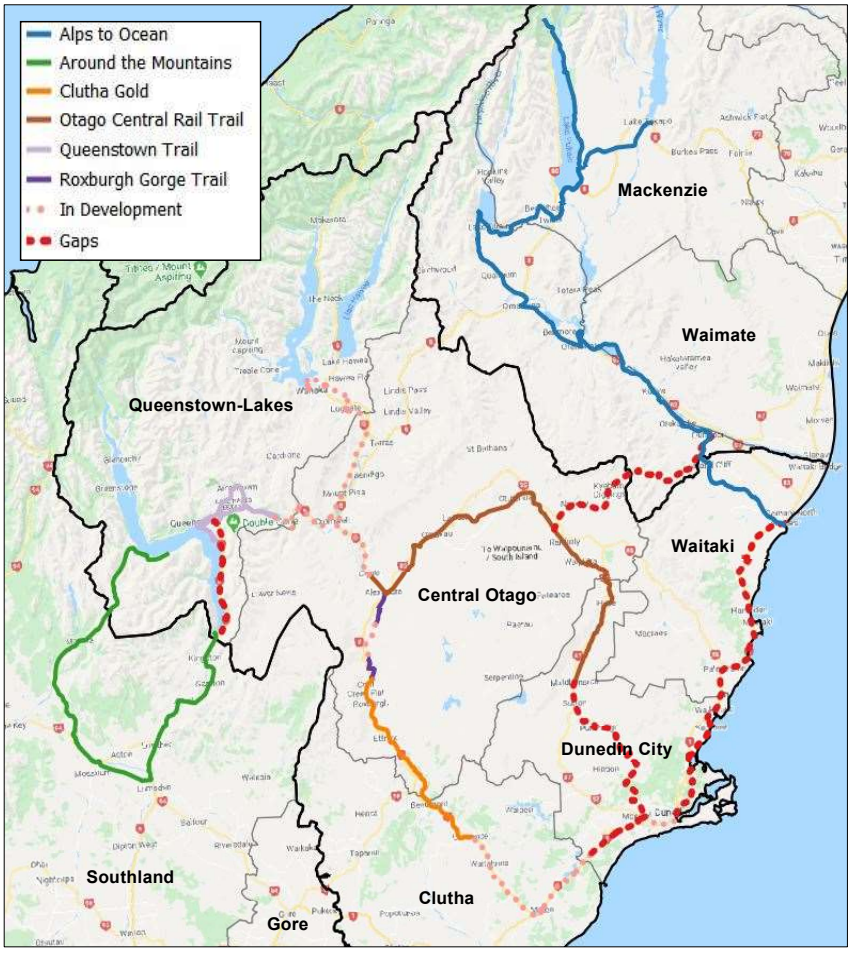


Figure 1: Otago Regional Trail Network

Table 2-1: Otago Regional Trails

Trail Name	District	Start-Finish	Purpose of Trail[1]
Clutha Gold Trail	Balclutha / Central Otago	Roxburgh Dam to Lawrence via Millers Flat and Beaumont Extension in development from Lawrence to Lake Waihola	Trail (**no mode specified**)
Roxburgh Gorge Trail	Central Otago	Roxburgh Dam to Alexandra	**Pedestrian and cycle**
Otago Central Rail Trail	Central Otago/ Dunedin	Middlemarch to Clyde	Recreational trail for **cyclists, walkers and horse riders**
Dunedin Tunnels Trail	Dunedin	Caversham and Wingatui In development	Recreational trail for **walkers, cyclists and horse riders**
Queenstown Trails	Queenstown Lakes	Greater Queenstown/ Wakatipu Basin area (urban trails)	**Walking, hiking, cycling, mountain biking, horse riding, roller skating** and **any similar non motorised** recreational leisure activities
Kawarau Gorge Trail	Queenstown Lakes	Queenstown Trails end to Cromwell In development	**Pedestrian and cycle** trail connecting to the current Great Rides in Central Otago and Otago
Lake Dunstan Trail(s)	Queenstown Lakes	Cromwell to Clyde Wanaka (Luggate) to Pisa Moorings In development	**Pedestrian and cycle** trails connecting to the current Great Rides in Central Otago and Otago
Around the Mountains Cycle Trail	Queenstown Lakes/ Southland	Kingston to Water Peak Station via Mavora Lakes	**Cycle** trail
Alps to Ocean Cycle Trail	Waitaki/ Mackenzie	Southern Alps (Mt Cook) to Oamaru	**Cycle** trail

2.2 Network in Development

Significant sections of the Otago regional trail network are currently in development, either with funding for planning and/or funding for construction. These include:

- Clutha Gold Trail extension from Lawrence to Lake Waihola.
- Dunedin Tunnels Trail from Wingatui to Caversham.
- a series of cycle trails linking Queenstown, Wanaka, Cromwell and Clyde, through Kawarau and Cromwell Gorges and around Lake Dunstan.

The business case that secured funding for the new trails between Queenstown, Wanaka, Cromwell and Clyde, also secured funding to better connect the Roxburgh Gorge Trail. This includes closing a 13 km gap on the Roxburgh Gorge Trail between Doctors Point and Shingle Creek, which is currently being filled by a 45-minute jet boat transfer.

[1] Interpreted from registered Trust instruments available at https://ct-register.companiesoffice. govt.nz/

Funding has been secured for a new crossing over the Clutha River using the old Alexandra Bridge alignment. This will improve connection between the Roxburgh Gorge Trail and Otago Central Rail Trail, which currently requires a 10 km detour via the Alexandra to Clyde River Track or use of a narrow clip-on on the SH8 Alexandra Bridge.

2.3 Network Gaps

The network gaps described below are not funded for planning or construction (refer Figure 1).

2.3.1 Waitaki

The Waitaki District's A2O is not connected to the Otago trail network. The A2O is only connected to Mackenzie District in Canterbury.

Connection to the Otago regional trail network has been mooted across the Kakanui Range at Danseys Pass. A connection here, or anywhere across the Hawkdun/St Bathans/Dunstan Range would require a skill and fitness level much greater than is required for the A2O or Otago Central Rail Trail.

The A2O terminates at the east coast. There is a gap between Oamaru and Dunedin (see 'Dunedin' below and an inter-regional gap north to Canterbury).

2.3.2 Dunedin

Dunedin's main urban area is not connected to Otago's trail network. The connection between Dunedin/Wingatui and the Otago Central Rail Trail at Middlemarch was filled by Dunedin Railways Ltd (DRL) operating the historic Taieri Gorge Railway. However, in April 2020, DRL suffered the economic impact of COVID-19 and was closed, with its track and equipment 'mothballed' for the foreseeable future.

The Dunedin Tunnels Trail, when completed, will terminate at Wingatui. There is no connection south from Mosgiel to the Dunedin Airport or beyond to Lake Waihola and the Clutha Gold extension, which is under development from Lawrence.

In early 2020, Dunedin City Council (DCC) and Waitaki District Council undertook a joint Feasibility Study investigating extending the Alps to Ocean Cycle Trail from Oamaru to Dunedin. The study found that an off-road, primarily coastal route between Oamaru and Dunedin is technically feasible and would provide economic and social benefits, including increased visitor expenditure and health benefits to locals and visitors using the trail. Dunedin Council will consider options for the Dunedin to Palmerston section through the next Long Term Plan.

2.3.3 Clutha

Balclutha is Clutha District's largest township. Balclutha is currently not connected to the regional cycle trail network. This is a gap.

2.3.4 Queenstown-Lakes

The Around the Mountain Trail starts at Walter Peak Station on the southern-west shore of Lake Wakatipu and ends at Kingston, at Lake Wakatipu's southern tip. Connection to the Queenstown Trails requires two transfers via boat (Walter Peak Station and Kingston) or road (Kingston).

2.3.5 Interregional Connections

There is no connection from the Otago regional trail network to Westland. A 'Heartland Ride' is identified west from Wanaka/Lake Hawea, however this is via SH6. Heartland Rides aim to encourage cyclists away from busy state highways and onto scenic, quiet, back-country roads. SH6 is not suitable as a Heartland Ride. However, there are no quiet, back-country roads across the Main Divide in the Haast Pass area and only short sections of remnant Bridle Track.

2.4. Network Management

There is no prescribed governance and management structure for cycle trails in New Zealand. Different trails have different trail governance and management structures, land ownership, marketing and maintenance arrangements.

The majority of trails in Otago's regional trail network are governed and managed by Trusts. The two inter-regional trails (Alps 2 Ocean and Around the Mountain) are governed and managed by the local Territorial Authority.

Trails need to be managed in a way that makes clear responsibility for on-going maintenance, maintenance standards, asset inspections, asset renewal and funding contributions. Even in cases where maintenance is specified as a purpose of the trust, responsibility is often shared. For example, the Otago Central Rail Trail is maintained by the Department of Conservation, while the Trust upgrades the trail facilities such as toilets, information boards and shelters, as well as funding trail resurfacing.

The information in Table 2-2 is sourced from a 2016 Ngā Haerenga NZ Cycle Trail Evaluation Report[2]. It sets out the roles and responsibilities for Otago's six Great Rides including governance, land ownership, asset management and maintenance.

Table 2-2: Roles and Responsibilities

NZ Cycle Trail	Governance	Land ownership	Asset Holder	Responsible for trail maintenance
Otago Central Rail Trail	Otago Central Rail Trail Charitable Trust	DOC	Central Otago District Council	DOC
Roxburgh Gorge Trail	Roxburgh Gorge Trail Trust	LINZ, Central Otago District Council, private landowners	Central Otago District Council	Clutha Gold Trails Trust
Clutha Gold Trail	Clutha Gold Trail Trust	LINZ, Central Otago District Council, private landowners	Central Otago District Council	Central Otago Clutha Trails Trust
Queenstown Trails	Queenstown Trails Charitable Trust (formerly Wakatipu Trails Trust)	DOC, LINZ, Central Otago District Council, private landowners	Queenstown Trails Trust	Queenstown Lakes District Council
Alps 2 Ocean Cycle Trail	Waitaki District Council	McKenzie District Council, Waitaki District Council, DOC, private landowners	McKenzie District Council, Waitaki District Council	Waitaki District Council
Around the Mountains	Southland District Council	LINZ, Genesis, Southland District Council, Waka Kotahi, DOC, private landowners	Southland District Council	Southland District Council

[2] Ngā Haerenga NZ Cycle Trail Evaluation Report 2016 available at https://www.mbie.govt.nz/dmsdocument/1248-nz-cycle-trail-evaluation-report-2016-pdf

3. Supporting Regional Trail Network Development

This section sets out possible mechanisms ORC could use to assist development of an integrated regional trail network in Otago.

ORC currently identifies the regional trail network in the RLTP (see section 1.5) developed by the joint RTCs. Through the RLTP development process, ORC facilitates prioritisation of regional trails on behalf of territorial authorities (TAs) and advocates for funding through the National Land Transport Fund. For example, the current RLTP includes a Central Otago District Council project for maintenance and Operations of Cycle Trails.

There are a number of additional ways that ORC could assist or support development of an integrated regional trail network.

These include:

- providing funding.
- leading/coordinating as a 'regional project'.
- providing specialist public transport services.
- allowing use of land/assets.

These opportunities, and a high-level summary of the advantages and disadvantages of each, are set out below.

3.1 Providing Funding

The planning, construction, ongoing maintenance and promotion of Otago's trail network requires considerable funding. At present, funding is provided by central and local government, through sponsorship and grants. Funding could be used for land purchase, planning, construction, consenting, ongoing maintenance or any combination of these.

Advantages	Disadvantages
Powerful mechanism through which ORC can influence, facilitate and support trail network development	Requires use of ORC budget and administration to oversee
Likely to enable growth and expansion of regional network development where funding is a constraint	May require ORC to set up new or specific grant scheme
May stimulate new match funding	May reduce funding shortfall causing other funders to redirect contributions elsewhere

3.2 Leading/coordinating as a 'regional project'

The governance, management and development of Otago's regional trail network is predominantly led by groups of community volunteers formed as Trusts, with support from local TAs or government agencies. There is no overarching regional governance setting strategy or providing leadership and direction. Case studies in the NZCT Evaluation Report (2016) found trail networks that involved multiple agencies sometimes had difficulty working to a common goal. Case studies also found the existence of a dedicated and specialist marketing and promotion team, at the regional level, was a key factor of trail success.

A regional level team, established to support the planning and implementation of trails, could have a similar impact in Otago and be a key factor in trail success, with benefit coming from overarching leadership and coordination.

Advantages	Disadvantages
Creates a single point of contact across the region for trail development	Likely to require additional operational budget
Helps create a shared vision for trails in Otago and strengthen 'Brand Otago'	May create tension where governance of trails is established

Advantages	Disadvantages
Likely to result in regular reporting to RTCs against planned regional outcomes	
May remove competition between trails eg for funding	
Formalises and directs more resources to current ORC role taken through RLTP development	

3.3 Providing Specialist Public Transport Services

There are a number of gaps in Otago's regional trail network, some of which are being filled by local commercial operators.

There is an opportunity for ORC to fill some of the gaps providing specialised public transport bus or ferry services. Examples are between Dunedin and Middlemarch, Lake Waihola or north of Palmerston, and Queenstown to Kingston or Walter Peak Station.

Advantages	Disadvantages
Fills a gap in the network enabling people to continue their journey with relative ease	A service is likely to operate at a loss due to the size of the gaps and relative demand
May create a new service for local community	May create competition with local commercial operators and cause them to cease operating

3.4 Allowing Use of Land/Assets

ORC could allow trails to be developed on land or assets owned by the Council or Council controlled organisations. For example, the ORC owns land within the coastal Otago area primarily associated with ORC's Flood Protection and Drainage schemes. The opportunity to use ORC flood protection infrastructure ('flood banks') has been raised at both the political and community level. Local communities understand the extent and interconnectedness of ORC's flood bank network. They value their rivers and enjoy the opportunity to engage with them.

ORC's flood banks play a vital flood hazard mitigation role by protecting people's homes, businesses and assets. In many instances, flood banks are located in areas where there are gaps in Otago's trail network.

Advantages	Disadvantages
Enables trail developers to negotiate with a single landowner (ORC)	May present a risk to flood protection asset if access and trail design is not suitable
Promotes access to areas of high community value ie local waterways	May require change to current maintenance arrangements eg livestock grazing
Helps achieve objectives of RTC to grow and expand Otago's trail network	May create community expectation that all flood banks are suitable
Creates opportunity for ORC to raise awareness about regional resources through storytelling/information boards	Likely to require some change in staff responsibilities to deal with new BAU eg managing public access during flood events
Creates opportunity for regional partnerships with ORC partnering with TAs and local stakeholders	May be difficult to manage public access or expectations of access

The use of flood banks to support the development of an integrated regional trail network is discussed in more detail below.

4. Use of Flood Protection and Drainage schemes

There have been two recent approaches to ORC to assist trail development through the use of ORCs 'floodbanks'. These are described in Table 4-1 below.

Table 4-1: Community approaches to use flood banks

Dunedin	A submission to the 2020/21 Annual Plan asked ORC to endorse the use of flood banks on the Silverstream and Taieri River as a means of extending the Dunedin Tunnels Trail to Waihola, and linking to the Clutha Gold Trail and on to Central Otago. The submission also referenced the need for a shared vision, supported by a robust strategic plan that emphasised collaboration, integration and partnerships.
Balclutha	During "Our Place" consultation in 2017, Balclutha District Council (BDC) received a number of submissions asking for improved wayfinding, access and extension to the Blair Athol Walkway. Over the 2019/20 summer, BDC worked with ORC to trial a pebbled trail surface to improve accessibility. Following review of this trial, BDC has now developed a proposal to create linkages and destination walkways along ORC's flood banks, with improved trail surfacing and wayfinding signage.

The map in Figure 2 shows ORC owned land in the Coastal Otago area, including substantial land ownership in the Lower Taieri and Lower Clutha river catchment areas.

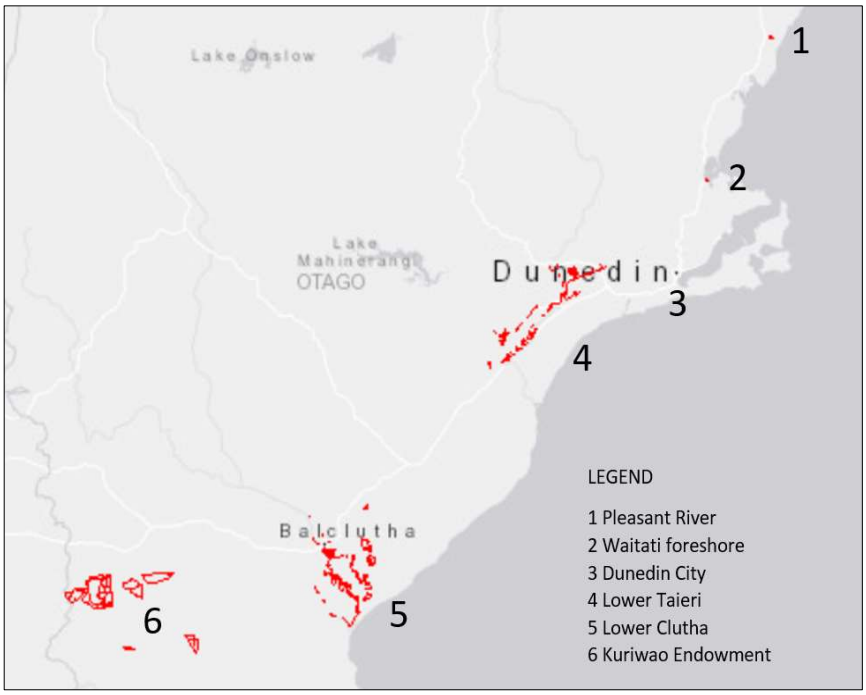


Figure 2: ORC Coastal Otago Land Holdings

The land holdings, located in six distinct geographic areas, are described in Table 4-2 below.

Table 4-2: ORC Coastal Otago land ownership

Ref No.	Geographic area	Description
1	Pleasant River	An area of riverbed.
2	Waitati foreshore	An area of farmland and foreshore in Waitati village.
3	Dunedin City	Commercial and residential properties adjacent to the Water of Leith, Lindsay Creek, and the Otago Harbour basin.
4	Lower Taieri	Floodbanks and farmland associated with the Lower Taieri Flood Protection Scheme.
5	Lower Clutha	Floodbanks and farmland associated with the Lower Clutha Flood Protection Scheme.
6	Kuriwao Endowment	Farmland endowed to ORC to help fund the Lower Clutha Flood Protection Scheme

4.1 Lower Taieri

The ORC's Lower Taieri Flood Protection and Drainage Scheme is primarily designed to mitigate the effects of flooding from the Taieri River and Silverstream. ORC owns a substantial amount of land associated with the Lower Taieri Flood Protection Scheme. The map in Figure 3 shows the extent of the land ownership in the Lower Taieri catchment area.

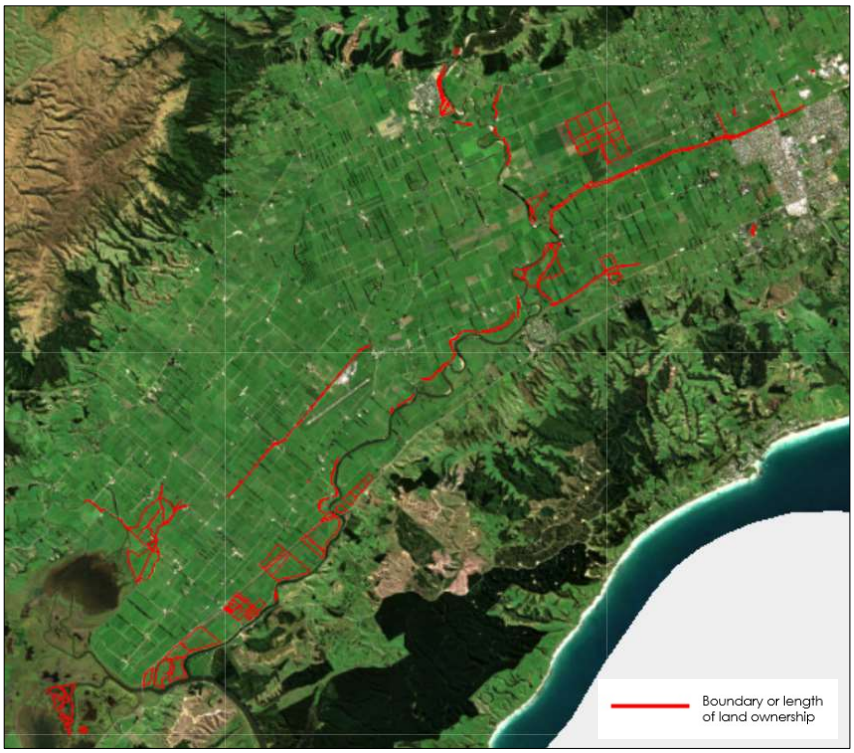


Figure 3: Lower Taieri land ownership

The map in Figure 4 shows the location of ORC flood banks in the Lower Taieri catchment area.

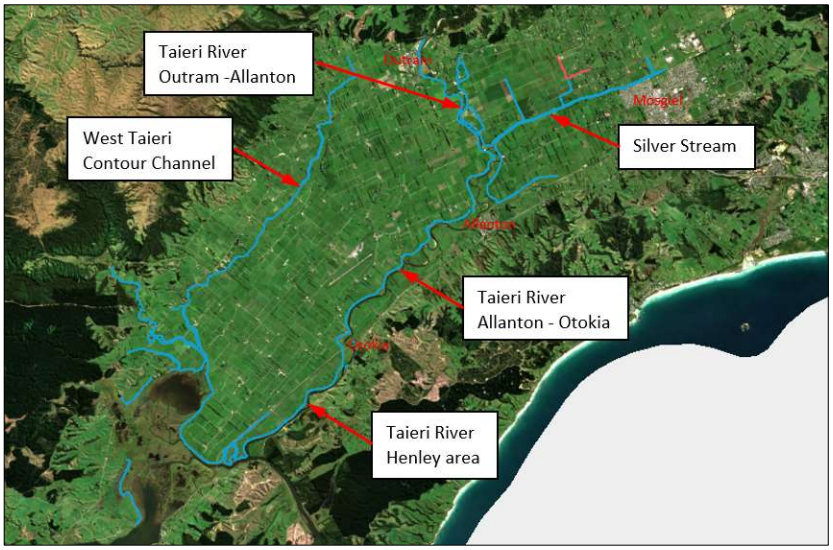


Figure 4: Lower Taieri flood banks

In the Lower Taieri catchment area, the land most likely to benefit the development of Otago's regional trail network are the floodbanks alongside the Silverstream and the Taieri River.

The area around the West Taieri Contour Channel, on the Maungatua side of the Taieri Plains, is omitted. This is because this channel is on land that is entirely privately owned. The channel, which has one flood bank on the true left, bisects many working farms.

4.1.1 Silverstream

Silverstream is a small river flowing close to Mosgiel. It rises in the Silverpeaks and flows through steep-sided forest to Whare Flat, enters the Taieri Plains at the foot of Three Mile Hill and joins the Taieri River two kilometres north of Allanton.

The river's flow is generally small (at below one cm/s).

4.1.1.1 Public Access

There is currently a walkway along the true left[3] of the Silverstream, between Wingatui Road and Gladfield Road.

4.1.1.2 Land Ownership

Ownership of the flood banks along the Silverstream is relatively simple. The majority of the land used for the walkway is owned by ORC, with some sections nearer to Mosgiel being owned by Dunedin City Council. All the floodbanks south of Gladfield Road are owned by ORC.

4.1.1.3 Operational Requirements

Due to operational requirements, the true right bank is not suitable for construction of a public trail. This is because a section of the true right bank, immediately downstream of Gordon Road, has been constructed as a "spillway" with a lower spill over height than the flood bank on the true left. The spillway is a critical element of the flood protection scheme, the main purpose of which is to protect Mosgiel by preferentially flooding the farmland on the opposite side of the stream from the town.

Formation of a public trail along the true right bank could negatively impact the operation and integrity of the spillway. For example, the formation of a trail could change the constructed height of the flood bank,

[3] The bank or side of a waterway is always named relative to the direction in which the water is flowing ie facing downstream

reducing the 'tipping point' of the spillway. Path related structures (signage, rails) could catch or trap debris along the spillway, changing or concentrating flood flows.

4.1.2 Taieri River

The Taieri River is the fourth longest river in New Zealand. It is 288 kilometres long. The Taieri River starts in the Lammerlaw Range, flows north, then east around the Rock and Pillar range before turning southeast to reach the sea 30 kilometres south of Dunedin.

The Taieri River's median flow rate is 15 cm/s. The flood protection scheme has a design flow of 2,500 cm/s. During a flood event, the river's flow out to the sea is constrained by the narrow Taieri Gorge. The flood protection scheme design protects Mosgiel by allowing water to spill over onto farmland on the Taieri Plains. The extent of the floodway is shown in Figure 5.

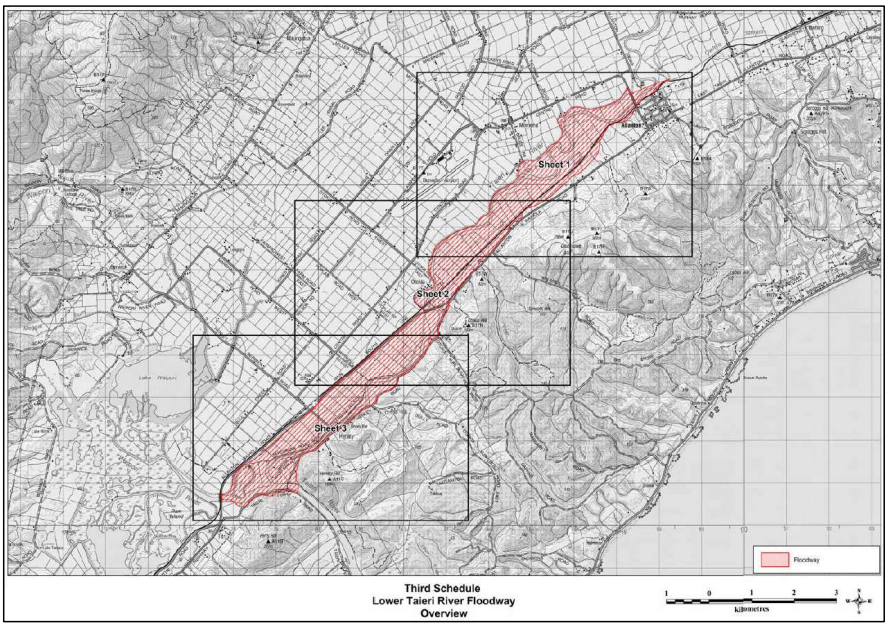


Figure 5: Lower Taieri floodway

4.1.2.1 Public Access

There is currently no public access along the Taieri River flood banks.

4.1.2.2 Land Ownership

Ownership of floodbanks on the Taieri River is complex. In addition to ORC and DCC, floodbanks are owned by local farmers, Waka Kotahi and KiwiRail. In some places, floodbanks are built on Hydro Parcels which are administered by LINZ or DOC.

Along the true right, ORC owns approximately 20% of the flood bank land between Outram and Allanton, and approximately 60% of the flood bank land between Allanton and Otokia.

Along the true left, ORC owns approximately 60% of the flood bank between Outram to Allanton. Downstream of Allanton there is no flood bank on the true left. ORC has a very low rate of land ownership beside the river in this area.

4.1.2.3 Operational Requirements

Two sections of the Taieri River flood bank system are not suitable for the construction of a public trail.

The Riverside Road spillway operates between Outram and Silverstream. The Riverside Road spillway is designed to provide spill-over of 1000 m3/s of water during a flood. During very large flood events, this

volume of water makes the flood banks a very dangerous place to be. This is reflected in ORC's strict guidance for their own staff operating in these areas during flooding. ORC manages a series of control gates along the true left bank. These 'drop gates' have a simple but functional design that is highly vulnerable to tampering.

The flood bank in the Henley area, below the SH1 bridge at Otokia, is a low-level bank designed to protect farmland in smaller floods only. In larger floods, the floodbank overtops resulting in the whole area, up to SH1, forming the floodway. ORC pastureland in this area also becomes inundated.

4.2 Lower Clutha area

The ORC's Lower Clutha Flood Protection and Drainage Scheme is primarily designed to mitigate the effects of flooding from the Clutha River. The map in Figure 6 shows the extent of the ORC's land ownership.

Figure 6: Lower Clutha land ownership

The map in Figure 7 shows the location of ORC flood banks in the Lower Clutha catchment area.

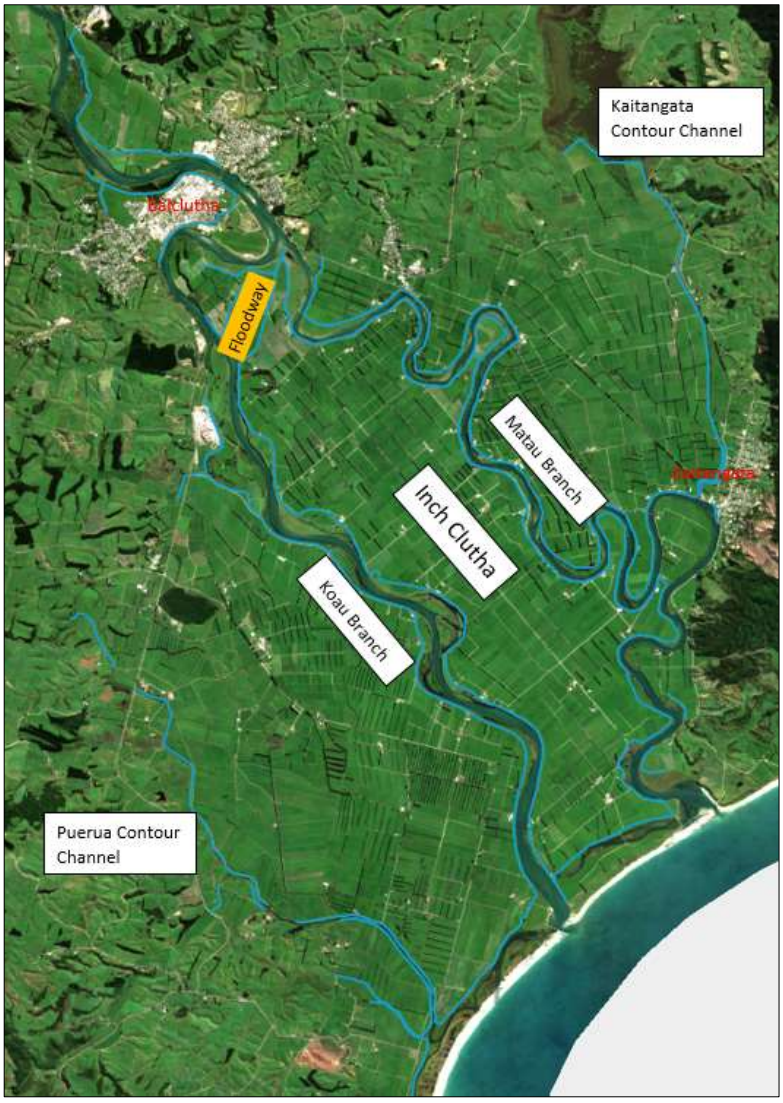


Figure 7: Lower Clutha flood banks

4.2.1 Clutha River

The Clutha River is the longest river in the South Island. It is 338 kilometres long. It flows from Lake Wanaka through Central and South Otago to the sea near Balclutha. With a catchment of nearly 22,000 square kilometres, the Clutha River is the highest volume river, and the swiftest, in New Zealand, discharging a mean flow of 614 cm/s.

Downstream of Balclutha the river widens into the Clutha delta and divides into two branches - Matau (northern) and Koau (southern) – to create the large flat island of Inch Clutha.

4.2.1.1 Public Access

Balclutha communities currently use local and regional flood banks for walking and cycling. The well-established Blair Athol Walkway traverses' sections of flood bank as it follows the Clutha River around the town's perimeter. Less formal trails connect to the Blair Athol Walkway.

4.2.1.2 Land Ownership

Flood protection scheme land and the flood banks in the Lower Clutha are in mixed ownership. For example, the right flood bank on the Koau Branch from Finnegand to the mouth is 11.2 km long, of which 50% is owned by ORC and 35% is Hydro parcels. The remainder is mostly privately owned, with some Clutha District Council land.

In addition, ORC owns approximately 35% of the Kaitangata Contour Channel true right flood bank and 70% of the Koau Branch true left flood bank. Along the Matau Branch, ORC owns approximately 50% of the true right flood bank and 40% of the true left flood bank. It is estimated that approximately 2/3^{rds} of the land not owned by ORC is hydro parcels.

4.2.1.3 Operational Requirements

One section of the Lower Clutha flood protection scheme is not suitable for the construction of a public trail. This is the section at the upstream end of Inch Clutha, where there is a spillway and floodway. This area can be inundated during floods.

There are no other operational requirements related to the Lower Clutha flood banks that would restrict the formation of a trail.

4.3 Lease Agreements

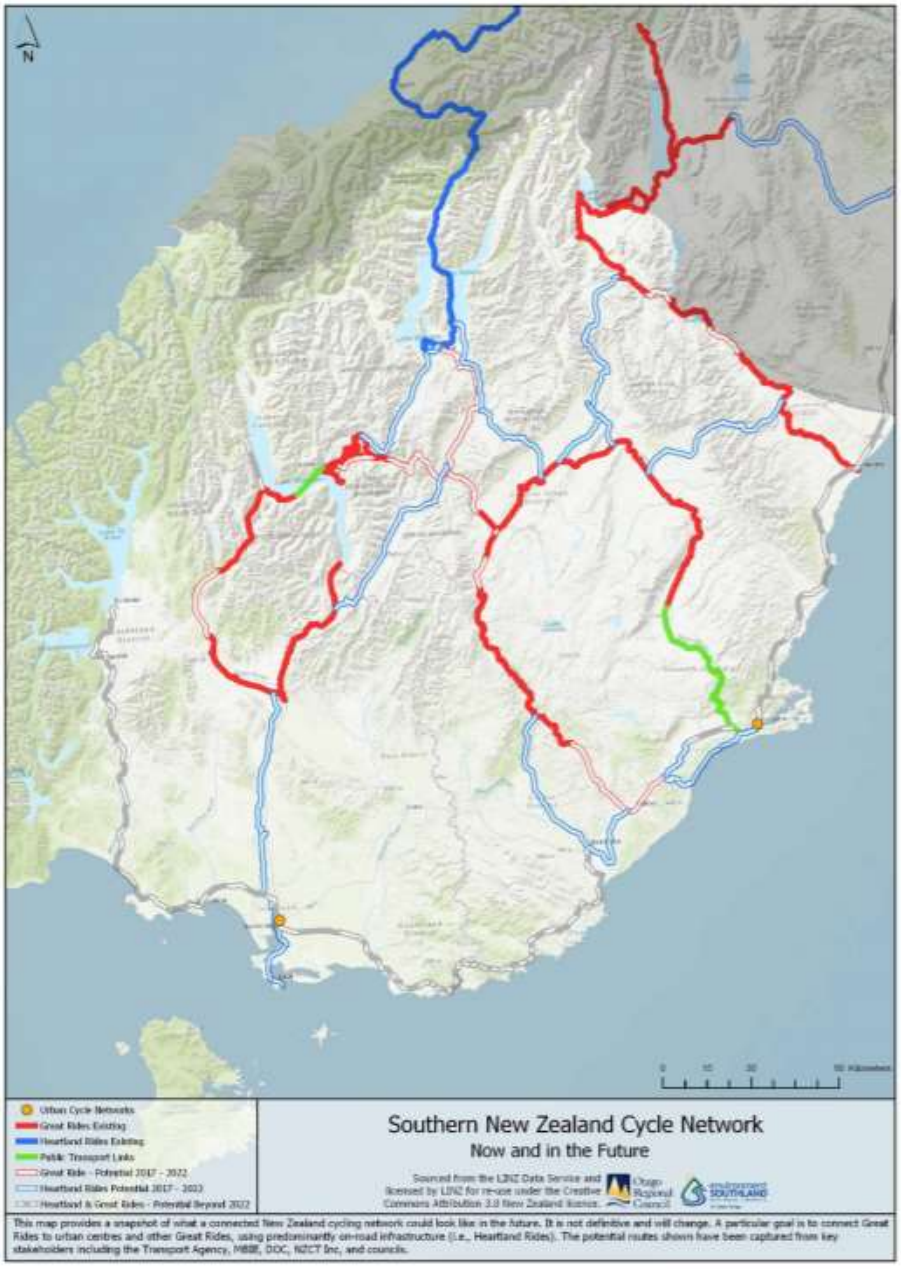
Most land owned by ORC is subject to lease agreements. Leases typically fall into two categories - land leases and grazing leases. Terms and conditions of leases vary. Durations are often quite long, for example ORC is party to land leases that for run 21 years. Leases can have automatic rights of renewal or be 'rolling'. For example, ORC is party to grazing leases that are ongoing, with provision for three months' notice of termination.

Within the Flood Protection and Drainage scheme areas, ORC uses grazing leases to ensure grass on flood banks and river berms is managed in a way that reduces the need to mow large areas of grass. Changes to lease arrangements that resulted in the removal of stock would require alternative management methods to be considered to ensure waterways were kept clear.

Depending on terms and conditions, the decision to vary a lease may not rest solely with ORC.


Appendices

Appendix A Southern NZ Cycle Network



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7.3. ORC Role in South Dunedin/Harbourside Adaptation collaboration with DCC

Prepared for:	Strategy and Planning Committee
Report No.	P&S1885
Activity:	Safety & Hazards - Flood Risk Management
Author:	Sharon Hornblow, Natural Hazards Analyst; Jean-Luc Payan, Manager Natural Hazards
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	24 November 2020

PURPOSE

[1] To seek a decision on how Council wishes to collaborate with Dunedin City Council on delivery of Otago Regional Council's South Dunedin/Harbourside natural hazards adaptation programme of work.

EXECUTIVE SUMMARY

[2] Over the past 15 years, Otago Regional Council (ORC) has undertaken a programme of technical work aimed at providing better understanding of the South Dunedin natural environment, and how the physical environment influences natural hazards and the impacts of climate change in South Dunedin and Harbourside. The aim of the ORC programme of work is progressing the development of a multi-hazard 'Climate Change Adaptation Plan' for South Dunedin and the Harbourside areas. The programme of technical work also aims at supporting Dunedin City Council (DCC) and the South Dunedin Future (SDF) programme.

[3] ORC's focus is currently on technical work and developing a better understanding of the physical environment. Council has expressed a desire for ORC to be actively involved in the decision-making on adaptation for the South Dunedin and Harbourside areas that will be informed by this work.

[4] Although ORC and DCC have strong collaborations to ensure alignment, the different programmes of work for South Dunedin and Harbourside are not linked and instead are progressing in parallel. There is currently no fully integrated programme of work with formally agreed objectives and shared resources such as a jointly appointed programme director.

[5] Council needs to decide how it wishes to continue to collaborate with DCC on the adaptation of South Dunedin/Harbourside. It is timely to do so as preparation of the Draft 2021/31 Long Term Plan is underway.

[6] This paper presents three collaboration options for Council to choose from.

RECOMMENDATION

That the Council:

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

2) ***Notes*** *the programme of work being delivered by ORC in relation to South Dunedin/Harbourside natural hazards adaptation.*

3) ***Selects*** *one of the options presented in this report for continuing to collaborate with Dunedin City Council on delivery of that programme.*

4) ***Authorises*** *staff to engage with Dunedin City Council to progress the preferred option and to report back to Council.*

BACKGROUND

[7] In the last 15 years approximately, Otago Regional Council (ORC) has undertaken a programme of technical work aimed at providing better understanding of the South Dunedin natural environment, and how the physical environment influences natural hazards and the impacts of climate change in South Dunedin and Harbourside (Figure 1). The aim of the ORC programme of work is progressing the development of a multi-hazard 'Climate Change Adaptation Plan' for South Dunedin and the Harbourside areas. A multi-hazard approach recognises that, whilst climate change and sea level rise are frequently referred to in South Dunedin, any adaptation plan will need to address all kinds of natural hazards, their interactions, and cascading effects. Parts of Dunedin City that are outside South Dunedin are also exposed to natural hazards and sea level rise. A detailed description of ORC's programme of technical work is provided in the Appendix.

Figure 1. Map of South Dunedin and Harbourside with reclaimed and low-lying areas highlighted. Current ORC groundwater monitoring network is shown.

[8] The programme of technical work also aims to support Dunedin City Council (DCC) and the South Dunedin Future (SDF) programme. SDF is a programme of work lead by DCC designed to improve the wellbeing of South Dunedin residents through effectively responding to the climate-driven challenges. Key priorities for the programme over the next 2 years are[1]:

a. Empower the community through on-going engagement on short, medium, and longer-term options to enable future decision-making for South Dunedin

[1] https://www.dunedin.govt.nz/council/council-projects/south-dunedin-future

b. Build the technical information base to develop future options for South Dunedin (drawing on existing data sources, identifying data gaps and prioritising new data collection)
c. Develop an overall plan for future development in South Dunedin within an adaptive planning framework.

[9] The SDF programme has multiple working and advisory groups and panels with representatives from each council. For example, ORC is part of the following groups:
a. The Senior Officers group: strategic alignment
b. The Technical Advisory Group: technical alignment
c. Community engagement panel: communication and engagement alignment

[10] ORC is currently involved in the SDF programme by providing information on the physical environment and on the impacts of natural hazards and climate change. Dedicated support is also provided during the on-going engagement to inform the community about the physical environment and enable informed decision-making (refer Appendix).

ISSUE

[11] As discussed in the previous section, ORC's focus is currently on technical work and developing a better understanding of the physical environment. Council has expressed a desire for ORC to be actively involved in the decision-making on adaptation for the South Dunedin and Harbourside areas that will be informed by this work.

[12] Although ORC and DCC have progressed discussions around a joint programme of work (including joint governance and resourcing) and both councils staff have a strong collaboration to ensure alignment, the different programmes of work for South Dunedin and Harbourside are not fully integrated and are progressing in parallel. There is currently no fully integrated programme of work with formally agreed objectives and shared resources such as a jointly appointed programme director.

[13] The area subject to ORC's natural hazards investigations is larger than the study area for the SDF programme (Figure 1). Further, ORC's work addresses multi-hazard interactions whereas the hazards component of the SDF programme is focussed on major climate change challenges (rising sea level, ground water and flooding risks).

[14] There is no formal or agreed structure for both councils' elected members to discuss alignment and make joint recommendations on matters related to the adaptation of the South Dunedin and Harbourside areas.

[15] Council needs to decide how it wishes to continue to collaborate with DCC on the adaptation of South Dunedin/Harbourside. It is timely to do so as preparation of the Draft 2021/31 Long Term Plan is underway.

DISCUSSION

[16] ORC has successfully collaborated with the Otago territorial authorities on natural hazards adaptation and other matters such as land transport. For example, in 2006 Queenstown Lakes District Council (QLDC) and ORC jointly developed a flood risk

management strategy (*Learning to Live with Flooding: A Flood Risk Management Strategy for the communities of Lakes Wakatipu and Wanaka*, 2006) to help the community manage its exposure to flood risk. In 2012 ORC and the Clutha District Council (CDC) jointly prepared the Milton 2060 Flood Risk Management Strategy to enable long-term, sustainable occupation and development in the Milton area. Between 2013 and 2020 ORC supported DCC by providing natural hazards information, knowledge, and technical advice through a collaborative approach, to help inform the district plan review (Second Generation District Plan, 2GP) and to ensure that the effects of natural hazards are avoided, or adequately mitigated.

[17] The scale and complexity of the South Dunedin and Harbourside environment (physical, social, legislative, moral) and the complementary roles and responsibilities of ORC and DCC, require both councils to, at a minimum, continue the collaboration in its current form or to strengthen it by, for example, having a fully integrated programme of work and a programme-specific elected members' governance structure.

[18] Having a fully integrated ORC/DCC programme of work and a joint governance structure would improve alignment of objectives, sharing of resources and improve alignment of decision-making. It is the most efficient way of operating, especially in relation to public and stakeholder communications and engagement.

[19] This is in line with some of the recommendations of the Resource Management System review which is proposing better integration at local government level[2].

OPTIONS

[20] Council has three options to choose from, as follows.

[21] **Option 1** (status quo): ORC's role is to focus on the technical aspects, principally natural hazards identification, assessment, and reporting. ORC and DCC programmes of work remain separate with ORC providing input to the SDF programme. ORC would continue to have separate public communications and engagement activity.

[22] **Option 2**: This option is similar to Option 1 but includes a joint governance structure involving ORC and DCC elected members. This would create a forum for political discussion and provide oversight. A similar example is the Connecting Dunedin (transport) arrangement between ORC, DCC and Waka Kotahi/NZTA.

[23] **Option 3**: ORC and DCC develop a fully integrated programme of work with agreed objectives, scope, and shared resources such as a jointly appointed programme director. As with Option 2, a joint governance structure involving ORC and DCC elected members would be put in place. Option 3 would draw from the example of the Wakatipu Transport Governance Group and Way2Go transport partnership between ORC, Queenstown-Lakes District Council and Waka Kotahi/NZTA.

CONSIDERATIONS

Policy Considerations

[2] *New directions for resource management in New Zealand*, Resource Management Review Panel, June 2020 (https://www.mfe.govt.nz/publications/rma/new-directions-resource-management-new-zealand)

[24] The currently operative Regional Policy Statement for Otago provides for regional, city and district councils the opportunity to prepare strategies or other similar documents to assist in the management and reduction of natural hazard risk and adaptation to, and mitigation of climate change. It also encourages regional, city and district councils to develop community relevant responses to the impacts of natural hazards and climate change, in collaboration with the relevant local authority, key stakeholders and affected community (Method 6, Non-RMA strategies and plans, Otago Regional Policy Statement, 2019).

Financial Considerations

[25] Option 3 would require additional annual costs of approximately $50,000 to be included in the Draft ORC 2021-31 Long Term Plan for programme management.

Significance and Engagement

[26] This paper does not trigger ORC's policy on Significance and Engagement.

Legislative Considerations

[27] The likely reforms of the Resource Management Act and strengthening of provisions to do with local authority leadership for climate change adaptation are noted.

Risk Considerations

[28] The risks associated with misalignment between the councils' programmes of work are discussed above.

NEXT STEPS

[29] Engage with DCC to progress the preferred option, including identifying resourcing and funding requirements, and report back to Council for decision-making.

ATTACHMENTS

1. Appendix ORC climate change and natural hazards monitoring and modelling South Dunedin [**7.3.1** - 31 pages]

Appendix: ORC climate change and natural hazards monitoring and modelling workstreams for the South Dunedin and Harbourside area

Table of Contents

1.0 INTRODUCTION

In recent decades ORC has undertaken a programme of technical work aimed at providing better understanding of the South Dunedin natural environment, and how the physical environment influences natural hazards and the likely impacts of climate change in South Dunedin. The overall objective of the programme of technical work is to assist in making the right adaptation decisions at the right points in time. The scope of this programme extends beyond the South Dunedin flat with the plan for encompassing all the low-lying area around the coast of Dunedin's Central Business District (CBD), from the Oval to the University of Otago (Harbourside). The aim of the ORC programme of technical work is progressing the development of a multi-hazard 'Climate Change Adaptation Plan' for South Dunedin and the Harbourside areas. This includes an expanded groundwater monitoring network, a 'next generation' groundwater flood model, a seismic hazard assessment including liquefaction susceptibility, and coastal hazards (erosion and elevated sea level) assessment. A multi-hazard approach recognises that, whilst climate change and sea level rise are frequently referred to in South Dunedin, any future adaptation plan will need to address all types of natural hazards, and their interactions and cascading effects.

Data collection has progressed significantly in the four years since ORC outlined needs for better understanding the issues of the multi-hazard setting of South Dunedin (ORC 2016 report, "the Natural Hazards of South Dunedin"). The scope of this project has also extended beyond the South Dunedin flat with the plan for an improved groundwater model now encompassing all the low-lying area around the coast of Dunedin's CBD, from the Oval to the university.

This report gives a summary of ORC's climate change impact monitoring and modelling work plans for the South Dunedin and Harbourside area, describing current technical data campaigns, outlining the hydrological and geological monitoring and research completed in the area since 2016. The hydrological, geological and communications sections of this report each contain a summary of work planned for this year and proposed future work. This includes an expanded groundwater monitoring network, alignment with Dunedin City Council (DCC) to model and monitor urban stream and stormwater flood flows, a greater density of rain gauges in Dunedin, the 'next generation' groundwater flood model, elevated sea level monitoring, and seismic hazard and liquefaction susceptibility data.

This report explains why these data are necessary for progressing the development of a multi-hazard 'Climate Change Adaptation Plan' for South Dunedin and Harbourside area. It summarises efforts ORC has made (and continues to expand on in conjunction with the DCC) to engage with the wider community and stakeholders.

2.0 HYDROLOGICAL CYCLE MONITORING AND MODELLING

2.1 Background

Naturally occurring physical processes combined with human activities can together, or separately, affect flood hazard in the low-lying, reclaimed parts of Dunedin City. These are listed in the table below, along with a summary of observed trends, future predictions, and interdependencies with other factors. Future changes in mean sea level, rainfall and groundwater level are the processes most likely to exacerbate the effects of this hazard.

Factors which can influence flood hazard	
Heavy rainfall	• Many recorded instances of rainfall leading to surface flooding. • Heavy rainfall events have occurred frequently over the last decade. • Potential for storm events to bring heavier rainfall, due to effects of climate change.
Sea level	• Records show mean sea level has been rising at Dunedin since 1900, and the rate of global sea level rise is predicted to increase. • Further increases in mean sea level would translate into a rise in the mean groundwater level. • Groundwater level fluctuates (by up to 0.5 m near the coast) on a twice-daily cycle in response to normal ocean tides.
Groundwater	• There is already a shallow water table beneath South Dunedin. • An increase of the median annual groundwater levels will, in time, result in permanent / intermittent surface ponding on parts of the plain. • Higher groundwater levels would mean that surface ponding in response to rainfall or elevated sea levels would occur more frequently.
Ground subsidence	• There is now survey evidence of a decrease in land elevation over time across the wider Dunedin area, though this varies between ~1-5 mm per year across the city. • Consolidation of sediment beneath the South Dunedin plain may also contribute to an overall reduction in land elevation. • If ground subsidence is occurring, then the effects of sea level rise and heavy rainfall will be further compounded and be felt sooner than expected.
Storm and wastewater networks	• Groundwater seeps into the aged storm and wastewater pipes beneath the plain, which drain (or are pumped) to the sea, suppressing the water table. • Much of this network is due for replacement, which would reduce seepage of groundwater into pipes. Groundwater level could increase as a result. • The residual risk should the pumping system(s) fail is large, with significant groundwater ponding likely to occur through Tainui and Musselburgh areas, even on a dry, summer day.
Shoreline change	• An overall trend of shoreline retreat has been observed along much of the St Kilda / St Clair dune system, although some accretion has occurred towards Lawyers Head. • Extensive flooding on the plain would occur if erosion of the dune system meant it could not provide a buffer against direct inundation from the sea. Tsunami and storm surge events could damage and erode the dunes extensively.
Seismic	• There are several known or suspected geological faults in the Dunedin area which may have a potential to generate large earthquakes. • Large earthquakes could result in increased flood hazard on the South Dunedin plain, due to liquefaction-related land subsidence or direct, sudden, changes in land elevation relative to sea level.

There is a need for better understanding, in Dunedin City, of how natural environmental aspects of the water cycle behave in conjunction with urbanised (piped stormwater and wastewater networks) aspects the urban environment. Many of Dunedin CBD and South Dunedin's public assets are situated on a low-lying reclaimed coastal plain, in many cases seaward of the original 1800s shoreline. Figure 1 shows the shoreline as it was recorded by early European surveyors, circa 1850, to highlight the importance of the area reclaimed from the Otago Harbour. Parts of greater South Dunedin are lower-lying than those reclaimed from the harbour as they were only filled to a level just above the water table at the time, using compressible fill material such as sand from the nearby dunes, resulting in a lower final elevation across this area (Fordyce, 2014).

In June 2015 large areas of South Dunedin were flooded by a rainstorm totalling 144 mm over 24 hours, and up to 12 mm per hour at peak intensities. Parts of Dunedin City Council stormwater infrastructure was unable to cope with the runoff and the shallow angle of fall to the sea from most of the South Dunedin area, combined with elevated sea level through parts of the event (storm surge) impeded drainage (ORC, 2015). This was further exacerbated by a high local groundwater table, brought about by multiple recent rainfall events filling the available pore space in the soils of the area, decreasing natural storage capacity (ORC, 2016).

An outcome of this event was the recognition that ORC and DCC needed to understand to what extent the stormwater flows (and overflows), wastewater network 'leakiness' and groundwater levels each contributed to the event. Understanding the distribution of the rainfall through the sub-catchments of Dunedin's hills is also important, as large differences between the local rain gauges can be recorded in heavy rainfall events. Finally, it is necessary to include the contribution that elevated sea level events, such as storm surge, and future elevated sea level due to climate change impacts will have on flood hazard in the low-lying, reclaimed parts of the city. A complete understanding of the water cycle and relative sea level rise (see Figure 2 depicting the multi-faceted water cycle interactions in South Dunedin) is required to inform flood mitigation and climate change adaptation decisions which need to be made together by ORC and the Dunedin City Council.

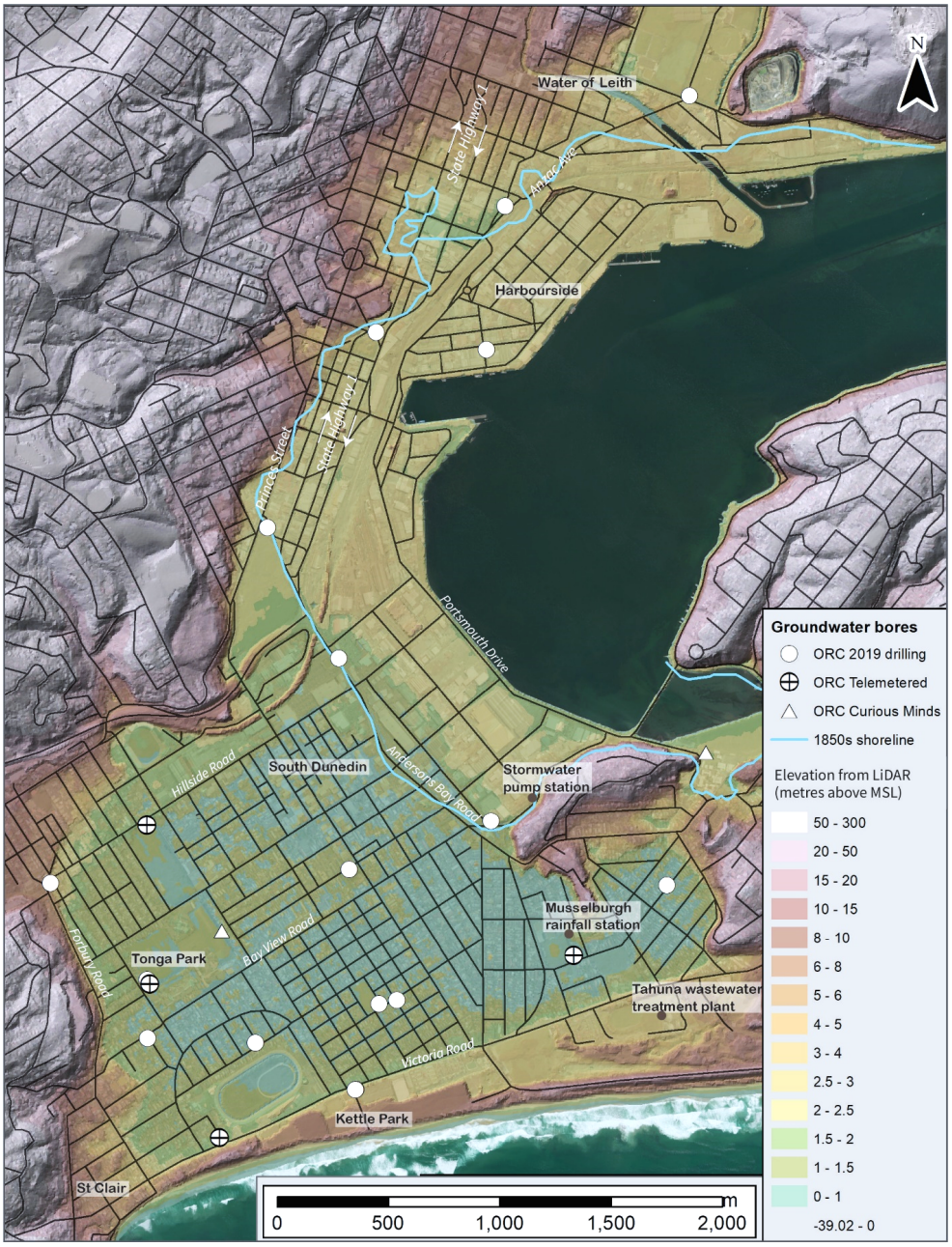

Figure 1. Elevation map of the South Dunedin and Harbourside area. In addition to reclamation on the edge of Otago Harbour, the lowest parts of South Dunedin (green and blue colours below ~1.5 m elevation above mean sea level) are reclaimed from coastal lagoon and wetland areas.

Beginning with the installation of the Green Island sea level monitor in 2002 (installed by NIWA and maintenance taken over by ORC in 2004) ORC has gradually built up a scientifically robust network of land and water level monitoring stations which, in conjunction with rainfall data and information from the DCC on stormwater and wastewater flows, are beginning to paint a detailed picture of the hydrological hazards which impact central Dunedin's coastal suburbs.

This section of the report describes ongoing data collection work by ORC in describing the impacts of intense rainfall, pluvial (runoff) flooding, and both surface and deep groundwater flow paths. Coastal data capture such as heights of storm-surge at the coast and the relationship of coastal processes to longer-term sea level trends is important for understanding coastal hazards such as erosion and inundation and has direct implications for behaviour of groundwater in the city.

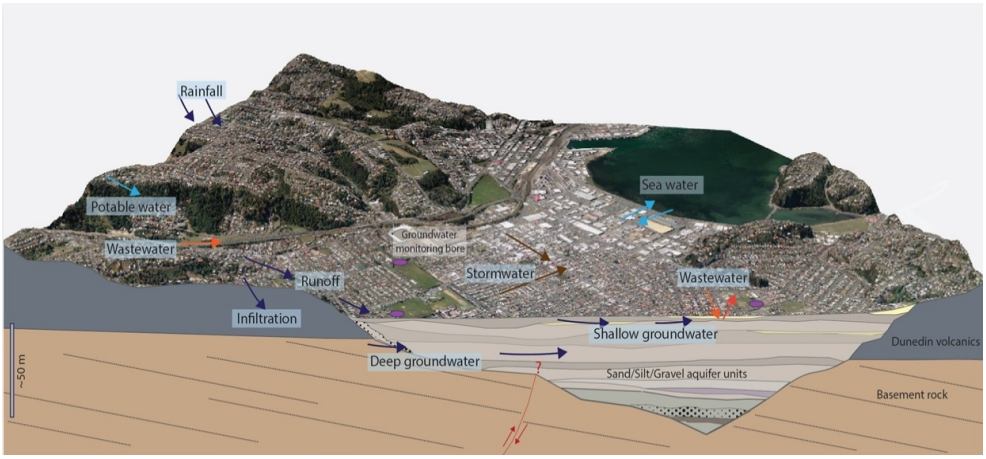

Figure 2. Complex water-cycle interactions which take place in South Dunedin, which is situated on an ancient river valley cut through basement rocks of Dunedin Volcanics and Caversham Sandstone and since in-filled by younger, silty sediments.

2.2 Groundwater

2.2.1 Monitoring network extent

The land surface in the greater South Dunedin area and the harbourside CBD area is low-lying and surrounded by steep hill suburbs. Most housing in the area is built on ground that is below current mean high-water springs (MHWS) with much of it within 50 cm of current mean sea level (Figure 1). The South Dunedin flat has no natural drainage and, prior to settlement and modification by Europeans was a generally marshy area of wetland and lowland forest vegetation with a lagoon and low, rolling sand dunes at the southern coast. This physical setting means the area is vulnerable to surface flooding and groundwater levels reaching the surface in low-lying areas, due to heavy rainfall and elevated sea level events expected to become more frequent due to climate change impacts (Rekker, 2012; Fordyce, 2013; Glassey, 2017; Cox et al., 2020).

This section summarises the long-term monitoring data collected by ORC from Dunedin City groundwater bores, with daily rainfall totals at Musselburgh also shown when relevant.

Groundwater monitoring in urban Dunedin has expanded from the four telemetered sites in South Dunedin (established a decade ago) to a network of 23 currently operational groundwater monitoring bores. Most of the newly established sites are a result of targeted scientific partnership projects, such as NZSeaRise (https://www.searise.nz), and working together with a consortium of interested parties to develop an improved understanding of groundwater and geotechnical properties in the area. This setup has worked well, ensuring effective use of publicly available data, managed by ORC. The needs of the different parties undertaking climate change and adaptation modelling will help inform direction of future investigations and ensure ORC's environmental monitoring is a relevant and future-proof part of national climate change data gathering efforts.

The complete network which ORC has access to data from is summarised in the table below.

Table 1. Summary of ORC's 23 Groundwater Monitoring Bores' origins, in the South Dunedin and Harbourside area, which ORC now owns/maintains (after Cox et al., 2020)

Campaign	Period	Overview	Piezometer or Well information	Pressure transducer
Otago Regional Council	Ongoing from 2009	Four long term monitoring sites at Kennedy St, Bathgate, Tonga, and Culling (2014) Parks	Cased drill holes with 80 mm diameter piezometers, 4.2 to 6 m deep. Upstands were installed at Tonga & Kennedy St following 2015 floods. Else toby box flush with ground.	Vented & unvented transducers. Telemetered PT data, air-pressure corrected to ORC office barometer (Stafford St). Manual dips at 1-3 month intervals.
Curious Minds	Ongoing from 13 June 2017, with some data gaps and calibration issues	Two piezometers located in Kings & Bayfield High School fields.	32 mm diameter (ID 25 mm) HDPE pipes installed to 3.7 m using a lost cone penetrometer. Slotted over lower 3 m with filter sock, cased in washed sand and capped with bentonite clay to seal blind pipe. Toby box flush to ground.	Seametrics CT2X sensor recoding P, T and specific conductivity. 12V system with solar panel. Van Walt Ultima Mark2 GSM logger telemetering data to www.vanwaltconnect.com Irregular manual calibration.
Consortium (ORC, DCC, GNS Science, EQC, Canterbury University)	Ongoing from 5 March 2019. Datasets contain drawdown/recovery from purging for regular sampling.	Eight of the CPT investigation sites had piezometers installed at the time by Golder Associates.	42 mm diameter PVC pipes at depths of 2.8 to 6 m. Lower 3 m slotted, cased in K2 sand (96 mm bore diameter) and capped with bentonite seal. Toby box flush to ground.	Unvented Seametrics Level Scout loggers. Manual dips every 4-6 weeks for calibration. Data downloads every 3 months.
NZSeaRise (GNS	Three deep (21,22 & 45 m) and one	Installed May-June 2019 by Roto Sonic	125 mm bores installed with 80 mm diameter	Unvented Seametrics Level Scout loggers.

Science, ORC & Oceana Gold)	shallow (6 m) drill holes. Extra geological work done on core material for NZSeaRise project. Logging from 13 June 2019.	3" drilling (McNeil Drilling Group)	casing. 3 m screens near base of holes, cased in sand & gravel, capped with bentonite backfill. Two with lockable steel upstands, two with toby box flush to ground.	Manual calibration dips every 4-6 weeks. Data downloads every 3 months. Some observations with cable-less Seametrics CT2X conductivity logger (roving between sites).
Harbourside (ORC & GNS Science)	Five drillholes (6.5-16m deep) in the harbourside area. Logging from 13 June 2019.	Installed May-June 2019 by Roto Sonic 3" drilling (McNeil Drilling Group)	125 mm bores installed with 80 mm diameter casing. 3 m screens near base of holes, cased in sand & gravel, capped with bentonite backfill. Three with lockable steel upstands, two with toby box flush to ground.	Unvented Seametrics Level Scout loggers. Manual calibration dips every 4-6 weeks. Data downloads every 3 months.

2.2.2 Recent analysis and reporting of groundwater data

GNS Science, and co-authors from the University of Otago and Otago Regional Council, have recently released a report which analyses the first year of data from the expanded groundwater monitoring network (Cox et al., 2020). This report first describes the groundwater surface across the South Dunedin and Harbourside area covered by the monitoring network, using data from all ORC's currently operational piezometers instrumented with loggers collecting data at 15-minute intervals (Figure 3a). It illustrates some of the potential uses of the data from the expanded network, with some analysis of rainfall recharge and coastal influence. There is some discussion of further improvement to the network, which are being considered by ORC.

The conductivity monitors in some of ORC groundwater bores have allowed for analysis of conductance (proxy for saltiness from sea water mixing) of groundwater and what this might mean for how sea level rise will impact groundwater levels in future (Figure 3b). This data, considered together with depth to water table variations through rainfall events and tidal cycles, has brought forward our understanding of how the water surface moves beneath the reclaimed, low-lying parts of Dunedin.

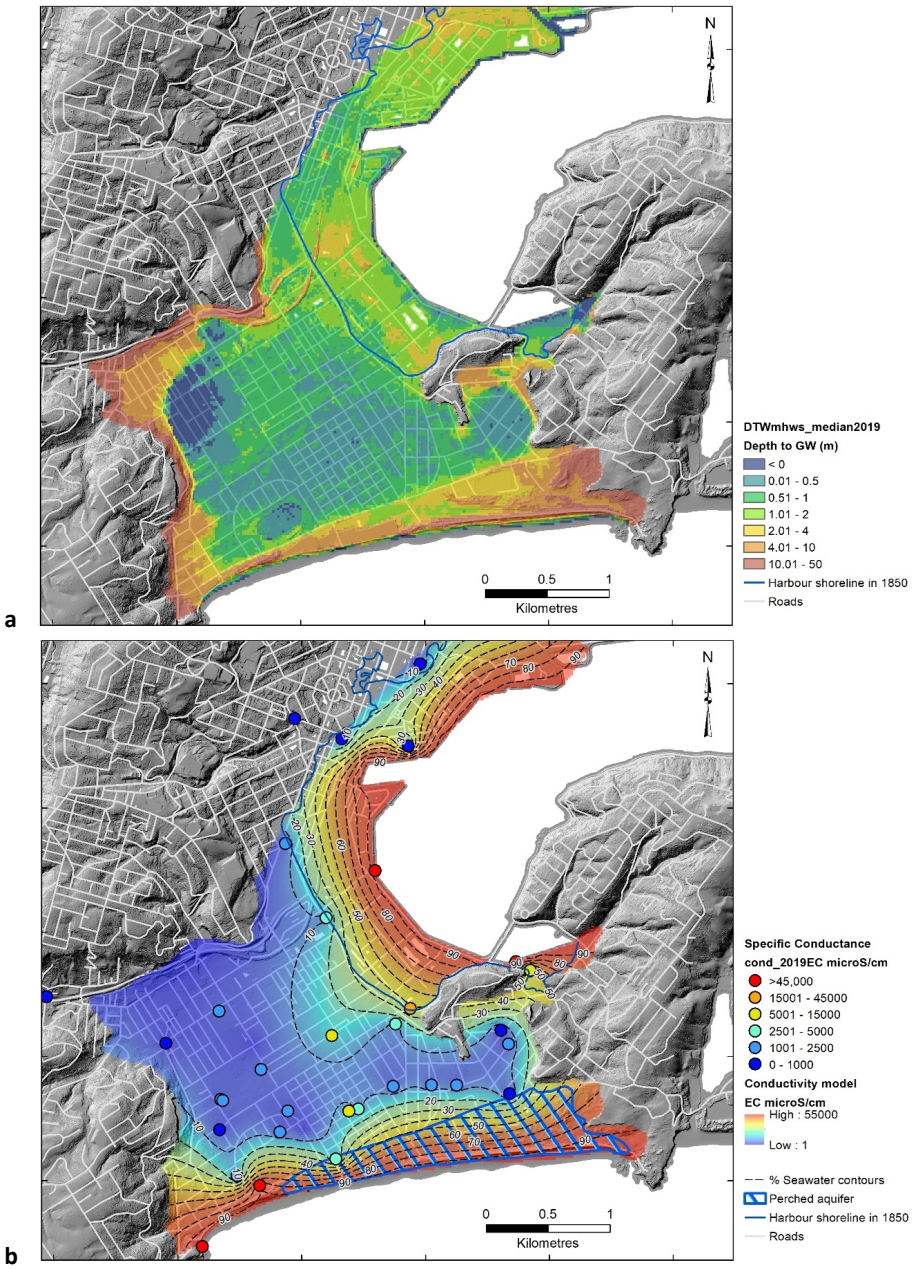

Figure 3. (**a**) the median depth to the groundwater table at high tide from one year of data and (**b**) the specific conductance of groundwater (proxy for salt-water content) and perched freshwater body in sand dunes. Cox et al., 2020.

One of the takeaway points from this report is that most South Dunedin soils are not as porous as previously assumed, in the aftermath of the June 2015 flood event (Cox et al., 2020). This means there could be some drainage solutions to explore in future. More importantly, this report shows how well the groundwater monitoring network is working and that it's the right sort of investment to help scientists understand the geology and water cycle behaviours beneath the city.

2.2.3 Monitoring improvements planned for 2020-21

ORC is currently preparing a drilling and instrumentation campaign aimed at filling gaps identified after the analysis of the first year of data from the expanded groundwater monitoring network. This will make the network fit for modelling purposes in future. Additional bores are proposed in both South Dunedin and Harbourside. The need for additional monitoring is discussed further in section 3.3.

2.2.4 Groundwater management

There has been ongoing community interest in the feasibility of infrastructural solutions to rising groundwater, and responses to this issue in other countries, especially following the June 2015 flooding. In 2016/17, ORC and DCC jointly commissioned Golder Associates and Deltares Ltd to carry out an international review of situations where protection options have been implemented, or are being implemented, for managing rising groundwater (Figure 5). The review focused on areas where protection is the primary mitigation measure or is a significant component of a suite of measures. The factors that made protection a viable option or component in each situation were described. This is intended to help decide what it would take for the option to be viable for further consideration for South Dunedin. The report does not make recommendations on which protection options to investigate and whether protection is likely to be a viable option for South Dunedin.

Figure 5. Greater New open canal dug during the district renovation of Oosterwolde-Zuid, The Netherlands: water storage, drainage, improved water quality and overall quality of the public space. (Golder Associates report on protection options for managing rising groundwater in South Dunedin to ORC (2017).

2.3 Rainfall

The weather events that impact on Dunedin are major drivers in determining the natural hazards which affect the city and combine to create the overall climatic picture. Dunedin's Musselburgh rain gauge (See Figure 1, situated adjacent to the DCC Musselburgh wastewater pumping station) has the longest continuous rainfall record in the Dunedin area. Very heavy rain can be experienced within Dunedin City, and the Musselburgh site has recorded a rainfall total of over 200 mm in a 24-hour period (Table 2). Given that a warmer atmosphere can hold more moisture, there is potential for storm events to bring heavier (or more intense) rainfall in the future as global temperatures increase (MfE, 2008; 2020). Heavy rainfall events, like the June 2015 event, could therefore be expected to become a more common occurrence, as the annual mean temperature in the eastern South Island increases over the 21st century (MfE, 2008; 2020).

Table 2. The highest daily manual (9am) rainfall totals observed at Musselburgh since records began in 1918. Source: NIWA Climate Database

End of event date	Amount (mm)
23 April 1923	229
5 June 1980	119
4 June 2015	**113**
4 Dec 1938	113
20 March 1929	104

The sub-catchments around the periphery of the South Dunedin plain are generally steep, urbanised (with a greater proportion of impervious surfaces such as buildings, concrete and asphalt), and particularly exposed to easterly storm events. As a result, the runoff from these catchment areas onto the plain that is associated with heavy rainfall events occurs rapidly (Figure 6).

Figure 6. Runoff onto Forbury Road during the June 2015 flood event. Source: Otago Daily Times.

MetService's new Otago Weather is currently being installed near Hindon and is expected to be operable by the end of 2020. As well as assisting in forecasting heavy rainfall events, and helping with flood modelling and preparedness during such an event, the radar can also show to what extent rainfall varies across catchments, particularly, between the South Dunedin Musselburgh rain gauge and ORC's nearest recorders in Pine Hill and Swampy Spur.

ORC is planning to install additional hourly rainfall monitoring stations in the South Dunedin and Harbourside catchments. The data from these new stations, whose locations are yet to be determined, will ultimately provide much more accurate groundwater and surface (stormwater) flow modelling inputs for Dunedin's urban catchments.

2.4 Coastal process and sea level monitoring

The St Clair-St Kilda coast has been heavily modified since European settler occupation of the area, and it remains subject to periods of erosion and accretion, despite recent efforts to impede erosion at the St Clear seawall and nearby closed landfill site (located behind dunes in the centre of Figure 7 below).

Figure 7. The Moana Rua dunes in front of Kettle Park (centre of image) form the seaward face of the closed historic landfill beneath the playing fields. DCC are currently exploring options for protection and adaptation in the area with projected sea level rise (St Kilda-St-Clair Coastal Plan). Photo credit Mike Hilton.

There are historic reports of storm-surge flooding from both the harbour and open coast which reached well into the settled area during the late 19th and early 20th centuries, exacerbated by modification and mining of the St Clair sand dunes. This mining took place to supply settlers with fill for low-lying sections, many of which were reclaimed from wetland to just above the height of the water table at the time (Figure 8).

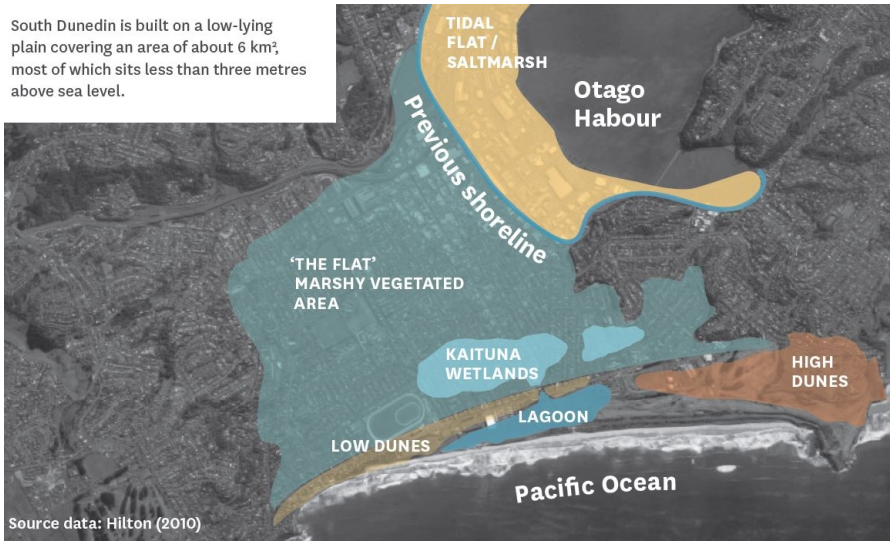

Figure 8. Simplified geomorphic map of the South Dunedin area, from a 2016 ORC communication pamphlet. Source data is from Hilton (2010).

There has been a gradual amassing of data in the coastal space aimed at identifying both absolute and relative sea level rise components, as well as understanding different aspects of storm surge and its relationship to groundwater. The National Institute for Water and Atmospheric Research (NIWA) have maintained (maintenance taken over by ORC in 2004) a tide gauge on Green Island off the coast of Brighton since 2002 (Figure 9). In 2016 a continuous Global Navigation Satellite System (GNSS) instrument was also installed for ORC on the island to monitor vertical tectonic movement. Establishing vertical tectonic movement is important, as is can augment or diminish rates of sea level change recorded by the tide gauge.

Figure 9. Location of the tide recording gauge on Green Island.

In 2019, an undersea pressure transducer was purchased by ORC and installed on the shore platform just off St Clair near the saltwater pool. This device records the water depth every few minutes and is an effective way of picking up near shore wave set-up effects of local storm surges. Data is currently being captured and analysed by University of Otago Geography staff and students. Once several elevated sea level events have been captured these will be compared to offshore sea level and coastal groundwater levels to analyse hazards posed by coastal floods. An example of data output from a DCC Ocean Beach Survey Report (Nguyen & Hilton, 2020) is shown in Figure 10.

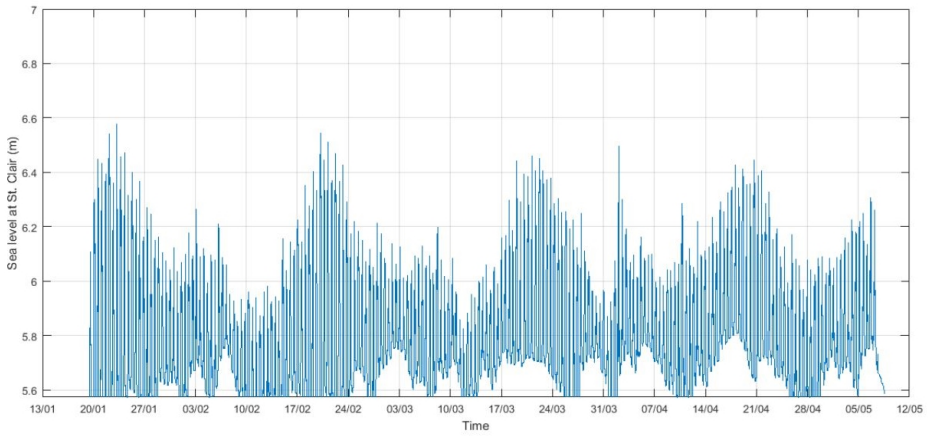

Figure 10. Five months of data from 2019 deployment of the coastal pressure transducer. Vertical Datum is in NZGD 2000, therefore MHWS is 6.16 m. Note how maximum wave heights (which does not include the run-up of the wave on the beach) is about half a metre more during some king tides.

Table 3. Summary of coastal process monitoring which ORC currently oversees.

Owner/partnership	**Detail**	**Justification**	**Data format/reporting**
ORC & University of Otago School of Surveying, 2016	RTK GNSS on Green Island	Logging absolute land position to identify vertical land component of sea level rise. Supplements OU survey school 3 long term survey points in city.	12 monthly report from School of Surveying on long term trends and shorter events (i.e. earthquakes)
ORC & NIWA 2002	Sea level recorder on Green Island	Logging relative sea level for Dunedin, to compare to data collected at Dunedin Wharf and nationally	Automatic telemetered. NIWA reporting as needed
ORC & DCC & University of Otago Geography Department 2019	Coastal pressure transducer St Clair	One of two (UoO owns/monitors Lawyers Head transducer) Coastal sea level to compare to Green Island for storm surge analysis for DCC's St Kilda-St Clair Adaptation Plan	Sea level at St. Kilda is measured by Pressure Transducer (PT) RBR Duet2, sampled at an interval of 6 minutes. Sea level at St. Clair is measured by PT RBR Solo3, sampled at an interval of 5 minutes.

2.5 NZSeaRise project – ORC contribution

In 2018 ORC joined the NZSeaRise research venture with the Research Trust of Victoria University of Wellington and GNS Science. The project objective is to improve sea-level rise projections for New Zealand to better anticipate and manage the impacts of rising sea level on low-lying cities. The project will deliver an authoritative, scientifically robust and localised set of national probabilistic sea level rise projections to the end of the 21st century and beyond. Initial probabilistic model results, depicting the impact of Antarctic and Southern Ocean warming on sea level rise in south-eastern New Zealand, are expected in coming months. South Dunedin has been selected as a regional case study as it is a low-lying densely populated urban area likely to be impacted by sea level rise, potentially coupled with land subsidence. The ORC contribution to the project is to improve understanding of groundwater and to work with GNS scientists to collate information about the physical environment of South Dunedin to inform a robust geological model of the area. The NZSeaRise project is due for completion in June 2022.

As noted earlier, current groundwater modelling efforts are limited by a lack of subsurface data. To rectify this knowledge gap, ORC Natural Hazards staff worked with GNS Scientists on the 2019 drilling programme and the consortium CPT/piezometer effort to recover information about subsurface conditions in South Dunedin and Harbourside. This information has helped build the updated 3-D geological model of South Dunedin and will inform future modelling of the Harbourside area as well as allowed for important dating of sediments from various depths, allowing subsidence and sea level history of the area to be reconstructed (see Section 3 of this report, on geohazards workstreams). It has also helped ORC and GNS Science to improve the understanding of groundwater connectivity and behaviour (Cox et al., 2020). Second, deep drilling and core recovery allows for direct dating of sediments from various depths. Understanding the geological subsidence over time is important for modelling sea level impacts into the future.

Although the NZSeaRise project has a South Dunedin focus, ORC is future-proofing the work so it can be readily expanded to the Harbourside area as more data is acquired. This includes expanding the geographic scope of the groundwater model north to Logan Park, and initiating the collection of groundwater data in the northern part of the city. The following section outlines how ORC is working to ensure the groundwater model provided by NZSeaRise researchers (which has a focus on understanding sea level impacts) can be adapted to include factors such as rainfall recharge of groundwater, and the piped infrastructure network.

2.6 Next generation modelling in collaboration with Dunedin City Council: rainfall, runoff, groundwater and piped networks

The natural catchment of South Dunedin is slightly larger than that of Lindsay Creek in North East Valley (12.5 km^2) which, for comparison, had a peak flow of about 30 cubic metres per second (m^3/s) during the June 2015 flood. Unlike Lindsay Creek however, the South Dunedin catchment does not have a single large channel to convey floodwater to the ocean. Instead, the South Dunedin plain has a highly modified hydrology, associated with its piped stormwater system. Rain which falls on the plain is caught in kerb and channel and then conveyed into stormwater pipes. These pipes discharge stormwater mainly to Otago Harbour (Figure 11), but also directly to the Pacific Ocean (at the St Clair esplanade), via gravity outfall or pumping stations.

Once the stormwater pipes reach capacity, excess water will flow overland and tend to pond in the lowest-lying areas. This water will then either infiltrate to groundwater, naturally evaporate, or eventually be removed by the stormwater system once the period of peak flow has passed. Man-made features such as fences and buildings, and natural topographic features can act to impede or re-direct stormwater during storm events. In addition, the large proportion of the South Dunedin plain that is now covered by impermeable surfaces (buildings, concrete and asphalt) can restrict the infiltration of surface water into the ground. The imperviousness of the South Dunedin plain has been assessed as 60% overall, although this is much higher in the commercial and industrial areas in the north, where imperviousness can reach 100% (URS, 2010).

Figure 11. Stormwater outflow to Otago Harbour, near the intersection of Orari Street and Portsmouth Drive, June 2015. Source: Otago Daily Times.

ORC water table monitoring since from mid-2009, and subsequent modelling, has indicated that the water table height within South Dunedin is influenced largely by sea level, which has risen by about 17 cm since European settlement. Therefore, further rise in sea level could have a significant impact on groundwater levels in South Dunedin, though no significant trend can yet be seen in the short data record (Rekker 2012, 2016, Cox et al 2020). Determining the extent of this impact depends on the collection of robust hydrogeological data such as the stratigraphy of soils at depth, and physical properties relating to the transport of water beneath the ground surface, such as hydraulic conductivity. Previous modelling which investigated sea level impacts on groundwater flooding included assumptions of these properties which may over or under-estimate surface ponding of water. Another important factor which needs further analysis is the extent to which piped waste- and stormwater networks beneath South Dunedin act as a drain on the water table. Fordyce (2013) used temporary groundwater monitoring network, deployed in 2012-2013, and wastewater network monitoring to prove how Dunedin's very old and often incompletely sealed wastewater network fortuitously acts as a drain on the high groundwater table, especially during heavy rainfall events (Figure 12).

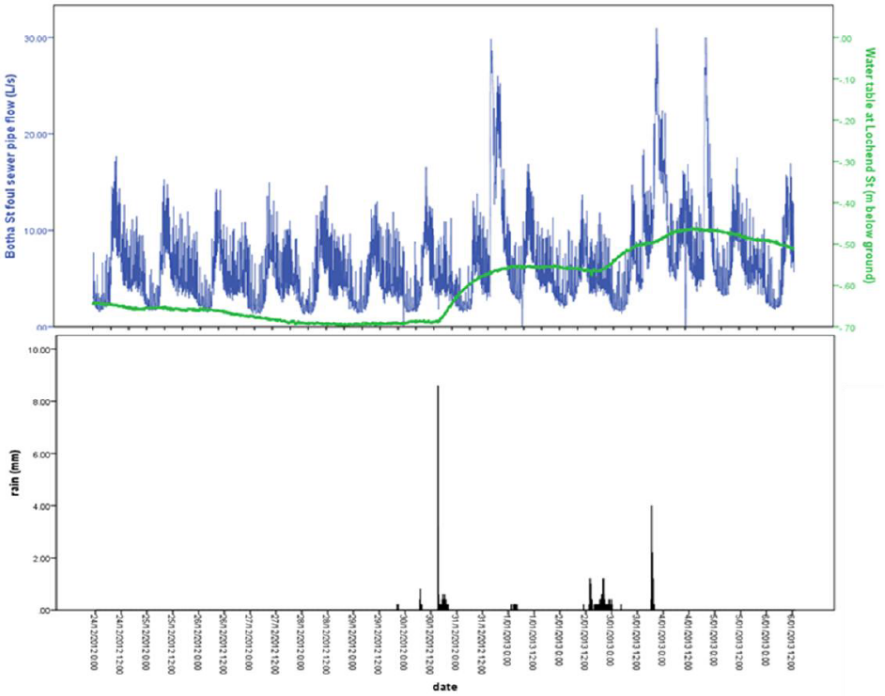

Figure 12. Graph of wastewater pipe flow (blue line), groundwater elevation (green), from temporary monitoring in the Tainui area, and rainfall (black), between 24/12/12 and 6/1/13. Source: Fordyce (2013).

Previous ORC groundwater models have only considered passive groundwater behaviour with tidal/sea level rise impacts. They have not attempted to model rainfall recharge or the extent to which the infrastructure, which DCC maintains, impacts on the amount of water going into the groundwater system versus the piped networks. Cox et al. (2020) show initial rainfall recharge index values based on the 2019-2020 data captured across the improved groundwater monitoring network. However, the time period of data collection did not include any significant rainfall events and so ability to model how the groundwater surface responds during flood events is limited.

Furthermore, the Musselburgh rainfall recording station, used as an indicator of rainfall totals in Dunedin's central city coastal catchments (i.e. the area considered in this report) naturally can record different rainfall totals to its nearest rain gauge sites in Pine Hill and Swampy Spur. This reflects rainfall gradient due to elevation and temperature, but also local geography and hourly totals vary depending on storm direction and type. In order to adequately measure complete hydrological cycle behaviour, and for Dunedin City to have better information when planning stormwater network flood level design (Figure 13), full understanding of the distribution of rainfall in different-size events across the city is needed.

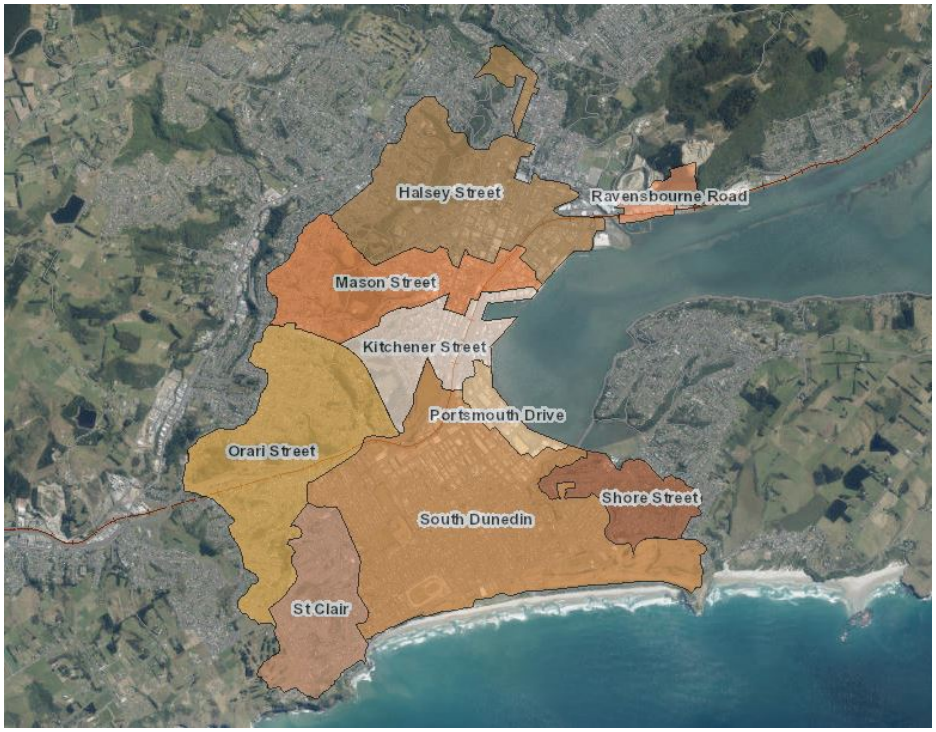

Figure 13. Dunedin City Council's stormwater sub-catchment areas. Each sub-catchment's stormwater system is designed to perform under certain durations and intensities of rainfall and is currently being reviewed through the DCC's Integrated Catchment Model (ICM) process.

ORC have established a technical advisory group with the DCC and one of the aims is to streamline the hydrological monitoring and modelling and long-term technical work programmes. Accurate knowledge is required of the volume and speed of water which makes its way to the flood-prone coastal areas of Dunedin's central city via steep, inner-city and suburban catchments. The small streams are captured by the DCC stormwater network, though in cases of high rainfall intensity an unknown amount of water overflows the stormwater network and crosses sub-catchment boundaries on the flat. An example of improving understanding of flows in these sub-catchments could be putting temporary flow monitors in place where streams enter stormwater system.

ORC will work with DCC over the coming year to ensure adequate rainfall, stormwater and wastewater data are available in addition to the newly increased groundwater monitoring data network, for both DCC and ORC hydrological and engineering modelling needs into the future. Having a more accurate map of rainfall distribution and measuring flows in different branches of the stormwater network, will allow a more accurately account for water which doesn't make it into the piped network and represents as either runoff flooding, or enters the groundwater system. Different-size rainfall events also present different challenges, so continuous monitoring over a period of years would be needed in order to capture enough heavy and long-duration rainfall events. Stormwater flow data for hillside catchments leading to important mains such as Forbury Road would allow better establishment of the pressure-points where flood protection stormwater infrastructure requires upgrade, and therefore can help mitigate the contribution of stormwater overflows in the hill catchments to flooding on the

flat. This will also aid the design of stormwater infrastructure that will both cope with high-rainfall events in the short-term and address issues of rising groundwater in the mid to long-term

The challenges presented by climate change in the unique setting of South Dunedin and Harbourside mean ORC's environmental responsibility in the city is intertwined with the Dunedin City Council's need to adapt legacy infrastructure to a changing and sensitive coastal environment. It is vital that our technical work programme delivers the information needed to make adaptation decisions. In turn this depends on a clear understanding of what the adaptation options and pathways could be and the process and timeframe for decision-making on those options and pathways.

3.0 GEOHAZARD RESEARCH AND MODELLING

3.1 Seismic hazard investigations

In 2018 geologists from GNS Science, the University of Otago and the Geological Survey of Spain have completed a study of unknown faults underlying the Dunedin area (Villamor et al., 2018) (Figure 14). Following the 2010-11 Christchurch earthquakes, there has been a national focus on improving understanding of faults near cities, as a moderate earthquake near an urban area can cause significant damage. Newly calculated earthquake magnitude estimates for fault sources near Dunedin range from MW 6.7 to 7.7 and recurrence intervals range from 5000 years to several millions of years. The shaking scenarios from known faults have been re-assessed and predicted levels of ground shaking could result in damage to unreinforced masonry, localised landslides, and liquefaction in some areas. The likelihood of this type of shaking occurring is low though not necessarily lower than those of the faults involved in the Canterbury earthquake sequence.

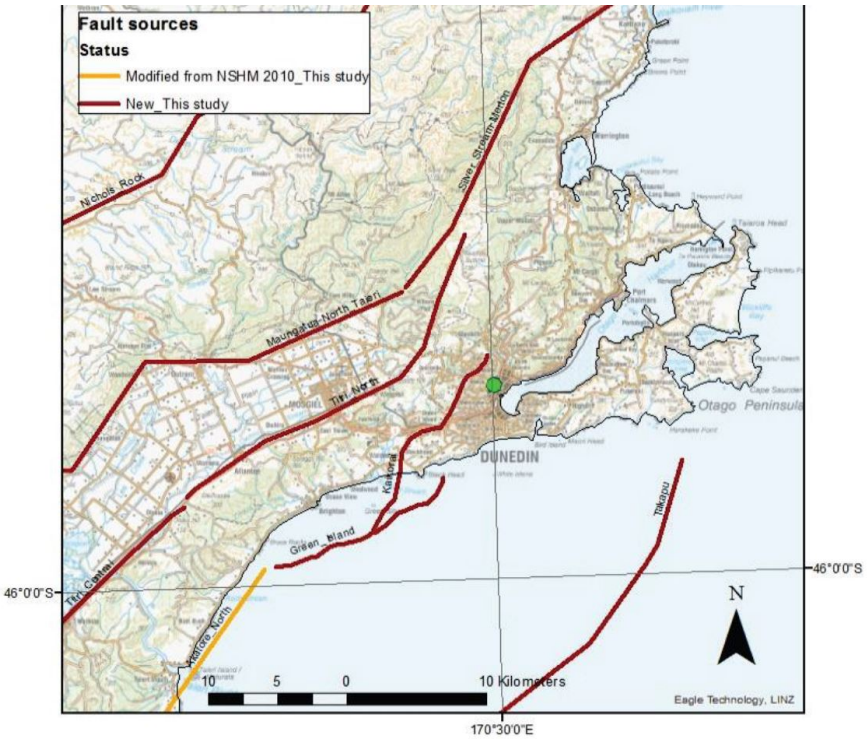

Figure 14. Updated surface traces for fault sources in the Dunedin region. Orange lines: fault sources modified from the 2010 National Seismic Hazard Model (NSHM, Stirling et al., 2010). Red lines: new fault sources (not in the current NHSM). Figure from Villamor et al. (2018)

The work has spurred further research into liquefaction risk in Dunedin CBD and South Dunedin, and through 2019, ORC worked with several organisations (including EQC, GNS Science, University of Otago and the Dunedin City Council) to fund a variety of subsurface investigations in South Dunedin

to determine geotechnical and geological properties and groundwater characteristics. Work is ongoing, including involvement of active fault researchers in the placement of groundwater drill holes, so that core samples might be collected to help delineate some of the more tentatively mapped active faults and understand more about their previous activity.

ORC also commissioned a report on active faults in the Clutha and Dunedin City districts, which is currently being completed. The report contains new detail on the estimated recurrence interval of the nearby Titri and Akatore Faults (Figure 14), from paleoseismic investigations completed since the Villamor report (Barrell, in prep).

3.2 Liquefaction susceptibility mapping

In 2019 sixteen cone penetrometer tests (CPT) were carried out as part of work led by EQC and the University of Canterbury to better understand ground conditions and liquefaction potential in South Dunedin. A further eight drill holes were completed around the South Dunedin and Harbourside areas, and core recovered and analysed by GNS Science and University of Otago geologists.

Previous work by GNS commissioned by ORC (Barrell et al., 2014) ORC report Liquefaction Susceptibility of the Dunedin City area, 2014) mapped liquefaction hazard areas based on the potential for liquefaction susceptible materials to be present. The South Dunedin flat and Harbourside areas were classified with a moderate to high liquefaction potential. This reflects the geomorphic history of the area (shallow marine/estuarine) which entails a high likelihood of fine-grained soils and a shallow groundwater across the area.

In July 2020, in order to refine the understanding of the liquefaction susceptibility in South Dunedin, ORC commissioned a report (Review of liquefaction data, (GeoSolve, 2020) on the assessment of the raw CPT data from the work carried out by ORC, NZSeaRise, and the consortium CPT and piezometer installations which took place in South Dunedin in 2019. Additional sites from previous CPT work available in South Dunedin were also included in the analysis.

The CPT data from each site has been analysed in relation to theoretical settlement which would occur in standardised earthquake cases (e.g. NZS 1170 Serviceability Limit States and Ultimate Limit States which specify different peak ground accelerations and annual exceedance probabilities). This is an industry standard approach for assessing settlement that may result from seismic shaking, to help determine foundation design for any occupied structures so they are safe and serviceable for a design lifetime with exposure to expected seismic hazards. A Liquefaction Severity Number (LSN) was assigned to the uppermost 10 m of each CPT (sometimes multiple CPTs were completed at a site) which provides a useful summary of relative liquefaction susceptibility across the South Dunedin area.

The LSNs for an earthquake scenario considered to have an estimated annual exceedance probability (AEP) of 1 in 100 years were all below 10, which indicates settlement of only a few centimetres (less than 70 mm, and generally less than 40 mm) is expected at all tested sites in such a seismic event. The LSNs returned for this earthquake scenario are displayed as coloured dots in Figure 15 to give an idea of the spatial variability of liquefaction susceptibility. 1 in 100 years recurrence event has been chosen as it is commonly used when discussing natural hazard risk. The results from other earthquake scenarios show similar variability across the area.

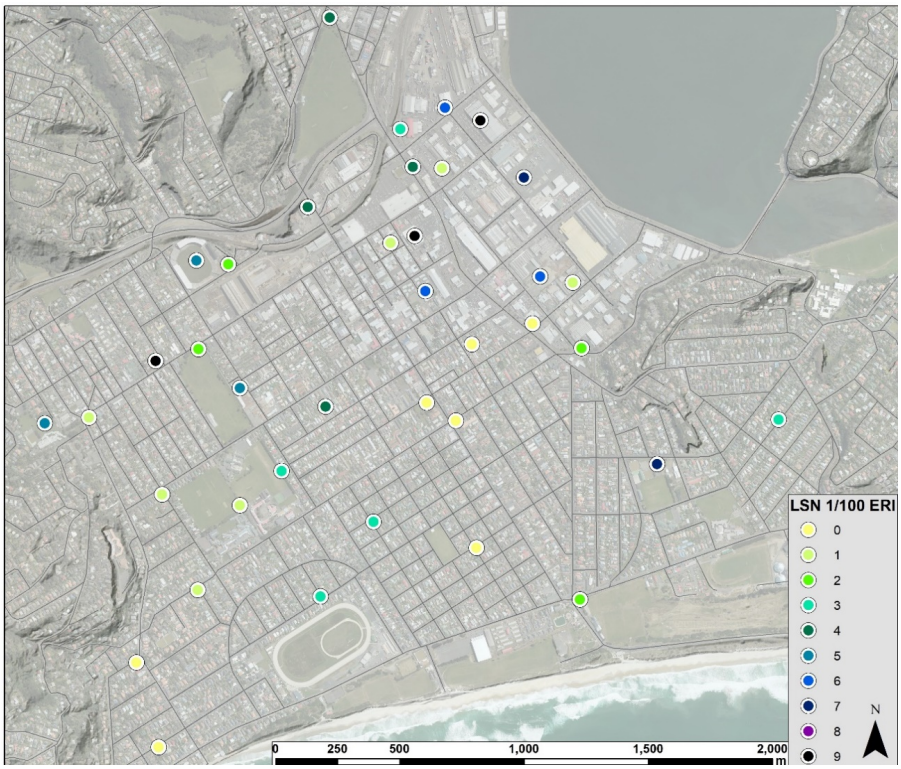

Figure 15. Locations of sites analysed in the liquefaction susceptibility report. Coloured dots represent the Liquefaction Susceptibility Numbers (LSN), summarising how severely the ground would be impacted by shaking, calculated for a 1 in 100-year AEP (or ERI, estimated recurrence interval) earthquake scenario (Mw5.8, 0.11 g).

3.3 Geological and tectonic Investigations

In addition to the CPT data gathering, deeper boreholes were drilled in the greater South Dunedin area in 2019. These were geologically logged, samples were collected from the drill core for scientific dating purposes, and geotechnical data at each drill site were recorded. This work was funded by ORC.

These data, in addition to that collected by University of Otago geologists and existing bore hole and geotechnical data for the area, form the basis of an updated geological model. The work, briefly presented in this report, summarises geological, geotechnical, and geophysical investigations carried out in 2019 and will be used in modelling the impacts of various sea level rise scenarios on the groundwater and future surface flooding. Results of the investigations and groundwater monitoring can also be used in further seismic hazard analyses which will guide assessments of subsurface infrastructure investment and inform planning decisions.

Geological drill hole logs and CPT data have been collated by GNS Science to create an interpretive 3-dimensional geological model of the South Dunedin subsurface geometry. Basement rocks, such as the Dunedin Volcanics and Caversham Sandstone (Figure 16a), and the younger Holocene sediments, which in-filled the valley beneath South Dunedin as sea level rose after the Last Glacial Maximum

(Figure 16b), are depicted in the model. A final GNS report on the modelling and interpretation of results is currently in preparation (Glassey et al., in prep).

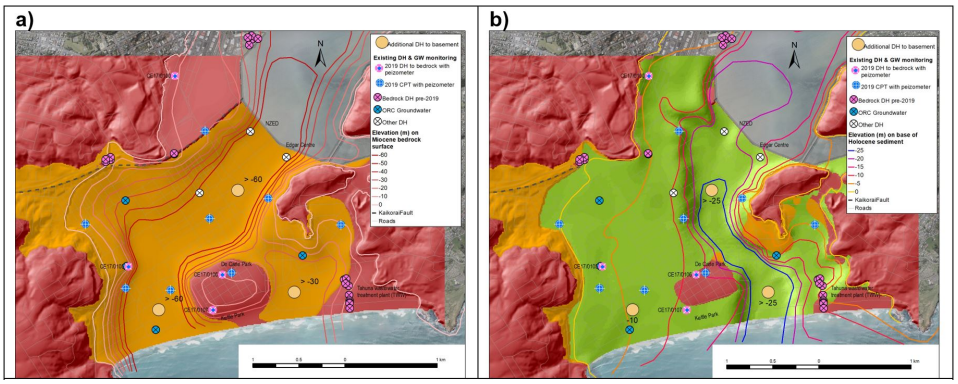

Figure 16. Locations of three recommended deep drill holes (orange circles) shown in relation to key existing subsurface investigations and a) the Miocene bedrock surface (red is Dunedin Volcanics and orange is the Caversham Sandstone) and estimated minimum depth to the bedrock at these new drill hole locations, and b) the base of the modelled Holocene surface (green) with minimum depths to the base of the Holocene sediments. Glassey et al. (In prep).

The 2019 Drilling Programme in South Dunedin was hugely successful in identifying the complexities in the basement shape, and the differing depths of young sediment through the South Dunedin flat. More of this type of data collection around the harbourside reclaimed area, and/or the collection of currently privately-held data in the area such as the Dunedin Hospital rebuild area, will be needed to extend the model into harbourside reclaimed areas, and complete groundwater modelling there. A plan is in place to prioritise siting additional groundwater bores in areas where GNS Science geologists have identified a need for more information for the NZSeaRise project and other, seismic hazard work.

The Green Island GNSS station (see also section 2.4), maintained by the University of Otago Survey School and funded by ORC, has been operating for over four years, with over 700 daily position estimates. This time interval has allowed horizontal velocities to be well defined, but at least 5 years of data is considered necessary to establish a reliable vertical signal.

Figure 17 shows the horizontal and vertical movement recorded on Green Island from 2016 installation to 2020. The variability of the readings, especially vertical (rms error +/- 9.0 mm), is apparent, which is why a long, continuous record will be important for understanding of long-term sea-level trends separate from seasonal variability. The record clearly shows an overall downward vertical trend of about 5 mm per year, and the impact of the Kaikoura earthquake, especially on horizontal movement, is also clear. As this is a potentially local tectonic trend, corroborating such findings with data such as dates from drill core material collected in the 2019 South Dunedin Drilling programme, will be an important aspect of ongoing research.

The Green Island station is also useful in that it ties into a regional network of GNSS survey points which allow geodesists to analyse the regional tectonic signal and strain accumulation on local faults. This information has many practical uses, especially in the development of the National Seismic Hazard Model.

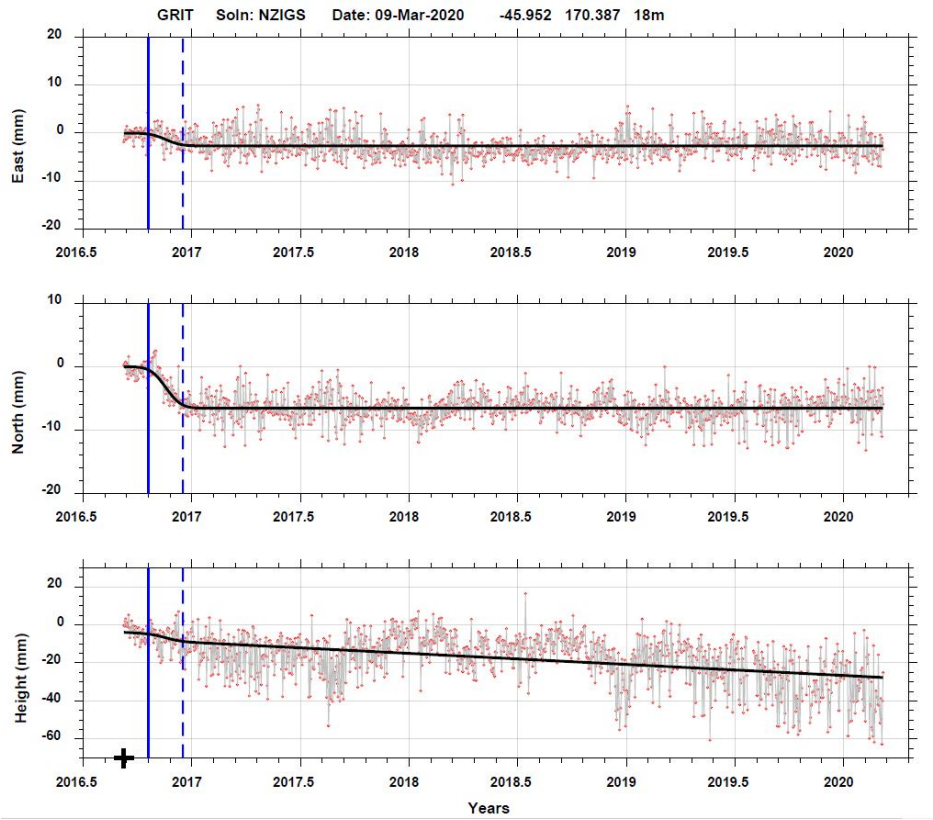

Figure 17. Horizontal and vertical position time series with seasonal trends removed. The vertical (blue) solid line indicates the time of the Kaikoura 2016 earthquake.

4.0 COMMUNICATION WORK AND FURTHER COLLABORATION

4.1 South Dunedin sea level and groundwater bore kinetic/visual display

The data collected from Dunedin's groundwater monitoring bores is a mixture of telemetered (automatic live updates from a logger in the bore every 15 minutes) and manually recorded. This year ORC worked with Otago Museum staff to use the telemetered data from the bores, and the Green Island sea level recorder, in a mechanical groundwater level exhibit (Figure 18). The exhibit is currently located in the South Dunedin Community Network rooms shop front, on King Edward St.

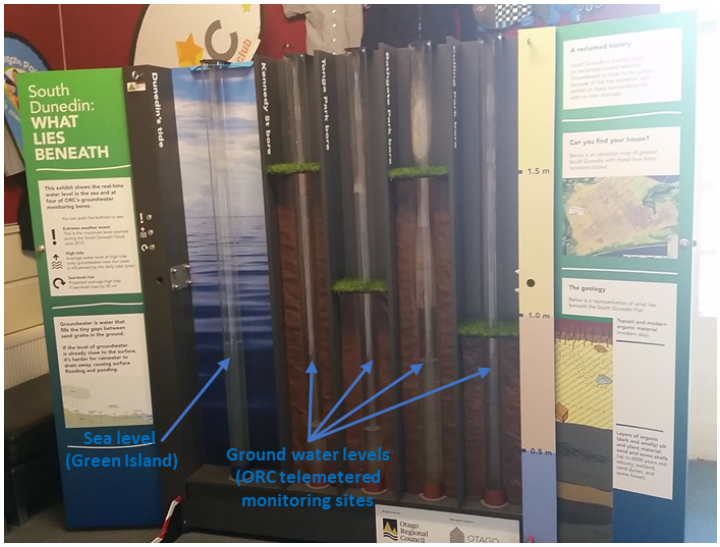

Figure 18. South Dunedin sea level and groundwater bore kinetic/visual display during a South Dunedin Community Hui in November 2020

This display makes the information available on the ORC Water Info website (https://www.orc.govt.nz/managing-our-environment/water/water-monitoring-and-alerts) accessible , visible and understandable for a wide range of public, including children. This exhibit is to be used for community meetings and school groups to educate them on what groundwater is and how the groundwater in South Dunedin is influenced by the rising tides, the heavy rainfall event in June 2015 and the projected average high tide if sea-level rises by 30 cm.

4.2 South Dunedin Future (DCC)

One aim of ORC's programme of technical work is to support DCC's South Dunedin Future (SDF) programme. SDF is a programme of work lead by DCC designed to improve the wellbeing of South Dunedin residents through effectively responding to the climate-driven challenges. Key priorities for the programme over the next 2 years are:

- Empower the community through on-going engagement on short, medium, and longer-term options to enable future decision-making for South Dunedin
- Build the technical information base to develop future options for South Dunedin (drawing on existing data sources, identifying data gaps and prioritising new data collection)

- Develop an overall plan for future development in South Dunedin within an adaptive planning framework.

ORC is currently involved in the SDF programme by providing information on the physical environment and on the impacts of natural hazards and climate change. Dedicated support is also provided during the on-going engagement to inform the community about the physical environment and enable informed decision-making.

4.3 Contributing to the national geotechnical database

ORC is working collaboratively with DCC, EQC and GNS Science to promote the national geotechnical database (NZGD) and to ensure all geotechnical data, recovered through consents, geological modelling and climate change adaptation research within the South Dunedin and Harbourside area, can be uploaded to the NZGD. This would streamline the process for upgrading geological/liquefaction/hydrological models into the future.

4.4 Engagement with the local and scientific community

In late 2016 DCC and ORC jointly undertook a series of sessions with the South Dunedin community on actions following the 2015 flood and the changing environment. The natural hazards of South Dunedin were explained based on ORC's 2016 natural hazards report along with what is presently known about the changing climate and its potential effect on groundwater levels. The sessions were attended by approximately 300 members of the public (Figure 19).

ORC is also closely working with DCC to continue bringing future engagement sessions to the community as part of SDF and ORC's own climate change adaptation work. This has recently involved staff participation at drop-in information sessions and community hui.

Figure 19. One of the joint DCC/ORC community information sessions that took place in South Dunedin in late 2016.

ORC also maintains a publicly accessible Water Monitoring and Alerts website (WaterInfo) where groundwater, rainfall, river flow and sea level data are updated with live data. Figure 20 shows

examples of the displayed data which the public can view. This website is a useful resource for school science and geography projects, as well as containing freely available data for professional scientific and hydrological studies.

Figure 20. Some of the groundwater and sea level data for the South Dunedin area available on ORC's WaterInfo website.

In 2017 ORC was involved in the 'What Lies Beneath' project, part of the Government-funded Curious Minds Programme. In this initiative, King's and Bayfield High School students were paired with scientists of GNS Science and ORC to investigate the changing nature of the physical environment in South Dunedin (Figure 21). This hands-on project aimed to encourage students to look at the ground beneath their feet, schools, homes and community to give them a better understanding of South Dunedin's changing physical environment and its impacts on residents and businesses. With the support of scientists, they undertook research, collected and analysed data, and presented their findings to their peers, families and wider community. Some of the students presented at an ORC councillor workshop in 2017.

The project played an important and innovative role in providing knowledge to the wider community through the younger generation. This was facilitated by encouraging the students to discuss their findings with their families at home and the conclusion of the project through an evening of student presentations to the community. Bringing knowledge to the community is key in enabling them to engage in the decision-making process.

Engagement has also taken place recently through work with the NZSeaRise project and its associated communications. Working collaboratively with existing science projects, and contributing to and co-funding new ones is an excellent way of having a presence in the scientific community and the outreach done through university and Crown Research Institutes engagement teams, ensuring ORC has a place in the positive scientific work being done on Dunedin's understanding of, and adaptation to, climate change.

Figure 21. ORC Natural Hazards and GNS Science staff delivering the Curious Minds programme to pupils of Bayfield High School and Kings High School, in 2017.

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7.4. Lake Hayes Culvert

Prepared for:	Strategy and Planning Committee
Report No.	OPS1024
Activity:	Environmental: Water
Author:	Gavin Palmer, General Manager Operations
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	25 November 2020

PURPOSE

[1] To receive information on the activities and associated cost and timeframe that would be required to increase the outlet capacity of Lake Hayes (State Highway 6 culvert).

EXECUTIVE SUMMARY

[2] Queenstown-Lakes District Council (QLDC), Friends of Lake Hayes (FOLH) and the Wakatipu Reforestation Trust have expressed concerns about high lake levels and the performance of the culvert at the outlet of Lake Hayes (Figure 1). Those concerns are to do with impacts on public use of a section of the walkway and trail around the perimeter of the lake, including organised events, effects on Crested Grebe habitat, increased runoff of nutrients (from flooded land) and the death of native plants being propagated by the Trust for local biodiversity and restoration projects.

[3] In September 2019 Council resolved to "*formally invite QLDC, the Department of Conservation and the NZTA to co-fund, with ORC, scoping the investigation and establishment of a target water level range for Lake Hayes and scoping the investigation, consenting, design, construction, maintenance and funding of infrastructure to manage the lake level to that range. This option would require incorporation of activity and funding of ORC's share of the scoping investigation into draft Annual Plans.*"

[4] This scoping work has been completed and is described in the **attached** report "*Lake Hayes Culvert Project Scoping Report*" (26 November 2020).

[5] If Council was to include the project in the 2021/31 Long Term Plan and to commence work in July 2021 then, based on the programme described in the scoping report, a new culvert beneath State Highway 6 (SH6) would become operable in early to mid-2023.

[6] The two options that have been scoped are estimated to cost $657,000 and $621,000 respectively to implement.

[7] The Department of Conservation has recently advised ORC that the department intends raising and improving the flood-prone section of their walkway and trail this Summer.

RECOMMENDATION

That the Council:

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

2) ***Notes*** *the activities, estimated cost and timeframe that would be required to increase the outlet capacity of Lake Hayes (State Highway 6 culvert).*
3) ***Notes*** *the improvement and maintenance works that will be undertaken by the Department of Conservation on the department's Lake Hayes walkway and trail this Summer.*

BACKGROUND

[8] QLDC, FOLH and the Wakatipu Reforestation Trust have expressed concerns about high lake levels and the performance of the culvert at the outlet of Lake Hayes (Figure 1). Those concerns are to do with impacts on public use of a section of the walkway and trail around the perimeter of the lake, including organised events,[1] effects on Crested Grebe habitat, increased runoff of nutrients (from flooded land) and the death of native plants being propagated by the Trust for local biodiversity and restoration projects.

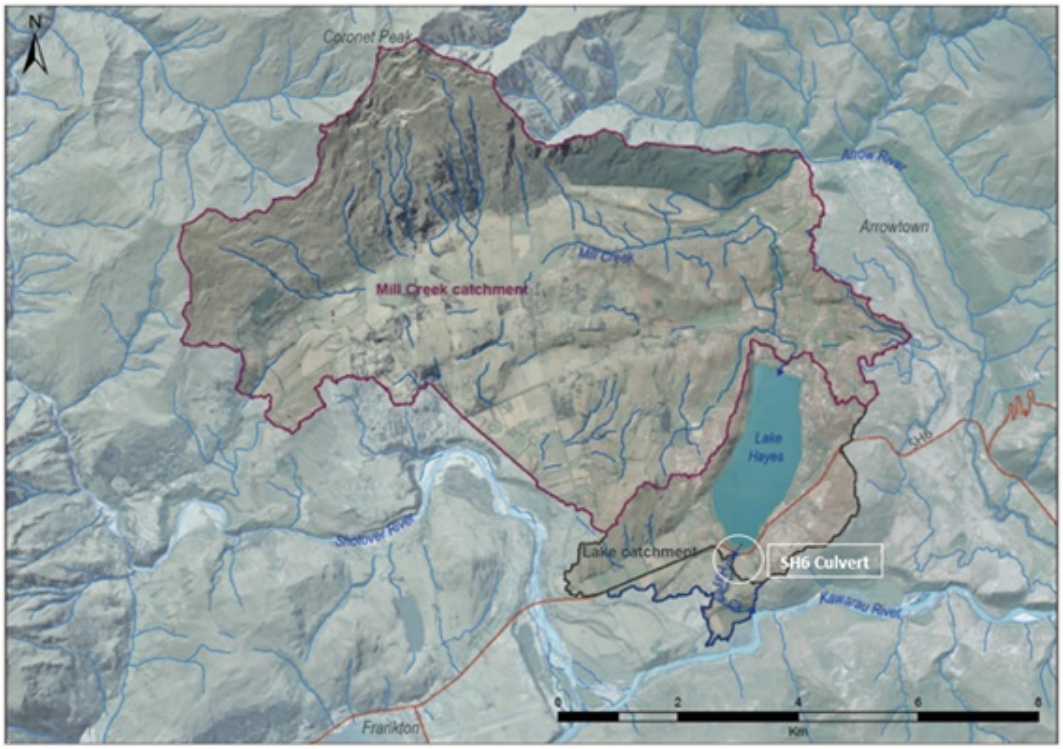


Figure 1: Location of SH6 culvert, Hayes creek, Arrowtown.

[9] The culvert is owned by Waka Kotahi/NZTA. Waka Kotahi/NZTA has advised that it has no plans to replace or alter it.

[10] In September 2019 Council resolved to "*formally invite QLDC, the Department of Conservation and the NZTA to co-fund, with ORC, scoping the investigation and establishment of a target water level range for Lake Hayes and scoping the investigation, consenting, design, construction, maintenance and funding of infrastructure to manage the lake level to that range. This option would require incorporation of activity and funding of ORC's share of the scoping investigation into draft Annual Plans.*"

[1] The flood-prone section of track is part of the route of the Queenstown Marathon. The marathon takes place each year in November.

[11] In accordance with the Council resolution, provision was made in the 2020/21 Annual Plan to undertake the scoping exercise and the Department of Conservation, QLDC and Waka Kotahi/NZTA were invited to co-fund that work. In response to this invitation, QLDC and Waka Kotahi/NZTA agreed to co-fund the work with ORC. ORC subsequently commissioned Calibre Consulting Ltd to undertake the scoping and to prepare a report, with advice from Mitchell Daysh Ltd on the planning and consenting matters.

[12] This scoping work has been completed and is described in the **attached** report "*Lake Hayes Culvert Project Scoping Report*" (26 November 2020).

DISCUSSION

[13] If Council was to include the project in the 2021/31 Long Term Plan and to commence work in July 2021 then, based on the programme described in the scoping report, a new culvert beneath SH6 would become operable in early to mid-2023.

[14] The two options that have been scoped are estimated to cost $657,000 and $621,000 respectively to implement.

[15] The cost of establishing a target water level range as part of the project is approximately $25,000. Some of this cost would be avoided if the water level range specified in the Lake Hayes Management Strategy is used. This range was determined in 1995 and may not be appropriate for existing and future land use around the margins of the lake.

[16] As noted in the scoping report, some of the planning and consenting cost could be avoided if the existing global consents held by Waka Kotahi/NZTA could be utilised.

[17] The Department of Conservation has recently advised ORC that the department intends raising and improving the flood-prone section of their walkway and trail this Summer.

CONSIDERATIONS

Policy Considerations

[18] Depending on timing, the project would potentially create employment opportunities in a District that has been impacted by COVID-19.

[19] Otago is divided into six Special Rating Districts (SRDs) for the purposes of funding river management works. Hayes Creek lies in the Wakatipu Special Rating District. The SRDs are not intended for the purposes of funding new assets or funding improvements to assets owned by others.

Financial Considerations

[20] Estimated costs are detailed in the scoping report (**attached**). The cost analysis assumes that no business case, problem definition or further benefit analysis are required.

[21] The project is not provided for in the current (2018/28) Long Term Plan.

Significance and Engagement

[22] Hayes Creek is not part of an ORC flood or drainage scheme. ORC has no flood or drainage infrastructure on Hayes Creek.

[23] The works trigger ORC's policy on Significance and Engagement because of their scale. The project would need to be included in the 2021/31 Long Term Plan if it is to proceed.

Legislative Considerations

[24] ORC has the powers and functions of a Catchment Board. Under s126(1) of the Soil Conservation and Rivers Control Act 1941 ORC has the function "*to minimise and prevent damage within its district by floods and erosion*". This function is exercised in the context of other relevant legislation including the Resource Management Act and the Local Government Act 2002.

[25] There is no statutory obligation on ORC to manage the level of Lake Hayes to a particular level or range.

Risk Considerations

[26] Implementation risks are described in the scoping report (**attached**).

[27] High lake levels do not pose a direct threat to public safety provided users of the walkway and track exercise caution.

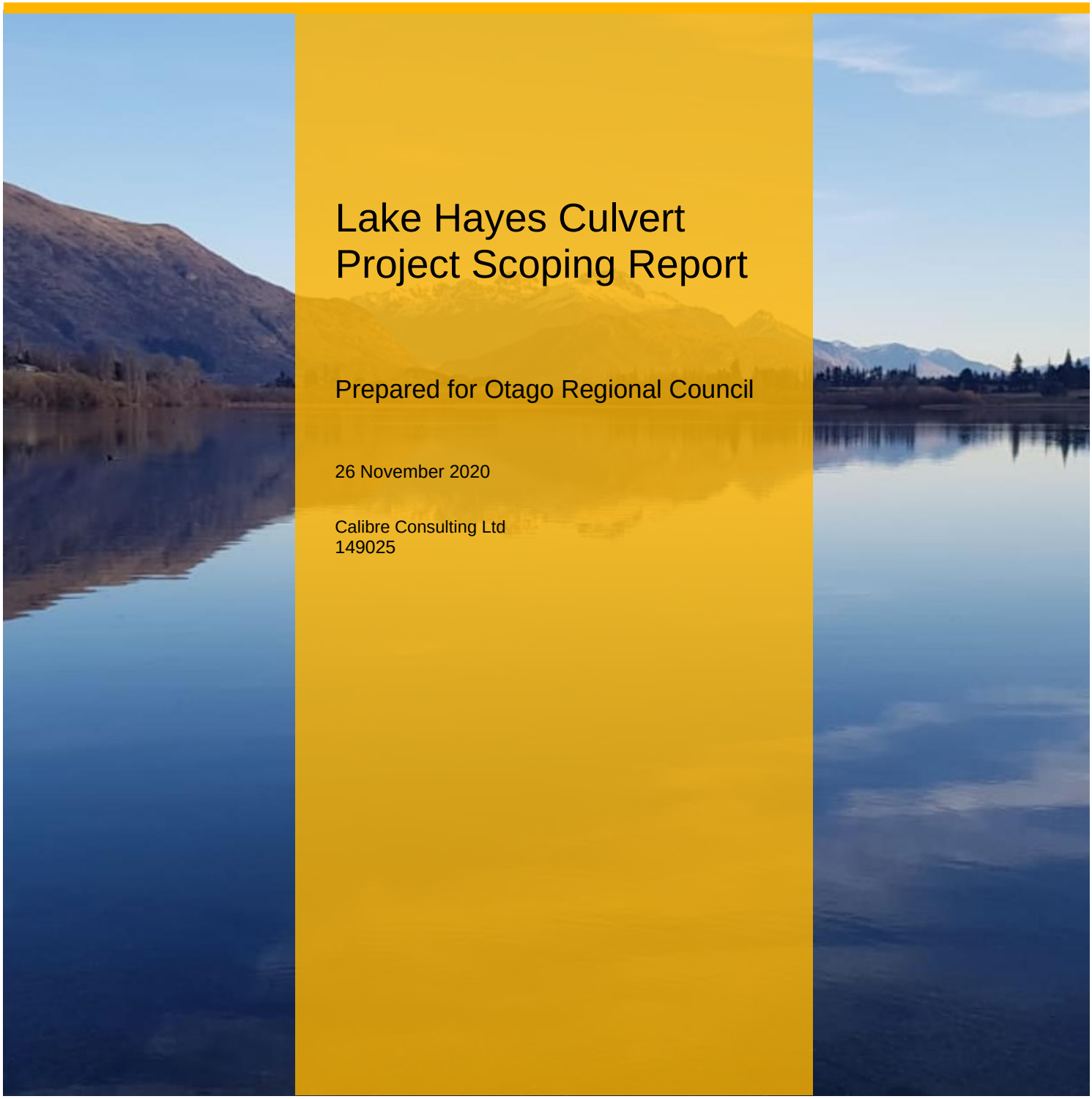
NEXT STEPS

[28] The next steps are to incorporate the information on culvert replacement into Council decision-making on the Draft 2021/31 Long Term Plan.

ATTACHMENTS

1. Lake Hayes Project Scoping Report - Final [**7.4.1** - 64 pages]

Report



Lake Hayes Culvert Project Scoping Report

Prepared for Otago Regional Council

26 November 2020

Calibre Consulting Ltd
149025

QUALITY ASSURANCE STATEMENT

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Approved for Issue by	Chris Wrathall	

DOCUMENT CONTROL

ISSUE	DATE	ISSUE DETAILS	AUTHOR	CHECKED	APPROVED
0	19/11/2020	Draft	GA	AB	CW
1	25/11/2020	Final	GA	AB	CW

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Contents

Tables

Figures

Appendices

Appendix A Appendix Risks Register
Appendix B Indicative Concept Drawings
Appendix C Mitchell Daysh Consent Scope Memorandums

1. Executive Summary

Calibre was engaged by the Otago Regional Council (ORC) to prepare a detailed scoping document for a potential project involving an upgrade to the existing Lake Hayes outlet culvert. The culvert is located at the Southern end of Lake Hayes, it consists of a single 1.35m diameter, 28-metre-long, corrugated aluminium culvert passing under State Highway 6 at Route Position 983/5.74 (approximately 1km south of the intersection with Arrowtown-Lake Hayes Road). Records show that this pipe was installed in 2002, as replacement for the previous twin 0.9m diameter corrugated steel pipes. The culvert discharges into Hayes Creek, which then flows into the Kawarau River approximately 1.3km downstream.

The principal driver behind this investigation is the regular feedback form the community regarding flooding to the walkway at the southern end of the lake. We note that although we have been provided with information in regard to a number of broader issues around Lake Hayes, this report and scoping document is focused around the outlet culvert and potential scope and options associated with this culvert.

The two culvert upgrade options considered as part of this report were as follows:

- Option 1 – Installation of new concrete box culvert approximately 1500mm wide x 1000mm high x 28m long, to replace the existing 1350mm dia. corrugated aluminium culvert.
- Option 2 – Installation of an additional circular culvert with a diameter of approximately 600-900mm and 28m in length, alongside the current 1350mm dia. culvert.

The indicative high-level cost estimates associated with these two options are $657,000 and $621,000 respectively.

The key issues identified during the limited stakeholder consultation that was undertaken were; the regular flooding to the lake walking track and subsequent impact on the amenity value of this asset; as well as concerns for the overall lake health and ensuring that any work undertaken does not have a negative impact on the existing wetlands. It was noted that none of the parties spoken to were opposed to the idea of potentially raising the level of the existing walking track.

Throughout this exercise a significant number of high-risk items were identified for any potential works that may be undertaken to increase the capacity of the existing culvert. The key risks include significant environmental impacts, impact and interruption to the existing adjacent critical infrastructure (state highway and in ground services), the risk that due to downstream constraints, any culvert work may not have a significant impact on the overall lake level, health and safety risks associated with completing the works and the potential for other unintended negative side effects both within Lake Hayes and downstream in Hayes Creek. We recommend that these risks be carefully considered and appropriately managed if the project proceeds.

Given the current level of uncertainty around the best solution to resolve the underlying issues that have been identified, we recommend that a business case type of approach be considered when proceeding any further. It should evaluate the various options, ensuring all potential solutions are looked at in a holistic manner. It should consider all of the key factors that impact on the success of the project such as environmental impacts, costs, risks and desired stakeholder outcomes.

2. Introduction

Calibre was engaged by the Otago Regional Council (ORC) to prepare a detailed scoping document for a potential project involving an upgrade to the existing Lake Hayes outlet culvert. The principal driver behind this investigation is regular feedback form the community around flooding to the walkway at the southern end of the lake. There have been concerns raised that this is as a result of a lack of capacity within the existing culvert and a perception that in the years since 2002, when the current lake outlet culvert was installed, the lake level has been held at approximately 200-300mm above its prior average level.

The culvert is located at the Southern end of Lake Hayes, it consists of a single 1.35m diameter, 28m long corrugated aluminium culvert at a depth varying between approximately 3-4m, passing under State Highway 6 at Route Position 983/5.74 (approximately 1km south of the intersection with Arrowtown-Lake Hayes Road). Records show that this pipe was installed in 2002, as replacement for the previous twin 0.9m diameter corrugated steel pipes. The culvert discharges into Hayes Creek, which then flows into the Kawarau River approximately 1.3km downstream.

The aim of this report is to engage with the key stakeholders identified by ORC to develop an understanding of the key project drivers as well as a review of existing available relevant information. Using this to provide guidance for a scope determination around how to proceed with the potential project and options.

Figure 1: Aerial Photo of Lake Hayes. (Photo credit: Google Images)

We note that there are also a number of other potential projects and initiatives underway around Lake Hayes. These items are independent of this scope of work and have not been considered in detail as part of this exercise, although any further work involving the culvert should consider the impact these might have on any potential preferred solution and consider a holistic view to what is intended to be achieved in the surrounding area.

Other initiatives currently being considered include the following:

- Diversion of Arrow River irrigation water into Lake Hayes.
- Establishment of new wetland areas to the Northern end of Lake Hayes.
- Other options to reduce nutrient runoff or engineer improved water quality within the lake and reduce the potential for algae blooms.

3. Stakeholder Consultation

As part of this investigation we undertook initial consultation meetings with key project stakeholders as identified by the ORC. These included the Friends of Lake Hayes (FOLH) community group, Queenstown Lakes District Council (QLDC), New Zealand Transport Agency (NZTA) the Department of Conservation (DoC) and the Otago Regional Council (ORC).

If this project progresses to the next stage, then other key stakeholders including Iwi and Fish and Game will need to be included in the consultation process.

There are also several existing reports and documents that have been provided to us by the various stakeholders as listed below:

- Lake Hayes Remediation Options Overview Report – Prepared by GHC Consulting Ltd, dated March 2019.
- Lake Hayes Management Strategy – Prepared by ORC and QLDC, dated September 1995.
- Lake Hayes Eutrophication and options for management Technical Report – Prepared by BM Robertson, dated August 1988.
- Lake Hayes Outlet Culvert site visit and meeting notes – Prepared by FOLH, dated 29 November 2019.
- Replacement Culvert Drawings – Prepared by Opus, dated February 2002.
- Resource consents for the replacement culvert dated 24 January 2002.
- Lake Hayes Replacement Culvert Hydraulic design letter – Prepared by Opus, dated 26 November 2001.
- Lake Water quality modelling report – Prepared for ORC by Waikato University, dated April 2019.
- ORC Memorandum in response to a potential large boulder impeding the downstream flow – Prepared by ORC, dated 5 March 2019.

As part of the scoping exercise we have completed a high-level review of these documents and utilised this existing information where appropriate for this engagement.

3.1 Friends of Lake Hayes (FOLH)

We met with representatives from the FOLH group including Mike Hanff on Thursday 16 July 2020. As part of this meeting we undertook a site visit to view the existing culvert and went for a walk to view other key site features around the southern end of Lake Hayes. The key site observations made by Calibre and information and considerations identified by FOLH were as follows:

- Anecdotally the members of FOLH believe that the average lake level is sitting approximately 300-500mm higher than it has done historically, prior to the installation of the new replacement culvert in 2002.
- At the time of our inspection the water level at the outlet culvert was approximately 150mm below the top of the 1350mm diameter pipe.
- The walkway at the southern end of the lake is prone to regular flooding. We did a site walkover to view this section of the walkway. It was noted that a few years ago a flooding event at Lake Hayes caused disruption to the planned Queenstown marathon.
- The impact on the long-term health of the lake is a key consideration for any project proposed at Lake Hayes.
- It was noted that maintaining suitable wetlands at the southern end of the lake is important as they act as a natural buffer to the lake and provide habitat for many important species.
- We completed a site walkover of the section of Hayes Creek immediately downstream of the culvert for approximately 200m. It was noted during our visual inspection that this section of creek appeared to be free flowing and clear of any significant obstructions. It was noted that the Hayes Creek has a very low gradient between the outlet culvert and a waterfall feature close to where it enters the Kawarau River.

3.2 Queenstown Lakes District Council (QLDC)

We met with Ulrich Glasner, Chief Engineer from QLDC on Wednesday 26 August 2020. The key discussion points and considerations identified by QLDC were as follows:

- Confirmed that there are several QLDC services (foul sewer and water) within the carriageway that sit directly above the existing outlet culvert. There are also communications/data cables within the carriageway that are owned by others.
- The walkway around the lake has a large amenity value. The QLDC acknowledged that this walkway seems to be getting flooded more frequently and is supportive of improving the resilience to flooding for this walkway. They noted that one option may be to raise the level of the walkway.
- The QLDC want to see the wetlands maintained and are an important consideration with any future work.
- The QLDC noted that they are currently involved with FOLH looking at a potential wetland at the Northern end of the lake. This project is independent of any potential work associated with the existing outlet culvert.
- QLDC noted that they recommend this potential project takes into consideration all of the influencing factors and other potential initiatives being considered around Lake Hayes, rather than just an assessment of the performance of the outlet culvert in isolation.

3.3 New Zealand Transport Agency (NZTA)

We met with John Jarvis, Senior Network Manager Otago from the NZTA on Friday 24 July 2020. The key discussion points and considerations identified by NZTA were as follows:

- Confirmed that the existing 1.35m diameter culvert is an NZTA asset. New culvert was installed circa 2002 to replace the two old culverts (2 x 0.9m dia.) that were in poor condition and needed to be replaced.
- NZTA provided Calibre with a copy of the most current set of drawings they had on file for the current 1.35m diameter culvert.
- The key NZTA drivers regarding any potential new culvert are as follows:
    - Minimise any disruption to the roadway.
    - Ensure good buildability for any new culvert solution.
    - Ensure a competent contractor with strong traffic management background is engaged to undertake any work.
    - The final solution must have good durability and be low maintenance, there is a preference for a precast concrete box culvert type solution.
    - The final solution must maintain the existing road width and must not introduce any new stopping or access areas in the adjacent area.
- It was noted that Aspiring Highways (a collaboration led by Fulton Hogan) is the existing maintenance contractor for this area. It was recommended by NZTA to contact this team to discuss potential buildability considerations prior to the design work being completed.
- NZTA noted that they had originally proposed a 1.6m diameter replacement culvert but following input from ORC to try and ensure the lake ‘wasn’t drained’ the final culvert was installed at 1.35m dia.

3.4 Department of Conservation (DoC)

We met with Geoff Owen, Operations Manager Queenstown Lakes District from the Department of Conservation on 14 October 2020. The key discussion points and considerations identified by DoC were as follows:

- DoC confirmed that the walkway around the lake is currently maintained by them. They completed some work a few years ago to raise this walkway slightly in the vulnerable area at the Southern end of the lake.
- DoC acknowledged that raising the level of the existing walkway in the vulnerable locations would be an option they would be happy to explore. If this was to be pursued, then a review of the most appropriate way to undertake this work should be completed. It was noted that the existing walkway may have experienced some slumping in locations particularly where it bisects the wetlands at the southern end of the lake and has water transfer occurring through the subbase of the walkway.

- DoC confirmed that the ongoing health and performance of the existing wetland areas was their key indicator. They would want to ensure that any work undertaken with the culvert would not have a negative impact on the existing wetland.

3.5 Otago Regional Council (ORC)

We met with Jean-Luc Payan, Manager Natural Hazards from the ORC to discuss the potential scope of the culvert project and assess the archival information and data currently held by ORC relevant to this scope of work. ORC was able to locate information on the Lake Hayes catchment, lake bathymetry, flow data (both inflow and discharge), limited level data plus reports on the outlet efficiency and lake water quality as listed in 3. The key existing data currently available is as listed below:

- 2016 LiDAR data for Lake Hayes.
- Catchment Boundary Layer with the outlet at the Mill Creek Fish Trap.
- Discharge/stage measurement at the Mill Creek Fish Trap; records from 31 March 1983 till current date. It was noted that we need to be very cautious with this data, particularly around high flows as a noticeable amount of water bypasses the measuring site.
- Lake Hayes Bathymetry collected as part of the 2019 Waikato University report.
- Lake stage level at the North East Corner; records from 29 October 2019 till current date.
- Discharge/stage measurement at Hayes Creek (Lake Hayes Estate); records from 16 October 2018 till current date.

4. Project Scoping

We note that it is outside the scope of this report to make any recommendations as to which organisation/s should lead the project and how any associated costs should be divided.

Preliminary work will need to be undertaken between the relevant parties to establish the appropriate lead agency, asset ownership plan and project funding agreement. These will incur costs for ORC and other parties involved.

4.1 Project Management and Co-ordination

The proposed project will require a significant level of input from many different stakeholders and specialist consultants. As such it is critical that the project is well managed by a suitable person who can co-ordinate all the relevant parties and ensure suitable oversight and project controls are put in place. The key requirements and scope required for this role include the following:

- Understanding the key project drivers for the various stakeholders, maintaining a flexible approach with optioneering and project direction and having an appreciation for how it fits in with the big-picture outcomes. Supporting a business case type approach to reviewing the potential options and evaluating their individual merits and weaknesses to ensure the right solution is implemented.
- Managing the stakeholder engagement process in conjunction with the client's communications team and other relevant groups within the client's organisation.
- Engaging with a suitable consulting partner/s who can deliver the proposed specialist services as outlined in the sections below.
- Working with the consultant team to establish a project delivery plan and programme.
- Project manage the consenting process.
- Project manage the modelling process.
- Managing the project delivery against the project programme and budget.
- Lead and document project team meetings and workshops with key project participants.
- Liaising with the client on a regular basis to engage with key staff members and provide regular project updates and reporting to the client's key project contact.
- Co-ordinating the various investigation and design components to ensure they follow a logical and collaborative process.

- Co-ordinating the risk assessment and management process.
- Supporting the client with the evaluation of options and recommendations to establish a proposed preferred solution to implement.
- Co-ordinate the preparation of the tender documents and support the tender process.
- Support the client with the engagement of a suitable contracting partner.
- Supporting the delivery of the project through the construction phase as required, to support the scope as outlined in section 4.8

4.2 Site Surveying

There is currently a lack of detailed survey information available for the site, particularly in the critical location of Hayes Creek downstream of the culvert to the waterfall upstream of the discharge into the Kawerau River. We have identified this item as one of the key initial scopes of work required to determine if the project is to proceed, as it is required to allow for the other elements to progress. The survey work to Hayes Creek downstream of the culvert is critical to allow for a better understanding of the outflow capacity of the Lake. Based on the limited observations taken on site and the obviously shallow grade of this creek, we would not recommend undertaking any further investigation or design work without better understanding the profile of the downstream creek. Any potential works to the culvert should be looked at in close conjunction with the downstream constraints. If there are critical downstream constraints identified as part of this work, then there may be a requirement to remove these as part of the overall project. This work would be subject to the appropriate consents being granted. Any removal works and consenting would add additional costs to the project.

As part of the project we recommend that the following geographic locations require a detailed survey prior to commencing the modelling and design work:

- Existing outlet culvert and the area adjacent to this culvert.
- The Hayes Creek outlet stream between Lake Hayes and the culvert (upstream of the culvert).
- The Hayes Creek outlet stream downstream of the culvert between the culvert and the waterfall feature approximately 1km downstream.
- The existing walking track located at the south-western end of the lake.

The detailed survey scope is proposed to include the following (read in conjunction with Figures 2 and 3 below):

- The outlet stream from the lake edge to the culvert under SH 6. The survey is proposed to extend 20m either side of the outlet stream. Features to be surveyed include the adjacent boardwalk and the Lake Hayes water level.
- The inverts and diameter of the culvert under SH 6 is to be confirmed.
- Hayes Creek downstream of the culvert. Cross-sections of the outlet stream are required to the point where there is an obvious waterfall approximately 1km downstream of the culvert. It is proposed that cross-sections will be at approximately 50-100m spacings. The cross-sections must be taken in locations where there are obvious restrictions to the flow and any obvious features between these sections will also be surveyed. The length of the stream needs to be walked before starting the survey to determine these locations and ensure they are captured. The cross-sections are to include changes in grade (top of banks, bottom of banks etc.), water level, bed of stream able to be surveyed from bank.
- Any obstructions or additional culverts between the SH 6 culvert and the waterfall need to be surveyed. Including Inverts and diameters where required.

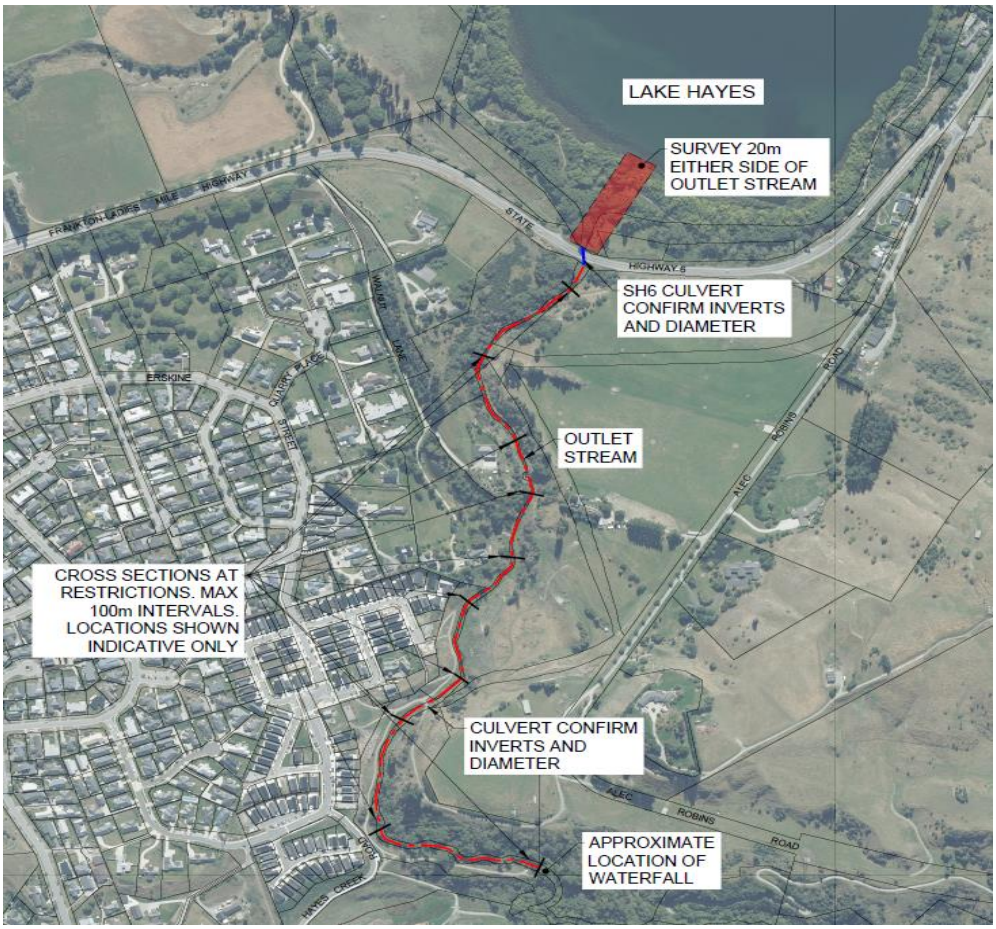


Figure 2: Plan of Proposed Survey Locations (Photo credit: Google Images)

- Install monitoring pegs along the existing walking track located at the south-western end of the lake to confirm current level and check if the existing walking track is subsiding. We note that this includes the section of the track that is most prone to flooding with high lake levels. It is proposed that this will involve the following:
  i. Placing approximately 5 monitoring pegs (use uncarved wooden land transfer pegs with nail in top) at approximately even intervals along at the edge of the section of track indicated in Figure 3.
  ii. Establishing the monitoring control marks on higher ground.
  iii. Placing 2 other reference marks on higher ground.
  iv. Taking the levels using a total station from the control mark placed. This process can then be repeated at future agreed intervals to monitor for any changes if required.

Figure 3: Plan of Proposed Survey Location at South-Western Walkway (Photo credit: Google Images)

All coordinates are to be in terms of GD2000 Mt Nicolas Circuit. The vertical Datum is to be the Otago Metric Datum (Dunedin Vertical Datum 1958 plus 100m). It is recommended that the level survey information is tied into the existing water level indicator and/or electronic lake level recorder.

4.3 Planning and Consenting

Refer to Appendix C for the Lake Hayes culvert consenting scope memorandum prepared by Mitchell Daysh, dated 30 October 2020 and the Waka Kotahi consent review prepared by Mitchell Daysh, dated 17 November 2020.

4.4 Environmental Assessments

The full extent of the Environmental assessment work required will depend on several key factors. At this stage we have based the below scope on the assumption that the works will be confined to the culvert and area immediately adjacent to the culvert, and that any work will not have a significant impact on the potential low water level of the lake. It is proposed that the initial scope will allow for the following items:

- Survey of the existing aquatic value around the culvert and within the area likely to be disturbed.
- Initial report looking at the potential impact of the works on the critical existing wetland areas at the southern end of the lake.

If it is found through the project that there is a risk of a more significant impact to the lake level, then further detailed assessment work would likely be required.

4.5 Hydrological and Hydraulic Modelling

We propose that an initial hydraulic profile of the culvert be established via a simple 1D network model. This will allow the simulation of different flow scenarios with respect to rainfall events and associated Lake levels. The model will require a suitable hydrological analysis to be undertaken to assess inflows into Lake Hayes under different rainfall events. Details for any such modelling will be agreed with ORC. This will include establishing target water levels for Lake Hayes as well as establishing acceptable frequencies for flooding of the existing lake side walkway in the critical locations.

The required information to inform this work will include:

- Relevant survey and as-built data.
- QLDC's Natural Hazard Maps indicate some hydraulic analysis has previously been undertaken for the inflows into Lake Hayes. Any available historical records or information relating to this work will be very helpful.
- Obtain all relevant monitoring data with respect to lake levels and/or upstream/downstream flow.

We also recommend extending the model to include the downstream Hayes Creek to understand the impact this Creek has on the performance of the culvert and the receiving environment.

4.6 Civil, Structural Design and Geotechnical

The civil and structural design will need to be completed in conjunction with the other professional services being undertaken. The final solution will be dependent upon the outcome of the earlier investigation works. The anticipated scope of work required will be as outlined below:

- Site investigations to establish and gather additional information on the key site parameters; including the existing services, geotechnical investigations and surrounding site conditions.
- Concept design - working with the modellers to determine the most appropriate size and level for upgraded culvert. Includes analysis of various options considering potential sensitivity to lake level and impact on downstream creek and infrastructure.
- Review the constructability of the concept design option to identify the best solution for managing the project risks, minimising the disruption to the surrounding infrastructure during construction and providing a long-term durable and low maintenance solution. We recommend that this step involve a suitable Contractor (potentially through formal Early Contractor Involvement (ECI)) to help develop a robust design plan with regards to constructability and put steps in place to manage the project risks.
- Complete the detailed design, drawings and specification documentation. Prepare a schedule of quantities for the physical works to include in the tender document package.
- Complete a design features report and safety in design documentation.
- Provide a PS1 producer statement for the design.

4.7 Tender Documentation and Procurement of Physical works

The scope of work required for this stage of the project will likely include the following:

- Preparation of a procurement plan that complies with the relevant organisations procurement policy.
- Compile the relevant tender documentation and prepare a Request for Tender (RFT) document.
- Assist with the preparation of a draft construction contract.
- Manage the tender process and respond to queries throughout this period.
- Assist the client tender evaluation team and prepare a recommendation report.

4.8 Contract Administration and Construction Monitoring

The contract administration and construction monitoring for the replacement works will involve monitoring the construction stage of the project and ensuring the overall successful delivery of the project in line with the design intent. It will involve taking an active role in project planning, risk management, tracking and management of the overall budget and programme, valuing and managing variation claims, dispute management, stakeholder engagement and communication, liaising with the Principal to provide expert advice. The responsibilities will include:

- Engineer to the Contract and Engineers Representative duties.
- Monitoring Health, Safety and Environmental (HSE) matters, ensuring compliance with the contract documentation and consent requirements.
- Actively monitor the project programme and budget.
- Chair and document regular project meetings with the Contractor.
- Regularly review the project risks and actively participate in proactive risk identification.
- Regular project reporting and updates to the Principal.
- CM3 level construction monitoring services including responding to contractor queries, managing construction quality control and ensuring approvals occur for all quality hold points.
- Facilitate the project start up meeting and the proposed project risk identification and construction methodology workshop.
- Manage and proactively participate in the stakeholder engagement with support from the relevant client personnel.
- Provide a PS4 Producer statement for the completed works.

4.9 Project Communications

Include an allowance for formal project communication. This will likely be led by the lead agency's in-house communications team with support from the project manager and wider project delivery team. This will include regular public updates, stakeholder engagement, consultation meetings and other project related communications.

4.10 Project Close-out

Include an allowance for a formal project close-out process with the following items:

- Defects liability period.
- Asset transfer including allowance for legal input.
- Lessons learnt and project outcomes session.
- Prepare an operations/maintenance plan for the asset and/or incorporate into the appropriate agencies existing schedule.

5. Project Risks

There are many significant risks associated with the potential culvert upgrade project such as environmental, health and safety, economic and reputational. Please refer to Appendix A for a copy of the current project risk register.

6. Concept Options for a Replacement Culvert

The below concept options have been considered from a high-level practicality and constructability perspective only and have not yet been analysed with any modelling or design calculations. The intention of the concept designs is to provide some guidance as to what a potential solution might look like and allow for some high-level cost estimates to be established.

We also note that as highlighted elsewhere in the report, any proposed culvert improvement works need to be considered in conjunction with several other crucial factors that require significant additional investigation work. As such the outcome of those investigations may result in an alternative solution being proposed than those currently listed below.

6.1 Option 1 – Install a New Precast Concrete Culvert to Replace the Existing Culvert

Option 1 allows for the installation of new concrete box culvert approximately 1500mm wide x 1000mm high x 28m long, to replace the existing 1350mm dia. corrugated aluminium culvert on the same alignment. This would allow for an increase in the overall capacity of the outflow culvert when running to full depth with a larger cross-sectional area (1500mm^2 vs the current 1383mm^2). Careful consideration would need to be given to the invert level for the proposed new culvert for the purposes of this option we have allowed for retaining the same invert level as the existing culvert. Due to the size and rectangular shape of the box culvert this would provide greater flow capacity than the current culvert at both lower and higher lake levels. The new box culvert would require a suitable culvert head wall as well as some additional excavation work at the upstream and downstream ends of the culvert to adjust Hayes Creek to suit the increased width of the culvert.

Constructing this option will likely require a significant open cut excavation across State Highway 6. This would likely need to be completed in at least two stages, to ensure a minimum of one lane traffic access was maintained throughout the duration of the construction works. The trench excavation would need to be approximately 4m deep to reach the required invert for the culvert and as such would require significant shoring and temporary works. There are also several existing services running in the road reserve, these will require careful investigation, planning, excavation and protection to prevent damage during the culvert installation works.

We note that excavation across the state highway presents a significant risk to the project and considerable thought would need to be given to the programme, construction methodology and traffic management plan to manage this risk and minimise the duration and impact of the distribution.

Careful consideration will also be required to plan the methodology for how to install the culvert on the same alignment whilst maintaining the flow out of the lake. Temporary works to create a suitable diversion are likely to be required with this option. The risk of a flooding event occurring during construction will need to be considered and suitable mitigation to minimise the impact of such an event established.

Please refer to appendix B for the concept sketches numbered 712282/S01-S02

6.2 Option 2 – Install an Additional New Culvert Adjacent to the Existing Culvert

Option 2 allows for the installation of an additional circular culvert with a diameter of approximately 600-900mm x 28m length, alongside the current 1350mm culvert. This would allow for an increase in overall capacity of the outflow culvert without the need to replace the existing culvert entirely as it still appears to be in a good condition. The additional culvert could be set at such a height above the invert of the existing culvert that it allows for significantly more flow at higher lake levels, whilst ensuring the flow at lower lake levels remained similar to the existing. There are a number of options for the material choice for the proposed new culvert, we have allowed for installing one similar to the existing corrugated aluminium culvert. Additional excavation work and installation of a suitable headwall would also be required at the upstream and downstream ends of the culvert and to adjust Hayes Creek to suit the alignment of the additional culvert.

Constructing this option will likely require an open cut excavation across State Highway 6. This would likely need to be completed in at least two stages, to ensure a minimum of one lane traffic access was maintained throughout the duration of the construction works. The trench excavation would need to be approximately 4m deep to reach the required invert for the culvert and as such would require significant shoring and temporary works. There are also several existing services running in the road reserve, these will require careful investigation, planning, excavation and protection to prevent damage during the culvert installation works.

We note that excavation across the state highway presents a significant risk to the project and considerable thought would need to be given to the programme, construction methodology and traffic management plan to manage this risk and minimise the duration and impact of the disruption.

Please refer to Appendix B for the concept sketches numbered 712282/S03-S04.

Alternatively, depending on the exact ground conditions present and the final diameter of the culvert required, it may be possible to jack a steel culvert under the highway. This would negate the need for a full open cut trench across the highway and as such reduce the disruption to the traffic flow and risks involved with exposing the existing in-road services. However, we note that this option would require further detailed investigations to establish if it was feasible.

6.3 Option 3 – Do Nothing

Option 3 is to do nothing. Given the risks and costs involved with completing any works to the existing culvert it is worth considering this option as part of any future investigations as there may be more cost-effective alternative option/s to resolve the existing issues, rather than to undertake significant works to the current culvert. This may include one or more of the following items below:

- Raising the level of the existing walking track in locations where it is vulnerable to flooding.
- Improving the flow in the downstream section of Hayes Creek through alterations to the existing channel or regular maintenance of the channel to clear any debris.
- Regular maintenance of the upstream creek and culvert entrance to maintain clear flow.

7. Procurement Considerations

There are various options available for procuring both the design and construction elements of the proposed outlet culvert project. Given the complexity and potential uncertainty around project scope and outcome the recommended option is outlined in Section 7.1 below. Some variations to this option are outlined in Section 7.2. Several procurement specific risks, to be considered regardless of the procurement option adopted, have been provided in Section 7.3.

It is recommended that a Procurement Plan be adopted at the relevant stage of the project. The Procurement Plan may identify a different procurement approach to this report based on the scale and risk of the work once there is more clarity around the potential final solution. The Procurement Plan should also be written to align with the relevant organisation's procurement policies.

7.1 Recommended Procurement Option

The recommended procurement option involves engaging a lead consultant to act as the overall project manager for the project. They would then assemble a project delivery team who would undertake all of the proposed investigation and scoped design work. This would involve co-ordinating the various sub-consultants that may be required and engaging with and managing the various stakeholders.

Given the high level of potential risk and uncertainty around the final project scope, we recommend that the initial scope and investigation work be completed in a staged manner with key project milestones established to review the progress at these points. These milestone reviews would involve key decision makers from the relevant organisations leading the project.

Once the design work is completed, a procurement plan and tender package could be prepared, and the work tendered on the open market. A lead Contractor would then be engaged to carry out the physical works.

The advantage of this option is that it provides options for how and when the work might be issued to a consultant and/or contractor. It also provides the client with a single point of contact to co-ordinate all the various elements and clear oversite to the project.

This option provides the greatest flexibility in how and when the work might be procured and delivered.

7.2 Variations to Procurement Options

There are some variations to the above options that should be considered at the time of preparing a full Procurement Plan for this project. These variations include:

- There is an opportunity to incorporate ECI into the procurement process to engage a contractor early. This would help manage the construction risks throughout the design process and potentially provide some efficiencies or cost savings in the construction phase. This would also encourage innovation in the design and construction process.
- There may be an opportunity to consider a design/build type contract. Although, due to the uncertainty around the potential scope and complexity of the design this option would involve a lot of risk and could likely only be considered at a later stage in the project once the all of the initial investigation work was complete and all of the culvert design parameters were clearly established and agreed.

7.3 Procurement Risks

The main procurement risks and potential mitigation measures are presented in Table 3 below. This list is not exhaustive, and it is recommended that it be further developed during the design stage of the project and when considered as part of a Procurement Plan.

Table 1: Procurement Risks

Procurement Risk	Mitigation Measures
Chosen procurement option does not comply with the lead agency procurement policy.	Check policy and ensure that procurement of design and construction services meets requirements. Form a Procurement Plan for the project to assist in guiding procurement throughout the different stages of the project and ensure that the methods used are in keeping with the Lead agency's procurement policy.
High costs of procurement e.g. tender preparation and evaluation time	Ensure supplier selection method is in keeping with the scale and the risk of the project to avoid additional time and cost spent preparing the tender and evaluating responses.
High or non-competitive prices received from tenderers, or low number of responses reducing competitiveness.	Ensure tender is tailored to known capable suppliers to encourage their responses. Ensure supplier selection method is in keeping with the scale and risk of the project to minimise tendering costs for contractors, and ultimately not deter them from bidding for the work.
High risk and complex nature of any potential construction work in this location.	Structure RFT to correctly assess the desired attributes of the tenderers. Set up the contracts with suitable risk allocation measures in place to ensure risk is allocated to the parties best suited to manage that particular risk.

8. Cost Estimates

The below cost estimates have been developed based on the concept designs described in section 6.1 and 6.2. They are intended as a high-level guide to assist the ORC with project planning and high-level decision making only.

Table 2: High-level Cost Estimate

Task	Option 1 - New Precast Concrete Culvert	Option 2 - Additional Steel Culvert Pipe
Preliminary Costs		
Reaching agreement between the relevant stakeholders to establish the appropriate lead agency, asset ownership and project funding agreement	$20,000	$20,000
Professional Fees		
Project Management and Co-ordination	$40,000	$40,000
Site Surveying	$15,000	$15,000
Planning and consenting costs (including consent authority fees)	$74,000	$74,000
Environmental	$15,000	$15,000
Modelling	$25,000	$25,000
Civil, Structural and Geotechnical	$20,000	$20,000
Tender and Procurement support	$10,000	$10,000
Contract administration and Construction Monitoring	$20,000	$20,000
Formal project communication team input	$10,000	$10,000
Project wrap-up, asset transfer, legal costs	$30,000	$30,000
Internal Agency Costs		
Lead agency internal staff costs	$30,000	$30,000
Physical Works		
Construction Estimates	$290,000	$260,000
Construction Contingency (20%)	$58,000	$52,000
Total	**$657,000**	**$621,000**

We note that there may be an opportunity to reduce the costs associated with the planning and consenting phase of the project if the existing Waka Kotahi consents as outlined in Appendix C are appropriate to utilise.

There is also an opportunity to reduce the costs associated with option 2 if it is possible to jack the additional steel culvert under the highway. This would negate the need for a full open cut trench across the highway. However, we note that this option is still subject to further detailed investigations around the existing ground conditions and the size of the pipe required to be installed.

9. Programme

The high-level programme prepared below is intended to provide indicative timeframes around key activities and can be used as a guide to assist with initial project planning. Some of the activities may be able to be undertaken concurrently although this would carry some risk around the potential for rework if unforeseen issues arise. If the project is to proceed to the next stage, then a detailed programme will need to be developed in conjunction with all the key delivery partners and stakeholders. We also recommend that the client also looks to establish key project gateways to assist with decision making and ensure the project scope and projected outcomes can be reviewed on a regular basis.

- Preliminary negotiation and agreement between agencies – 3-4 months
- Procure and engage professional services consultants – 4 weeks
- Initial site investigations, surveying, data processing and geotechnical investigations – 4 weeks
- Modelling and design work – 8 weeks
- Planning and Consenting process – 4-6 months
- Preparing RFT documentation and construction Procurement process – 6 weeks
- Contractor's project planning, mobilisation and construction time – 3-4 months
- Project wrap-up, asset transfer – 3 months

The overall estimated project timeframe is 18 – 24 months.

We note that there are likely to be a number of other potential constraints on the project programme such as issues encountered as the site/project investigations progress, consent conditions around when the physical works may be undertaken, contractor performance, weather events or flood risk and reaching agreement between multiple agencies and stakeholders.

We note that there may be an opportunity to reduce the duration of the planning and consenting phase of the project if the existing Waka Kotahi consents as outlined in Appendix C are appropriate to utilise.

Lake Hayes Culvert Project Scoping Report

Appendix A Appendix Risks Register

Opportunity | Go/NoGO | Proposal | Plan | Meet | Execute | Deliver | Close

Project Risks Register

Project Number:	712282	Project Manager:	Geoff Anderson
Project Name:	Lake Hayes Outlet Culvert - Scoping	Project Director:	Chris Wrathall
Current Date:	27/10/2020	Client:	Otago Regional Council

Send Email to Project Team

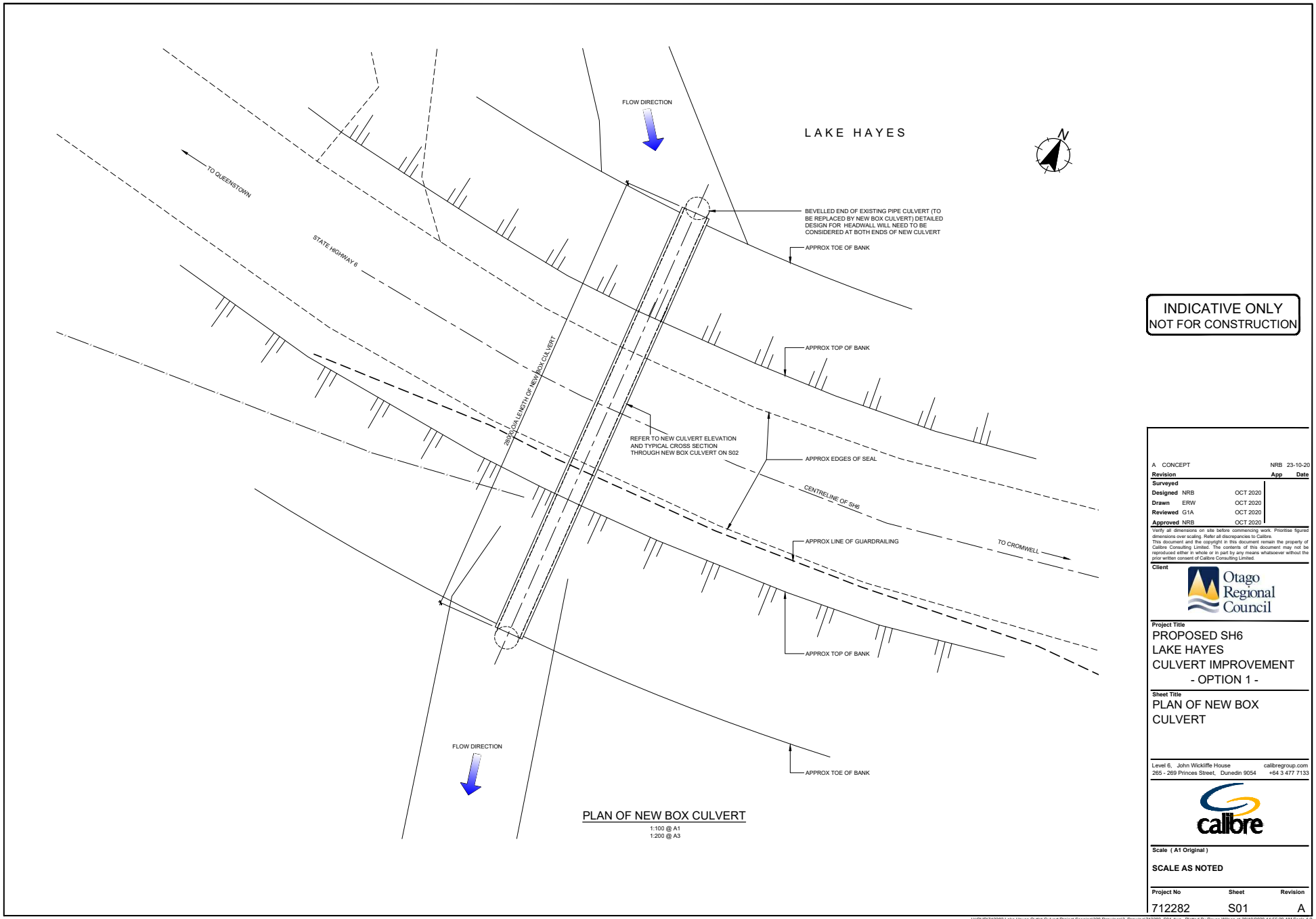
No.	Type	Date	Description	Notes	Risk/Issue/SiD Matrix			Counter measures	Responsibility & Action By	Risks After Controls	Actions Taken to Date	Comments	Status
					Probability	Consequence	Rating						
	Risks identified at initial Scoping Stage of the Project												
1.0	Risk	27/10/2020	Upgraded culvert does not result in any improvement to issues with regards to lake level or lake health	There may be other critical downstream constraints that limit effectiveness	Likely	Major	High	Complete a robust project investigation and design process to avoid proceeding with the project if it will be ineffective	T.B.C.	Med			
2.0	Risk	27/10/2020	Final lake level is too low		Possible	Extreme	High	Complete a robust project investigation and design process to manage this risk	T.B.C.	Med			
3.0	Enviro	27/10/2020	New culvert results in a negative impact on existing lake wetlands		Possible	Extreme	High	Complete a robust project investigation and design process to manage this risk	T.B.C.	Med			
4.0	Risk	27/10/2020	Consenting process	Timeframes, costs and issues gaining agreement from stakeholders	Likely	Moderate	Med	Engage a specialist planner with a strong track record in this type of consenting work. Work closely with all of the impacted parties.	T.B.C.	Low			
5.0	Risk	27/10/2020	Costs	Costs exceeding budget and not providing a cost effective solution	Likely	Major	High	Complete a robust business case analysis of the various options and only proceed with the project if it is the best option and makes economic sense	T.B.C.	Med			
6.0	Risk	27/10/2020	Public Interest/ Reputational risk	Significant public interest and political interest in the project.	Almost Certain	Moderate	Med	The ORC communications team will assist with managing this aspect of the project	T.B.C.	Med			
7.0		27/10/2020	Stakeholder Interest	Significant stakeholder interest in the project with potentially conflicting outcome drivers	Possible	Major	Med	Manage through robust stakeholder engagement throughout the process and a clear business case type outcome that dictates the most appropriate solution	T.B.C.	Low			
8.0	Risk	27/10/2020	Project H&S risks at both design and construction stage		Likely	Extreme	High	Project consultants and contractors develop detailed project specific H&S plans for all elements of the project.	T.B.C.	Med			
9.0	Risk	27/10/2020	Programme	Project not sticking on programme	Likely	Moderate	Med	Develop a robust programme that allows realistic timeframe for the investigation and design stages and has built in contingency	T.B.C.	Low			
10.0	Enviro	27/10/2020	Fish Passage	Requirements to maintain suitable fish passage throughout project works	Almost Certain	Moderate	Med	Engage a suitably experienced consultant and contractor with experience in these requirements and work closely with Fish and Game to utilise there expertise	T.B.C.	Med			
11.0	Risk	27/10/2020	Construction site directly through a State highway	Health and safety risk, economic and reputational impact of traffic delays	Almost Certain	Major	High	Experienced contractor required to undertake the works who understands the local road network and develops a robust traffic management plan in conjunction with NZTA and QLDC.	T.B.C.	Med			
12.0	Risk	27/10/2020	Damage to existing in ground services during construction	A significant number of high value services are located within the road corridor immediately above the location of the existing culvert	Possible	Extreme	High	Work closely with the asset owners and undertake onsite investigations to establish the existing asset locations and prepare robust methodology statements for undertaking any work adjacent to these services. Design a solution and implement a construction methodology that minimises the impact on these services.	T.B.C.	Med			
13.0	Risk	27/10/2020	New culvert causes adverse affects downstream	Additional capacity in culvert results in additional erosion or flooding to the downstream creek	Possible	Major	Med	Complete a robust project investigation and design process to manage this risk	T.B.C.	Med			
14.0	Risk	27/10/2020	Significant impact caused by other external initiatives being considered in the surrounding area.	Such as additional water diversions or wetland projects	Likely	Moderate	Med	Work closely with all stakeholders involved in these intiatives to understand the potential impacts and make suitable allowances for these as part of any investigation and design work.	T.B.C.	Low			

15.0	Risk	27/10/2020	Climate change, local land development and other considerations that may alter the long term flow requirements		Likely	Major	High	Experienced design consultant who can address these risks within the design process.	T.B.C.	Med			
16.0	Risk	27/10/2020	Environmental impacts as a result of the construction works required in the water way	Sediment discharge, damage to the surrounding river habitat etc..	Likely	Major	High	The successful contractor will need to develop a robust environmental management plan in line with the consenting requirements.	T.B.C.	Med			
17.0	Risk	9/11/2020	Site exposure to flood damage during construction		Likely	Major	High	Ensure the contractor develop's a robust flood risk management plan and work closely with relevant weather and flood prediction agencies.	T.B.C.	Med			
18.0	Risk	27/10/2020	Resource consent appeal	Project costs increase and programme delays. This is dependant on if a new consent is required.	Possible	Major	Med	Engage an experienced consultant to manage the consent process and actively engage with all key stakeholders throughout the process	T.B.C.	Low			
	Risks / Issues identified at Project Stage												
17.0													
18.0													
19.0													
20.0													

Likelihood Of Harm	Potential Consequences			
	Minor	Moderate	Major	Extreme
Almost Certain	Low	Med	High	High
Likely	Low	Med	High	High
Possible	Low	Low	Med	High
Unlikely	Low	Low	Med	Med
Rare	Low	Low	Low	Med

Lake Hayes Culvert Project Scoping Report

Appendix B Indicative Concept Drawings



PLAN OF NEW BOX CULVERT

1:100 @ A1
1:200 @ A3

INDICATIVE ONLY
NOT FOR CONSTRUCTION

Revision		App	Date
A CONCEPT		NRB	23-10-20
Surveyed			
Designed	NRB	OCT 2020	
Drawn	ERW	OCT 2020	
Reviewed	G1A	OCT 2020	
Approved	NRB	OCT 2020	

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Client

Otago Regional Council

Project Title

PROPOSED SH6
LAKE HAYES
CULVERT IMPROVEMENT
- OPTION 1 -

Sheet Title

PLAN OF NEW BOX CULVERT

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Project No	Sheet	Revision
712282	S01	A

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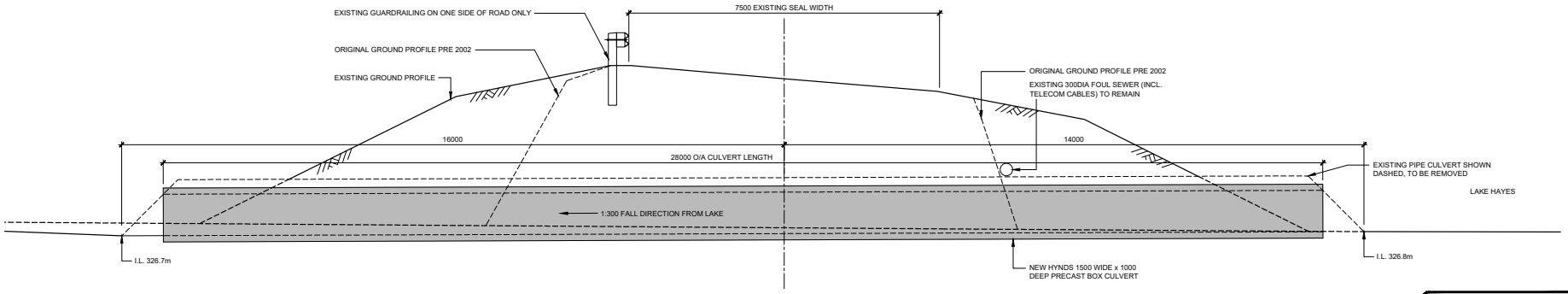

NEW CULVERT ELEVATION - OPTION 1

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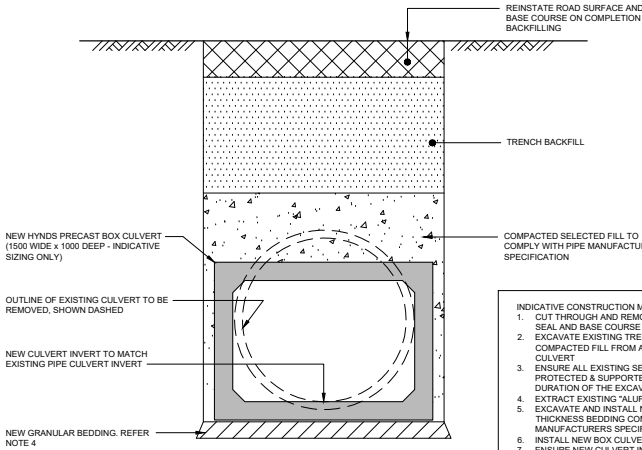
1:100 @ A3

INDICATIVE ONLY
NOT FOR CONSTRUCTION



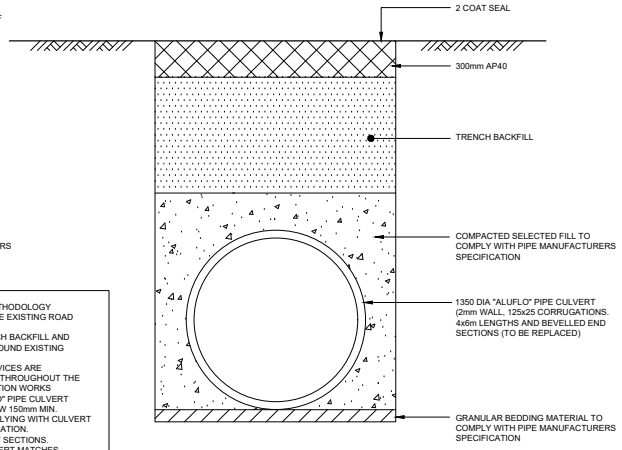
TYPICAL CROSS SECTION
THROUGH NEW BOX CULVERT

1:20 @ A1
1:40 @ A3

INDICATIVE CONSTRUCTION METHODOLOGY

1. CUT THROUGH AND REMOVE EXISTING ROAD SEAL AND BASE COURSE.
2. EXCAVATE EXISTING TRENCH BACKFILL AND COMPACTED FILL FROM AROUND EXISTING CULVERT
3. ENSURE ALL EXISTING SERVICES ARE PROTECTED & SUPPORTED THROUGHOUT THE DURATION OF THE EXCAVATION WORKS
4. EXTRACT EXISTING "ALUFLO" PIPE CULVERT
5. EXCAVATE AND INSTALL NEW 150mm MIN. THICKNESS BEDDING COMPLYING WITH CULVERT MANUFACTURERS SPECIFICATION.
6. INSTALL NEW BOX CULVERT SECTIONS.
7. ENSURE NEW CULVERT INVERT MATCHES EXISTING PIPE CULVERT INVERT
8. RE-INSTALL COMPACTED SELECTED FILL COMPLYING TO CULVERT MANUFACTURERS SPECIFICATION.
9. RE-INSTALL TRENCH BACKFILL AND ROAD BASE COURSE BEFORE REPAIRING ROAD SEAL

NOTE: CONTRACTOR TO ENSURE ALL SAFETY REGULATIONS ARE COMPLIED WITH ESPECIALLY REGARDING SHORING OF THE TRENCHING PROCESS



TYPICAL CROSS SECTION
THROUGH EXISTING PIPE CULVERT

1:20 @ A1
1:40 @ A3

Revision		App	Date
A CONCEPT		NRB	23-10-20
Surveyed			
Designed	NRB	OCT 2020	
Drawn	ERW	OCT 2020	
Reviewed	G1A	OCT 2020	
Approved	NRB	OCT 2020	

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Client

Otago Regional Council

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PROPOSED SH6
LAKE HAYES
CULVERT IMPROVEMENT
- OPTION 1 -

Sheet Title

CULVERT ELEVATION AND TYPICAL CROSS SECTION

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Project No	Sheet	Revision
712282	S02	A

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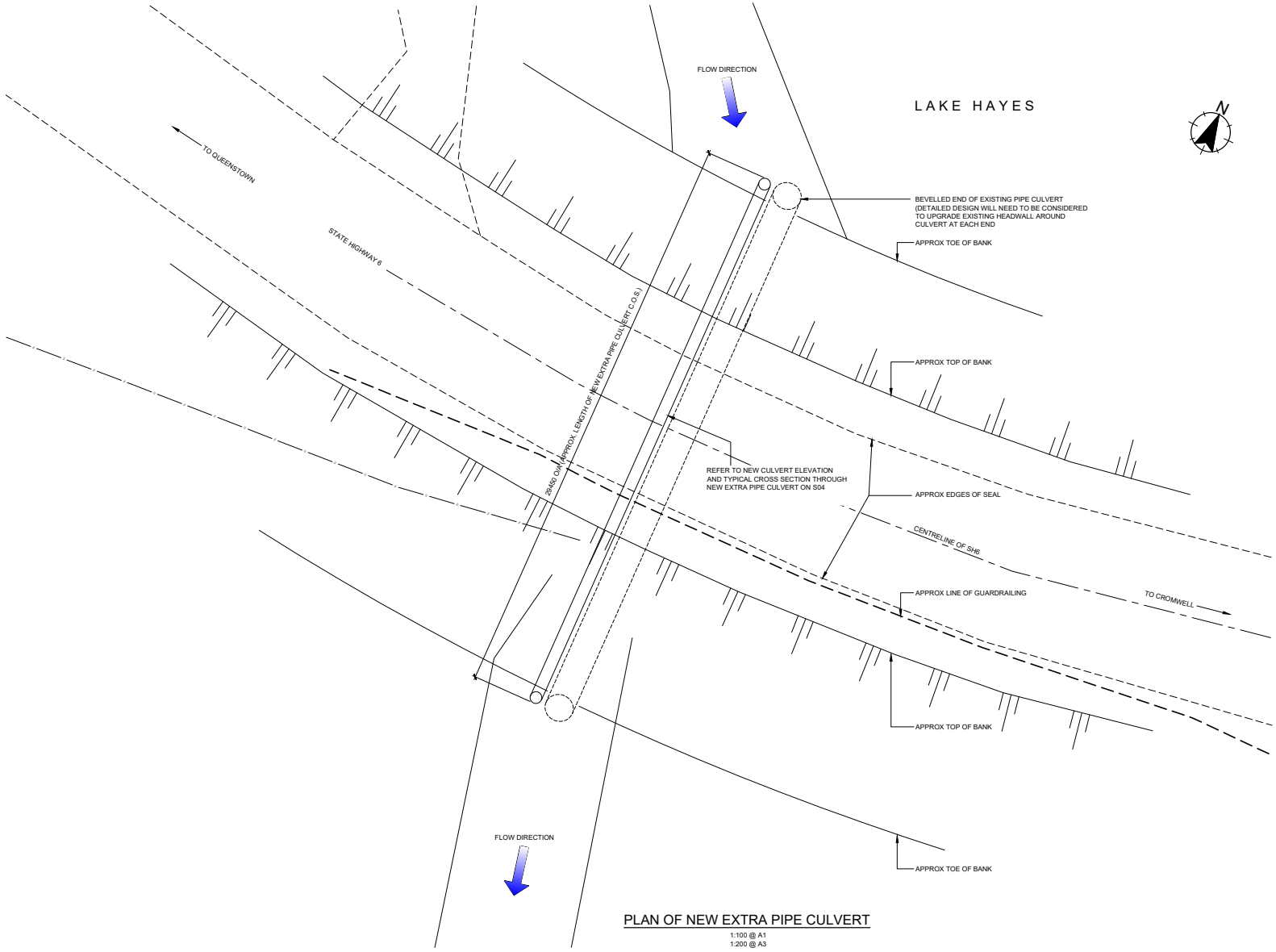

PLAN OF NEW EXTRA PIPE CULVERT

1:100 @ A1
1:200 @ A3

INDICATIVE ONLY
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Revision	App	Date
A CONCEPT	NRB	23-10-20

Surveyed		
Designed	NRB	OCT 2020
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Client

Otago Regional Council

Project Title

PROPOSED SH6
LAKE HAYES
CULVERT IMPROVEMENT
- OPTION 2 -

Sheet Title

PLAN OF NEW EXTRA PIPE CULVERT

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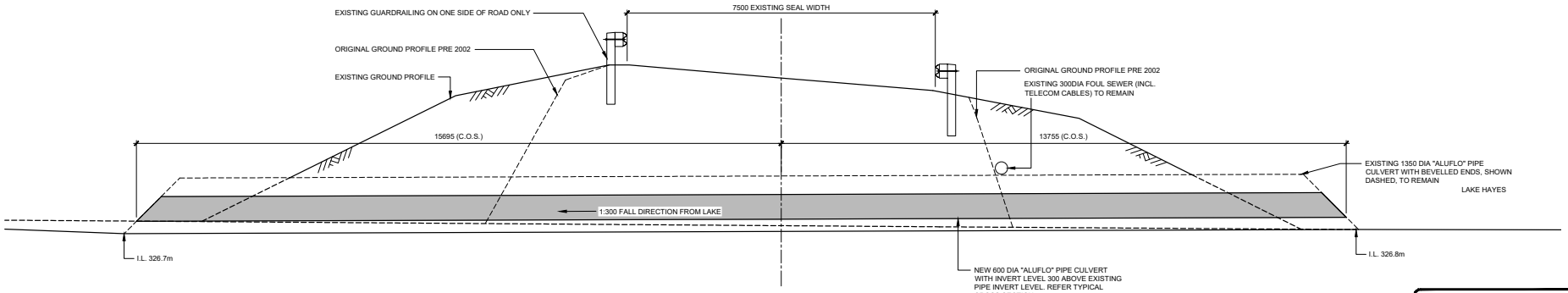
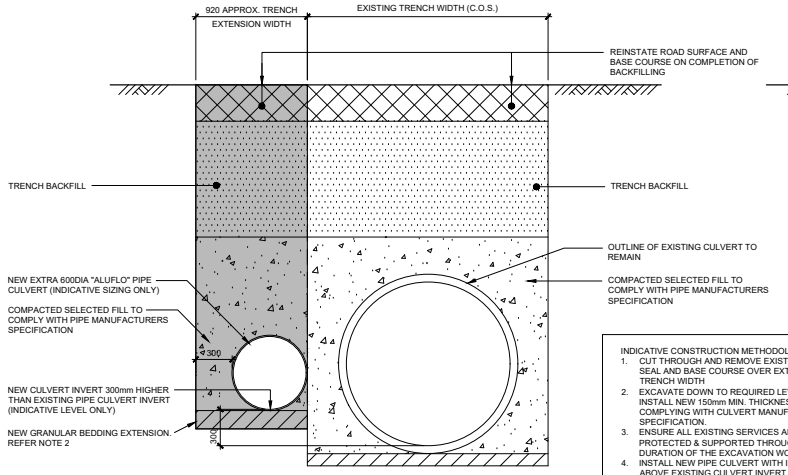


NEW CULVERT ELEVATION - OPTION 1

1:50 @ A1
1:100 @ A3

INDICATIVE ONLY
NOT FOR CONSTRUCTION



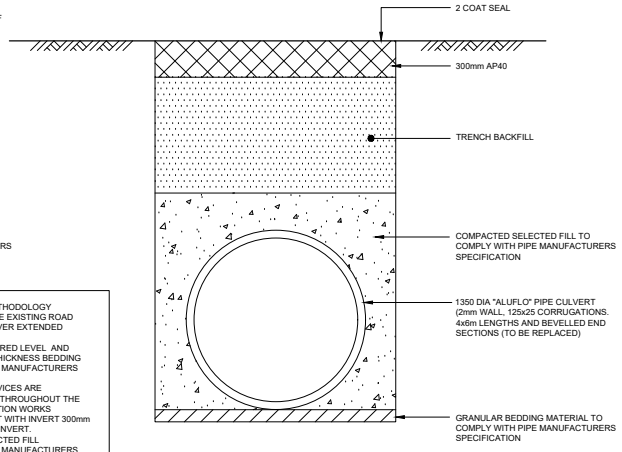
TYPICAL CROSS SECTION
THROUGH NEW BOX CULVERT

1:20 @ A1
1:40 @ A3

INDICATIVE CONSTRUCTION METHODOLOGY

1. CUT THROUGH AND REMOVE EXISTING ROAD SEAL AND BASE COURSE OVER EXTENDED TRENCH WIDTH
2. EXCAVATE DOWN TO REQUIRED LEVEL AND INSTALL NEW 150mm MIN. THICKNESS BEDDING COMPLYING WITH CULVERT MANUFACTURERS SPECIFICATION.
3. ENSURE ALL EXISTING SERVICES ARE PROTECTED & SUPPORTED THROUGHOUT THE DURATION OF THE EXCAVATION WORKS
4. INSTALL NEW PIPE CULVERT WITH INVERT 300mm ABOVE EXISTING CULVERT INVERT.
5. INSTALL COMPACTED SELECTED FILL COMPLYING WITH CULVERT MANUFACTURERS SPECIFICATION.
6. RE-INSTALL TRENCH BACKFILL AND ROAD BASE COURSE BEFORE REPAIRING ROAD SEAL

NOTE: CONTRACTOR TO ENSURE ALL SAFETY REGULATIONS ARE COMPLIED WITH ESPECIALLY REGARDING SHORING OF THE TRENCHING PROCESS



TYPICAL CROSS SECTION
THROUGH EXISTING PIPE CULVERT

1:20 @ A1
1:40 @ A3

Revision		App	Date
A	CONCEPT	NRB	23-10-20

Surveyed		
Designed	NRB	OCT 2020
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Client: Otago Regional Council

Project Title
PROPOSED SH6
LAKE HAYES
CULVERT IMPROVEMENT
- OPTION 2 -

Sheet Title
CULVERT ELEVATION AND TYPICAL CROSS SECTION

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Lake Hayes Culvert Project Scoping Report

Appendix C Mitchell Daysh Consent Scope Memorandums

MITCHELL DAYSH

Memorandum

To: Calibre Consulting Limited

From: Mitchell Daysh Limited

Date: 30 October 2020

Re: Lake Hayes Culvert Replacement – Consent Scoping

INTRODUCTION

You have requested our assessment of consenting issues and costs associated with the replacement of the culvert at the southern end of Lake Hayes by the Otago Regional Council (ORC). We understand that the proposal seeks to enable improved drainage at the southern end of the Lake by enlarging the existing culvert that runs beneath State highway 6, into Hayes Creek, which in turn joins the Kawarau River immediately south of Lake Hayes Estate. Our understanding of the culvert's location is shown within the red circle below. No further detail is available at this time.

CONSENTS REQUIRED

Given that the consents permitting the original works on the culvert have expired, variation of the consents is not possible. Accordingly, a fresh resource consent will be required.

Each of the relevant planning instruments are set out below, and the relevant consent requirements are highlighted.

NATIONAL ENVIRONMENTAL STANDARD FOR FRESHWATER 2020

Resource consent will be required under the National Environmental Standard for Freshwater (NESF). The NESF provides for earthworks and land disturbance within 10 metres of a natural wetland as a permitted activity if it is for the purpose of maintaining and operating infrastructure, provided the work is not for the purpose of increasing the size of the infrastructure. In this instance a larger culvert is proposed, and accordingly the proposed earthworks comprise a restricted discretionary activity pursuant to regulation 47 of the Standard.

Regulation 55 sets out a number of general conditions on natural wetland activities, including conditions relating to water quality and movement, earth stability and drainage, earthworks, land disturbance and vegetation clearance, habitats, historic heritage, the use of machinery, vehicles, equipment and construction materials, and other matters. These factors will drive the information required to support the application.

Part 3, subpart 3 provides specific requirements in respect of fish passage, including information requirements relating to culverts. Regulation 60 identifies that this subpart does not apply to existing structures, including any later alterations or extensions of that structure. It is therefore considered unlikely that this requirement will apply to the proposed culvert replacement. Notwithstanding this, the consent authority may seek to gather additional detail to ensure thorough records are maintained.

The ORC will act as consent authority for this consent for a restricted discretionary activity.

REGIONAL PLAN: WATER FOR OTAGO

The Regional Plan: Water for Otago (the Water Plan) identifies the margins of Lake Hayes as a Regionally Significant Wetland. The southern extent of the wetland includes State highway 6, as shown below.

Damming or diverting water within a Regionally Significant Wetland is a permitted activity where it was lawfully established prior to mid-2011, and where there is no change to the water level range of the wetland. Based on our understanding of the proposal, it is anticipated that water levels within the wetland will be reduced, and accordingly this aspect of the proposal is a non-complying activity.

As the proposed culvert will be larger than the existing culvert, the provisions of Rule 13.3.1.2 will not apply, and accordingly the replacement culvert will be a restricted discretionary activity. The relevant matters of discretion include:

- Adverse effects on natural and human use values for the wetland/Lake, or its natural character, amenity value or heritage value.
- Effects on a Regionally Significant Wetland
- Flow and sediment processes
- Adverse effects on a defence against water or existing public access
- Construction methodology
- Duration of the consent
- Information and monitoring requirements
- Existing lawful activities within the wetland/Lake
- Insurance or means to remedy the effects of failure
- The use of bonds or financial contributions
- Review of consent conditions
- Means to avoid animal waste entering the wetland.

The Plan is also clear that applications under this rule shall not be publicly notified.

Similarly, Rule 13.5.1.1 provides for the disturbance of a Regionally Significant Wetland and the resulting discharge or deposition of material which results from the replacement, reconstruction, demolition or removal of a structure. As the proposed works will result in a change to the water level range and the hydrological function of the wetland, this aspect of the proposal is a restricted discretionary activity. The assessment matters reflect those set out above in respect of Rule 13.3.1.2.

Although not part of the proposal as we understand it, Rules 13.6.2.0 and 13.6.3.1 encourage any planting to be undertaken within a Regionally Significant Wetland to be New Zealand native plants. Should exotic species be used, this aspect of the activity would be a discretionary activity. Similarly, it is appropriate to note that rule 13.7.3.1 identifies that the planting or removal/clearance of plant material from a Regionally Significant Wetland is a discretionary activity.

Overall, this proposal will comprise a non-complying activity under the Water Plan.

QUEENSTOWN LAKES DISTRICT PLAN

Queenstown Lakes District is currently operating under a complex plan framework. Portions of the operative District Plan have some effect, and a staged review of the Plan also has some effect.

Under the operative Queenstown Lakes District Plan (the operative Plan), utilities such as the proposed culvert are a permitted activity.

The proposed Queenstown Lakes District Plan (the proposed Plan) provides for an array of utility activities as permitted activities, and we consider that the proposed culvert is likely to be considered as a permitted activity. Notwithstanding this, we note that the culvert location is immediately adjoined by an outstanding natural feature annotation, to the northern side of the State highway. This has the effect of limiting earthworks within the annotation to $10m^3$. Failure to meet this requirement is a restricted discretionary activity.

Waka Kotahi will be required to provide approval pursuant to section 176 of the Resource Management Act 1991 for any works within the State highway road reserve.

INFORMATION REQUIREMENTS

To support the consent applications, expert assessments from other specialists will be required. We consider that those technical experts set out below should be engaged in respect of the resource consent applications and assessments of environmental effects:

- Ecology (in particular impacts on fish passage)
- Hydrology, in particular detailing the anticipated impacts on water levels within the wetland, and enabling further consideration of any resulting ecological impacts
- Construction methodology (including a traffic management plan)
- Landscape architecture

We have assumed that legal expertise will not be required in respect of this proposal.

Based on our experience in respect of obtaining similar specialist advice to support consent applications, we would recommend allowing up to $35 000 (excluding GST) for these components of the work.

AFFECTED PARTIES

We consider that the following parties will be potentially affected by the proposal. Early engagement with these parties is recommended to ensure a thorough, detailed understanding of any concerns they may hold, thereby enabling a response to be included within the project itself. The affected parties are:

- Department of Conservation
- Fish and Game New Zealand
- Te Ao Marama Incorporated
- Waka Kotahi (NZ Transport Agency)
- The owners and occupiers of any land immediately adjoining the works site, specifically:
    - Walnut Lane, Lot 2 DP 404519 (Flavell Family Trust)

- 64 Alec Robins Road, Pt Sec 28, Blk 9, Shotover SD, Secs 1-2 SO 383440 (Alexander Kenneth Robins, Anderson Lloyd Trustee Co Ltd, Robert Barry Robins)
- Lake Hayes-Arrow Junction Highway, Pt Sec 115, Pt Sec 210R, Blk 3, Shotover SD (Felzar Properties Limited)
- Lake Hayes-Arrow Junction Highway, Lot 1, DP15434, Blk 9, Shotover SD – Easement DP 22904 (Executors of the Estate of Dale Hunter)

We are aware that Te Ao Marama Incorporated operates on a cost recovery model for providing affected party approvals to resource consent applications. Given the very discrete nature of the proposal, we would anticipate these costs to be in the order of $2,000 excluding GST.

COST

In addition to the costs associated with the specialist inputs and affected party approvals identified above, we estimate the planning and resource management costs associated with the consenting the proposed culvert to be as follows:

Work phase	Mitchell Daysh fee (GST excl)
Provide project context and oversight of technical specialist inputs	$8,000
Site visit	$2,000
Consultation (involves preparing and sending a formal request for written approval)	$4,000
Prepare resource consent applications and assessments of environmental effects (one each for the Regional Council and the District Council)	$18,000
Oversight of consenting processes (assuming that notification is not required) and comment on draft conditions of consent	$5,000
Estimated planning and resource management fee	**$37,000**

This estimate excludes disbursements (travel costs, mileage, printing etc) and council fees, and assumes that the proposal does not warrant notification by either relevant consent authority. These costs are estimated for budgeting purposes only. Mitchell Daysh fees will be charged on a time spent basis.

In total therefore, we anticipate the costs of consenting the proposal to be in the region of approximately $74,000 (plus GST and disbursements).

ALTERNATIVE CONSENTING APPROACH

In lieu of this more traditional approach, we consider that there is significant scope to investigate a consenting approach focussed more specifically on both the existing consents and the requiring authority status that are held by Waka Kotahi NZ Transport Agency (Waka Kotahi). In our experience, it is likely that this approach may win some support from Waka Kotahi, as it offers an opportunity to streamline maintenance obligations, with the consent holder retaining responsibility for the ongoing management and maintenance of the replacement culvert.

GLOBAL CONSENT

We understand that Waka Kotahi holds a global consent from the ORC that enables various works supporting the activities required to maintain the State highway network throughout Otago. We have been unable to review that consent and have thus been unable to confirm that the works proposed would fit within the scope of that consent, however it is a reasonable conclusion that replacing a culvert within State highway road reserve is likely to be provided for.

Should the existing consent enable the proposed culvert replacement, with Waka Kotahi's approval it would be possible to rely on that consent to undertake the works. This would avoid the need for regional consents and consent under the NESF.

DISTRICT PLANS

Further, under both District Plans, State highway 6 is designated for State highway purposes. Should Waka Kotahi propose the works we consider that they would likely be viewed by the Queenstown Lakes District Council as giving effect to the designation and accordingly the provisions of the district plans would not apply to the works. In such instances, an outline plan or an application to waive the requirement for outline plan approval could be sought. Depending on the ORC's relationship with Waka Kotahi, this may be an option to pursue.

Should such a partnership not be possible for the work, the provisions of the Plans would apply, as below.

NEXT STEPS

In light of the above, and given the relative cost of preparing consent applications for the work, we consider the most appropriate next steps to include:

- Contact Waka Kotahi and obtain a copy of the global consent held.
- Review the consent conditions that would apply to a culvert replacement, and confirm that they are suitable to enable the works proposed.
- Discuss this approach with Waka Kotahi and confirm their support.
- Prepare and lodge an application for outline plan waiver under Waka Kotahi's name.

MITCHELL DAYSH

Memorandum

To: Calibre Consulting Limited

From: Mitchell Daysh Limited

Date: 17 November 2020

Re: Lake Hayes Culvert Replacement – Waka Kotahi Consent

INTRODUCTION

This memorandum supplements our earlier advice of 30 October 2020, and considers the global consents issued by the Council to Waka Kotahi NZ Transport Agency (Waka Kotahi) in 2012 to enable ongoing maintenance activities for the State highway network. It considers whether the proposed culvert replacement at Lake Hayes could fit within the scope of the authorised works and recommends a number of next steps.

In preparing this advice, we have considered the Waka Kotahi resource consent application, the addendum to the application, the section 42A report prepared on behalf of the Council, and the resource consents granted.

RESOURCE CONSENT APPLICATION

The resource consent application sought authorisation for maintenance activities associated with bridges and culverts throughout Otago, and includes a list of these structures. The application provides a comprehensive summary of the works proposed, details a number of works that are intended to be covered by the consent, and volunteers conditions and mitigation measures intended to address the effects of the proposal. A number of the mitigation measures advanced in the application is set out in Attachment 1.

We have reviewed the documentation and summarise the relevant aspects of the works and mitigation measures for which approval was sought, as follows:

- Extension, alteration or replacement of an existing structure that results in an increase in the scale or change in function of a culvert. Extension and alteration of existing culverts includes widening of the structure to provide for a carriageway of up to 12m wide in line with the Waka Kotahi's current standards, increasing the scale or altering erosion protection structures to improve effectiveness and the installation of safety barriers. Structure replacement includes culverts with a cross sectional area of 3.4m^2 or less. Culvert replacement may include establishing a parallel additional culvert to achieve a double barrelled culvert. Wingwall upgrade and repair will require an excavator, which would usually operate from the adjoining riverbank,

but on occasions it may need to be moved onto the riverbed if the bank is too high. This work can result in a change in scale and generally takes between two days and two weeks to complete.

- Demolition or removal of all or part of an existing culvert where the permitted activity rules are not met, for instance if the culvert is a registered historic place or archaeological site and the maintenance work requires its partial demolition or removal. The Lake Hayes culvert that this advice relates to is not such a structure.
- Alteration of the bed of a river or lake where the duration of the work exceeds 10 hours for completion. This includes clearing debris, alluvium or other material, associated deposition of material, removal of alluvium from the bed and reinstatement of the bank of any river or lake eroded by a flood event. It also includes disturbance associated with the extension, alteration or replacement of an existing structure.
- During culvert extensions, soil, vegetation and gravels may need to be cleared or excavated to expose the end of the culvert. Extensions to culvert length can be undertaken by a rubber ring joint, concrete or by a flexible jointing membrane. Granular fill is used as bedding in and around the extended structure, and ensures the invert is covered. Should scour protection be required, it will be placed rock, wingwalls, gabion baskets or reno mattresses at both the culvert inlet and outlet. Where possible, machinery will operate from the bank or dry bed of the river. These works typically take between half a day and three days.
- Drilling in the bed of a lake or river.
- Placement of structures in the bed of a water body including temporary diversion structures and temporary scaffolding.
- Temporary diversion of a river or lake outside the bed in order to carry out maintenance work where a dry work area is required and diversion within the bed is not practical.
- Discharge of contaminants to water (including stormwater and drainage water) associated with maintenance including extension, alteration or replacement of structures.
- Alteration of a regionally significant wetland associated with the extension, alteration or replacement of structures.
- Removal of plant material from a regionally significant wetland, including when undertaking maintenance activities. Every effort will be made to ensure that disturbance is limited (or minimised) to the extent necessary to remove the vegetation.
- Diversion from or within a regionally significant wetland, which may necessitate pumping of water.

The original application also sought to include gravel extraction, however that component of the application was withdrawn prior to the hearing of the application.

The application identifies that culvert replacement will follow the general methodology summarised below and set out in Attachment 1:

- Diversion established – when the water body is single channel, the diversion will need to be outside the riverbed.
- Existing structure(s) removed.
- Base prepared by excavating to a solid base.
- Placing and compacting suitable bedding material .
- Install new culvert.
- For wetlands, the replacement culvert inlet level to be placed no lower that the existing inlet invert level.
- Backfill placed around culvert and compacted.
- Rock scour protection or timer and driven rail or post protection or concrete wingwalls placed as required at tile culvert inlet and/or outlets.
- Remove diversion, reinstate road surface.

The application identifies that this work typically takes between one day and three weeks.

In addition to the broad activity description and methodology outlined above, the application also proposes the following mitigation measures outlined below:

- Work to be done in accordance with the NZ Electricity Code of Practice for Electrical Safe Distances (NZEP 34:2001) to minimise the likelihood of adversely affecting the transmission network and to recognise the NPS on Electricity Transmission.
- Works will be carried out in a way that will not alter the water level or hydrological function of wetlands.
- The potential for runoff of sediment laden water from work sites will be minimised, fish passage shall be maintained and bed disturbance minimised.
- Consultation with the Department of Conservation will be a fundamental component of this application in terms of identifying potential effects of the proposed activities on areas of high conservation value. Notification provisions are designed to minimise the potential for adversely affecting iwi values.

Finally, the application also volunteered a comprehensive suite of consent conditions. In general terms, the conditions of consent applicable to the proposed activities replicate those volunteered, and accordingly further analysis of the volunteered conditions is not considered necessary.

APPROVED CONSENTS

The relevant approved resource consents[1], including the full suite of conditions, are attached as Attachment 2. The consents and conditions are summarised below:

Resource consent	Description and conditions
Land use consent RM11.209.01	To: › Place, replace, alter, extend, reconstruct, demolish and remove structures that are fixed in, on, under or over the bed, including the associated disturbance and deposition of materials. › Clear debris or redistribute alluvium from within, or immediately surrounding, and structure in order to safeguard the function or structural integrity of the structure. › Drill the beds of various watercourses. For the purpose of maintaining state highway bridges, culverts and other structures.
Summary of relevant conditions:	› Carriageway width should not exceed 12 metres in width. › Works should not occur in the wet bed if the timing or location would adversely affect fish spawning or sensitive bird nesting or roosting. › Riffles, runs and pools altered or removed shall be reinstated. › Works shall not cause obstruction to any waterway or reduce the hydraulic capacity of any culvert. › Works shall not impede fish passage unless consultation with the Department of Conservation indicates that it is necessary for the protection of indigenous or threatened fish species. › Photographic records to be maintained and provided to the consent authority. › 20 working days notification of the works shall be provided to the Environmental Engineering and Natural Hazards Unit and the Environmental Services Unit of the Consent Authority, the Department of Conservation, the Otago Fish and Game Council, the New Zealand Historic Places Trust, and the relevant iwi. Specific detail is required. › An annual report is required to be provided to the Consent Authority of works undertaken in accordance with the consent. › Disturbance and duration of the works should be minimised, damage reinstated, and the site left tidy. Vehicles should operate outside of the wet bed as far as practicable.

[1] Consents RM11.209.03, RM11.209.04, RM11.209.05, and RM11.209.06 are coastal permits, and RM11.209.09 is a permit for discharge to air. These permits are not directly relevant to the proposed replacement culvert and have accordingly not been considered further within the context of this advice.

	▸ Works should not cause flooding, erosion, scouring, land instability or property damage. ▸ Hours of work shall be from 7am until 7pm Monday to Saturday. ▸ Conditions relating to discovery of koiwi tangata, Maori artefacts and any feature or archaeological material.
Discharge consent RM11.209.02	To discharge contaminants to water throughout the Otago region for the purpose of maintaining state highway bridges, culverts and other structures.
Summary of relevant conditions:	▸ All practicable steps to be taken to minimise the release of sediment into water. ▸ All practicable steps to be taken to prevent cement and cement products from entering water due to its high toxicity to fish. ▸ No lawful water take should be affected by the discharge. ▸ The discharge should not significantly adversely affect aquatic life.
Land use consent RM11.209.07	To remove plant material from Regionally Significant Wetlands throughout the Otago Region for the purpose of maintaining state highway bridges, culverts and other structures.
Summary of relevant conditions:	▸ 20 working days notification of the works shall be provided to the Environmental Engineering and Natural Hazards Unit and the Environmental Services Unit of the Consent Authority, the Department of Conservation, the Otago Fish and Game Council, the New Zealand Historic Places Trust, and the relevant iwi. Specific detail is required. ▸ Sites where wetland plants have been removed are to be replanted with native species propagated from local seed sources within one month of completing the works.
Water permit RM11.209.08	To temporarily divert the flow of a waterbody, water from or within any Regionally Significant Wetland, or water that affected the water level of any Regionally Significant Wetland for the purpose of maintaining state highway bridged, culverts and other structures.
Summary of relevant conditions:	▸ Water is not to be diverted into any other watercourse or onto land where it will enter another watercourse. ▸ Diversion may only occur when the diversion channel has been fully excavated, placed or constructed. ▸ Diversion may only remain in place for the duration of the works. ▸ Stranded fish to be removed and replaced in flowing water downstream of the diversion. ▸ Photographic records to be maintained and provided to the consent authority.

	▸ No lawful water take should be affected by the discharge. ▸ Works should not cause flooding, erosion, scouring, land instability or property damage.
Land use consent RM11.209.10	To place, replace, alter, extend, reconstruct, demolish and remove structures within a Regionally Significant Wetland and to disturb and deposit any substance within a Regionally Significant Wetland throughout the Otago region for the purpose of maintaining state highway bridged, culverts and other structures.
Summary of relevant conditions:	▸ Carriageway width should not exceed 12 metres in width. ▸ Works should not cause obstruction to any Regionally Significant Wetland or reduce the hydraulic capacity of any culvert. ▸ Works should not impede fish passage unless consultation with the Department of Conservation indicates that it is necessary for the protection of indigenous or threatened fish species. ▸ Photographic records to be maintained and provided to the consent authority. ▸ 20 working days notification of the works shall be provided to the Environmental Engineering and Natural Hazards Unit and the Environmental Services Unit of the Consent Authority, the Department of Conservation, the Otago Fish and Game Council, the New Zealand Historic Places Trust, and the relevant iwi. Specific detail is required. ▸ An annual report is required to be provided to the Consent Authority of works undertaken in accordance with the consent. ▸ Duration of the works should be minimised, and vehicles should operate outside of the wet bed as far as practicable. The site should be left tidy. ▸ Works should not cause flooding, erosion, scouring, land instability or property damage. ▸ Hours of work shall be from 7am until 7pm Monday to Saturday. ▸ Conditions relating to discovery of koiwi tangata, Maori artefacts and any feature or archaeological material.

All consents include standard review conditions.

In our view, none of these conditions are unusual, and could reasonably be expected to be imposed on any application of this nature. Indeed, the consultation and notification conditions are similar to those imposed on the Council's own global consents for river management and stream training. From a planning perspective they therefore represent a considered response to the variety of works proposed, however it will also be necessary to confirm that the methodology proposed for the replacement culvert at Lake Hayes can be appropriately aligned with the methodology advance by the Waka Kotahi consent application.

RECOMMENDATION AND NEXT STEPS

On the basis of our review of the Waka Kotahi consents, we consider that the Waka Kotahi consent could be relied upon to enable the proposed culvert replacement. To facilitate this, we recommend the following steps are followed:

- Calibre confirms that the methodology for the works can meet the conditions of consent set out in Attachment 2, and summarised above.
- Assuming that the conditions are acceptable, an indicative project schedule is prepared that can be used to demonstrate to Waka Kotahi how the consent conditions can be met (including the notification provisions applicable).
- The Council will then need to approach Waka Kotahi with a request to rely on the provisions of the existing consent for the replacement of the Lake Hayes culvert. Some discussion regarding financial responsibility for the works will also be required; both parties should consider entering into a formal agreement to facilitate this.

Given our conclusion in respect of this matter, it will also be appropriate to discuss the Council's ability to rely on the existing State highway designation for District Council approvals. This would enable an application to be made to the Queenstown Lakes District Council either for an outline plan or for the waiver of the outline plan requirement. While the application will need to be lodged by Waka Kotahi due to it holding financial responsibility for the works, we are aware that preparation of outline plan waivers by third parties for approval by and lodgement on behalf of Waka Kotahi is not unusual, and would recommend early engagement with Waka Kotahi in this regard.

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ATTACHMENT 1 – EXCERPTS FROM RESOURCE CONSENT APPLICATION

2.6 Removal of Aggraded Alluvium

From time to time removal of aggraded alluvium from the bed of some rivers may be required in order to restore the waterway area under bridges or culverts or avoid road structure scour. As flow disturbances three meanders upstream of a bridge or culvert can affect alignment at the bridge or culvert site, removal of aggraded alluvium may extend three meanders upstream and downstream of the structure and in most cases this will be within 100m of the structure. Removal of aggraded alluvium will be limited to that required for maintenance of the structure. The alluvium will be removed by machinery operating from the bank of the river or the dry bed where possible and the bed smoothed on completion.

Depending on the extent of the aggradation, the work will take in the order of half a day to two weeks to complete.

2.7 Clearance of Vegetation or Trees

During maintenance activities, it may be necessary to remove vegetation, trees and their root beds. The root beds and branches in particular can pose an obstacle to works and restrict flow.

Every effort will be made to ensure that the extent of disturbance to the bed of the affected watercourse or to the wetland is limited to the extent necessary to remove this vegetation.

2.8 Wingwall Upgrade and Repairs

The wingwalls of some older structures are built of timber with rail pile supports. Repair is sometimes necessary as a result of timber decay, poor support or scour underneath and behind the existing wingwall.

The repair requires the removal of the existing wingwall including the fill behind the wall. The new wall, typically precast concrete, is put in place and supports, generally railway irons, are driven at appropriate spacing. Granular backfill is then placed behind the new wall and compacted. If a new timber wall is being used then it is usually pre−assembled off site. In some instances it may be beneficial to construct new concrete wing walls on site. This requires preparation of the stream or river bank, construction of wooden boxing and pouring of concrete. The boxing will be removed once the concrete is cured.

Other wingwalls constructed of concrete or batter protection structures comprising stacked rock (rip−rap) will typically require repairs to cracks in the concrete and repositioning of rocks, especially after flood events.

This work typically requires the use of an excavator operating from the adjoining riverbank, although on occasions, the excavator may need to be rnoved onto the riverbed if the riverbank is very high.

The nature of this work involves erosion protection which typically involves minor extensions of wingwall and headwall structures which results in a change in scale of the existing structure.

This work generally takes between two days to two weeks.

2.13 Culvert Replacement

From time to time culverts may need to be replaced due to reduced structural integrity or because changes to the catchment over time mean that the culvert size is no longer sufficient. Alternatively a parallel additional culvert is added to achieve a double barrelled culvert.

During the replacement of a culvert in instances where water is continually flowing, it is necessary to divert/pump the watercourse around the work site. Where the river is in a single channel, this diversion will need to be outside the bed of the river. Once the river is diverted, the existing structure will be removed and the base prepared by excavating material to a solid base, placing and compacting suitable bedding material and installing the new culvert. The inverts of new culverts are generally placed about 100mm below the existing bed level to minimise the risk of scour and provide for fish passage, except where consultation has indicated that fish passage is not desired. Where the culvert is located at the outlet to a significant wetland or where wetland is located on both sides of the road, the replacement culvert inlet level will be placed no lower than the existing inlet invert level. Backfill is then placed around the culvert and appropriately compacted. Rock scour protection or timber and driven rail or post protection or concrete wingwalls are placed, as required, at tile culvert inlet and/or outlets. The final road surface is then reinstated.

This work takes a minimum of a day but may take in the order of two or three weeks.

2.14 Bridge Widening and Culvert Extension

Narrow or single lane bridges and culverts may no longer comply with the NZTA's design standards and wilt be widened or extended over time. Additional width may be required to provide for pedestrians or cyclists, to provide an additional or wider traffic lane to adequately provide for the volume of traffic on the road or to improve the alignment of the road, in order to improve road safety. This widening or extension will result in an increase in the scale or function of the structure and will generally provide for a carriageway width of 12m.

Generally the existing bank and riverbed are excavated down to a solid base where the new bridge abutment or extension is to be constructed. Piles wilt typically be boxed and poured insitu, are driven into the riverbed and bank with either a hydraulic hammer on an excavator or a drop hammer on a crane or are drilled with a drilling rig. Concrete placement needs to be undertaken in a dry situation. Once fully cured, the formwork is stripped and fill is then placed around the structures by excavator bucket and compacted.

Normally machinery will work from the bank, although in certain situations, especially where the banks are high, or where work is required on the piers, machinery may need to work from the riverbed, necessitating a cut in the riverbank for access. This work may require a diversion to isolate the work sites situated within or adjacent to the flow channel.

Typically this will take in the order of two to six weeks for smaller scale bridges and longer for larger scale bridges.

During culvert extensions, soils and vegetation will be cleared from around the end of the existing culvert and if necessary the gravels in the affected waterway or wetland will be excavated to expose the end of the culvert.

The extended section will be connected to the existing structure by a variety of methods depending on the culvert design and situation. The connection may be effected by way of a rubber ring joint, concrete, or with the application of a flexible jointing membrane. If the joint mechanism is concrete or a flexible jointing membrane, they are placed on the outside of the pipe spigot before connection.

Once the connection is secured, granular fill will be placed as bedding in and around the extended structure to protect it from scour and ensure that the culvert invert is covered. Scour protection such as placed rock, wing walls or structures such as gabion baskets or reno mattresses may be placed at the inlet and outlet of the culvert.

Where possible, machinery will operate from the bank or dry bed of the river however this may not always be practical, particularly where the banks are high.

This work takes a minimum of half a day but may take in the order of two or three days.

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ATTACHMENT 2 – RELEVANT RESOURCE CONSENTS

Our Reference: A378917 Consent No. RM11.209.01

LAND USE CONSENT

Pursuant to Section 104B and 104C of the Resource Management Act 1991, the Otago Regional Council grants consent to:

Name: NZ Transport Agency

Address: Level 2, AA Building, 450 Moray Place, Dunedin

To place, replace, alter, extend, reconstruct, demolish and remove structures that are fixed in, on, under or over the bed including the associated disturbance and deposition of materials; and

to clear debris or redistribute alluvium from within, or immediately surrounding, any structure in order to safeguard the function or structural integrity of the structure; and

to drill the bed of various watercourses

for the purpose of maintaining state highway bridges, culverts and other structures.

For a term expiring 22 February 2032

Location of consent activities: Various watercourses, crossing the state highway network throughout the Otago Region

Legal description of consent locations: Various, (as above) the state highway network throughout the Otago Region

Conditions

Specific

1. The works authorised by this consent shall be undertaken as described in the application for consent received by the Consent Authority on 29 July 2011. If there are any inconsistencies between the application and this consent, the conditions of this consent shall prevail.
2. This consent shall not lapse under Section 125 of the Resource Management Act 1991 until this consent expires.
3. The carriageway width of any bridge or culvert shall not exceed 12 metres in width as a result of widening.

4. Works shall not be undertaken in the wet bed of any watercourse if the timing or location would adversely affect fish spawning or sensitive bird nesting or roosting unless it is reactive maintenance (defined as necessary repairs to the structure such as replacing decayed structural timbers or damage to the foundations critical to the safety and function of the structure). The presence of such factors shall be identified by Schedule 1 of the Regional Plan: Water for Otago and by the notification process required by Condition 14 of this consent.
5. The clearance of alluvium for the purpose of redistribution shall be limited in extent to three meanders upstream and downstream of a legal structure and shall be for the purpose of minimising/preventing adverse effects to legal structures only.
6. (a) Any pits or holes formed during gravel clearance activities shall be filled in with gravel within two days of their formation.
   (b) On completion of each gravel clearance event, the consent holder shall ensure that the areas disturbed are contoured to a natural bed form, consistent with the adjacent bed areas.
7. No vegetation or storm debris or alluvium that has been removed in accordance with this consent or structures that have been demolished or removed in accordance with this consent shall be placed in the bed of the river where they:
   (a) divert, alter or constrain the flow of water from its natural course; or
   (b) block any navigable channel; or
   (c) obstruct or interfere with the free flow of flood waters in any flood; or
   (d) cause any significant adverse effect on aquatic life.
8. Erosion protection structures constructed and placed in the bed of a watercourse shall be no greater than 100 metres in length upstream and downstream of a bridge or culvert or 100 metres along a road.
9. The consent holder shall ensure that riffles, runs and pools are reinstated where works in the watercourse alter or remove these features.
10. Works undertaken on any bridge, culvert or erosion protection structure shall not cause obstruction to any waterway or reduce the hydraulic capacity of any bridge or culvert.
11. The works authorised by this consent shall not impede fish passage unless consultation between the consent holder and the Department of Conservation indicates that it is necessary for the protection of indigenous or threatened fish species. The consent holder shall notify the Consent Authority with sites where fish passage will be impeded prior to the works commencing.

Performance Monitoring

12. (a) Where works are undertaken on the Pomahaka River, Taieri River, Makarora River, Manuherikia River, Kawarau River, Waipahi River, Shag River and Clutha River/Mata-Au consideration shall be given by the consent holder to maintaining or enhancing angler access, where practicable.

    (b) The consent holder shall provide a report to the Consent Authority prior to undertaking works on these rivers that shows the consideration given to maintaining or enhancing angler access and details of works to be undertaken to maintain or enhance angler access, where applicable.

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13. The consent holder shall take colour photographs, no smaller than 200 x 150 millimetres, of all sites where work will/has been undertaken pursuant to this consent, which shall be accompanied by a description of the location of each site and the date the photographs were taken, as follows:
(a) No more than 20 working days prior to the start of works; and
(b) Following the completion of works and rehabilitation of the site.
The photographs taken under (a) and (b) above shall be forwarded to the Consent Authority within one month of the final photographs being taken.

14. (a) The consent holder shall notify the Environmental Engineering and Natural Hazards Unit and the Environmental Services Unit of the Consent Authority, the Department of Conservation, the Otago Fish and Game Council, the New Zealand Historic Places Trust, and the relevant iwi (through Kai Tahu ki Otago or Te Ao Marama) of works proposed to be undertaken not less than 20 working days prior to its commencement, unless it is reactive maintenance (defined as necessary repairs to the structure such as replacing decayed structural timbers or damage to the foundations critical to the safety and function of the structure) where not less than 10 working days notification shall be given prior to its commencement, or unless the work is being undertaken in accordance with the emergency provisions of Section 330 of the Resource Management Act 1991. Notification shall include the provision of a work programme, which shall include, but not be limited to, the following:
(i) The name of the affected waterbody or waterbodies.
(ii) The specific locations of the proposed works including New Zealand Transverse Mercator map reference.
(iii) A map identifying the location of each of the proposed works and location of any structures or sites which are listed in Schedule 1C of the Regional Plan: Water for Otago, or are registered with the New Zealand Historic Places Trust, or are nominated for registration with the New Zealand Historic Places Trust within 100 metres of the proposed work site.
(iv) An archaeological assessment prepared by an approved archaeologist for any sites identified in (iii) which are likely to be affected.
(v) Identification of any works within or 100 metres from a Regionally Significant Wetland, a Management Area identified in Schedule 2 and/or Cross Boundary Area identified in Schedule 3 of the Regional Plan: Coast for Otago and/or a community public water supply identified in Schedule 1B of the Regional Plan: Water for Otago.
(vi) Identification of any works within 1 kilometre upstream or downstream of an Otago Regional Council water level recorder.
(vii) A description of the activity, the methods to be used (including whether cement is to be used), approximate timing and duration of works and information on any diversion of the watercourse.
(viii) For vegetation removal only, the area and vegetation to be cleared and measures to avoid, remedy or mitigate effects on bed and bank erosion and on water levels.
(ix) For upgrading or repairing existing wing walls and placing, repairing or extending erosion protection structures only, design plans or comments outlining how the structures are fixed and any measures to avoid, remedy or mitigate effects on bed and bank erosion and the flood hazard.
(x) For placing or repairing bridge foundations only, design plans and measures to avoid, remedy or mitigate effects on the flood hazard.
(xi) For temporary diversions that will be in place for more than seven days, design

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plans of the diversion structures, an estimation of the diversion capacity and its adequacy to convey high flows and comments outlining how the temporary diversion structures will be fixed.
(xii) Methods proposed to avoid, remedy or mitigate any adverse effects of the works on indigenous aquatic values and water quality at each site.
(xiii) Any specific site control and mitigation measures to protect riparian flora, and the need for replanting to be completed by the consent holder.

15. The consent holder shall maintain a current list of the sections of road that comprise the state highway network and the bridges and culverts on the network and shall provide this to the Consent Authority on request.

16. The consent holder shall prepare and submit to the Consent Authority by 30 June each year a report that summarises works undertaken in accordance with this consent between 1 May of the previous year and 30 April. The report shall also summarise compliance with this consent and RM11.209.02, RM11.209.07 and RM11.209.08.

General

17. (a) Work shall be undertaken with the minimum time required in the wet bed of the watercourse and with the minimum necessary bed disturbance.
(b) Damage to riparian vegetation or riverbanks shall be minimised when exercising this consent.
(c) Any damage of the riverbank or riparian system shall be reinstated to a quality and natural profile at least equivalent to that prior to the works commencing within one month of completion of the works.
(d) Vehicles and machinery shall, as far as practicable, operate outside the wet bed of rivers.
(e) At the completion of the works authorised by this consent, the consent holder shall ensure that all plant, equipment, chemicals, fencing, signage, debris, rubbish and any other material brought on site is removed from the site. The site shall be tidied to a degree at least equivalent to that prior to the works commencing.

18. The consent holder shall ensure that once completed the works authorised by this consent do not cause any flooding, erosion, scouring, land instability or property damage.

19. All machinery and equipment that has been in watercourses shall be water blasted and treated with suitable chemicals or agents prior to being brought on site and following completion of the works, to reduce the potential for pest species being introduced to or taken from the watercourses, such as didymo. At no time during the exercise of this consent shall machinery be washed within the bed of a watercourse.

20. Except for reactive works (defined as necessary repairs to the structure such as replacing decayed structural timbers or damage to the foundations critical to the safety and function of the structure) hours of work under this consent shall be from 7.00 am to 7.00 pm, Monday to Saturday and shall not be undertaken on public holidays.

21. All works shall comply with the New Zealand Electrical Code of Practice for Electrical Safe Distances 34:2001 and the Electricity (Hazard from Trees) Regulations 2003.

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22. If the consent holder:
(a) Discovers koiwi tangata (human skeletal remains), or Maori artefact material, the consent holder shall without delay:
(i) Notify the Consent Authority, Tangata whenua and New Zealand Historic Places Trust and in the case of skeletal remains, the New Zealand Police.
(ii) Stop work within the immediate vicinity of the discovery to allow a site inspection by the New Zealand Historic Places Trust and the appropriate runanga and their advisors, who shall determine whether the discovery is likely to be extensive; if a thorough site investigation is required and whether an Archaeological Authority is required.
(iii) Any koiwi tangata discovered shall be handled and removed by tribal elders responsible for the tikanga (custom) appropriate to its removal or preservation. Site work shall recommence following consultation with the Consent Authority, the New Zealand Historic Places Trust, Tangata whenua, and in the case of skeletal remains, the NZ Police, provided that any relevant statutory permissions have been obtained.

(b) Discovers any feature or archaeological material that predates 1900, or heritage material, or disturbs a previously unidentified archaeological or heritage site (including Maori, European/Pakeha or Chinese origin), the consent holder shall without delay:
(i) Stop work within the immediate vicinity of the discovery or disturbance; and
(ii) Advise the New Zealand Historic Places Trust, and in the case of Maori features or materials, the Tangata whenua, and if required, shall make an application for an Archaeological Authority pursuant to the Historic Places Act 1993; and
(iii) Arrange for a suitably qualified archaeologist to undertake a survey of the site. Site work shall recommence following consultation with the Consent Authority.

Review

23. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
(a) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or
(b) ensuring the conditions of this consent are consistent with any National Environmental Standards, Regulations, relevant plans and/or the Otago Regional Policy Statement; or
(c) requiring the consent holder to adopt the best practicable option, in order to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

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Notes to Consent Holder

1. *The consent holder shall comply with all notices and guidelines issued by Biosecurity New Zealand, in relation to avoiding spreading the pest organism Didymosphenia geminata known as "Didymo" (refer to www.biosecurity.govt.nz/didymo).*
2. *This consent does not confer any right of access over any land. Any arrangements necessary for access are the responsibility of the consent holder.*
3. *During the exercise of this consent, the consent holder should ensure that fuel storage tanks and machinery working and stored in the construction area are maintained at all times to prevent leakage of oil and other contaminants into the watercourse. No refuelling of machinery should occur within the watercourse. In the event of contamination, the consent holder should undertake remedial action and notify the Consent Authority within 5 working days.*
4. *The consent holder should ensure that any contractors engaged to undertake work authorised by this consent abide by the conditions of this consent. A copy of this consent should be present on site at all times while the work is being undertaken.*
5. *The consent holder should notify the Department of Conservation, the Otago Fish and Game Council, the New Zealand Historic Places Trust, and the relevant iwi (through Kai Tahu ki Otago or Te Ao Marama) of work undertaken in accordance with Section 330 of the Resource Management Act 1991 within 7 working days of completing the works. This notification is for information purposes.*

Issued at Dunedin this 22nd day of February 2012
Reissued at Dunedin this 14th day of March 2012 to correct reference from condition 16 to 14 in condition 4

Julene Ludlow
Manager Resource Management Administration

Our Reference: A378917 Consent No. RM11.209.02

DISCHARGE PERMIT

Pursuant to Section 104B of the Resource Management Act 1991, the Otago Regional Council grants consent to:

Name: NZ Transport Agency

Address: Level 2, AA Building, 450 Moray Place, Dunedin

To discharge contaminants to water throughout the Otago region

for the purpose of maintaining state highway bridges, culverts and other structures

For a term expiring 22 February 2032

Location of consent activity: Various watercourses, crossing the state highway network throughout the Otago Region

Legal description of consent location: Various, (as above) the state highway network throughout the Otago Region

Conditions

Specific

1. The discharges authorised by this consent shall be undertaken as described in the application for consent received by the Consent Authority on 29 July 2011. If there are any inconsistencies between the application and this consent, the conditions of this consent shall prevail.
2. This consent shall not lapse under Section 125 of the Resource Management Act 1991 until this consent expires.
3. This consent authorises the discharge of silt and sediment resulting from instream works, debris from cleaning of structures and cement from structure construction to be discharged into watercourses, subject to the terms and conditions of this consent.
4. The consent holder shall take all practicable steps to minimise the release of sediment into water while disturbing the bed of the watercourse including, but not limited to:
   (a) undertaking works during low flows;
   (b) constructing and operating temporary diversions; and
   (c) operating machinery from the river bank, where possible.
5. The consent holder shall ensure that all practical measures are taken to prevent cement and cement products, from entering flowing water due to its high

toxicity to fish. This shall include, but not be limited to:
(a) avoiding flowing water come into contact with the concrete until the concrete is firmly set.
(b) using boxing or other similar devices to contain wet cement during construction of the structure.
(c) ensuring that the handling of cement is undertaken in a manner that does not result in spillage into any watercourse.
(d) if any concrete is spilled beyond the boxing, pouring of concrete shall stop immediately and all concrete shall be removed from the watercourse.
(e) no equipment used in the pouring of concrete shall be washed out on site.

Performance Monitoring

6. The consent holder shall notify the Waitaki District Council (Water Unit) prior to exercising this consent on the Kakanui River or Shag River, and any surface water takers within 100 metres of the proposed works at least 10 working days prior to commencing the work, unless the work is being undertaken in accordance with the emergency provisions of Section 330 of the Resource Management Act 1991. The following shall be made available at notification:
(a) The specific location of the proposed works including New Zealand Transverse Mercator map reference;
(b) A description of the activity, the methods to be used (including whether cement is to be used), approximate timing and duration of works and information on any diversion of the watercourse; and
(c) Methods proposed to avoid, remedy or mitigate any adverse effects of the works on water quality.

General

7. No lawful take of water shall be adversely affected as a result of any discharge authorised by this consent.

8. The consent holder shall ensure that the discharge does not give rise to any significant adverse effect on aquatic life.

Review

9. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
(a) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or
(b) ensuring the conditions of this consent are consistent with any National Environmental Standards, Regulations, relevant plans and/or the Otago Regional Policy Statement; or

(c) requiring the consent holder to adopt the best practicable option, in order to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

Issued at Dunedin this 22nd day of February 2012

Christopher P. Shaw
Manager Consents

Our Reference: A378917 Consent No. RM11.209.07

LAND USE CONSENT

Pursuant to Section 104B of the Resource Management Act 1991, the Otago Regional Council grants consent to:

Name: NZ Transport Agency

Address: Level 2, AA Building, 450 Moray Place, Dunedin

To remove plant material from Regionally Significant Wetlands throughout the Otago region

for the purpose of maintaining state highway bridges, culverts and other structures

For a term expiring 22 February 2032

Location of consent activity: Various, state highway network throughout the Otago Region

Legal description of consent location: Various, state highway network throughout the Otago Region

Conditions

Specific

1. The works authorised by this consent shall be undertaken as described in the application for consent received by the Consent Authority on 29 July 2011. If there are any inconsistencies between the application and this consent, the conditions of this consent shall prevail.
2. This consent shall not lapse under Section 125 of the Resource Management Act 1991 until it expires.

Performance Monitoring

3. The consent holder shall notify the Environmental Engineering and Natural Hazards Unit and the Environmental Services Unit of the Consent Authority, the Department of Conservation, and the relevant iwi (through Kai Tahu ki Otago or Te Ao Marama) of work proposed to be undertaken in accordance with this consent not less than 20 working days prior to its commencement, unless it is reactive maintenance (defined as necessary repairs to the structure such as replacing decayed structural timbers or damage to the foundations critical to the safety and function of the structure) where not less than 10 working days notification shall be given prior to its commencement, unless its being undertaken in accordance with the emergency provisions of Section 330 of the Resource Management Act 1991, in which case the provisions of the

Resource Management Act shall apply. The following must be available in the forward work programme supplied:
(a) The name of the Regionally Significant Wetland.
(b) The specific location of the proposed vegetation removal including New Zealand Transverse Mercator map reference.
(c) Identification of the plant species to be removed, the methods to be used, and approximate timing and duration of works.
(d) Methods proposed to avoid, remedy or mitigate any adverse effects of the works on wetland values; and replanting to be completed by the consent holder.

4. The consent holder shall replant those sites where wetland plants have been removed in accordance with this consent with native species propagated from local seed sources within one month of completing the works.

Review

5. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
(a) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or
(b) ensuring the conditions of this consent are consistent with any National Environmental Standards or Regulations; or
(c) requiring the consent holder to adopt the best practicable option, in order to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

Issued at Dunedin this 22nd day of February 2012

Christopher P. Shaw
Manager Consents

Our Reference: A378917 Consent No. RM11.209.08

WATER PERMIT

Pursuant to Section 104B and 104D of the Resource Management Act 1991, the Otago Regional Council grants consent to:

Name: NZ Transport Agency

Address: Level 2, AA Building, 450 Moray Place, Dunedin

To temporarily divert the flow of a waterbody, water from or within any Regionally Significant Wetland, or water that affects the water level of any Regionally Significant Wetland

for the purpose of the maintaining state highway bridges, culverts and other structures throughout the Otago region

For a term expiring 22 February 2032

Location of consent activity: Various, state highway network throughout the Otago Region

Legal description of consent location: Various, state highway network throughout the Otago Region

Conditions

Specific

1. The diversions shall be undertaken as described in the application for consent received by the Consent Authority on 29 July 2011. If there are any inconsistencies between the application and this consent, the conditions of this consent shall prevail.
2. This consent shall not lapse under Section 125 of the Resource Management Act 1991 until it expires.
3. Water shall not be diverted into any other watercourse or onto land where it will enter another watercourse.
4. The diversion of water shall only occur once the diversion channel has been fully excavated, placed or constructed.
5. The diversion shall only remain in place while the works permitted by Land Use Consent RM11.209.01 are being undertaken. On completion of the works, the diversion shall cease and the site shall be returned to its natural state.
6. The consent holder shall slowly dewater and/or divert the works area and shall ensure that no fish become stranded. Stranded fish shall be removed and

replaced in flowing water downstream of the diversion.

Performance Monitoring

7. The consent holder shall take colour photographs, no smaller than 200 x 150 millimetres, of the sites, which shall be accompanied by the date the photographs were taken, as follows:
(a) before the diversions commence;
(b) during the diversion; and
(c) after the diversion has ceased and rehabilitation of the site,
These photographs shall be provided to the Consent Authority within one month of the final photographs being taken.

8. The consent holder shall notify the Waitaki District Council (Water Unit) prior to exercising this consent on the Kakanui River or Shag River and any surface water takers within 100 metres of the proposed works at least 10 working days prior to commencing the work, unless the work is being undertaken in accordance with the emergency provisions of Section 330 of the Resource Management Act 1991. The following shall be made available at notification:
(a) The specific location of the proposed works including New Zealand Transverse Mercator map reference;
(b) A description of the activity, the methods to be used (including whether cement is to be used), approximate timing and duration of works and information on any diversion of the watercourse; and
(c) Methods proposed to avoid, remedy or mitigate any adverse effects of the works on water quality.

General

9. No lawful take of water shall be adversely affected as a result of the diversion.

10. The consent holder shall ensure the diversion does not cause any flooding, erosion, scouring, land instability or damage of any other person's property.

Review

11. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
(a) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or
(b) ensuring the conditions of this consent are consistent with any National Environmental Standards or Regulations; or
(c) requiring the consent holder to adopt the best practicable option, in order to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

Note to Consent Holder

1. *The consent holder shall ensure that any contractors engaged to undertake work authorised by this consent abide by the conditions of this consent. A copy of this consent shall be present on site at all times while the work is being undertaken.*

Issued at Dunedin this 22nd day of February 2012

Christopher P. Shaw
Manager Consents

Our Reference: A378917 Consent No. RM11.209.10

LAND USE CONSENT

Pursuant to Section 104B and 104C of the Resource Management Act 1991, the Otago Regional Council grants consent to:

Name: NZ Transport Agency

Address: Level 2, AA Building, 450 Moray Place, Dunedin

To place, replace, alter, extend, reconstruct, demolish and remove structures within a Regionally Significant Wetland and to disturb and deposit any substance within a Regionally Significant Wetland throughout the Otago region

for the purpose of maintaining state highway bridges, culverts and other structures.

For a term expiring 22 February 2032

Location of consent activities: Various, state highway network throughout the Otago Region

Legal description of consent locations: Various, state highway network throughout the Otago Region

Conditions

Specific

1. The works authorised by this consent shall be undertaken as described in the application for consent received by the Consent Authority on 29 July 2011. If there are any inconsistencies between the application and this consent, the conditions of this consent shall prevail.
2. This consent shall not lapse under Section 125 of the Resource Management Act 1991.
3. The carriageway width of any bridge or culvert shall not exceed 12 metres in width as a result of widening.
4. Works undertaken on any bridge, culvert or erosion protection structure shall not cause obstruction to any Regionally Significant Wetland or reduce the hydraulic capacity of any bridge or culvert.
5. The works authorised by this consent shall not impede fish passage unless consultation between the consent holder and the Department of Conservation indicates that it is necessary for the protection of indigenous or threatened fish species. The consent holder shall notify the Consent Authority with sites where

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fish passage will be impeded prior to the works commencing.

Performance Monitoring

6. The consent holder shall take colour photographs, no smaller than 200 x 150 millimetres, of all sites, which shall be accompanied by a description of the location of each site and the date the photographs were taken, as follows:
(a) No more than 20 working days prior to the start of works; and
(b) Following the completion of works and rehabilitation of the site.
The photographs taken under (a) and (b) above shall be forwarded to the Consent Authority within one month of the final photographs being taken.

7. (a) The consent holder shall notify the Environmental Engineering and Natural Hazards Unit and Environmental Services Unit of the Consent Authority, the Department of Conservation, the Otago Fish and Game Council, the New Zealand Historic Places Trust, and the relevant iwi (through Kai Tahu ki Otago or Te Ao Marama) of works proposed to be undertaken not less than 20 working days prior to its commencement, unless it is reactive maintenance (defined as necessary repairs to the structure such as replacing decayed structural timbers or damage to the foundations critical to the safety and function of the structure) where not less than 10 working days notification shall be given prior to its commencement, or unless the work is being undertaken in accordance with the emergency provisions of Section 330 of the Resource Management Act 1991. Notification shall include the provision of a work programme, which shall include, but not be limited to, the following:
(i) The name of the affected Regionally Significant Wetland and/or waterbody and/or portion of coastal marine area(s).
(ii) The specific locations of the proposed works including New Zealand Transverse Mercator map reference.
(iii) A map identifying the location of each of the proposed works and location of any structures or sites which are listed in Schedule 1C of the Regional Plan: Water for Otago, or are registered with the New Zealand Historic Places Trust, or are nominated for registration with the New Zealand Historic Places Trust within 100 metres of the proposed work site.
(iv) An archaeological assessment prepared by an approved archaeologist for any sites identified in (iii) which are likely to be affected.
(v) Identification of any works within or 100 metres from a Management Area identified in Schedule 2 and/or Cross Boundary Area identified in Schedule 3 of the Regional Plan: Coast for Otago and/or a community public water supply identified in Schedule 1B of the Regional Plan: Water for Otago.
(vi) Identification of any works within 1 kilometre of an Otago Regional Council water level recorder.
(vii) A description of the activity, the methods to be used (including whether cement is to be used), approximate timing and duration of works and information on any diversion of a watercourse.
(viii) For temporary diversions that will be in place for more than seven days, design plans of the diversion structures, an estimation of the diversion capacity and its adequacy to convey high flows and comments outlining how the temporary diversion structures will be fixed.
(ix) Methods proposed to avoid, remedy or mitigate any adverse effects of the works on any Regionally Significant Wetland or on any regionally significant wetland value.

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8. The consent holder shall prepare and submit to the Consent Authority by 30 June each year a report that summarises works undertaken in accordance with this consent between 1 May of the previous year and 30 April. The report shall also summarise compliance with this consent.

General

9. (a) Work shall be undertaken with the minimum time required in the Regionally Significant Wetland and with minimum disturbance.
(b) Vehicles and machinery shall, as far as practicable, operate outside the Regionally Significant Wetland.
(c) At the completion of the works authorised by this consent, the consent holder shall ensure that all plant, equipment, chemicals, fencing, signage, debris, rubbish and any other material brought on site is removed from the site. The site shall be tidied to a degree at least equivalent to that prior to the works commencing.

10. The consent holder shall ensure that once completed the works authorised by this consent do not cause any flooding, erosion, scouring, land instability or property damage.

11. All machinery and equipment that has been in watercourses shall be water blasted and treated with suitable chemicals or agents prior to being brought on site and following completion of the works, to reduce the potential for pest species being introduced to or taken from the Regionally Significant Wetland.

12. Except for reactive works (defined as necessary repairs to the structure such as replacing decayed structural timbers or damage to the foundations critical to the safety and function of the structure) hours of work under this consent shall be from 7.00 am to 7.00 pm, Monday to Saturday and shall not be undertaken on public holidays.

13. All works shall comply with the New Zealand Electrical Code of Practice for Electrical Safe Distances 34:2001 and the Electricity (Hazard from Trees) Regulations 2003.

14. If the consent holder:
(a) Discovers koiwi tangata (human skeletal remains), or Maori artefact material, the consent holder shall without delay:
(i) Notify the Consent Authority, Tangata whenua and New Zealand Historic Places Trust and in the case of skeletal remains, the New Zealand Police.
(ii) Stop work within the immediate vicinity of the discovery to allow a site inspection by the New Zealand Historic Places Trust and the appropriate runanga and their advisors, who shall determine whether the discovery is likely to be extensive; if a thorough site investigation is required and whether an Archaeological Authority is required.
(iii) Any koiwi tangata discovered shall be handled and removed by tribal elders responsible for the tikanga (custom) appropriate to its removal or preservation. Site work shall recommence following consultation with the Consent Authority, the New Zealand Historic Places Trust, Tangata whenua, and in the case of skeletal remains, the NZ Police, provided that any relevant statutory permissions have been obtained.

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(b) Discovers any feature or archaeological material that predates 1900, or heritage material, or disturbs a previously unidentified archaeological or heritage site (including Maori, European/Pakeha or Chinese origin), the consent holder shall without delay:
(i) Stop work within the immediate vicinity of the discovery or disturbance; and
(ii) Advise the New Zealand Historic Places Trust, and in the case of Maori features or materials, the Tangata whenua, and if required, shall make an application for an Archaeological Authority pursuant to the Historic Places Act 1993; and
(iii) Arrange for a suitably qualified archaeologist to undertake a survey of the site.
Site work shall recommence following consultation with the Consent Authority.

Review

15. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
(a) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or
(b) ensuring the conditions of this consent are consistent with any National Environmental Standards or Regulations; or
(c) requiring the consent holder to adopt the best practicable option, in order to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

Notes to Consent Holder

1. *This consent does not confer any right of access over any land. Any arrangements necessary for access are the responsibility of the consent holder.*
2. *During the exercise of this consent, the consent holder should ensure that fuel storage tanks and machinery working and stored in the construction area are maintained at all times to prevent leakage of oil and other contaminants into the Regionally Significant Wetland. No refuelling of machinery should occur within the Regionally Significant Wetland. In the event of contamination, the consent holder should undertake remedial action and notify the Consent Authority within 5 working days.*
3. *The consent holder should ensure that any contractors engaged to undertake work authorised by this consent abide by the conditions of this consent. A copy of this consent should be present on site at all times while the work is being undertaken.*

4. *The consent holder should notify the Department of Conservation, the Otago Fish and Game Council, the New Zealand Historic Places Trust, and the relevant iwi (through Kai Tahu ki Otago or Te Ao Marama) of work undertaken in accordance with Section 330 of the Resource Management Act 1991 within 7 working days of completing the works. This notification is for information purposes.*

Issued at Dunedin this 22nd day of February 2012

Christopher P. Shaw
Manager Consents

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