Ashburton District Council

AGENDA

Notice of Meeting:

A meeting of the Ashburton District Council will be held on:

Date: **Wednesday 15 May 2024**

Time: **1.00pm**

Venue: **Hine Paaka Council Chamber**
Te Whare Whakatere, 2 Baring Square East, Ashburton

Membership

Mayor	Neil Brown
Deputy Mayor	Liz McMillan
Members	Leen Braam
	Carolyn Cameron
	Russell Ellis
	Phill Hooper
	Lynette Lovett
	Rob Mackle
	Tony Todd
	Richard Wilson

Meeting Timetable

Time	Item
1.00pm	Council meeting commences
2.00pm	Nicki Malone (Xyst) via MS Teams
2.30pm	Waitaha Primary Health – David Matthews

1 Apologies

- Cr Lynette Lovett

2 Extraordinary Business

3 Declarations of Interest

Members are reminded of the need to be vigilant and to stand aside from decision making when a conflict arises between their role as an elected representative and any private or other external interest they might have.

Minutes

Reports

Business Transacted with the Public Excluded

4. Council Minutes – 1 May 2024

Minutes of the Council meeting held on Wednesday 1 May 2024, commencing at 1pm in the Hine Paaka Council Chamber, Te Whare Whakatere, 2 Baring Square East, Ashburton.

Present

His Worship the Mayor, Neil Brown; Deputy Mayor Liz McMillan and Councillors Carolyn Cameron, Russell Ellis, Phill Hooper, Tony Todd and Richard Wilson.

In attendance

Hamish Riach (Chief Executive), Toni Durham (GM Democracy & Engagement), Jane Donaldson (GM Strategy & Compliance), Leanne Macdonald (GM Business Support), Shirin Khosraviani (Acting GM People & Facilities) and Phillipa Clark (Governance Team Leader).

Staff present for the duration of their reports: Ian Soper (Open Spaces Manager), Bert Hofmans (Open Spaces Planner), Mark Low (Strategy & Policy Manager), Richard Mabon (Senior Policy Advisor), Erin Register (Finance Manager) and Ian Hyde (Planning Manager).

1 Apologies

Crs Leen Braam, Lynette Lovett and Rob Mackle — Sustained

2 Extraordinary Business

Nil.

3 Declarations of Interest

Nil.

Presentations

- Transwaste Canterbury – 2.10pm-3pm
- Ashburton Contracting Ltd – 3.55pm-4.40pm

4 Confirmation of Minutes – 17/04/24

That the minutes of the Council meeting held on 17 April 2024, be taken as read and confirmed.

McMillan/Wilson — Carried

5 Community Roading Reference Group – 15/04/24

That Council receives the minutes of the Community Roading Reference Group meeting held on Monday 15 April 2024.

Cameron/Todd — Carried

- **Terms of Reference**

That Council adopts the Community Roading Reference Group Terms of Reference.

Cameron/Todd — Carried

6 Ashburton Bike Skills Park Concept Plan

Walter van der Kley, spokesperson for the Bike Skills Park Working Group, was welcomed to the meeting and invited to introduce other Group members.

The Bike Skills Park Group are seeking Council's support for the concept plan before they progress the project further. A fundraising sub-committee has been set up. Once funding is in place the Group plan to go through an open tender process to select a contractor.

That Council approves the concept plan for a Bike Skills Park on the Ashburton Domain.

McMillan/Cameron Carried

7 Canterbury Climate Partnership Plan - Actions

1. **That** Council provides the feedback under paragraphs a) to j) below and advises the Mayoral Forum Secretariat of its support for the draft Actions as presented:

   a) Councillors noted the risk of unintended consequences generally, and specifically in relation to Action 2. Councillors asked how decision-makers would manage the risks of unintended consequences from decisions.

   b) In regard to Action 2 and the creation of carbon inventories, Officers noted that previous efforts to collaborate on the development of Council-only carbon inventories appeared to have foundered over a failure to agree a common methodology. Councillors asked for confirmation of the outcomes of those previous efforts and how this risk would be managed for a Canterbury-wide inventory.

   c) In relation to Action 2 and the CCPP generally, Councillors noted no mention of genetically-engineered organisms as a potential technology to reduce emissions (e.g. growing a GE clover which results in a lower methane impact). Likewise it made no mention of low-emissions alternatives to support existing and future renewable energy generation.

   d) In relation to Action 2 and the economic impacts of transition to a low-emissions future, Councillors noted the importance of continued economic growth to funding that future and maintaining affordability for consumers and residents.

   e) There are risks to the local economy due to its heavy reliance on agricultural production and how the profitability of that production might be affected through climate change mitigation efforts. Concern was also expressed that those efforts will lead to emissions leakage to countries with higher emission production.

   f) It was pointed out that leading thinkers believe that lowering emissions from agriculture will be necessary if NZ farming is to retain its position as the most efficient farmers in the world. Other international producers are closing the GHG gap on New Zealand production and are on track to surpass NZ if we do not continue to improve.

   g) In relation to Action 3, Councillors noted that effective adaptation planning is a multi-faceted issue involving river management, town planning and infrastructure investments, to name but three elements. A similar point was made in relation to Action 4 as nature-based solutions touches on biodiversity, open spaces, urban design and district planning – amongst other activities.

   h) In relation to Action 4.2a, Councillors supported the action proposed.

i) In relation to action 5, Councillors are supportive of measures to support community understanding with effective communication tools. Councillors observed that the *"It's Time, Canterbury"* initiative has not enjoyed the profile or impact they had expected it would. Councillors asked for more information on how and what would be required to develop *"It's Time, Canterbury"* into a comprehensive resource hub.

j) In relation to Action 7, Officers noted that NZ Transport Agency is changing its procedures to ensure better accounting for greenhouse gas emissions in roading procurement.

Ellis/Cameron Carried

8 Amalgamation of Drinking Water Reserves

That Council amalgamates the eleven drinking water reserves into one Group Water Supply Reserve to be used only for the drinking water activity.

Cameron/Todd Carried

9 Dog Control Fees 2024-25

1. **That** Council adopts the dog registration and control fees and charges for 2024/25 as set out in Appendix 1.
2. **That** the dog registration and control fees and charges for 2024/25 are publicly notified.

Todd/Ellis Carried

10 Road Naming – McKain Future Investments Ltd (Stage 3)

That the private right-of-way to be developed as part of Stage 3 of subdivision SUB22/0015 within the subdivision known as McKain Future Investments, located at Trevors Road, be named Temple Lane.

McMillan/Ellis Carried

11 Road Naming – West Town Belt Developments

That the road to vest in Council as part of Subdivision SUB23/0034 within the subdivision known as West Town Belt Developments, located on West Town Belt in Rakaia, be named Kay Way.

Todd/Cameron Carried

12 Financial Variance Report

Officers will report back with an explanation on the footpath activity over-spend.

That Council receives the March 2024 financial variance report.

Cameron/Wilson Carried

13 Mayor's Report

That the Mayor's report be received.

Mayor/McMillan Carried

Transwaste Canterbury – 2.10pm

Gil Cox (Chair), Hayden Leach (Regional Manager Canterbury Landfill & Energy, WM) and Jeremy Parker (Commercial Manager).

The presentation gave an overview of Transwaste Canterbury's Kate Valley landfill operation. *(Powerpoint circulated)*

Welcome to Staff

Katie Perry, People & Capability Manager, introduced new staff – Karen Bruce (Accounts Administrator) and Andrew Malcolm (Safety & Wellness Lead).

Council also acknowledged the long service of Sheree Dougherty, LIM Officer (15 years).

Business transacted with the public excluded – 3.05pm

That the public be excluded from the following parts of the proceedings of this meeting, namely – the general subject of each matter to be considered while the public is excluded, the reason for passing this resolution in relation to each matter, and the specific grounds under Section 48 (1) of the Local Government Official Information and Meetings Act 1987 for the passing of this resolution are as follows:

Item No	General subject of each matter to be considered:	In accordance with Section 48(1) of the Act, the reason for passing this resolution in relation to each matter:	
14	Library & Civic Centre PCG – 16/04/24	Section 7(2)(h)	Commercial activities
15	People & Capability Report	Section 7(2)(a)	Protection of privacy of natural persons
16	Council Shareholding	Section 7(2)(h)	Commercial activities
17	ACL quarterly update	Section 7(2)(h)	Commercial activities

Ellis/McMillan Carried

Council adjourned for afternoon tea from 3.05pm until 3.28pm.

The meeting concluded at 4.42pm.

Confirmed 15 May 2024

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MAYOR

5. Methven Community Board – 22 April 2024

Minutes of the Methven Community Board meeting held on Monday 22 April 2024, commencing at 9.00 am, in the Mt Hutt Memorial Hall Board Room, 160 Main Street, Methven.

Present

Kelvin Holmes (Chair), Megan Fitzgerald, Robin Jenkinson, Allan Lock, Richie Owen; and Mayor Neil Brown.

In attendance

Neil McCann (GM Infrastructure & Open Spaces), Leanne Macdonald (GM Business Support), Ian Soper (Open Spaces Manager, Linda Clarke (Communications Advisor), Michelle Hydes (Property Officer) and Mary Jenkin (Governance Support).

1 Apologies

Deputy Mayor Liz McMillan and Cr Rob Mackle — Sustained

2 Extraordinary Business

That pursuant to Section 46A(7) of the Local Government Official Information and Meetings Act 1987 the following item be introduced as extraordinary business, to be taken with the public excluded:

- Lease agreement Section 7(2)(h) Commercial activities

Holmes/Fitzgerald — Carried

3 Declarations of Interest

Nil.

4 Confirmation of Minutes

That the minutes of the Methven Community Board meeting held on 11 March 2024 be taken as read and confirmed.

Jenkinson/Lock — Carried

5 Discretionary Grant Request – Mt Hutt College Centennial Project

That the Board uplifts the discretionary grant request – Mt Hutt College Centennial project, for discussion.

Holmes/Lock — Carried

That the Methven Community Board declines the Mt Hutt College Centennial project funding application.

Holmes/Lock — Carried

Activity Reports

That the reports be received.

Owen/Fitzgerald — Carried

6.1 Democracy & Engagement

- **Long-Term Plan 2024-34 Consultation**

On behalf of the Board, the Chair commented positively on the Methven community's involvement in the LTP consultation and the way in which the process has been executed.

- **Representation Review**

The Mayor reported that Council will look at a preliminary representation proposal on 5 June which will then be adopted for consultation. The Board will have the opportunity to comment before Council adopts the final proposal in September.

- **NZ Community Board Conference**

That the Methven Community Board be represented at the 2024 Community Board Conference by Megan Fitzgerald and Richie Owen.

Holmes/Jenkinson Carried

6.2 Business Support

- **Customer Request Management**

It was noted that CRM1600238/24 has not been completed and needs to be followed up by Council officers. It relates to a damaged sign at the intersection of Tactician Lane and Racecourse Avenue.

6.3 Compliance and Development

- **Methven resource consent hearing**

It was reported that mediation between the parties commenced on 18 April, as scheduled. The Board will be provided with an update on a likely date for final decision.

6.4 Infrastructure & Open Spaces

- **Roading**

The Board asked officers to follow up on the need for trees in the dog park (Line Road) to be trimmed back. A request was also made for an update on street sweeping (to understand the extent of the township area that is swept). The Chair has observed leaves on Dolma Street and asked if this street is included.

- **Methven Mall**

The Board recalled discussion last year about improving access to the footpath from the Mall carpark. Officers were to investigate and report back on options to resolve the issue, particularly for wheelchair users. This will be followed up and reported back at the next meeting.

- **Reserves**

Some minor tree work has been undertaken to remove dead branches and trees on the Methven Walkway by an arborist. The Board discussed the need for a new fence and the access issue due to the water race.

Business transacted with the public excluded –9.45am

That the public be excluded from the following parts of the proceedings of this meeting, namely – the general subject of each matter to be considered while the public is excluded, the reason for passing this resolution in relation to each matter, and the specific grounds under Section 48 (1) of the Local Government Official Information and Meetings Act 1987 for the passing of this resolution are as follows:

Item No	General subject of each matter to be considered:	In accordance with Section 48(1) of the Act, the reason for passing this resolution in relation to each matter:	
7	**Extraordinary business** - Lease agreement	Section 7(2)(h)	Commercial activities

Owen/Lock Carried

The meeting concluded at 9.55am.

6. Creative Communities Grants Assessment – Round 2 2023/24

Minutes of a meeting of the Creative Communities Fund Assessment Committee, held in the Ashburton Lakes Room, Te Whare Whakatere, 2 Baring Square East, Ashburton, on Wednesday 24 April 2024, commencing at 4pm.

Present

Femke van der Valk (Acting Chair on behalf of Kay Begg), Cr Tony Todd, Tiipene Philip, Peter Muir, Martine Tait, Naneh Manoa and Kate Beaumont-Smith.

In attendance

Shirin Khosraviani (Art Gallery & Museum Director) and Ann Smith (Community Liaison Officer)

1 Apologies

That apologies for absence be accepted from Kay Begg and Cr Leen Braam.

Peter/Kate Carried

3 Conflicts of interest – N/A

5 General Business

- At Kay Begg's request, Femke van der Valk agreed to Chair this meeting, in Kay's absence.
- Newah Guthi New Zealand received funding in Round 1 for the same event held in November 2023. Recommend using some or all the remaining Festival Funds, or they apply for the next round of funding in August 2024.
- Kate Low - supporting video presentation for her application.

That the list of grant applications be approved.

Peter/Kate Carried

6 Creative Communities Scheme grant applications

A total of 10 applications were received for funding requesting a total of $28,823. There was $17,850 available for distribution, plus $2,691 left-over Festival funding. 9 applications were approved.

The merits of each application were discussed, and the following funding decisions were made:

No.	Applicants	Amount requested	Amount granted
1	**Ashburton Embroiderers' Guild**	$1,565	**$1,565**
2	**Ashburton Highland & National Dancing Association**	$2,000	**$2,000**
3	**Ashburton Society of Performing Arts**	$2,103	**$2,103**
4	**Ashburton Writers Group**	$430	**$430**

5	**Ashburton Youth Café - BASE**	$2,000	**$2,000**
6	**CanInspire Trust**	$3,960	**$3,960**
7	**Kate Low**	$5,200	**$3,792**
8	**Newah Guthi New Zealand**	$4,050	**$2,691**
9	**The Glow Show Company Limited**	$4,515	**$2,000**
10	**Ynes Guevara Valdez**	$3,000	**$0**
	Total	$28,823	**$20,541**

Communication to grant recipients

Emails and/or letters will be sent to the groups to inform them of the outcome of their application. This will include a reminder of the requirement to acknowledge the CCS funding for the project in the activity promotions.

Recommendation to Council

That Council receives the minutes of the Creative Community Fund Assessment Committee meeting held on 24 April 2024.

The meeting concluded at 5pm.

7. Review into the Ashburton Water Zone Committee

Author *Toni Durham: GM Democracy & Engagement*
Executive Team Member *Hamish Riach: Chief Executive*

Summary

- The purpose of this report is to present to Council findings from the recent review into the Ashburton Water Zone Committee.

Recommendation

1. **That** Council receives the Ashburton Water Zone Committee Review Report.
2. **That** Council provides the report to Environment Canterbury for consideration as a part of their Zone Committee review for the Canterbury Mayoral Forum, due to be completed in November 2024.

Attachment

Appendix 1 Ashburton Water Zone Committee Review 2024

Background

The current situation

1. The purpose of this report is to update Council on the review of the Ashburton Water Zone Committee (a joint committee of Ashburton District Council and Environment Canterbury).

2. The review was called for by the ADC in response to perspectives expressed questioning the role and purpose of the Ashburton Water Zone Committee (AWZC). The Canterbury Mayoral Forum, as stewards of the Canterbury Water Management Strategy, had called for a review of Zone Committees in 2023, however, there were expectations of a considerable delay to this work being undertaken.

3. As such, Ashburton District Council passed the following resolution on the 6 December 2023. *"That Council requests the Chief Executive to undertake a review of the Ashburton Zone Committee function early in 2024". (Mayor/Ellis)*

4. Environment Canterbury has since commenced their zone committee review. This review will focus on what structure, function and resourcing are needed to support local freshwater leadership into the future. The review will be reported back to the Canterbury Mayoral Forum in November 2024.

5. The ECan review's objectives are to answer the following main questions:

    - What local freshwater leadership is required in the future?
    - For which actions will key partners (Environment Canterbury, Territorial Authorities and mana whenua) need local leadership to deliver freshwater management outcomes in the future?
    - What resourcing is required to support local leadership?

6. The report attached as Appendix 1 covers in the history and context of the establishment of the AWZC, the findings of the recent research and key discussion points.

7. Officers advise that as the ECan review is now underway, that the findings of the AWZC review are used to provide a local context for the AWZC.

Options analysis

Option one – Council receives the AWZC review and that this is provided to ECan to inform the wider Zone Committee review (recommended option).

8. This option would see Council receive the report as per the Council resolution passed in December 2023.

9. Given the recent announcement of the ECan-led review of Zone Committees over 2024, the report will be provided to ECan to provide a localised perspective of the AWZC.

Advantages:	***Disadvantages:***
Signals to the AWZC, ECan and the community that the review has found that the current model has room for improvement. Ensures Council remains at the table discussing what an evolution of the AWZC could be following the wider Zone Committee review that is scheduled to conclude in November 2024.	Keeps ADC contributing to the joint committee for year 1 of the LTP despite there being reservations about the form and function
Risks: Reputational - Council could be perceived as walking away from what some believe is a successful committee	

Option two – Council receives the AWZC review and decides to take further action around its involvement with the joint committee.

10. This option would see Council receive the AWZC report and take further action around its involvement, or otherwise, with the current joint committee arrangement.

11. A potential outcome of this could result in the disestablishment of the committee or result in AWZC being a committee solely of ECan. This is not recommended until the findings of the ECan-led Zone Committee report have been reported to the Canterbury Mayoral Forum.

Advantages:	***Disadvantages:***
The AWZC funding could be either saved from the LTP 2024-34 budget or redirected to Council-controlled freshwater management issues including potential stockwater closures and stormwater management	Potential for Council to become disconnected from conversations about the future of freshwater management leadership for the District Risk of losing AWZC administered freshwater project funding for the district
Risks: Reputational - Council could be perceived as walking away from what some believe is a successful committee. This could create a strained relationship between ECan and ADC as well as with key freshwater stakeholders in the district.	

Legal/policy implications

Canterbury Water Management Strategy

12. The Canterbury Water Management Strategy (CWMS) has its origins in the Canterbury Strategic Water Study (CSWS), which was initiated by central and regional government in response to severe droughts of the late 1990s. Building on the CSWS, the CWMS was released in March 2009 as a product of the Canterbury Mayoral Forum (a group comprising of the ten mayors of Canterbury's territorial authorities and the Chair of the regional council) and a steering group of key stakeholders.

13. The CWMS was developed as a non-statutory framework to promote consensus-building through collaborative governance. It proposed Canterbury be divided into 10 zones for water management, with each zone having a zone committee of local people. The CWMS established ten regional targets:

    - Ecosystem health and biodiversity
    - Natural character of braided rivers
    - Kaitiakitanga
    - Drinking water
    - Recreational and amenity opportunities
    - Water-use efficiency
    - Irrigated land area
    - Energy security and efficiency
    - Indicators of regional and national economies
    - Environmental limits

Climate change

14. The CWMS, and in turn, the AWZC, seek to address matters of freshwater management, which are invariably intertwined with changing climates.

Review of legal / policy implications	
Reviewed by In-house Counsel	*Tania Paddock; Legal Counsel*

Strategic alignment

Wellbeing		Reasons why the recommended outcome has an effect on this wellbeing
Economic	✓	Freshwater management is integral to all wellbeings within the Ashburton District.
Environmental	✓	
Cultural	✓	
Social	✓	

Financial implications

Requirement	Explanation
What is the cost?	Currently Council's involvement in the Joint Committee is circa $45,000 + resource providing administrative support.
Is there budget available in LTP / AP?	Yes – this is budgeted in the current financial year and to continue in the LTP 2024-34
Where is the funding coming from?	The Water Zone Committee is funded 100% from the General Rate based on CV
Are there any future budget implications?	No
Reviewed by Finance	Erin Register; Finance Manager.

Significance and engagement assessment

Requirement	Explanation
Is the matter considered significant?	No
Level of significance	Medium
Rationale for selecting level of significance	N/A
Level of engagement selected	1. Inform
Rationale for selecting level of engagement	Council has undertaken targeted research to develop the review report. The community will be informed of the outcome of the decision through the usual media channels and ECan will be provided the report to consider as a part of their review in Zone Committees.
Reviewed by Strategy & Policy	*Mark Low: Strategy & Policy Manager*

Appendix 1

Ashburton Water Zone Committee Review

Contents

1. Executive Summary

This review examines the effectiveness of the Ashburton Water Zone Committee (AWZC) in fulfilling its role and function within the context of the Canterbury Water Management Strategy (CWMS) and the evolving landscape of freshwater management. Initiated by the Ashburton District Council (ADC) and a catalyst for the broader review of Zone Committees by Environment Canterbury (ECan), this assessment aims to inform decision-making regarding the future of the AWZC.

The CWMS, established in response to water challenges in the late 1990s, introduced a collaborative framework for managing water resources in Canterbury. Zone Committees, including the AWZC, were formed to develop actions and strategies to achieve the CWMS goals. However, concerns have emerged regarding the AWZC's effectiveness and relevance, prompting this review.

Through a mixed-method approach involving literature review, interviews with key stakeholders, and a survey of current committee members, several findings have emerged:

- **Achievements of the AWZC**: Notable successes include initiatives such as the Hinds Water Catchment project, Managed Aquifer Recharge Trial, and support for the Mid Canterbury Catchment Collective, demonstrating effective local leadership in freshwater management.
- **Challenges and Concerns**: Issues such as community representation, shifting focus from strategic to localized priorities, unequal representation within the joint committee, and the inherent limitations of the Zone Committee structure have been identified as areas of concern.

The findings suggest that while the AWZC has achieved significant successes, its effectiveness and relevance have been challenged by evolving dynamics and perceptions. Decisions regarding the future of the AWZC require careful consideration of potential alternatives within the broader context of freshwater management in the region.

2. Introduction

The purpose of this report is to review the Ashburton Water Zone Committee (a joint committee of Ashburton District Council and Environment Canterbury) and consider if its form and function remains fit for purpose for Ashburton District Council (ADC).

The review was called for by the ADC in response to views expressed questioning the role and purpose of the Ashburton Water Zone Committee (AWZC). The Canterbury Mayoral Forum, as stewards of the Canterbury Water Management Strategy, had called for a review of Zone Committees in 2023, however, there were expectations of a considerable delay to this work being undertaken.

As such, Ashburton District Council passed the following resolution on the 6 December 2023.

> *"That Council requests the Chief Executive to undertake a review of the Ashburton Zone Committee function early in 2024". (Mayor/Ellis)*

Since this resolution was passed, Environment Canterbury has commenced planning the 2024 zone committee review. Officers have discussed this review with relevant ECan staff who have confirmed that the review will focus on what structure, function and resourcing are needed to support local freshwater leadership into the future. The review will be reported back to the Canterbury Mayoral Forum in November 2024.

The review's objectives are to answer the following main questions:

- What local freshwater leadership is required in the future?
- For which actions will key partners (Environment Canterbury, Territorial Authorities and mana whenua) need local leadership to deliver freshwater management outcomes in the future?
- What resourcing is required to support local leadership?

2.1. What is the Canterbury Water Management Strategy?

The Canterbury Water Management Strategy (CWMS) has its origins in the Canterbury Strategic Water Study (CSWS), which was initiated by central and regional government in response to severe droughts of the late 1990s. Building on the CSWS, the CWMS was released in March 2009 as a product of the Canterbury Mayoral Forum (a group comprising of the ten mayors of Canterbury's territorial authorities and the Chair of the regional council) and a steering group of key stakeholders. [1]

The CWMS was developed as a non-statutory framework to promote consensus-building through collaborative governance. It proposed Canterbury be divided into 10 zones for water management, with each zone having a zone committee of local people. The CWMS[2] established ten regional targets:

1. Ecosystem health and biodiversity
2. Natural character of braided rivers

[1] Source: Thomas, R (2018): Perceptions of Legitimacy within the Collaborative Processes of Freshwater Management in Canterbury

[2] Source: Canterbury Water Management Strategy – Strategic Framework https://www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-water-management-strategy/

3. Kaitiakitanga
4. Drinking water
5. Recreational and amenity opportunities
6. Water-use efficiency
7. Irrigated land area
8. Energy security and efficiency
9. Indicators of regional and national economies
10. Environmental limits

2.2. What is a Zone Committee?

The Zone Committee structure was established in 2010 by the Regional Council - Environment Canterbury. Throughout Canterbury, 10 Zone Committees were formed, each as a joint committee of the respective local territorial authority/authorities and regional council, to develop actions and tactics on the ten targets of the Canterbury Water Management Strategy. Of the ten Zone Committees established, 9 remain in existence today (the Hurunui Waiau Uwha committee was disbanded in 2021 due to the committee becoming dysfunctional).

The remaining zone committees are:

- Kaikōura
- Waimakariri
- Christchurch West-Melton
- Banks Peninsula
- Selwyn Waihora
- Ashburton
- Ōrāri Temuka Ōpihi
- Upper Waitaki
- Lower Waitaki South Coastal

Zones in Canterbury were identified large enough 'to enable the management of abstraction from surface and groundwater systems to be integrated with the management of the irrigated areas' where usage occurs, and small enough to restrict 10 people having their say to their own localities[3]. The intention was for zonal areas to develop solutions with final sign off carried out by the Regional Council (Environment Canterbury (ECan)), under integrated management between local, regional and central government.[4]

[3] Source: Source: Canterbury Water Management Strategy – Strategic Framework, page 9, https://www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-water-management-strategy/

[4] Source: Thomas, R (2018): Perceptions of Legitimacy within the Collaborative Processes of Freshwater Management in Canterbury

3. Methodology

The review used a mixed-method approach to gather information about the Ashburton Zone Committee. Mixed method in this respect included a desktop review of the various reports on the CWMS, direct conversations with key stakeholders and a survey of current Zone Committee members. The collated information has formed the basis of this report to Ashburton District Council elected members.

3.1. Literature Review

Environment Canterbury's website contains a wealth of information on the Canterbury Water Management Strategy and associated Zone Committees. The key documents relied on for this review include:

- Canterbury Water Management Strategy Strategic Framework 2009
- Canterbury Water Management Strategy Targets and Goals (updated in 2021)
- Ashburton Zone Committee ZIP and Annual Progress Reports
- Ashburton Water Zone Committee Minutes and Terms of Reference 2010 – 2024

Other reports reviewed are sourced in the report and shown in the reference list.

3.2. Interviews

Seven in-depth semi-structured interviews were held over the course of the review. Interviewees included present and former members of the Ashburton Zone Committee, rūnaka, and parties who originally develop the CWMZ and Zone Committee structure. The interviews were confidential and the views and perspectives presented have been anonymised for the purpose of this report. These interviews ranged in length from 45 – 90 minutes.

The key questions focused on the following:

- What has AZC done well?
- What has AZC not done so well?
- What should AZC do more/less of?
- What has changed since the AZC was established?
- Is the Zone Committee still fit for purpose? If not why?
- If not a ZC, then what could take its place?
- Does the District Council have a role in an alternative going forward?
- What do you think the wider community views of AZC effectiveness are?

3.3. Survey of existing committee

The current Ashburton Zone Committee were invited to participate in a short survey (via the online tool Survey Monkey) of their views of the achievements of the ZC. The results have been anonymised for the purpose of the report.

The key questions focused on the following:

- How long have you been a member of the Ashburton Water Zone Committee?

- On a scale of 1-5, how would you rate your satisfaction with the achievements of the AWZC since you became involved?
- What do you believe the AWZC has done well?
- What do you believe the AWZC could improve on?
- What should the AWZC do more of?
- What should the AWZC do less of?

4. Findings

The following summarises the findings from the three sources of information used for the review.

4.1. Literature Review

The development of the Canterbury Water Management Strategy in 2007-2009 was a significant undertaking that acknowledged the challenging freshwater environment for the region. The approach of providing a collaborative framework to help manage the multiple demands on water was a relatively uncommon approach, heralded for taking a consensus-building approach to address complex problems.

The Water Zone Committees were tasked with developing actions and tactics to deliver on the 10 targets of the CWMS in their respective Zone. This was captured in the Zone Implementation Programmes (ZIPs). These recommended actions and approaches for integrated water management solutions to achieve the CWMS principles, targets and goals encompassing environmental, cultural, economic and social outcomes. The approach taken by the Zone Committees in developing the ZIP was through a collaborative and consensus approach. Ashburton Zone Committee submitted its first ZIP in 2011.

The CWMS and associated ZIP are non-statutory documents, but are expected to be implemented, resourced and given effect to subject to long-term plan, annual plan and other statutory processes. The ZIP was also expected to inform initiatives of industry and communities[5]. Progress reports are produced regularly to monitor progress[6].

Academics and research institutions have taken a keen interest in the progress of the CWMS particularly given the collaborative governance model used. The problems it is aiming to address are complex and multi-layered, with the vision capturing benefits across all four well-beings (cultural, economic, environmental and social) for current and future generations. The very nature of the issues means that the success or otherwise of actions against targets may take extended periods of time to show results.

The Ashburton Water Zone Committee has a Terms of Reference (ToR) agreed to by both the regional and local authority. The most recent ToR document was reviewed in 2021[7]. The document outlines the membership, purpose, functions, selection, appointment and member terms. The ToR allows for a membership of:

- 1 elected member appointed by ADC
- 1 elected member appointed by Environment Canterbury
- 1 nominated representative from Te Ngāi Tūāhuriri Rūnanga, Te Rūnanga o Arowhenua, and Te Taumutu Rūnanga respectively
- Between 4-7 community members (with a provision that this number may be exceeded if ADC and ECan agree)

Members are paid an honorarium of $4,000 per annum for appointed members, $5,000 per annum for Deputy Chair and $6,000 per annum for Chair.

[5] Source: Ashburton ZIP 2022 https://www.ecan.govt.nz/data/document-library/?ids=2138524,2138496,2138517,2138514,2138534,2138527,2138520,1582364,2138539,2138529,1712593

[6] Source: AZC Progress Reports https://www.ecan.govt.nz/your-region/your-environment/water/whats-happening-in-my-water-zone/ashburton-water-zone/ashburton-water-zone-progress-report/

[7] Source: AZC Terms of Reference https://www.ecan.govt.nz/data/document-library/?ids=4412538,2948544

Currently Council's involvement in the Joint Committee costs approximately $45,000 per annum. Administrative support, meeting rooms, live-stream functionality and catering are also provided by ADC. These costs are funded 100% by the General Rate.

AWZC Action Plan

Each Zone Committee has an action plan which outlines how they will work with the community to give effect to the CWMS.

The AWZC's Action Plan 2021-2024 contains important actions and priorities for the Ashburton district, including Ōtūwharekai/Ashburton Lake water quality, Hakatere/Ashburton River (including Carters Creek enhancement and the Wakanui hāpua project), Hekeao/Hinds catchment improvements, enhancing mahinga kai values and the utilisation of stockwater races in the district.

AWZC is not the party primarily responsible for advancing or achieving many of these actions. However, it has played a large part in supporting and advocating for progress and has also played an important conduit role between local and regional councils, mana whenua and the wider community. Council should therefore be mindful of the impact that changing the AWZC structure may have on these progressing actions and priorities.

4.2. Interviews

The interviews conducted uncovered a rich diversity of thought on the Ashburton Water Zone Committee past, present and into the future. The perspectives provided ranged from the macro (wide lens / helicopter view) to the micro (narrow focus on specific issues / projects) and depended on the association of the interviewee to AZC.

There was unanimous recognition of the role of AZC at the beginning of the CWMS journey and all acknowledged that the collaborative framework of the ZC created the opportunity for people with different perspectives to come together and work through complex freshwater challenges.

From this basis, there then emerged two divergent themes of the future role and purpose of AZC. The first is that the current model is fit for purpose and needs improved recognition from local government (both at the regional and district level) to return legitimacy and status to the AZC. The divergent view to this is that the AZC has achieved all it can and that it is time for a fresh approach to freshwater leadership at the local level. The themes will be discussed in greater detail in section 5 of the report.

4.3. Survey of existing committee

The Ashburton Zone Committee has a current membership of eleven people. All were invited to participate in the survey to provide their perspectives of the Zone Committee. 4 responses to the survey were received. The data has been treated as qualitative in nature given the small survey base and only general themes have been extracted for this report.

- Satisfaction with the achievements of the AZC were split evenly between satisfied and dissatisfied

- Some believed that the AZC protects entrenched interests (such as agricultural water users)
- Others believed that the AZC enhanced collaboration and supported local projects well
- Areas for improvement included working more collaboratively with Rūnanga and others, being more involved with local and regional decision-making processes including stockwater, greater accountability to the Zone Action Plan and being more closely involved with the Otuwharekai report
- Respondents were evenly split on if the AZC remains fit for purpose to provide freshwater leadership for the community into the future.

5. Discussion

5.1. What has worked well?

The achievements of the Ashburton Water Zone Committee have given effect to the vision of the CWMS, *"to enable present and future generations to gain the greatest social, economic, recreational and cultural benefits from our water resources within an environmentally sustainable framework"*[8].Over the past 13 years there are some notable success stories for the Ashburton Zone Committee.

5.1.1. Hinds Water Catchment

In 2014, the AWZC established the Hinds Drainage Working Party (HDWP) to facilitate a water body by water body approach to develop management plans for the main water bodies of the Lower Hinds Plains. The group comprised a mix of AWZC appointees and elected community members. In March 2016 the working party presented 16 water management recommendations to the zone Committee. The committee then worked with HDWP members, Rūnaka, ECan and the wider community to implement these recommendations. A review[9] undertaken five years later showed significant progress on the actions, specifically:

- Boundary Drain – adaptive minimum flow trial
- Rock weir trials for habitat diversity
- Community water quality monitoring to be continued to 2026
- Giving effect to HDWP recommendations through plan changes (specifically Plan Change 7)
- Managed aquifer recharge and near river recharge

5.1.2. Managed Aquifer Recharge Trial to Hekeao Hinds Water Enhancement Trust

The Hinds Drains Working Party recommended the concept of a Hekeao/Hinds MAR trial to AWZC, which has successfully run since June 2016. In 2019, the Hekeao Hinds Water Enhancement Trust (HHWET) was formed to lead the trial from pilot to catchment scale.

There are now numerous operational sites which are augmenting (increasing) groundwater across the Hinds Plains area. Since its implementation, the MAR project has achieved a new level of community support, leading to the introduction of targeted rates to fund further expansion of the trial.

5.1.3. Mid Canterbury Catchment Collective

The AWZC provided seed funding for the establishment of a co-ordinator role within the Mid Canterbury Catchment Collective. The MCCC went on to receive significant central government funding to place catchment communities in the Ashburton District at the centre of decisions and direction on biodiversity, water quality and the environment. Nine localised catchment collectives sit under the umbrella of the MCCC who provide facilitative support to the locally led initiatives.

[8] Source: Canterbury Water Management Strategy – Strategic Framework https://www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-water-management-strategy/
[9] Source: Hinds Water Catchment progress report https://www.ecan.govt.nz/get-involved/news-and-events/zone-news/ashburton/progress-review-an-opportunity-to-celebrate-efforts-in-the-lower-hinds-catchment/

Throughout New Zealand catchment collectives have been operative in varying degrees for a number of years, and when successful, can provide water quality solutions, backed by science on the ground level.

5.1.4. AWZC Funding

Over the past 14 years the AWZC has invested several hundred thousand dollars into local biodiversity and water quality enhancement projects. This is now a primary role of the AWZC.

5.2. What hasn't?

While the AWZC has had some considerable wins since its formation, interviewee and survey respondent feedback indicated there were aspects of the Zone Committee that weren't working as well as they either once had, or ever did. These four key themes are outlined below:

5.2.1. Community Representation

Community representatives on the Zone Committee are appointed through an application and interview process, with appointments made by a panel of the CWMS partners, as per the Terms of Reference[10]. There is a consistent perception that the AWZC is not representative of the local community, with those interested and able to apply having a greater personal interest in freshwater management. To a degree this holds true, as the very essence of volunteering to be on the AWZC means a committee member is likely to have a vested interest in freshwater management in some way, shape or form. However, the perception that the needs/wants of the agricultural community are over-powering in AWZC decision-making does exist amongst past and current members.

Some solutions were suggested in the form of having some positions to AWZC elected, like a local government election. This would, to a degree, allow for a more democratic process for some of the positions on the committee. Alternatively, nominated positions could be made on the committee to ensure different representation was evident, such as representation from specific social cohorts in the community. A third view to this was that removing all community representatives would be the best solution as the community needs should/could be represented by Ashburton District Council, Environment Canterbury and Te Runanga o Ngai Tahu.

A view expressed by iwi (noting that this cannot be interpreted as unanimous agreement of all iwi representatives) is that the AWZC has served its original purpose and that the iwi-voice now has other, more influential platforms/committees.

5.2.2. Function of AWZC

A second theme that became apparent through the research, was that the work being undertaken by AWZC has changed over time. Some interviewees considered that the focus in recent years had largely been about distributing funding from the Zone Committee Action Plan budget. In their view this was a diminishment from the broader advocacy work undertaken in the earlier years of the AWZC, when they felt there was a greater opportunity to influence decision-makers at a strategic

[10] Source: AZC Terms of Reference https://www.ecan.govt.nz/data/document-library/?ids=4412538,2948544

level. Examples given were the early work undertaken on the original Ashburton River Review in 2013 and ECan plan changes 1 and 2 which deeply involved the Zone Committee.

Review of minutes over the 14 years of the AWZC show that in the past several years the focus of the committee does appear to have shifted from the strategic to the localised. It is not clear if this is an intentional shift.

5.2.3. Joint Committee Approach

A third theme raised was the apparent inequality of the joint committee between the regional and district council. Some interviewees signalled that Ashburton District Council has been disconnected or missing from the joint committee for some time and that the Regional Council was the primary focus of members. This could be argued as being inherent in the differences in the roles and functions of each Council which is driven by legislation. In simpler terms, ADC's role in freshwater management is peripheral to the regional council's.

It was suggested that the status of the Zone Committee's was greater when Environment Canterbury was under statutory management, and the ZC's were held in high regard. As the regional council has transitioned back to a fully elected council, there is a view that the role of the Zone Committee has diminished in the eyes of elected members and management. When discussed in greater detail the ZC has been left out and not involved in several projects that involved the catchment including the work about Otūwharekai water quality. Whether an intentional decision or not, the effect has resulted in a belief of AWZC being disempowered in the management of freshwater in the District.

Likewise, the role of the District Council for some has felt distant and at arms length, to the point that ADC has been described as 'missing in action'. Some interviewees believe that the Zone Committee has an important role in the future of stockwater, for example, and expect that Council would be consulting and working closely with the ZC on future plans.

5.2.4. Zone Committee Structure

The fourth theme that emerged, although more difficult to articulate, was the inherent challenges that exist with the very nature of the structure of Zone Committees. They were established to take an *empowered collaborative approach* to freshwater management at the local level. The way in which the CWMS envisioned this working was that the implementation programmes "*will be social contracts in which all parties agree on a balanced way forward that will enable community and economic wellbeing to occur whilst safeguarding the ecosystems on which they depend. Once the programmes have been put in place stakeholders and investors must both be confident that all elements will be delivered in their entirety. Legal processes that follow in the wake of the adoption of the programmes should not be allowed to undermine this balanced, holistic approach to managing water resources in each zone and across the region as a whole*[11]*".*

Fourteen years on, the reality of this vision in the challenging and complex world of freshwater management is becoming evident for AWZC as a joint committee. To some extent, the ideology of the Zone Committee to take a collaborative governance consensus-building approach could be viewed as it's downfall due to the resource-intense and high-trust approach needed. This may have consequentially led to concerns with the role and function of the AWZC.

[11] Source: Canterbury Water Management Strategy – Strategic Framework, page 58 https://www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-water-management-strategy/

5.3. Discussion

The CWMS is a long-term strategy to managing freshwater resources in Canterbury. The Zone Committee approach to delivering locally led solutions to local issues feeds into the overall direction set by the CWMS. There have been notable achievements with Zone Committees and the AWZC has had a number of success stories since its inception. However, in recent years, the intention of the AWZC appears to have shifted from a high-order strategic focus to more localised, lower-order priorities. As the AWZC is a Joint Committee of both ADC and ECan this may have been an intentional shift, or it could be the result of a shift in status of the role of Zone Committees by ADC and Ecan.

Regardless of the intention or otherwise, the ability of the Zone Committees to function in a consensus-building approach will inherently always be limited by resources, perceptions of legitimacy in terms of the range of views being able to influence decisions and the decision-making power afforded. An OECD (2017) report recognised that collaborative governance faces challenges like slow implementation due to needing trust, varying community abilities to grasp complex information, and the risk of certain interests dominating if representation isn't fair, which can hinder meeting water quality goals[12].

The collaborative governance approach of Zone Committees appears to be clashing with the actuality that regional councils must follow RMA policies and are answerable to Central Government[13]. The frustration expressed by current and former committee members highlights that the feeling of being able to make meaningful change is a reality of this clash. Iwi articulated this succinctly when they indicated that their time and resources can now be more effectively used sitting at tables of more influence than Zone Committees. This view is afforded by iwi due to local Rūnanga now having direct relationships with industry players within the district. While collaborative governance holds the potential for steering clear of the confrontational aspects often found in traditional policymaking by promoting cooperation and shared governance[14], in reality the view that the ZC structure likely needs to evolve to meet the current and future delivery needs of the CWMS is valid.

The Zone Committee model in Canterbury is unique in the broader New Zealand context. When looking at how other regions are addressing freshwater management issues at the local level, Catchment Collectives are more commonly found. While the Mid Canterbury Catchment Collective is a relatively new arrangement for the district, the valuable localised role they play has merit and may be the evolution of the local aspect of freshwater management. However, there would need to be a number of matters addressed before committing to this approach. These include, but are not limited to:

- Ensuring that the MCCC retains its role and function as a catchment collective (and doesn't become a quasi-Zone Committee)
- Establishing clear roles for ADC and ECan (if any) in the catchment collective structure
- Establishing where the 'local' line in freshwater management for catchment collectives sit

[12] Source: https://www.oecd.org/stories/ocean/the-canterbury-water-management-strategy-new-zealand-307e7d5e/
[13] Source https://www.oecd.org/stories/ocean/the-canterbury-water-management-strategy-new-zealand-307e7d5e/
[14] Source Thomas, R (2018): Perceptions of Legitimacy within the Collaborative Processes of Freshwater Management in Canterbury

5.4. Where to from here?

Since the review being initially requested by Ashburton District Council in December 2023, Environment Canterbury has heeded the call from the Canterbury Mayoral Forum to review the entire Zone Committee Structure across Canterbury. With this work now underway, it would be premature of ADC to make decisions around future involvement with the Joint Committee for the AWZC without considering the findings of the Environment Canterbury review. This will be reported to the Canterbury Mayoral Forum in November 2023.

The Zone Committee role has changed since it was initially established, and the leadership required in managing freshwater in Canterbury does appear to have altered. At the local level, the AWZC has achieved a number of meaningful actions. However, as stakeholders have developed and matured, the ZC approach has become less meaningful and authoritative than it once was. This is not because of a lack of effort of past and present members, it appears to be more a result of the mana and authority afforded to Zone Committees by the Joint Committee partners of ECan and ADC. The next evolution of freshwater management in Canterbury requires careful consideration to ensure that the many gains that have been made to date are not lost.

6. References

Ashburton Zone Committee Agendas and Minutes https://www.ecan.govt.nz/data/document-library/?Search=ashburton+committee+agenda&locations=3275&documentTypes=-1&pageSize=12&start=1&sortDir=desc

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8. Update on Lake Hood Water Quality

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Summary

- The purpose of this report is to give Council an update on Lake Hood water quality issues, as well as a summary of the NIWA report that has been received.

Recommendation

That Council receives this report.

Attachments

Appendix 1 NIWA report
Appendix 2 Water Quality Taskforce submission on ECan LTP

Background

Lake Hood Water Quality

1. In early 2023, Lake Hood experienced a cyanobacteria algal bloom. This resulted in Te Mana Ora (Community and Public Health) issuing a public health notice for Lake Hood, which was in place from 16 March 2023 to 15 May 2023.

2. A second bloom occurred in early 2024, with Te Mana Ora issuing a public health warning on 5 January 2024. This warning is yet to be lifted.

3. Following the first algal bloom, representatives of Council, Lake Hood Extension Project (LHEP), Ashburton Aquatic Park Charitable Trust (AAPCT) and the Huntington Park Property Owners Association established the Lake Hood Water Quality Taskforce in early 2023. The Taskforce's Terms of Reference require the Taskforce to investigate and report on operational and technical options to prevent and manage seasonal algal blooms in Lake Hood, ensure lake water quality otherwise continually meets resource consent conditions and the lake is of a standard suitable for water contact recreation.

4. As landowner, Council is ultimately responsible for lake operation and management. Therefore, the Taskforce terms of reference state Council will make the final decision regarding the mitigation measures to be implemented for the lake.

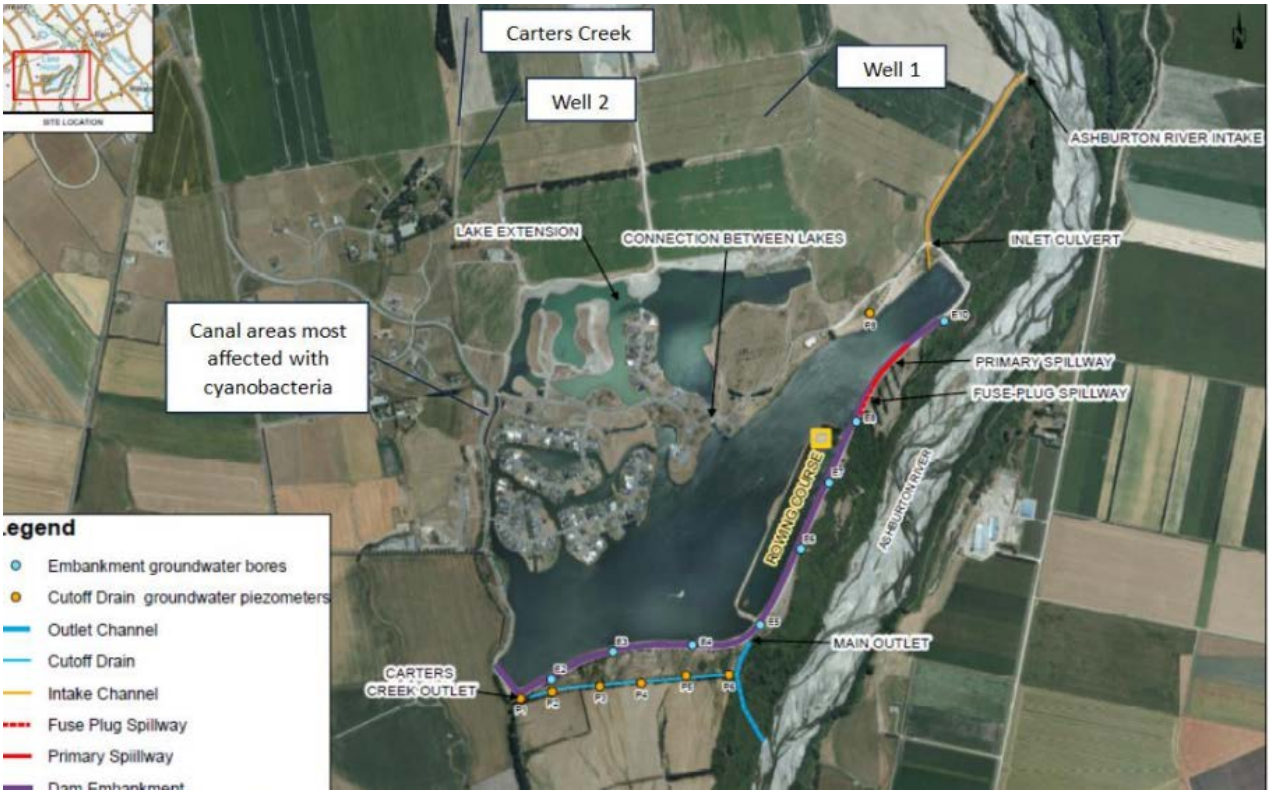
Taskforce Actions

5. The Taskforce has been extensively investigating options to improve lake water quality. Options for lake restoration will, to some degree, be a matter of trial and error, as no one single solution will solve Lake Hood's water quality issues.

6. The formation of cyanobacteria blooms is generally linked with changes in environmental conditions. Favourable bloom conditions include the right combination of warm temperatures, sunlight, low or stable water flows and high nutrients levels (particularly nitrogen and phosphorus). Human activities, such as nutrient and sediment additions to waterways can also contribute.

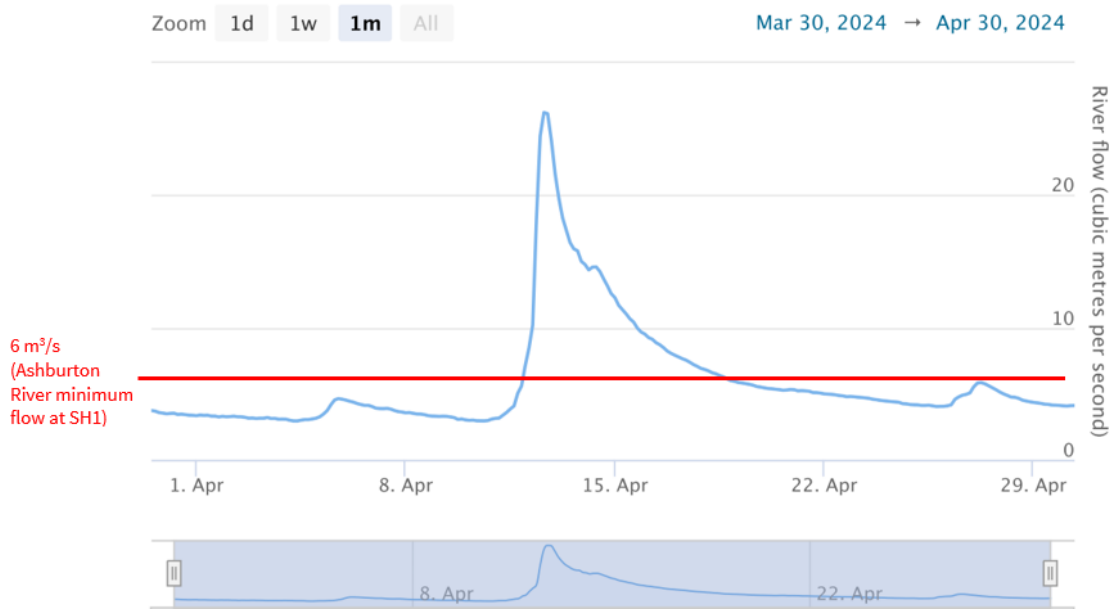
7. An initial focus of the Taskforce's was on controlling the relatively high nutrient levels (particularly, nitrogen and phosphorous), as high nutrient levels were considered to be one of the contributors to the algal bloom. Therefore, reducing nutrient loads, both external (from nutrients that are entering the lake from surface and groundwater) and internal loads (nutrients that are recycled within the lake or legacy phosphorus loads contained in the sediment on the lake floor) would help to improve water quality.

8. A further priority has been to find a way to increase water flows into, and around the lake. Due to the original lake design, water does not circulate around the lake in an optimal manner (including over to the western canal where blooms have started in recent years as shown on the plan below).



9. Further, another contributor to the blooms has been the inability to take enough water from the Ashburton River under the lake's water take and use resource consent. This has been exacerbated in the 2023/24 summer with the new Ashburton River minimum flow restrictions taking effect from 1 July 2023, which puts the lake's resource consent on restriction as river levels drop. No water can be taken when the river level drops below 6 m^3/s as measured at the SH1 bridge. In the four-month period from when the public health warning was issued for the lake in early January 2024 until mid-April, water was only able to be taken from the river on eight days, resulting in a substantial drop in lake levels. Further, for the majority of these eight days the river was still on partial restriction, so this severely limited the amount of water that could be taken on those days.

10. The significant rainfall on the 11th/12th April 2024 increased minimum flows for a short duration to enable water to be taken to fill the lake again. However, as shown on the graph below, the river was only flowing above the river minimum flow of 6 m^3/s for approximately a week before dropping down below the minimum flow level again, which meant water could no longer be diverted into Lake Hood.



NIWA Report

Overview

11. While controlling nutrient loading and increasing the quantity of water coming into and circulating around the lake have been the Taskforce's priorities, the Taskforce recognised the need for a more thorough, scientific review before progressing any further with these mitigation measures.

12. Therefore, in early 2024 the Taskforce engaged NIWA to provide a report. The primary purpose of the report was, based on the data available, to aim to identify the driver/s contributing to cyanobacteria blooms in the lake and based on those conclusions, outline possible control options to reduce the risk of future cyanobacteria blooms.

13. In order to achieve this, NIWA:

    a. Analysed water quality data for the lake;

    b. Summarised the important characteristics of the cyanobacteria species identified in the lake;

    c. Assessed the relationship between water column phosphorus concentrations and cyanobacteria growth; and

    d. Reviewed options for the control of cyanobacteria.

14. The final NIWA report is contained in **Appendix 1** to this report.

15. Based on the data available, NIWA concluded:

    a. Total phosphorous levels were highest at the lake intake and Carters Creek inflows.

    b. Sediment phosphorus levels at two test points within the lake ranged between 440–820 mg/kg and are therefore considered 'moderate' and could contribute to algal blooms.

    c. Groundwater total nitrogen had increased in Well 2 above the lake from 2015 to 2023. Well 2 is shown on the plan earlier in this report. Groundwater inflows are a significant contributor of water into the lake.

    d. While there has not been any significant increase in lake water temperatures since 2010, there have been high water temperatures in recent years which indicates conditions favouring cyanobacteria growth.

    e. Low turbidity measurements and the shallow nature of the lake suggest that light usually reaches the lake bottom which can contribute to algal growth.

    f. pH has increased since 2015, and it was > 10 on several occasions, including at the lake outlet in 2023. Dissolved oxygen concentrations have also decreased in the same period. pH >10 or low oxygen concentrations can result in increased phosphorus release from the sediments, which again can contribute to algal growth.

16. NIWA were not able to identify the main contributing nutrient load to the lake, but concluded that it appears that the lake intake, Carters Creek, groundwater, and sediments are all relevant nutrient sources.

17. NIWA did however consider that from the information available, the available phosphorus concentration (being dissolved reactive phosphorous, or DRP[1]) must be less than ~0.020 mg/L to reduce cyanobacteria growth, but this may not eliminate *Dolichospermum* blooms in Lake Hood. DRP has historically been low at the lake outlet (< 0.005 mg/L) but much higher in the intake and Carters Creek (which has been as high as ~0.040 mg/L but more recently usually < 0.030 mg/L).

18. Further, NIWA confirmed toxic *Dolichospermum* is the dominant cyanobacteria species in lake in both the 2023 and 2024 blooms. The key characteristics of *Dolichospermum* make it a difficult species to manage and eradicate for several reasons. Firstly, *Dolichospermum* regulates its buoyancy and can move vertically

[1] Over time phosphate that is bound to lake sediment dissolves, and becomes available for uptake for aquatic plant and algae growth. In this dissolved form, it is called DRP. DRP concentrations are therefore an indication of a waterbody's ability to support algae and plant growth. By comparison, total phosphorous is the measure of all types of phosphorus present and included phosphate that is stuck to soil or sediment, as well is DRP which is more readily available for uptake by plants and algae.

through the water column to optimise its access to light and nutrients, leading to growth. It can also fix nitrogen from the atmosphere, giving it an advantage over other phytoplankton. Further, *Dolichospermum* has specialist cells (akinetes) which can propagate quickly. Seed banks made up of akinetes drop to the lake floor in suboptimal growth conditions, which allows *Dolichospermum* to survive through harsh conditions and re-emerge in favourable conditions (for example, optimal light, nutrients, temperature over summer months) leading to further blooms. Therefore, reoccurring blooms are very likely.

Key Recommendations

19. Based on the data available, NIWA's key recommendations to limit blooms in the lake are to flush the lake, implement nutrient controls in the Carters Creek and river intake inflows and undertake sediment capping within the lake. NIWA advised that reducing nutrient concentrations in the main water source of the lake (being the river intake) will likely have the greatest positive effect in reducing algal blooms throughout the lake over time, provided that legacy phosphorus stores in the sediments are capped.

20. Having access to more reliable, better quality water and putting water into the areas of the lake that would benefit most from flushing has always been a key priority of the Taskforce. NIWA has backed up this view by recommending increasing flows into and through the lake to decrease the hydraulic residence time in the lake, which would flush blooms out of the lake faster.

21. Getting more reliable water into the lake, for example by investigating options to either better utilise the current 2.5 cubic metres per second consented take, seek alternative consenting arrangements, or to review the regional plan's river restrictions are all options that are currently being considered and discussed with the relevant parties.

22. The Taskforce is also currently investigating options for getting water directly from the river intake into the western side of the lake to flush the canals, including through piping or open channels. There are various ways this can be achieved, so the Taskforce are scoping up options to find the most cost effective and hydraulically effective option.

23. A secondary outlet (likely near the rowing start area) would also be useful to rapidly release water from the main lake and enhance circulation.

24. Officers' preference is for permanent changes to the lake infrastructure (e.g. intake, outlets and infrastructure within the lake) and holding appropriate water consents in order to find a robust, long term solution to water quality issues.

25. As noted above, NIWA also concluded that more water is not the complete answer, as more water will bring more phosphorous into the lake. Therefore, they also

recommend implementing nutrient controls in the Carters Creek and river intake inflows and undertake sediment capping within the lake.

26. Sediment capping within the lake itself can be achieved through the application of metal salt products such as alum or Phoslock. These products are applied directly to water and minimise the release of phosphorous into the water column, therefore breaking the cyanobacteria growth cycle. Alum has an additional benefit over Phoslock as it also acts as a flocculant and can remove a cyanobacteria bloom within hours by flocking and settling the bloom to the sediment, and clearing the water column. Flocculation is however only temporary and the bloom will re-emerge in the right conditions.

27. Alum and Phoslock have been shown to be successful in many lakes around the world. However, these phosphorous control options do not remove phosphorus, but instead just lock it in place. Therefore, these treatments will need multiple applications to be continuously effective and will therefore be expensive.

28. The introduction of the weed harvester is also part of the solution to reduce internal phosphorous loading within the lake. Lake weed takes up phosphorus from the silts and harvesting and removing the weed from the lake removes the phosphorus in the lake weed.

29. Nutrient controls in Carters Creek and the lake intake can be achieved through the use of products such as Phosflow or BioChar which remove phosphorous in flowing water. Phosflow comes in a pellet form and is placed inside a pouch that is laid in the flowing water. As water passes through the pouch, the pellets absorb phosphorus. These pouches need to be replaced approximately every two months.

30. BioChar, which is a nutrient harvesting carbon product, is a cheaper alternative and works in a similar manner to Phosflow. Biochar is placed into mesh tubes and the mesh tubes are pinned to the stream bed to allow water to run through the mesh bags. Biochar acts as a type of filter due to its porous nature, absorbing phosphorus and therefore enabling it to be removed from the water when the mesh tubes are removed.

31. AAPCT (on behalf of the Taskforce, who is not a legal entity) recently applied to the Ashburton Water Zone Committee for $10,483 in funding to run a BioChar trial in Carters Creek. The Zone Committee were in support of the trial and recommended that ECan grant this full funding. ECan has also formally approved the funding. The Creek is currently dry, but the trial will likely start in June 2024 once the creek is flowing over the winter months.

32. Nutrient controls in the creek and river intake will also need to be a long-term commitment in order to be effective.

33. NIWA also recommended the use of sonication. This technology uses ultrasound waves to rupture the gas vacuoles in the cyanobacterial cells, causing them to sink into light limiting conditions. However, while ultrasound treatment has gained popularity because of its ease of operation, lack of chemical usage and minimal ecological impact, evidence has shown that it is expensive and ineffective at a whole lake scale, particularly in canals. For this reason, the Taskforce are not currently investigating this option.

34. Other options considered, but either discounted as not appropriate for the lake, or assessed as requiring further investigation are listed in Table 0-1 on pages 7 – 9 of the NIWA report.

Lake Management Mitigation Options

35. As a result of the NIWA report, the Taskforce is preparing a lake management plan to prioritise and scope up costs for the recommended mitigation options, as well as other potential options contained in the NIWA report.

36. The final lake management plan will be released to the public and also presented to Council in due course, along with funding options.

37. Officers have engaged Viv Eyberg to assist with analysing the mitigation options and scoping up Council's preferred option/s.

Other Updates

ECan Long-Term Plan Submission

38. The Taskforce recently submitted to Environment Canterbury's Long-Term Plan. The Taskforce's key points in its submission were:

    a. The work required to improve Lake Hood's water quality will be significant, expensive and complicated. The Taskforce needs ECan's support in order to achieve better water quality outcomes for the lake.

    b. The Taskforce now has received a report from NIWA which identifies as flushing the lake and controlling nutrient loading on the lake as the top priorities for improving water quality. As the ability to take more river water into the lake is restricted by the regional plan restrictions, the Taskforce requested ECan allocate funding in Year 1 to review the appropriateness of the recent Ashburton River consent review and undertake a plan change/further consent review to enable more practical and appropriate restrictions to be put in place.

    c. The Taskforce supported the funding allocated to undertake work on Carters Creek, but requested that this funding allocation be brought forward to start in Year 1.

39. A copy of the Taskforce's submission is contained in **Appendix 2**. Two members of the Taskforce also presented to ECan at its LTP hearings.

Weed Harvester

40. At the 4 October 2023 Council meeting, Council agreed to enter into a five year, open book contract with ACL for the operation of a weed harvester on Lake Hood. ACL subsequently purchased the weed harvester, which has recently arrived in New Zealand. ACL are working through obtaining the necessary approvals to operate the weed harvester on the lake.

41. The weed harvester will be in operation from the start of the growth season in spring 2024.

Legal/policy implications

Open Spaces Strategy

42. Lake Hood is recognised in the Open Spaces Strategy as a significant recreational asset in our District which has potential for enhancement.

43. One of the Action Plan Priorities in the Open Spaces Strategies to achieve objectives 4.4[2] and 4.9[3] is to encourage opportunities to assist in the enhancement of Lake Hood, in particular, to enhance the recreational potential of the area. Lake Hood is one of the 'Special Projects' referred to in Appendix 5 of the Strategy.

Climate change

44. One of the goals of Council's Climate Resilience Plan[4] is to ensure the sustainability of Council's assets for the present and future wellbeing of the Ashburton District.

45. The changing climate is predicted to result in increases to both extreme dry and wet conditions in the future[5]. These changing conditions may affect both water quantity and water quality in Lake Hood. As Lake Hood is a significant Council asset, Council must ensure it effectively manages this asset to take into account the effects of climate change.

[2] Objective 4.4: Open spaces with scenic, heritage natural and cultural values are made as accessible as possible without comprising their biodiversity values - especially those areas along District waterways, the coast, and lakes.

[3] Objective 4.9: Open space experiences across the district are enhanced through the investigation and implementation of special projects identified in Appendix 5.

[4] Climate Resilience Plan

[5] See page 4 of the Climate Resilience Plan

Strategic alignment

46. This report relates to Council's community outcome of 'a district of great places and spaces' because Lake Hood is an important recreational asset for the District which must be managed effectively for the benefit of both residents, as well as the wider community.

Wellbeing		Reasons why the recommended outcome has an effect on this wellbeing
Economic	✓	Lake Hood is an important asset for the community, as the wider community benefits from recreational events held at the Lake, as well as residential development that occurs. Therefore, the district will benefit from a well-managed lake.
Environmental		
Cultural		
Social	✓	If nothing is done about lake water quality, public health warnings on the lake are likely to be a frequent occurrence, meaning the lake will not be as freely available for recreational and social use.

Financial implications

Requirement	Explanation
What is the cost?	No cost, as this is an information report only.
Is there budget available in LTP / AP?	N/A
Where is the funding coming from?	N/A
Are there any future budget implications?	Once the Taskforce has scoped up mitigation options, officers will bring a further report to Council to seek funding.
Reviewed by Finance	Leanne Macdonald, Group Manager – Business Support

Significance and engagement assessment

Requirement	Explanation
Is the matter considered significant?	No
Level of significance	Medium
Rationale for selecting level of significance	This is a matter of high community interest and impact particularly to the Lake Hood community. The report outlines progress and steps being taken to address the issue.
Level of engagement selected	1. Inform – one-way communication

Rationale for selecting level of engagement	No wider community engagement is required. Council has already issued a media release on the NIWA report and will continue to provide regular updates to the public on Lake Hood. A public Taskforce meeting is also planned for June to give the public the opportunity to provide an update and allow the public to ask the Taskforce questions.
Reviewed by Strategy & Policy	Mark Low; Strategy and Policy Manager

Next steps

Date	Action / milestone	Comments
To be confirmed.	Officers will bring a further report to Council for funding options once mitigation options are fully scoped and costed.	

Appendix 1

Data analysis and literature review to inform Lake Hood water quality management

Prepared for Ashburton District Council and Ashburton Aquatic Park Charitable Trust

April 2024

Prepared by:
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Revision	Description	Date
Version 1.0	Report sent to client	27 March 2024
Version 1.1	Revised report sent to client	17 April 2024

Quality Assurance Statement		
	Reviewed by:	David Plew
	Formatting checked by:	Rachel Wright
	Approved for release by:	Scott Larned

Contents

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Executive summary

The Lake Hood Water Quality Task Force (hereafter the Task Force) approached NIWA to provide information regarding possible control options to reduce the risk of future cyanobacteria blooms in Lake Hood. The lake is man-made, owned by Ashburton District Council (ADC), and fed by and drains to the Ashburton River. The lake first opened in 2002 and experienced its first cyanobacteria bloom in early 2023 and its second bloom in January 2024.

The Task Force requires analysis and interpretation of existing lake and inflow water quality data and literature reviews to summarise important characteristics of the cyanobacteria species identified in the lake, determine published relationships between water column phosphorus concentrations and cyanobacteria growth, and review options for the control of cyanobacteria. The Task Force intends to use this information to aid in decision making regarding actions to reduce the risk of cyanobacteria blooms in Lake Hood.

In Lake Hood, DRP has been low at the outlet (< 0.005 mg/L) but much higher in the intake and Carters Creek (used to be as high as ~0.040 mg/L but more recently usually < 0.030 mg/L). The data and literature suggest that the bioavailable P concentration must be at least less than ~0.020 mg/L to reduce growth, but this may not eliminate *Dolichospermum* blooms in Lake Hood. Targeted investigations and experiments would be needed to confirm P limitation and refine the estimated threshold of ~0.020 mg/L P to restrict growth of the *Dolichospermum* species in Lake Hood.

The primary objective was to aim to identify the drivers contributing to cyanobacteria blooms, based on the available data.

Based on the supplied data and some additional data that we obtained, we found the following.

- While the annual and January mean air temperatures have increased since 2010, similar changes were not observed in lake water temperature. However, temperatures as high as 24.3°C (in the lake outlet) and regularly reaching or approaching 20°C indicate conditions favouring cyanobacteria growth. Generally, differences between surface and bottom temperatures were < 0.5°C, indicating vertically mixed conditions, but a 1.4°C difference was observed at a location near the lake intake on 16 January 2024, indicating that stratification occurs at least periodically.

- No conclusions can be drawn from wind speed observations. Assuming that the Lake Hood canals are wind-shaded by structures and trees, changes in wind speed are unlikely to have a great effect on vertical mixing in the canals.

- Dissolved oxygen concentrations were generally good (> 5 mg/L), except on two occasions (29 January 2019: 2.93–3.65 mg/L in Carters Creek, the lake intake, and the outlet; 30 March 2021: 2.35 mg/L in the intake and 2.97 mg/L in the outlet). A dissolved oxygen profile obtained on 16 January 2024 indicates hypoxia (< 2 mg/L dissolved oxygen) during stratification. Hypoxia can lead to phosphorus release from the lake sediments. Results from aeration trials using an aerator setup in a test canal indicate that the aeration setup did not prevent water column stratification and occurrence of hypoxia.

- pH values appear to trend upward over the 2014–2023 record. Values > 10 or approaching 10 enable sediment release of phosphorus, regardless of oxygen levels. Maximum field values > 11 were observed in October 2021 at the lake intake and well 2, and pH was 10 in October 2023 at the lake outlet. Laboratory measurements were lower (always < 10) than

field measurements, indicating some discrepancy between the two measurements, perhaps due to sample handling and holding times or other differences in the pH measurement methods.

- Low turbidity measurements and the fact that the lake is shallow suggest that light usually reaches the lake bottom and does not limit algal growth.
- Sediment phosphorus content values at the Trial Canal and lake intake sites were moderate (710 and 820 mg/kg dry mass, respectively) and could contribute to algal blooms.
- Groundwater total nitrogen has increased in well 2 from 2015 to 2023.
- Total phosphorus values were highest in the lake intake and Carters Creek inflows.
- The highest total biochemical oxygen demand values were found in the lake outlet.
- The highest chlorophyll *a* values (> 0.04 mg/L) were recorded in the lake outlet, while values were generally < 0.02 mg/L at the lake intake and in Carters Creek.
- *Dolichospermum* is the dominant cyanobacteria genus identified in samples collected in 2023 and 2024.

Based on a literature review on cyanobacteria characteristics, we note the following key cyanobacteria characteristics for managing blooms:

- *Dolichospermum* blooms have been associated with toxins.
- *Dolichospermum* can regulate its buoyancy and thus move vertically in the water column to optimise its access to light and nutrients. This can lead to shading of non-nuisance phytoplankton species.
- *Dolichospermum* can fix nitrogen from the atmosphere, giving it another advantage over other phytoplankton.
- *Dolichospermum* produces specialist cells called akinetes, which are spores that can propagate quickly. "Seed banks" made up of akinetes allow *Dolichospermum* to survive harsh conditions and cause blooms when conditions (e.g., light, nutrients, temperature) are right.

Based on a literature focusing on lake management options specifically intended to limit cyanobacteria blooms in Lake Hood, we suggest consideration of flushing, nutrient controls in inflows (esp. Carters Creek and ideally also in the intake culvert), sediment capping, and potentially sonication. The options we considered are summarised in Table 0-1.

Table 0-1: Summary of options, their purpose, and associated risks for controlling cyanobacteria in Lake Hood. Green options are considered potentially feasible for Lake Hood. Red options are not recommended for Lake Hood. Uncoloured options require further investigation before recommendations regarding their application to Lake Hood can be made.

Intervention	Target/purpose	Risks
Physical controls		
Hydraulic flushing, inflow diversion	Increase flow through the lake and thus decrease the hydraulic residence time, which would flush blooms out of the lake faster. Records show that there were only eight days in a 92-day period on which water was taken. More frequent water intake times could reduce the residence time in the lake but likely not (or only minimally) in the canals. A secondary outlet could be useful in rapidly releasing water from the main lake and enhancing circulation. Divert inflowing water from Carters Creek to better flushed parts of the lake.	While the main lake may profit from this, the canals may still not have enough water movement and keep blooms trapped in areas with longer water residence times. Surface scum formation may be prevented but cyanobacteria blooms are unlikely to be prevented just by creating another outlet. A nutrient-rich diverted inflow could negatively affect the new receiving environment.
Phytoplankton harvesting	Water filtration Withdraw water from near the surface rather than the lake bottom to remove cyanobacteria concentrated at the surface.	Water filtration may not be cost-effective and will not prevent bloom formation. The lake is quite shallow and easily mixed by wind, which means that cyanobacteria likely only form surface scums during calm conditions. This will not prevent bloom formation.
Artificial destratification	Install aerators to increase vertical mixing and prevent stratification and deoxygenation of bottom waters and thus P release from the sediments.	This could be promising but would only affect the sediment P load to the lake. If blooms are primarily fuelled by external nutrient sources (e.g., Carters Creek or groundwater), then this method is unlikely to be effective. In addition, if this is not timed well, then nutrients released from the sediments during stratification would be mixed to the surface and actually fuel blooms.
Aeration/oxidation	Increase dissolved oxygen to avoid hypoxia and reduce phosphorus release from the sediments. Phosphorus fuels algal growth.	This is considerably more expensive than destratification and Lake Hood is likely too shallow for this to work well.
Nanobubbles	Produce very small oxygen bubbles (nanobubbles), to oxygenate the water and sterilise and/or kill cyanobacteria and deactivate toxins.	The process has not been well defined and this is currently an expensive option.

Intervention	Target/purpose	Risks
Drawdown	Reduce the lake water volume or even entirely empty the lake to expose sediment and dry it out. This would eliminate seed populations of cyanobacteria.	This may be cost-effective but not aesthetically pleasing and would disrupt recreational use of the lake for weeks to months at a time. It would be harmful to fish and desirable macrophyte communities.
Dredging	Remove lake sediments that can release P during thermal stratification.	This does not affect external nutrient loading from Carters Creek and groundwater that may fuel blooms.
Benthic barriers	Apply clay, silt, sand, and gravel from external sources to bury the surface nutrient-enriched sediment.	This does not affect external nutrient loading from Carters Creek and groundwater that may fuel blooms.
Sonication	Break cyanobacteria cells using sonic pressure waves to rupture the gas vacuoles in the cells. This could be very effective in the summer. Reseeding of populations will be prevented.	This does not remove the driver of the blooms. This would require repeated treatments.
Chemical controls		
Hydrogen peroxide	Liquid application of this sterilising agent to lyse cyanobacteria cells.	Cyanobacteria blooms could return after a few weeks or months and repeated application may be required.
Flocculation and sediment capping	Apply a metal salt (alum or Phoslock®) to prevent sediment P release. Alum is also a flocking agent that can remove a cyanobacteria bloom in hours by flocculation and settling it to the sediment, clearing the water column. Alum floc on the sediment surface can strongly suppress germination of the algae spores (“seed banks”) in the sediments.	Multiple or regular application may be required.
Phosflow	Apply a bead form of Phoslock® in pouches that can be placed in the inflows (Carters Creek and Ashburton River intake culvert) to reduce inflow phosphorus concentrations.	The number of pouches required and disposal and pouch replacement costs need to be calculated. This may become a long-term commitment unless upstream phosphorus controls are put in place.
Algicides	Apply chemical compounds (usually copper-based) to kill cyanobacteria.	This can result in unwanted ecotoxicological effects or secondary pollution.
Biological controls		

Intervention	Target/purpose	Risks
Weed harvesting	Remove weeds and thus nutrients bound up in those weeds from the lake. This could also prevent anoxia in bottom waters.	If a hired weed harvester that is used elsewhere were used periodically, there is a risk of introducing fragments of other weeds to Lake Hood. Nutrient loads from inflows and the sediments (in anoxic conditions) could still fuel algal blooms.
Biomanipulation	Introduce new bacteria species to either outcompete cyanobacteria for nutrients or directly kill cyanobacteria.	With any new species introduction, there is risk of extreme perturbation of the lake ecosystem (e.g., one introduced species becomes dominant and outcompetes desirable native species) and unwanted consequences. Controlled laboratory and field trials are required before any such approach is considered for Lake Hood.
Floating wetlands	Construct floating wetlands that remove contaminants, especially nitrogen from the lake.	This could be an aesthetically pleasing option but restrict some recreational use of the lake. It may be difficult to quantify the effectiveness of nutrient removal by floating wetlands.

Before implementation of any large-scale control efforts, we recommend the following next steps:

1. Modelling
    a. A **hydrodynamic model** would enable estimation of residence times in different parts of the lake, i.e., the canals and the main lake, which will differ. A key preliminary step is to calculate the lake **water balance** from inflow, outflow, rainfall, and water level data spanning at least one year but ideally several years.
    b. A linked catchment and lake **water quality model** would quantify the nutrient loads from each source and estimate sediment nutrient fluxes over time, allowing for determination of the main nutrient source driving cyanobacteria blooms.
    c. **Scenario modelling** using the linked models would allow for testing of different management options (e.g., reduced nutrient loads, sediment capping) before implementation.
2. Data collection for model development
    a. Regular (at least monthly) **water column P and N sampling in the canals** where blooms are most likely to form.
    b. **Field measurements of fluxes of P from the sediment** for comparison with inflow nutrient loads.
    c. Controlled laboratory or mesocosm **experiments** using cyanobacteria from Lake Hood to describe the growth rate as a function of N and P concentration.
3. Ongoing water quality monitoring is required to determine the effectiveness of any mitigation measures.

1 Introduction

1.1 Background

Lake Hood is a man-made lake owned by Ashburton District Council (ADC). The lake is fed by the Ashburton River when flows exceed the minimum required for the river. The lake was commissioned in 2002 and experienced its first cyanobacteria bloom in early 2023. It was subsequently closed to contact recreation from 16 March to 15 May 2023 (McCracken et al. 2023). Another bloom was first detected in early January 2024 and the lake is currently subject to controls under the Interim 2009 *New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters* (Wood et al. 2009).

Following the first cyanobacteria blooms, the Lake Hood Water Quality Task Force (hereafter the Task Force) was assembled to determine and implement possible solutions that would reduce the risk of future cyanobacteria blooms. The Task Force was formed in May 2023 and members represent the following:

- the Joint Venture Committee, which is developing the lake extension and associated subdivisions and currently managing the lake and lake surrounds,
- residents,
- the Ashburton Aquatic Park Charitable Trust, which developed the original lake and is a Joint Venture partner, and
- the Ashburton District Council, which owns the lake, lake park surrounds, and future lake development land.

Lake Hood was constructed on riverbed gravels and first opened for recreational use in April 2002. The original lake area, including canals, is approximately 85 hectares (McCracken et al. 2023). From 2010, the lake was expanded to the north, adding approximately 26 hectares, including canals, to the original lake. Two thirds of the original lake bottom was sealed (covered) with clay excavated from a nearby site and the remaining lake bottom receives groundwater inflows.

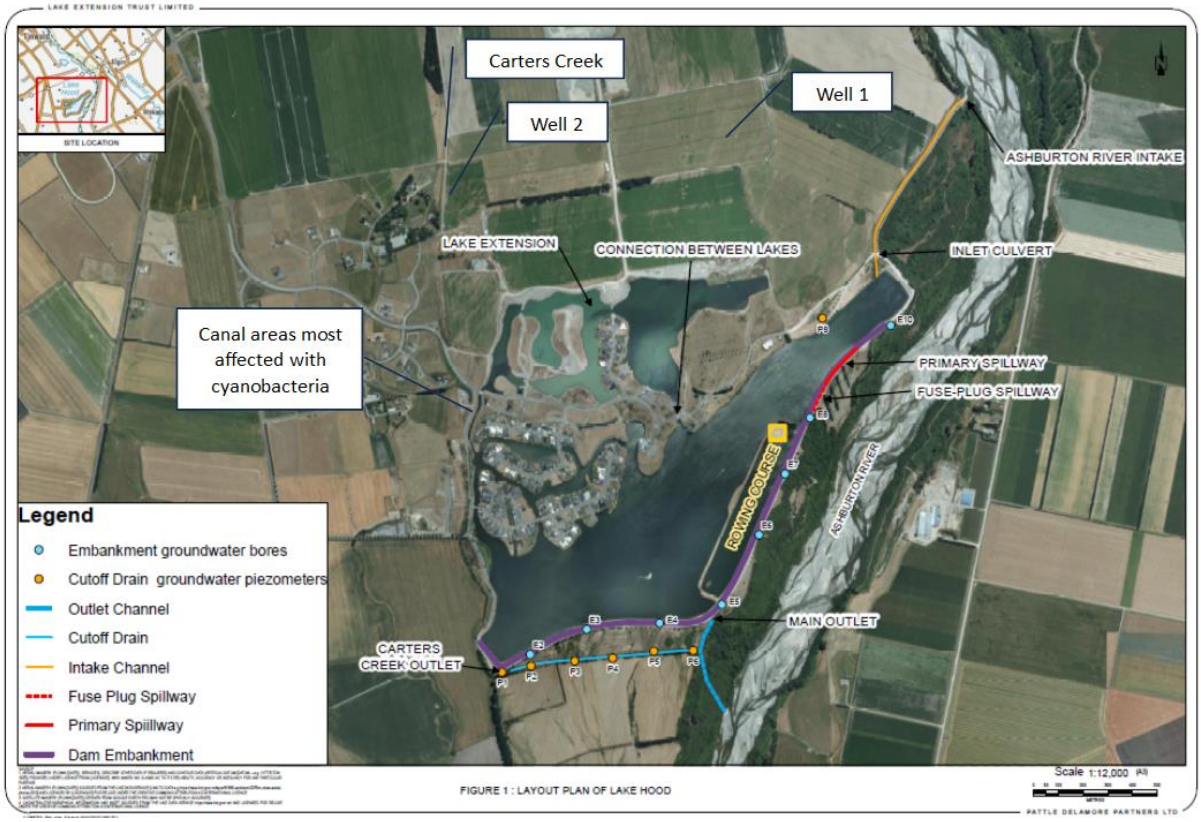

Figure 1-1: Map of Lake Hood and its Ashburton River intake and main outlet, as well as sampling sites and other features of interest. Map provided by the Task Force. The inlet sampling location is at the intake weir. We assume that the Carters Creek sampling location is in the creek before it enters the northwest lake extension and the lake outlet sampling location is in the lake itself near the outlet channel.

1.2 Objectives

The Task Force requires:

1. analysis and interpretation of existing lake and inflow water quality data, and
2. literature reviews to:
   - summarise important characteristics of the cyanobacteria species identified in the lake,
   - determine published relationships between water column phosphorus concentrations and cyanobacteria growth, and
   - review options for the control of cyanobacteria.

The Task Force intends to use this information to aid in decision making regarding actions to reduce the risk of cyanobacteria blooms in Lake Hood.

The primary objective is to identify the drivers contributing to cyanobacteria blooms, based on the available data.

1.3 Scope

The scope of the present work was to analyse and interpret existing lake and inflow water quality data, and to conduct the literature reviews described above to summarise important characteristics of the cyanobacteria species identified in the lake, relationships between water column phosphorus concentrations and cyanobacteria growth, and options for the control of cyanobacteria. The scope excludes formal trend analyses of time-series data, comprehensive cost/benefit analysis, and specific recommendations regarding cyanobacteria control options for Lake Hood.

2 Methods

The following tasks were completed in this study.

1. Examine the Lake Hood water quality database containing monthly consent compliance data collected since the lake was commissioned in 2002, and weather data from the Ashburton Airport weather station, to determine what changes in the lake and surrounding environment may have led to the blooms experienced in 2023 and 2024 to assist the Task Force in prioritising possible solutions to control and reduce the risk of future blooms.

2. Research the characteristics of the cyanobacteria species identified in the laboratory reports, with the purpose of informing the Task Force on which mitigation measures should be investigated to reduce the risk of future blooms. This includes information on the relationship between phosphorus levels in the lake and the potential for cyanobacteria blooms, with the aim of providing advice on the level of phosphorus removal needed to reduce the risk of future blooms.

3. Carry out a literature survey on options for the control of cyanobacteria and summarise these options. This will include chemical controls and consumption of the current toxin-producing cyanobacteria by other, beneficial species of bacteria, which are solutions being proposed by various companies wishing to assist the Task Force.

To complete task 1, we used data provided by the Task Force and plotted time series showing potential temporal and spatial variation in temperature, dissolved oxygen, nutrient, and cyanobacteria concentrations. While formal trend analyses of these time series were beyond scope, we did both visually inspect data and fit linear regressions to see if any trends were apparent. In the plots that follow in Section 3, we only show fitted linear regressions where the p value for the slope is < 0.05 (the p value indicates the probability that the slope is not significantly different from zero, $p < 0.05$ indicates the probability that there is a non-zero slope is at least 95%). We also assessed weather conditions using data from the Ashburton Aero weather station. NIWA did not collect any additional data as part of this work.

The following files were provided to NIWA.

1. A spreadsheet containing monthly consent compliance data since the lake was commissioned.

2. Test reports on cyanobacteria samples collected during the 2023 and 2024 blooms.

3. Test reports on lake sediment samples collected in September 2023.

4. Test reports on lake water quality at selected points that commenced in 2023 and are ongoing.

5. A spreadsheet containing weekly monitoring results from an aeration trial under way in one of the canals.

6. T&T reports on the expansion of the original lake.

7. NIWA reports on lake weed control.

8. Environment Canterbury reports on Carters Creek water quality.

The water quality database contains information from ~20 sites, including piezometer data, field measurements and water quality data including pH, water temperature, conductivity, water level, dissolved oxygen, tube clarity, turbidity, total suspended solids, total nitrogen, total ammoniacal nitrogen, nitrite nitrogen, nitrate nitrogen, total Kjeldahl nitrogen, dissolved reactive phosphorus, total phosphorus, total biochemical oxygen demand, chlorophyll *a*, faecal coliforms, *E. coli*, total dissolved nitrogen, total dissolved phosphorus, and volatile suspended solids (2015–2023 with data gaps).

Cyanobacteria test reports are four Cawthron laboratory reports (pdf files) from 2023. In addition, we directly had access to one NIWA test report from 2024.

We received spreadsheets for the "4 Point Water Tests" for three dates in 2023 and one date in 2024. These contain field measurements, climatic conditions, sediment and surface water monitoring results for four sites in the lake.

Aeration test data were provided in the form of 21 Excel spreadsheets that include canal aeration trial data (temperature, dissolved oxygen).

The following reports were provided to NIWA:

- Howard-Williams (short communication, 2017) Review of assessment of environmental effects
- McCracken et al. (2023) Briefing paper on cyanobacteria bloom risk
- Environment Canterbury (2019) Sources of nitrate in groundwater in the Tinwald, Ashburton area
- Sutherland et al. (2014) Lake Hood Aquatic Weed Survey 2014
- Tonkin & Taylor Ltd (2014) Lake Hood review of water management
- Tonkin & Taylor Ltd (2008) Implications for Water Quality – Assessment of the Extension to Lake Hood
- Tonkin & Taylor Ltd (2008) Lake Hood water quality monitoring and ecology
- NIWA short report (Clayton 2012) on lake inspection in January 2012

We reviewed the existing reports to better understand the history of Lake Hood and what has been monitored and recommended to date. Next, we reviewed the data listed above and produced graphics to qualitatively identify trends in the time series.

3 Water quality observations

Time series of water quality data are required to determine natural conditions and the effects of management interventions. This section serves to identify background conditions and changes in the measured variables that may co-occur with or contribute to cyanobacteria blooms in Lake Hood.

Lake Hood operates under consent CRC162113. Key requirements of the consent are as follows.

- The rate at which water is discharged from Lake Hood to the Ashburton River via the Lake Hood Outlet Drain, Bayliss Stream and Carters Creek shall not exceed a combined rate of 6.5 m^3/s for the purposes of maintaining water levels and water quality management.
- A representative sample of water shall be collected during the last five working days of each month and tested for total phosphorus (TP), nitrate-nitrogen (NO_3-N), suspended solids (SS), biochemical oxygen demand (BOD), pH, *Escherichia coli* (*E. coli*), total nitrogen (TN), dissolved reactive phosphorus (DRP), and temperature at the following locations:
  - the outlet of the existing outlet structure, being representative of any surface discharge from the lake
  - Carters Creek upstream of Lake Hood
  - Ashburton River intake canal immediately downstream of the Ashburton River intake structure
  - Groundwater up-gradient of Lake Hood in one of three bores (sampled quarterly only for TN, NO_3-N, and DRP).
- The discharge from Lake Hood (representing lake surface water) shall meet the following water quality standards:
  - SS < 50 mg/L
  - BOD < 5 mg/L
  - pH 6.5–8.5
  - *E. coli* rolling 4-monthly median < 126/mL
  - TN ≤ 110% of the groundwater or surface water inflow concentration or 3 mg/L (whichever is greater, based on the average monitoring result of the preceding 12-month period)
  - DRP < 0.3 mg/L
  - temperature ≤ 3°C above or below the temperature of the receiving water at the time of discharge.

3.1 Water level

Time series of water level at Carters Creek, lake intake and outlet, and in wells 1 and 2 (Figure 3-1a,b) do not show any significant trend from 2015 to 2023. Electrical conductivity has significantly decreased since 2015 only at the lake intake and well 1 ($p < 0.05$, Figure 3-1c).

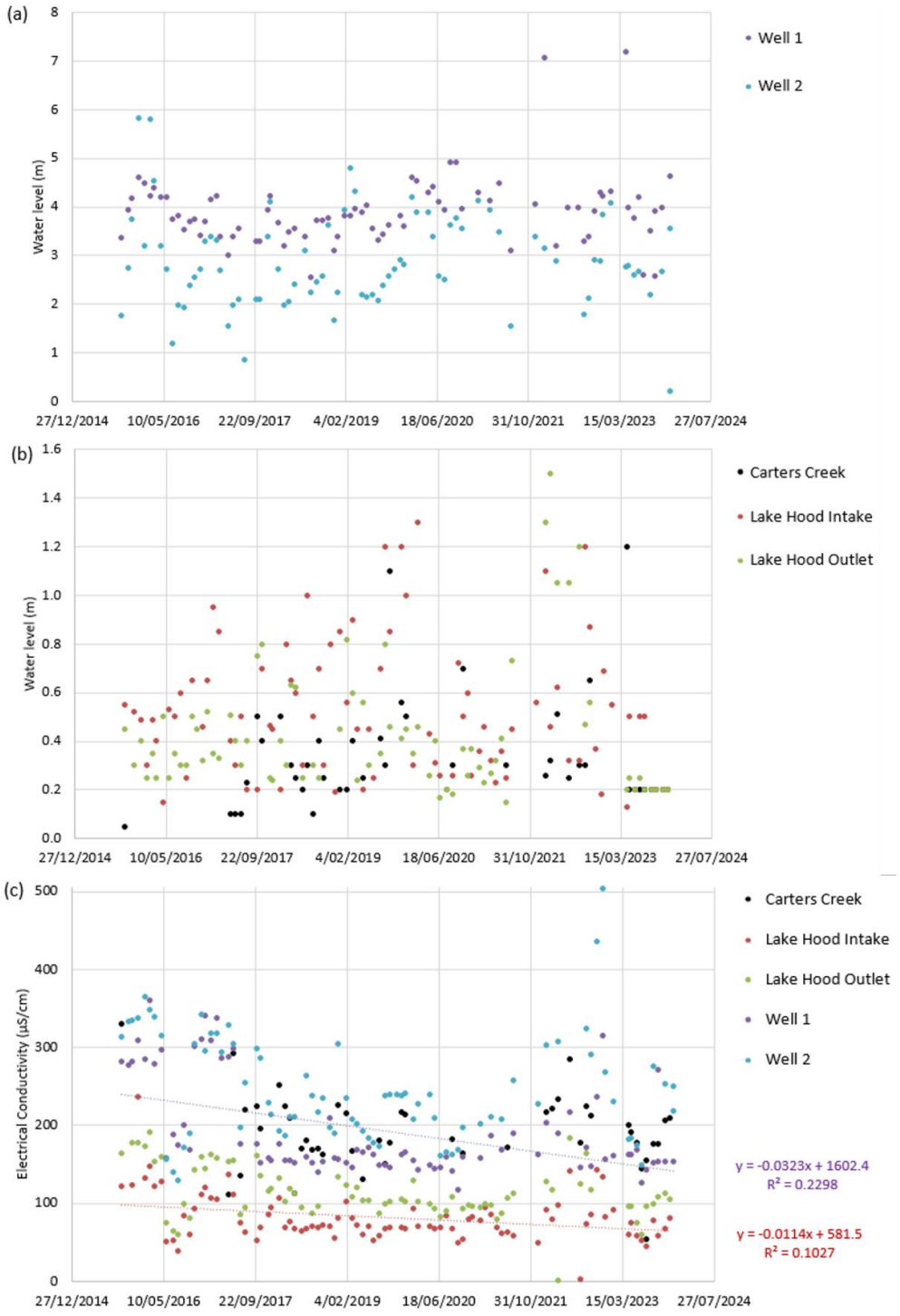

Figure 3-1: Time series of water level at (a) well 1 and 2, (b) Carters Creek, lake intake and outlet, and (c) electrical conductivity at five locations. Dashed lines are linear regressions, only shown for significant trends ($p < 0.05$). Equations for each location are marked by colour. Note that two outliers are not shown: 5.5 m at Lake Hood intake on 25 October 2016 and 3.0 m at Carters Creek on 27 February 2018.

3.2 Meteorological conditions

High temperatures can drive cyanobacterial growth, and thus air temperature can have a strong impact on cyanobacteria population dynamics. We obtained available air temperature data for Ashburton airport (2007–2023) at an elevation of 88 m above mean sea level (masl) from the CliFlo database (cliflo-niwa.niwa.co.nz) and considered time series of air temperature and wind speed.

While time series of annual mean air temperature increased significantly (Figure 3-2a), mean air temperature in January (as a representative summertime period) does not show any significant trend (although it increased). The mean air temperature in June (as a representative wintertime period) also increased significantly.

High wind speed can be an indicator of mixing in the lake and can reduce the risk of cyanobacteria bloom formation in the lake. The annual mean and summer wind speeds decreased from 2007 to 2023, but their trends were not significant (Figure 3-2b).

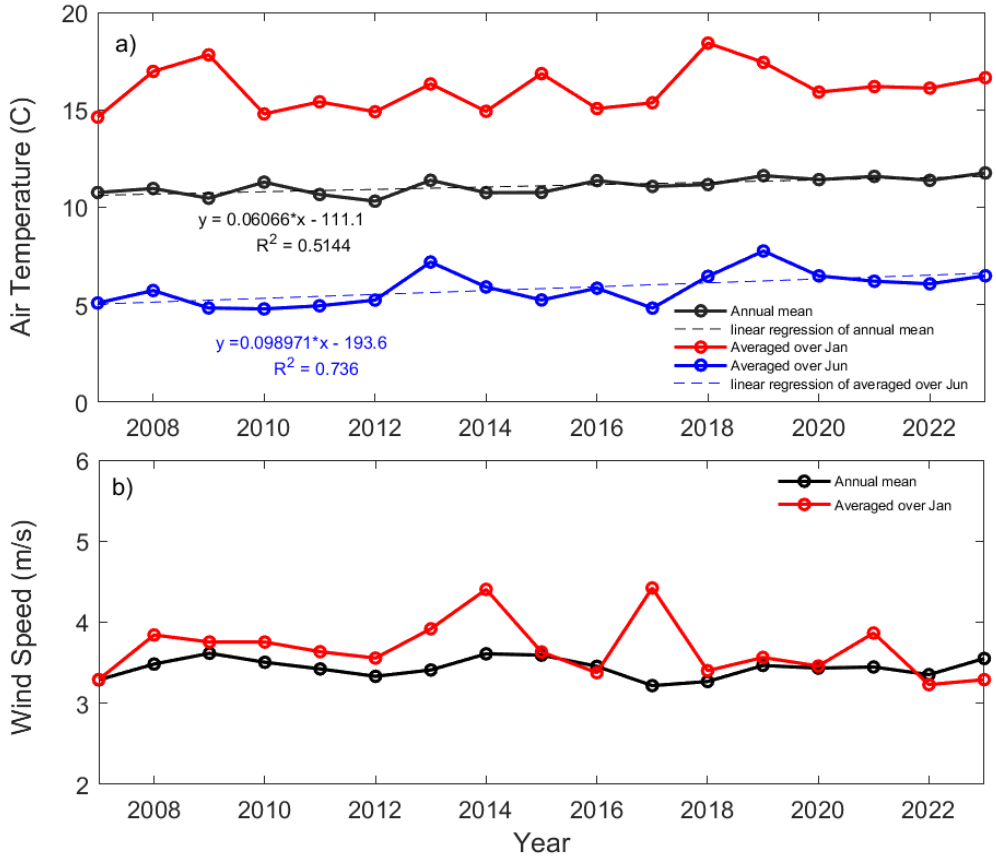

Figure 3-2: Mean annual (black) and averaged over January (red) air temperature (a) and wind speed (b) near Lake Hood. Dashed lines are linear regressions starting in 2001. Dash-dotted lines show linear regressions ($p < 0.05$) starting in 2010. Data from Ashburton airport (2007–2023) at 88 masl. Obtained from cliflo-niwa.niwa.co.nz.

3.3 Water temperature and dissolved oxygen

Figure 3-3 shows time series of surface water temperature measurements in 2015–2023 at five sites: Carters Creek, lake intake, lake outlet, well 1, and well 2. While the water temperature varied seasonally between 3.8 and 24.3°C, there was no significant trend. The highest recorded temperature (24.3°C) was at the outlet on 30 January 2018. A slight increase in the coldest winter water temperatures (i.e., minimum values each year) since 2017 corresponds with the warming winter air temperature (Figure 3-2a). The warmer winter temperature in recent years may have contributed to cyanobacteria blooms in the summer by enabling spores (or “seed banks”) to survive or thrive.

Measured profiles of water temperature at the outlet (max 3 m depth), intake (max 1.9 m depth), New Extension Near Model Boat Club Dock (max 1.5 m depth), and Test Canal Mid-point (max 1.5 m depth) on 16 January 2024 (when the wind was moderate) and on 13 December 2023 (moderate wind condition) show a < 0.5°C difference between the surface and bottom water temperature (not shown here). The only exception was at the lake intake on 16 January 2024, when a difference in the water temperature of 1.4°C (Figure 3-4a) was observed. These measurements indicate that periods of stratification occur in the lake; however, this may be an effect of warmer incoming water sitting above cooler lake water (or sometimes vice versa, if incoming water is cooler).

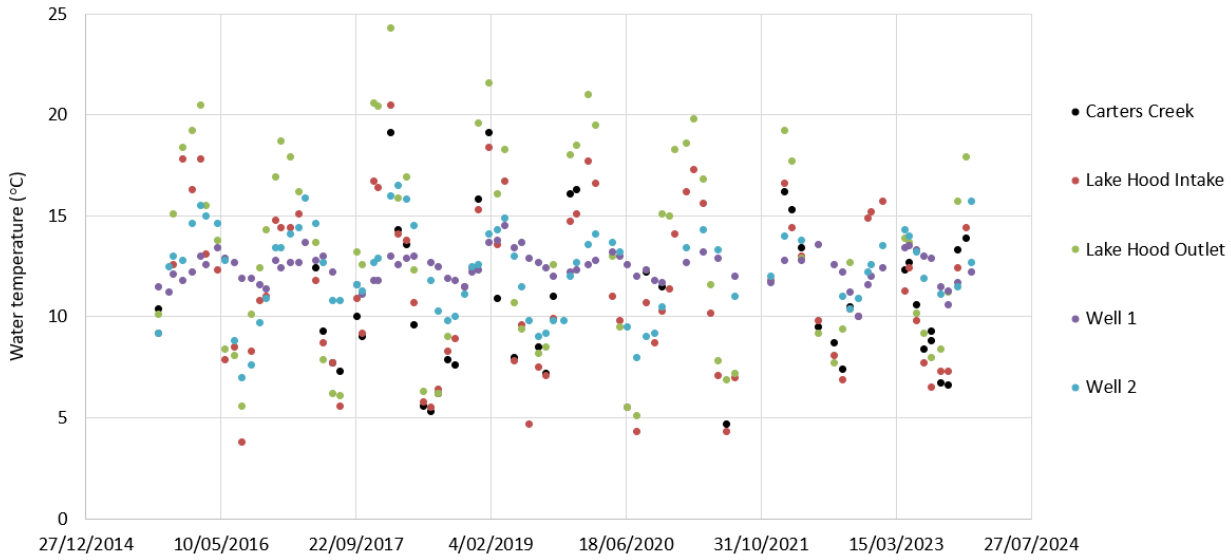

Figure 3-3: Time series of the measured water temperature at two inflows, two groundwater wells, and the outlet of Lake Hood.

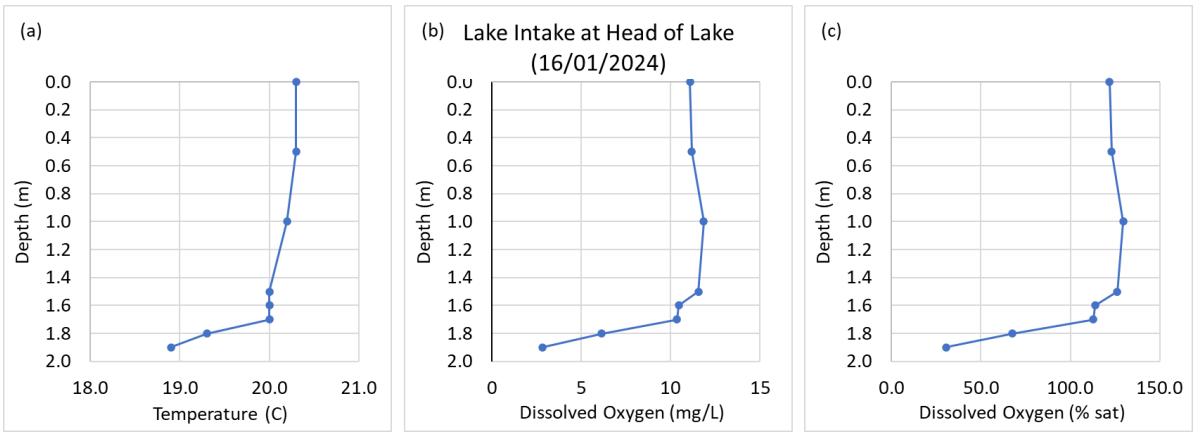

Figure 3-4: Profiles of water temperature (a) and dissolved oxygen concentration and saturation (b and c, respectively) at lake intake at head of lake on 16/01/2024.

3.4 Dissolved oxyen

Figure 3-5 shows time series of field measurements of dissolved oxygen (DO) in 2015-2023 in Carters Creek, the lake intake, and the outlet. The measured oxygen concentration was more than 5 mg/L most of the time, except on 29 January 2019, when DO was 2.93–3.65 mg/L across these locations, and 30 March 2021, when DO was 2.35 and 2.97 mg/L at the intake and outlet, respectively (Figure 3-5a). Time series of near-surface DO do not show any significant trends and concentrations are generally high (> 5 mg/L).

Profile measurements of dissolved oxygen at the outlet, intake, New Extension Near Model Boat Club Dock, and Test Canal Mid-point on 13 December 2023 and 16 January 2024 show < 0.5 mg/L difference in the dissolved oxygen between surface and bottom (not shown here), except at the lake intake on 16 January 2024, when a difference in DO of 8.23 mg/L was recorded (Figure 3-4). The bottom DO at this time was 2.85 mg/L, which is close to hypoxia (DO < 2 mg/L). Therefore, low bottom water oxygen concentrations may occur during stratified periods in Lake Hood.

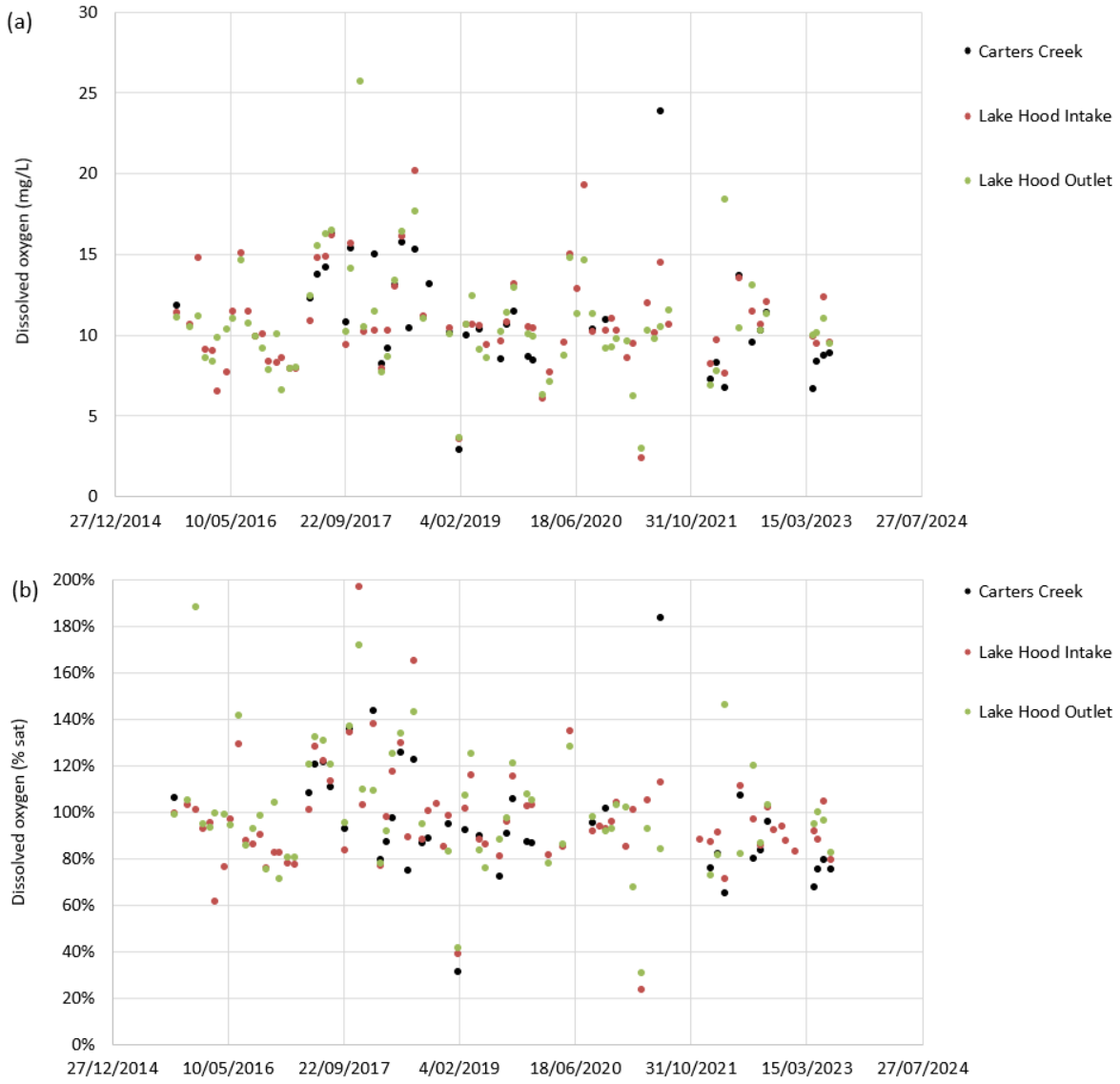

Figure 3-5: Time series of the measured dissolved oxygen concentration and saturation (a and b, respectively) in two inflows and at the lake outlet.

Time series of the surface and bottom water temperature at the canal east end, west end, and mid-end (Figure 3-6) show that the aerator that was turned on 30 October 2023 did not change the stratification pattern, i.e., diurnal stratification with a 1–2°C temperature difference between the surface and the bottom continued to occur in the water column. More importantly, profiles of dissolved oxygen at the west end near diffuser 6 on 8 January 2024 (Figure 3-7) show near-bed hypoxia (DO = 0.25 mg/L). These results indicate that the aeration setup could not prevent water column stratification and occurrence of hypoxia.

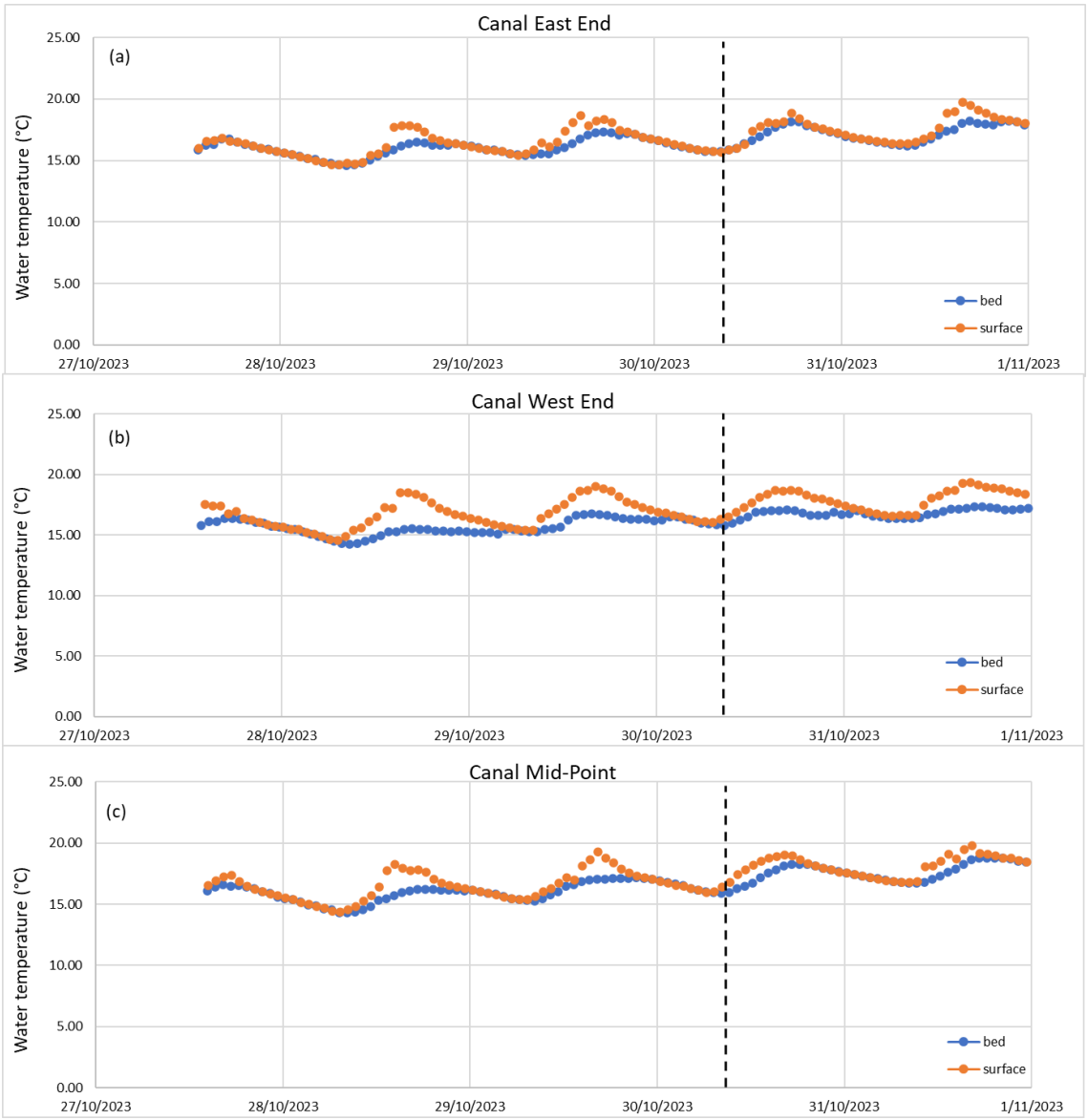

Figure 3-6: Time series of the surface and bottom water temperature at (a) the canal east end, (b) west end, and (c) mid-point. The dashed line shows when the aerator was turned on (9:00 am on 30 October 2023).

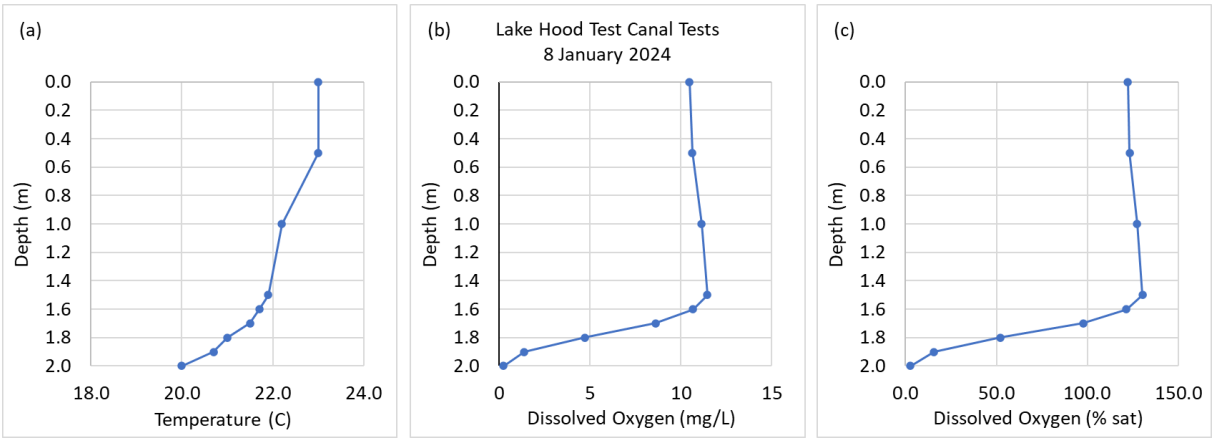

Figure 3-7: Profiles of (a) water temperature, (b) dissolved oxygen concentration, and (c) dissolved oxygen saturation at Lake Hood Test Canal on 8 January.

3.5 pH

High pH (>10) can result in phosphorus release from the sediments, regardless of oxygen levels (Gibbs et al. 2022). Time series of pH measurements in 2015–2023 in well 2, the lake intake, and in the lake outlet (Figure 3-8 a) show that pH values are usually within the consented range (6.5–8.5), with the highest values in the lake outlet. There are statistically significant increasing trends in pH. Maximum field values of > 11 were observed in October 2021 at the lake intake and well 2. At the lake outlet, the pH increased from 7.34 in May 2023 to 10.01 in October 2023 and 9.23 in November 2023. We note that laboratory pH measurements were lower than field measurements (Figure 3-8); this may be due to inconsistent field probe calibration, sample handling and holding times, or other differences in the pH measurement methods. A statistically significant ($p < 0.05$) trend was only observed in the lab measurements of the lake intake samples.

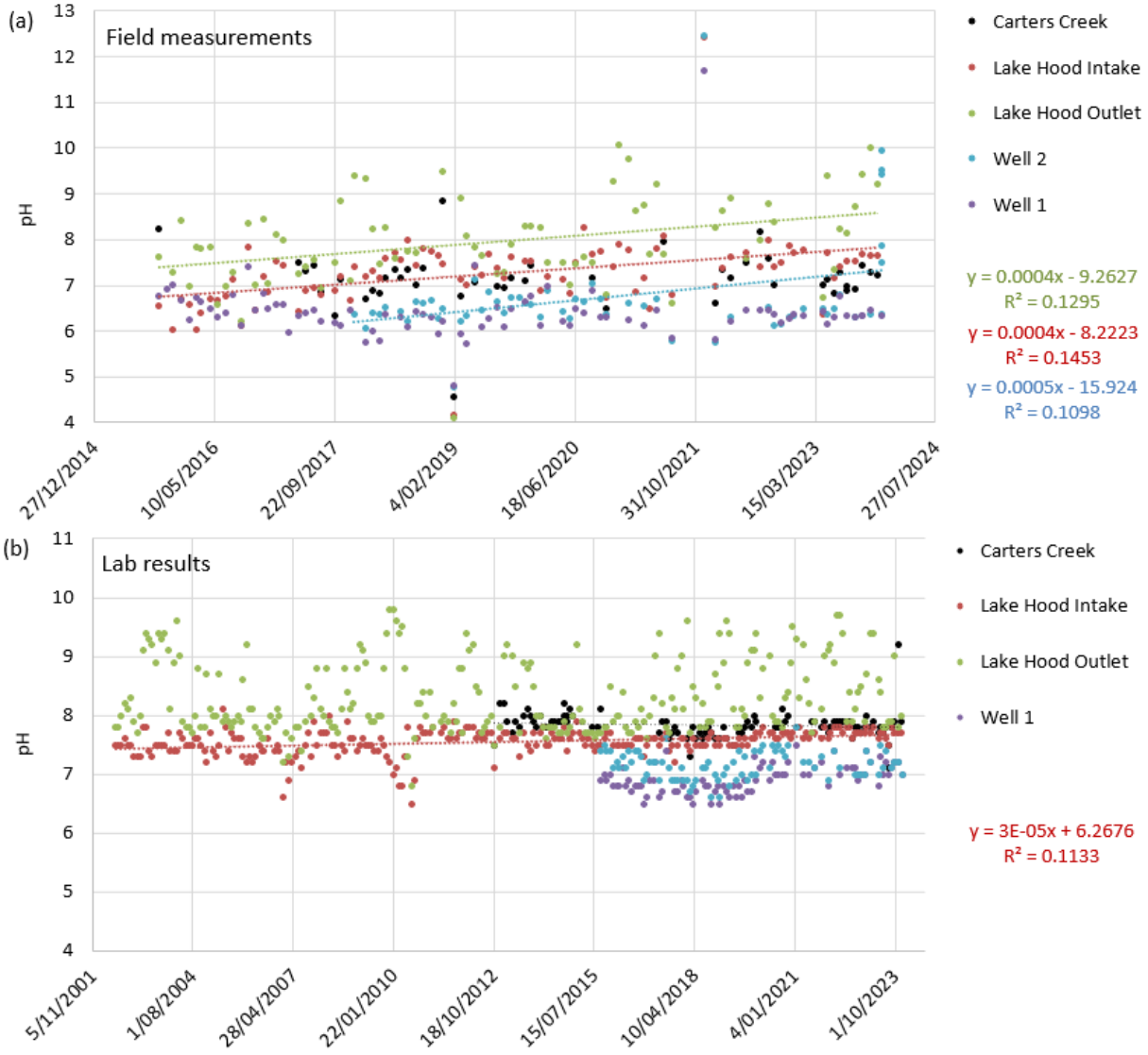

Figure 3-8: Time series of pH from measurements (a) and lab results (b) with linear regressions for significant trends (dashed lines). Equations are marked by colour for each location. Note the difference in the x-axis limits in the two panels.

3.6 Total suspended solids, turbidity, and water clarity

Total suspended solids (TSS) is a measure of particles suspended in the water column. This can include sediments, debris, and live or decaying organic matter including phytoplankton. Turbidity is a measure of the cloudiness or haziness caused by particles in water and thus affects water clarity. Water clarity is a measure of how far or deep light penetrates through the water by a visual clarity measure. Water clarity can be an indicator for algal or macrophyte growth because light conditions can limit growth.

Since 2001, total suspended solids are usually below the consent limit (50 mg/L) but have increased slightly in the Lake Hood intake, with maximum values of >500 mg/L in February 2018, December 2021, and August 2023 ($p < 0.05$, Figure 3-9a). There are no significant trends in TSS in Carters Creek or in the lake outlet (Figure 3-9b). A maximum value of 67 mg/L at Carters Creek was recorded in August 2023 (Figure 3-9b).

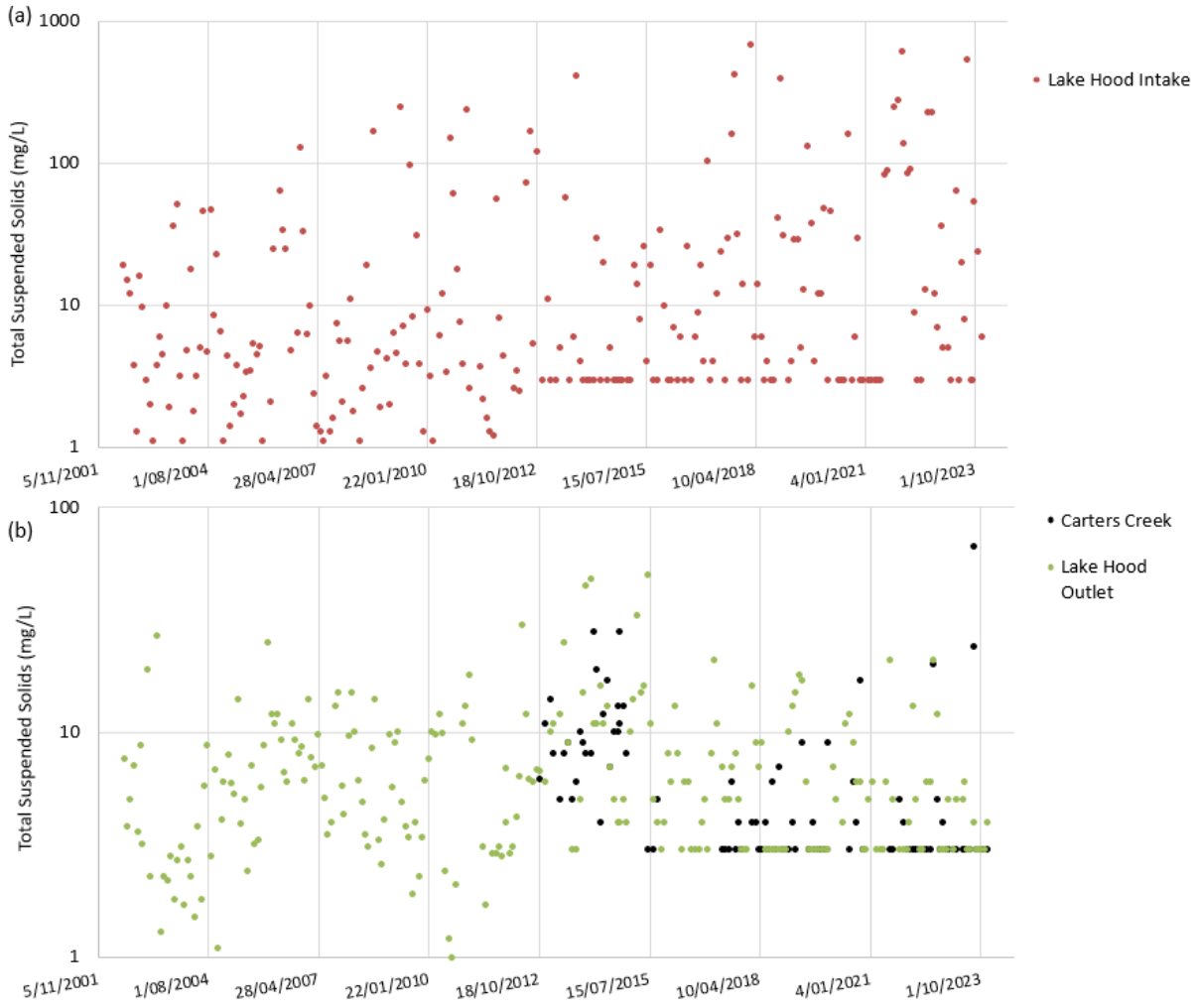

Figure 3-9: Time series of total suspended solids in (a) the Lake Hood intake and (b) Carters Creek and the Lake Hood outlet. Note that the y-axes are on a logarithmic scale and that the detection limit appears to be 3 mg/L since 12/12/2012.

In Lake Hood, water clarity was measured using a clarity tube, which is appropriate for measuring water clarity in relatively turbid water, where visibility through the water is less than 1 m. There are no significant trends in the clarity tube measurements or in turbidity at Carters Creek, the lake intake and outlet in 2015–2023 (Figure 3-10). Clarity tube values cannot exceed 1.0 m (the length of the

tube used in the measurements), but we note that several measurements are close to or even equal to 1.0 m. Secchi depth is a more common measure of visual water clarity or transparency through the lake water column and is obtained by lowering a Secchi disk into the lake until it is no longer visible and measuring the length of the submerged line. Given that clarity tube measurements are high in Lake Hood, visual water clarity measured by a Secchi disk might be a more informative measure and an indicator of light penetration through the water column to a certain depth. Then, the photic threshold, or the depth beyond which little to no photosynthesis occurs, could be defined.

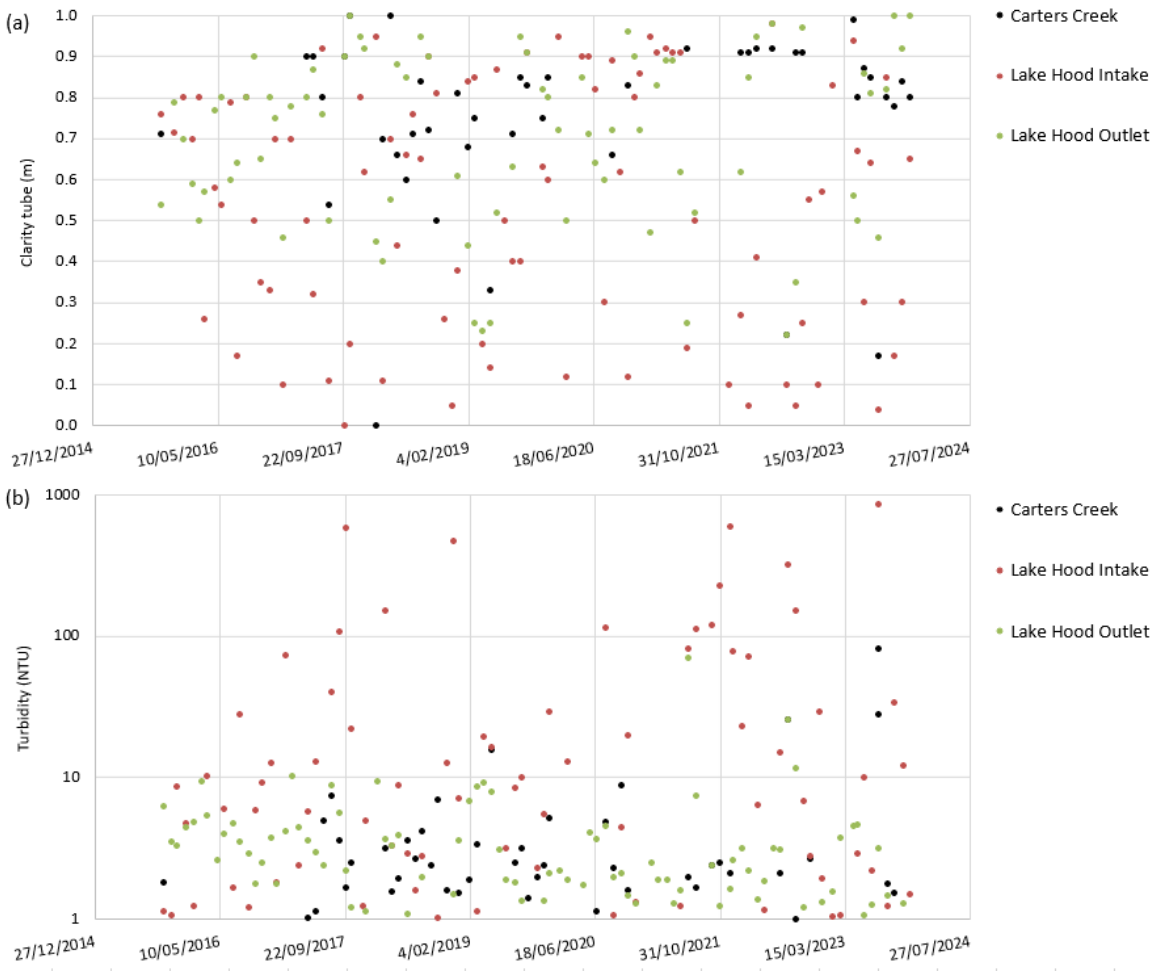

Figure 3-10: Time series of total suspended solids in (a) water clarity (clarity tube) and (b) turbidity at Carters Creek and the Lake Hood intake and outlet. Clarity tube values are always between 0 and 1 m (i.e., 1 m is the maximum possible value). Turbidity is plotted on a logarithmic scale.

Poor water clarity can indicate light limitation for phytoplankton and there are several measures of water clarity and influencing factors. Often, a relationship between TSS and turbidity can be determined, but this can vary greatly between different water bodies or different locations within a water body (e.g., 1:2 to 2:1 turbidity to TSS ratio in a US reservoir, Brown 1984). Measures of water clarity can be also related to turbidity.

Based on the water clarity tube measurements and the fact that Secchi depth is likely greater (as in Litton et al. 2004 and based on 2007–2008 Secchi depth measurements in Lake Hood, Tonkin & Taylor 2008), we expect light to penetrate through the water column, usually to the lake bottom. Low turbidity measurements and the fact that the lake is shallow (mean 2.39 m, max 4.25 m; Tonkin & Taylor 2008) also suggest that light likely reaches the lake bottom and does not limit algal growth. Even if light conditions are suboptimal beyond a certain depth, light is unlikely to limit the

cyanobacteria observed in Lake Hood, because they have the ability to control their buoyancy and thus adjust their vertical location in the water column and seek optimum light conditions for growth (see section 4.1.1).

We could measure light conditions in the lake over time and then calculate the light extinction coefficient and estimate the photic depth with respect to changes in TSS or turbidity, but – again – it seems unlikely that light is a limiting factor for cyanobacteria growth in Lake Hood.

3.7 Sediment nutrient content

Sediment nutrient content can be an indicator for potential sediment nutrient loading to Lake Hood. Phosphorus is especially of interest, as it is the limiting nutrient for cyanobacteria growth (see section 4). Lake Hood sediments were sampled once at four locations on 5 September 2023 and analysed for P, N, and C (Table 3-1).

Sediment total phosphorus content in Lake Hood ranged between 440–820 mg/kg. Sediment total phosphorus content values in the range 200–500 mg/kg can be considered low, 500–1000 mg/kg can be considered moderate, and >1000 mg/kg can be considered high (Pettersson et al. 1988). For example, sandy, coastal sediment P content can be 10 mg/kg or less, while iron- and carbonate-rich gyttja (sediment rich in organic matter in eutrophic lakes) P content can be as high as 10,000 mg/kg (Holtan et al. 1988). The sediment P content in different lakes considered by Petterson and Jansson (1988) ranged 550–649 mg/kg dry mass. In Lake Taihu (a large, shallow, eutrophic lake in China with frequent cyanobacteria blooms), sediment P content measurements ranged 330–1030 mg/kg dry mass (Trolle et al. 2009). Based on the available data for Lake Hood, the sediment total P content appears to be moderate.

Sediment total nitrogen content ranging 1,000–5,000 mg/kg can be considered low, 5,000–10,000 mg/kg can be considered moderate, and >10,000 mg/kg can be considered high. In Lake Taihu, sediment N content measurements ranged 380–2,370 mg/kg (Trolle et al. 2009). Based on the available data for Lake Hood (700–4,400 mg/kg), the sediment total nitrogen content appears to be low.

Sediment total organic carbon content ranging 1–5 g/100 g can be considered low, 5–10 g/100 g can be considered moderate, and >10 g/100 g can be considered high. For example, in Lake Taihu, sediment organic C content measurements ranged 1.68–9.38 g/100 g (Trolle et al. 2009). Based on the available data for Lake Hood (0.44–3.7 g/100 g), the sediment organic C content appears to be low.

Table 3-1: Total phosphorus, nitrogen, and carbon content in lake sediment samples collected from four sites on Lake Hood on 5 September 2023.

Site	Total P content (mg/kg dry mass)	Total N content (mg/kg dry mass)	Total organic C content (g/100 g dry mass)
Trial Canal	710	4,400	3.7
Lake intake	820	1,500	1.12
Lake outlet	440	900	0.71
New extension	550	700	0.44

The limited sediment sampling results suggest that the phosphorus nutrient content could contribute to the nutrient load that fuels cyanobacteria blooms.

3.8 Nutrients and chlorophyll *a*

In an earlier communication (2017) by Clive Howard-Williams to the Task Force, it was stated that nutrient and chlorophyll concentrations in the lake were high compared to concentrations in the Ashburton River. The river was deemed strongly phosphate limited – although no evidence was provided to show this (AEE section 8.1.9, as cited by Clive Howard-Williams), and the bioavailable nutrients dissolved inorganic nitrogen (DIN = NH_4-N + NO_3-N + NO_2-N, the sum of ammoniacal nitrogen, nitrate nitrogen, and nitrite nitrogen) and dissolved reactive phosphorus (DRP) were lower in the lake than in the river.

McCracken et al. (2023) also indicated that phosphorus is an important driver of cyanobacteria growth in Lake Hood:

> *The Carters Creek sample taken after a storm flow shows total nitrogen at nearly three times the 2023 lake level and total phosphorus at over 40 times the lake level. During the July 2023 flood, over 65% of the total phosphorus was dissolved reactive phosphorus, the most readily available form for algal and cyanobacterial growth. The Carters Creek water quality is important in that the creek discharges to the west-most canal where water flows are minimal and exchange between the canal and the main body of the lake is thought to be low (except during Carters flood flows), and where the 2023 Cyanobacteria bloom was first detected*.

Based on the available data, total nitrogen (TN) increased in well 2 in 2015–2023, with values of > 6 mg/L since August 2023 (Figure 3-11a). The maximum TN value of 10.3 mg/L was recorded in September 2023 at this location. TN does not show any obvious trends or large changes at other locations but has slightly decreased in well 1. Nitrate-nitrite (NO_3 and NO_2) in wells 1 and 2 were generally > 2 mg/L and increased significantly in well 1 in 2015–2023. Lake Hood inlet and outlet nitrate-nitrite concentrations were generally < 2 mg/L.

Total phosphorus (TP) values were highest in the lake intake and Carters Creek (Figure 3-12b; records at the wells are limited to 2015–2016). While peaks of TP > 0.2 mg/L were recorded in the lake intake over several years, the maximum value of 0.57 mg/L in the lake intake was in August 2023, which corresponds with the highest recorded dissolved reactive phosphorous (DRP) value of 0.38 mg/L at this location (Figure 3-12c). DRP values in other locations were generally < 0.15 mg/L.

Figure 3-11: Time series of (a) total nitrogen, (b) nitrate-nitrogen, (c) total phosphorus, and (d) dissolved reactive phosphorus. Dashed lines are linear regressions for significant trends ($p < 0.05$). Equations for each location are marked by colour. Not shown: DRP was > 0.1 on 28/7/2022, 25/7/2023, and 24/7/2023.

While the highest values of total biochemical oxygen demand (TBOD) were found in the lake outlet, it was generally < 2 mg/L in the lake intake and Carters Creek (Figure 3-12a), well below the consent condition of 5 mg/L.

Chlorophyll *a* (chl *a*) is a measure of phytoplankton biomass and showed slight decreases in Carters Creek since 2015 (section 3.8); however, there are no apparent chl *a* trends in the lake outlet or intake. Corresponding with phosphorus records, the highest values of chlorophyll *a* (> 0.04 mg/L) were recorded in the lake outlet, and chlorophyll *a* was generally < 0.02 mg/L at the lake intake and Carters Creek (Figure 3-12b). While chlorophyll *a* decreased slightly in Carters Creek since 2015, there are no apparent trend directions for chlorophyll *a* in the lake outlet or intake.

Figure 3-12: Time series of (a) total biochemical oxygen demand and (b) chlorophyll *a*. Not shown: BOD was 39 mg/L on 11/12/2013.

3.9 Trophic state

The Trophic Level Index (TLI, Burns et al. 1999) is widely used in New Zealand to track and report on the level of eutrophication in lakes. TLI is calculated from TN, TP and chlorophyll *a* concentrations (and Secchi depth can also be included, where available). In 2023, mean chlorophyll *a* was 13.5 mg/m^3, TN was 1,065 mg/m^3, and TP was 15.3 mg/m^3 in the Lake Hood outlet, representative of lake conditions. Based on these mean annual values, the trophic level index (TLI, Burns et al. 1999) is 4.76, indicating that Lake Hood is eutrophic, which is consistent with the assessment by Tonkin and Taylor (2008). In addition, the N:P ratio is high (69), indicating low P relative to N and thus P limitation for algal growth.

There are, unfortunately, no long-term data available on the phytoplankton population composition in Lake Hood (chlorophyll *a* is a measure of overall phytoplankton biomass but does not describe what species are present). Counts were obtained for cyanobacteria in the summer of 2023 (9 February 2023), and elevated levels of cyanobacteria were reported in subsequent counts from 23 March 2023, 29 March 2023, and 24 April 2023 by Cawthon and in full counts by NIWA for a sample from 4 January 2024 (see detailed discussion in section 4). The only non-cyanobacterial species mentioned in the Cawthron reports for 2023 was the large dinoflagellate *Ceratium* sp., which peaked in January. *Ceratium* sp. (motile) is likely to compete with *Dolichospermum* as they are both advantaged by being able to move up and down through the water column (buoyancy control) and are favoured under stratified and/or stable low wind/low mixing conditions (see section 4.1.1). This species was again prominent in the bloom seen recently, in March 2024. All other main phytoplankton species present in the March 2024 sample were identified. The other species in the March 2024 sample were dominated again by motile species of *Cryptomonas* sp. (Cryptophyceae) followed by several other motile species from a range of phyla including *Chroomonas* sp., *Eudorina* sp., *Trachelomonas volvocina,* and *Haematococcus* sp. Most of the remaining non-motile species were green algae, with only one diatom observed in the sample. Motile genera are likely advantaged by being able to maintain themselves at optimal levels for light in the water column if mixing was low. Domination of motile species (or species with buoyance control) indicates that motility is advantageous in Lake Hood either to gain nutrients or to maintain time in the best light environment for growth. This could also lead to the occurrence of shading of other non-motile phytoplankton groups if low mixing allows phytoplankton to concentrate at an optimal light depth. The occurrence of these species is expected in a eutrophic environment with low P compared to N, as diatoms are poor competitors at low phosphate concentrations (Egge 1998). Cyanobacteria are discussed in detail in the following section.

4 Cyanobacteria

Cyanobacteria are a group of phytoplankton also commonly called blue-green algae that can be of concern because some types can produce toxins that can compromise human, animal, and ecosystem health. Blooms observed in Lake Hood in 2023 and 2024 were sampled on at several sites on five occasions (Figure 4-1).

Figure 4-1: Approximate phytoplankton sampling locations in Lake Hood. Map provided by the Task Force (Les McCracken, March 2024).

Several different cyanobacteria were present in water samples collected from Lake Hood in 2023 and 2024. The sampled blooms were dominated by the genus *Dolichospermum* (previously found within the genus *Anabaena*, but separated from this now benthic genus in 2009, Wacklin 2009). In 2023, the following *Dolichospermum* species were identified: *Dolichospermum spiroides* (dominant), *Dolichospermum circinale* (subdominant, Figure 4-2), and *Dolichospermum cf. planctonicum. Dolichospermum circinale* dominated in March 2023, peaking at 15,000 cells per ml and at ~3 mm^3/L in biovolume (Ski Lane first Jetty, Figure 4-3). *Dolichospermum spiroides* dominated the cyanobacteria bloom in January 2024 at 61,000 cells/ml and ~9 mm^3/L in biovolume (Lake Hood Huntingdon Ave Canal, Figure 4-2). In water samples collected during another bloom in late February 2024, *Dolichospermum circinale* was dominant (~34,000 cells per ml) and *Dolichospermum spiroides* was subdominant (2,203 cells per ml), with *Dolichospermum planctonicum* also present (33 cells per ml) at Lake Hood Bayliss Beach. Similar *Dolichospermum circinale* cell counts (~30,000 cells per ml)

were found at Halston Close-Carters Creek Canal. The canal areas were the most affected by cyanobacteria.

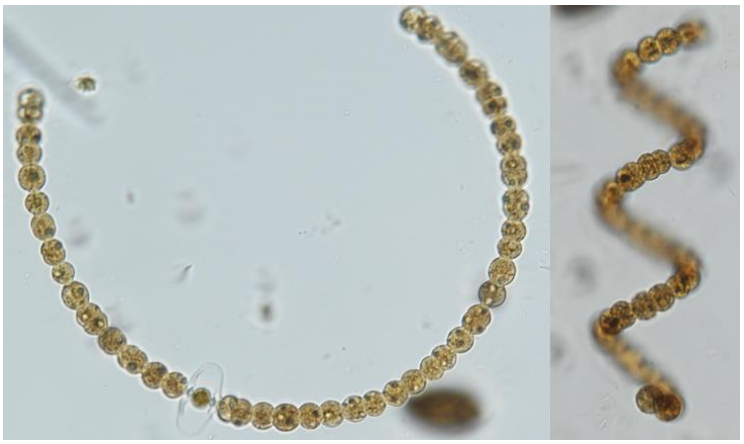

Figure 4-2: Images of *Dolichospermum circinale* (left) and *Dolichospermum spiroides* (right) taken of water samples collected for analysis from Lake Hood in March 2024. Source: Karl Safi, NIWA.

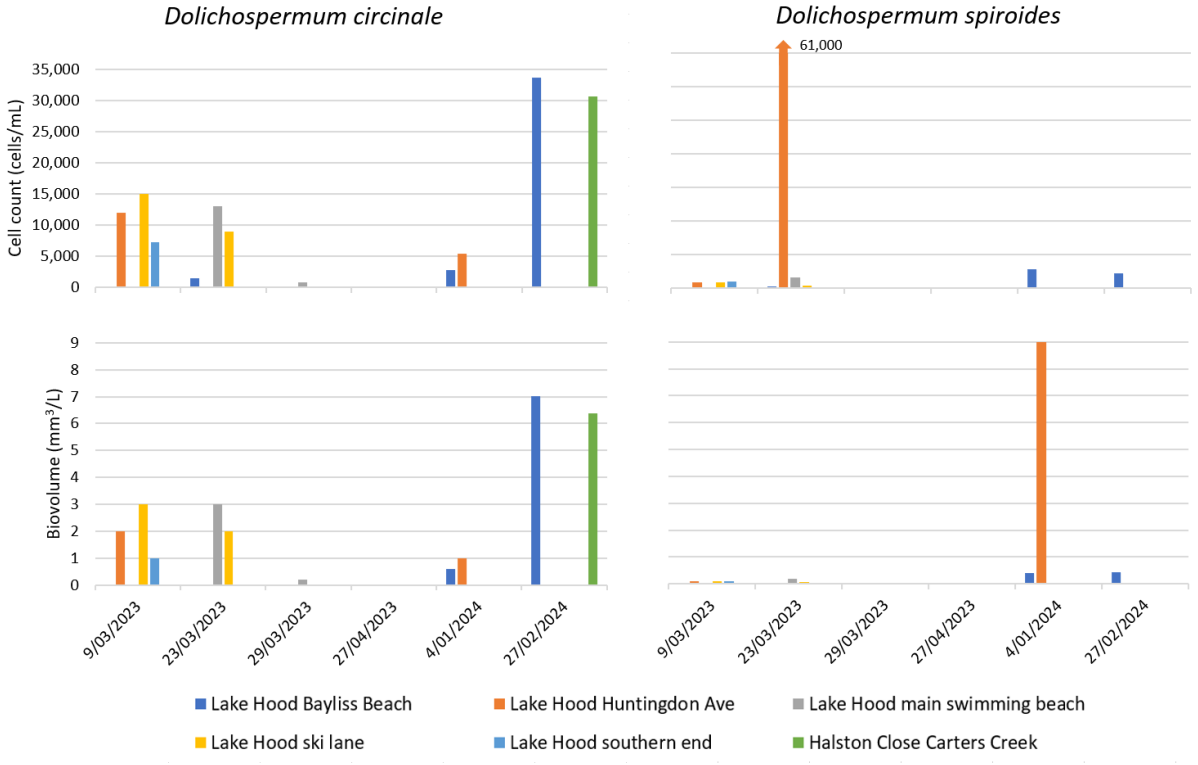

Figure 4-3: Cyanobacteria laboratory results from five sampling sites and dates for the two most dominant species, *Dolichospermum circinale* (left) and *Dolichospermum spiroides* (right) in Lake Hood. Biomass is presented as cell counts (top) and biovolume (bottom).

All other cyanobacteria were reported at much lower concentrations and were either smaller in size (and therefore biovolume), non-toxin producers, or benthic. These are unlikely to be of significant concern at present. *Aphanocapsa* sp. and *Pseudanabaena* sp. cells are generally < 3 µm in diameter, smaller than *Dolichospermum* cells (> 5 µm in diameter). *Limnococcus limneticus*, although larger in diameter, occurred in very low numbers and is not known to be toxic. *Phormidium* sp. (7.0–7.9 µm), although a recognised toxin producer in New Zealand, is benthic (bottom-dwelling) and was observed in very low numbers. *Phormidium* sp. do not propagate in the larger lake as they require

surfaces to grow on; however, this cyanobacterium could be coming from river inflows (detached benthic material) or could propagate on the lake fringes/edge, in which case its numbers may be underestimated in water column samples. *Aphanizomenon* was detected in extremely low numbers. This species has similar characteristics to *Dolichospermum* and could be problematic if found in large numbers. In 2024, toxin producing *Microcystis* sp. were also detected at low concentrations of 24 cells/ml and could also become problematic if found at much higher concentrations.

4.1 *Dolichospermum* characteristics

Dolichospermum blooms can be a threat to the environment and human health due to toxin production. This genus can produce a variety of highly potent toxins including the neurotoxins anatoxin and saxitoxin and the liver toxins microcystin and cylindrospermopsin (O'Neil et al. 2012, Li et al. 2016, Capelli et al. 2017, Österholm et al. 2020). This genus also produces lipopolysaccharides which can cause skin or lung irritations and gastroenteritis. In New Zealand, *Dolichospermum lemmermannii* has been found to produce anatoxin-a and microcystin (pers. comm. K. Thompson, unpublished data). Other *Dolichospermum* sp. are commonly seen in New Zealand as part of mixed cyanobacteria blooms associated with toxins, but in in those cases toxin production cannot be clearly attributed to this genus. Overseas, the genus has been associated with the production of anatoxin-a, anatoxin-a(S), cylindrospermopsins, and microcystins, so these toxins may also be produced in New Zealand (Guidelines for DWM 2020).

Dolichospermum has some special characteristics that may have led to its dominance in Lake Hood. These features are described in detail in the following sections.

4.1.1 Buoyancy control and temperature preference

Dolichospermum cells have gas vesicles that allow for buoyancy regulation in the water column. Compared to other phytoplankton without this capability, *Dolichospermum* may have a competitive advantage (Walsby et al., 1995). *Dolichospermum* can use its gas vesicles to move to optimal depths in the water column, to place itself in optimal light conditions to maximise growth during the day and descend to deeper water to obtain nutrients at night. This occurs most efficiently in stratified (not well mixed) deeper waters but can also occur in mixed shallow waters.

Thermal stratification divides the water column into a warmer top and a cooler bottom layer, often leading to lower nutrient concentrations in the top following phytoplankton growth (Figure 4-4). This provides an advantage for *Dolichospermum* because it can move down to the bottom layer to obtain more nutrients. Stratification may induce anoxic conditions (< 0.5 mg/L DO) in the bottom waters of the hypolimnion that can promote the release of nutrients, especially phosphorus, iron, and manganese from the sediments. This could increase *Dolichospermum's* advantage by increasing nutrient availability (Ismail et al. 2002, Dengg et al. 2023, Figure 4-4).

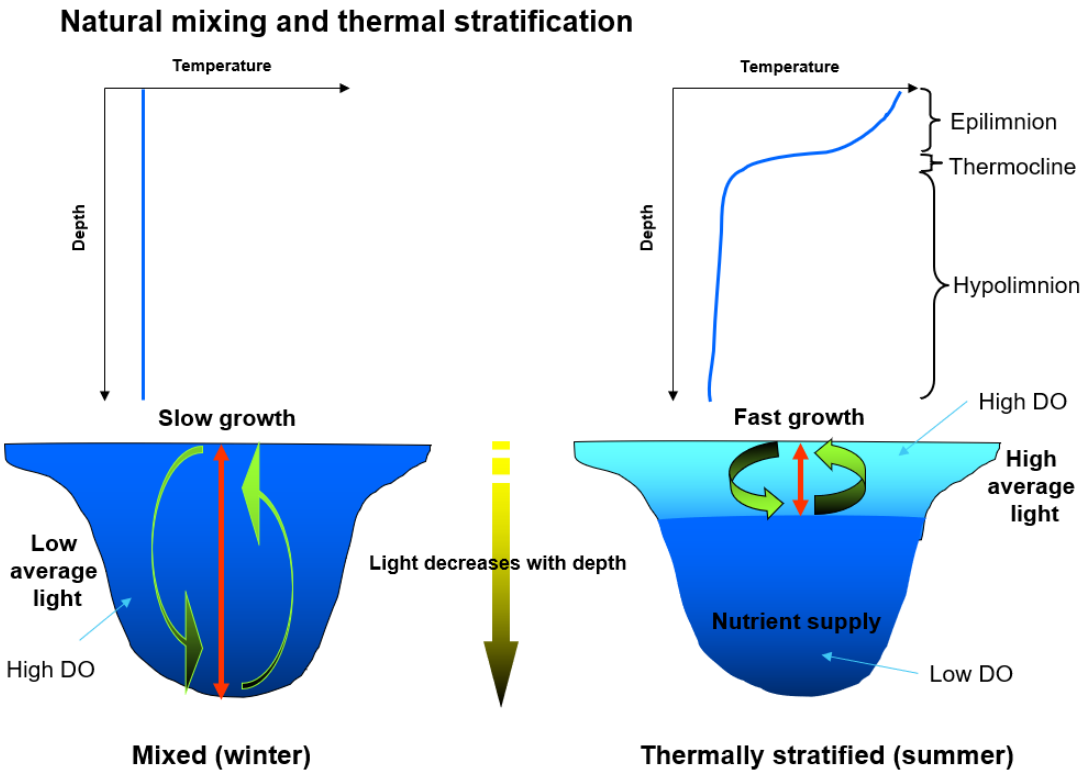

Figure 4-4: Diagrams showing how thermal stratification can affect the conditions for the growth of phytoplankton populations in the water columns of lakes. Source: Max Gibbs, NIWA.

Increasing temperatures due to climate change are predicted to favour cyanobacteria growth over other groups of freshwater phytoplankton (Paerl and Huisman 2008, Paerl and Huisman 2009, Paerl and Paul 2012). Cyanobacteria growth rates are higher at temperatures exceeding 25°C (Robart and Zohary 1987, Butterwick et al. 2005), while other algae have growth optima at temperatures below 25°C (Peeters et al. 2007).

Warming is also expected to enhance nutrient loading by inducing thermal stratification and phosphorus release from lake sediments (Jeppesen et al. 2009) and mineralisation in catchment soils (Moss et al. 2011). For example, Westwood and Ganf (2004) found that *D. circinale* populations grew faster when exposed to longer periods (multiple days) of stratification than short periods of stratification or mixed conditions. Experiments showed that *Dolichospermum* growth decreased with artificial mixing preventing thermal stratification (Reynolds et al. 1983, Nakano et al. 2001).

4.1.2 Nitrogen fixation

Dolichospermum can turn simple cells into heterocysts (Komárek and Anagnostidis 1989, Komárek 2010). Heterocysts are specialized nitrogen-fixing cells, which form during low nitrogen conditions (Stewart 1973, Figure 4-5). The primary function of these specialised cells is to fix nitrogen from the atmosphere which can then be used for biomass production (Schindler et al. 2008).

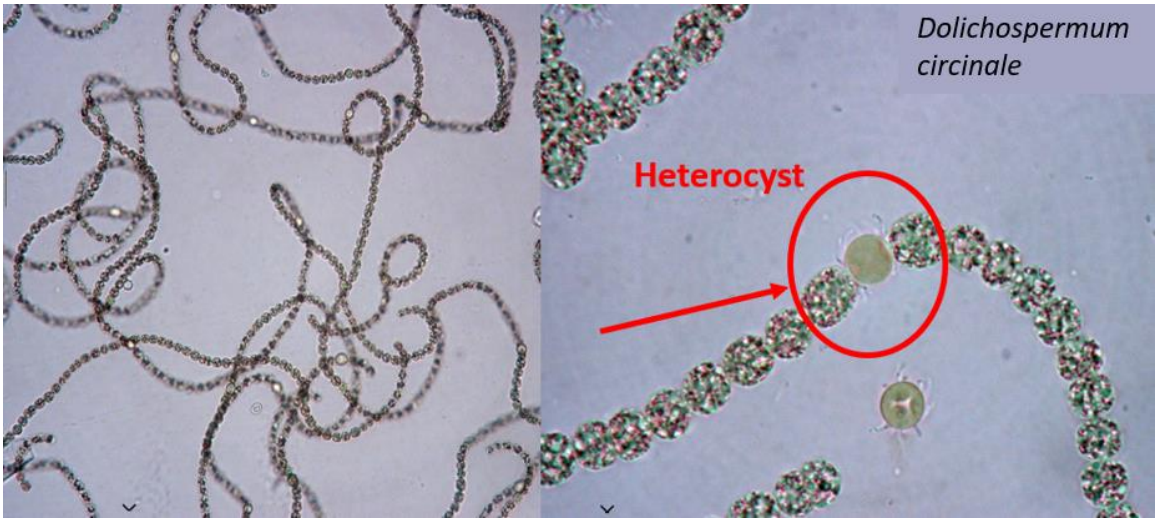

Figure 4-5: Images showing *Dolichospermum circinale*, showing a nitrogen fixing heterocyst within the filaments. Source: Karl Safi, NIWA.

4.1.3 Akinete production

Dolichospermum can also turn simple cells into akinetes, which are resistant spores that can quickly grow into new filaments or form seed banks (Komárek and Anagnostidis 1989, Komárek 2010). Akinetes can sustain long-term dormancy if conditions do not favour their germination, enabling *Dolichospermum* populations to survive under harsh conditions (such as overwintering, dry seasons, flooding; Stüken 2006). Once a bloom has occurred, the establishment of seed banks makes reoccurring blooms during optimum environmental conditions likely.

4.1.4 Allelochemical interactions

Cyanobacteria may dominate phytoplankton blooms due to production of allelochemicals that inhibit the growth of other phytoplankton (Schlegel et al. 1999, Fujii et al. 2002, Suikkanen et al. 2004, Suikkanen et al. 2005, Gorokhova and Engström-Öst 2009, Engström-Öst et al. 2011). For example, allelochemicals produced by *D. lemmermannii* decreased cell numbers of two phytoplankton taxa, *Rhodomonas* sp. and *Thalassiosira weissflogii* (Suikkanen et al. 2004).

4.1.5 Higher pH preference

Alkalinity and pH determine the chemical speciation of inorganic carbon, such as carbonate, bicarbonate, and carbon dioxide. Low carbon dioxide concentrations favour the growth of several cyanobacterial species. Hence, low alkalinity and hardness and high pH (a result of photosynthesis) give cyanobacteria a competitive advantage (Health Canada 2000, edited 2002). Elevated and apparently increasing pH in Lake Hood may not only promote P release from the sediments (see section 5) but also contribute directly drive cyanobacteria blooms.

4.2 Likely drivers of cyanobacteria blooms in Lake Hood

Considering water quality conditions based on the available data (section 3) and cyanobacteria observations, there are likely several drivers of blooms in Lake Hood:

- high temperature (regularly ~20°C and as high as 24.3°C in the lake outlet; advantageous for cyanobacteria, Robarts and Zohary 1987)
- high pH

- *Dolichospermum* mobility through buoyancy control
- *Dolichospermum* in Lake Hood fixes nitrogen (evidence of heterocysts suggests this)
- likely P limitation

Phosphorus is commonly considered to be the most limiting nutrient in freshwater ecosystems (O'Neil et al. 2012). High P concentrations often co-occur with severe cyanobacterial blooms in many regions of the world, such as in large lakes in North America and in China (Huang et al. 2016). In a recent study, which analysed data from 464 lakes covering a 14,000 km north-south gradient in the Americas and three lake depth categories, Bonilla et al. (2023) found that phosphorus was the primary resource explaining cyanobacterial biomass. Nitrogen was less significant and largely associated with shallow lakes (< 3 m depth). In this study, water temperature was not significantly related to cyanobacteria biomass. In a recent study of eight NZ lakes, Guildford et al. (2022) concluded that evidence of P limitation was stronger than for N limitation and more effort is needed to reduce P inputs to protect and remediate NZ lakes.

Ratios of TN:TP are sometimes used to determine N or P limitation for algal growth. Ratios greater than 15:1 can be indicative of potential P-limitation, and ratios less than 7:1 can be indicative of potential N-limitation, while ratios between 15:1 and 7:1 can be indicative of potential N- and P-colimitation (White 1983, Vant 1987, Havens et al. 2003, McDowell et al 2009, MfE 2007, Abell et al. 2010). A high concentration of P and a low N:P ratio can favour the development of cyanobacterial blooms (Smith 1983, Ekholm 2008), as some cyanobacteria can make up for nitrogen deficits by fixing nitrogen from the atmosphere. In a study on Lake Vombsjön (Li et al. 2018), TP had a stronger positive correlation with cyanobacteria biomass than dissolved inorganic phosphorus (DIP), and DIN had a stronger negative correlation with cyanobacteria biomass than TN. In this case, DIN:TP predicted cyanobacteria biomass development better than TN:TP. Hence, a low N:P ratio alone does not necessarily prevent the development of cyanobacterial blooms. These studies and other recent evidence suggest that different cyanobacteria have distinct ways of responding to P availability and that the control of cyanobacterial blooms by targeted nutrient reduction largely depends on the dominant species.

Lake Hood has a ratio of TN:TP greater than 15:1 (69:1 for mean TN and TP in the lake outlet in 2023) which is indicative of potential P-limitation. However, this could be different in the canals, where P concentrations are presumably higher (based on P concentrations measured in Carters Creek). Because *Dolichospermum* sp. is the dominant cyanobacterium in Lake Hood, P reduction may be effective in restricting cyanobacteria blooms, as P reduction is more effective in controlling nitrogen fixing *Dolichospermum* than non-nitrogen fixing cyanobacteria like *Microcystis* sp. (Wan et al. 2019). This and other studies suggest that P reduction may be the best approach for reducing cyanobacterial bloom formation in Lake Hood. However, N load reductions may also be required, as one study indicates that highly P-limited, eutrophic conditions can be "vulnerable to more intense and toxic (due to increased biomass) blooms of *Dolichospermum*" (Kramer et al. 2022).

Target N and P levels for management efforts are difficult to define, but some studies provide at least indicative ranges for N and P concentrations that may limit *Dolichospermum* growth in Lake Hood. Wang et al. (2022) incorporated parameter variability into cyanobacteria growth models and reported half saturation constant ranges for N and P based on experimental work by others. The half saturation constant in the Monod growth model (frequently used) represents the nutrient concentration at which the cyanobacteria growth rate is half of its maximum growth rate. For *Dolichospermum flos-aquae*, the nitrate (NO_3) half saturation constant range was 0.0014–0.5295

mg/L (Donald et al. 2013, Baldia et al. 2007) and the phosphate (PO_4, indicative of DRP) half saturation constant range was 0.0006–0.0208 mg/L (Willis et al. 2017, De Nobel et al. 1997). In a study using long-term data for > 2000 Finnish lakes, the authors concluded that TP thresholds of 0.010–0.061 mg/L may be appropriate for limiting toxic cyanobacteria growth (Vuorio et al. 2020).

In Lake Hood, DRP has been low at the outlet (< 0.005 mg/L) but much higher in the intake and Carters Creek (used to be as high as ~0.040 mg/L but more recently usually < 0.030 mg/L, Figure 3-11). The available information suggests that the bioavailable P concentration must be at least less than ~0.020 mg/L to reduce growth, but this may not eliminate *Dolichospermum* blooms in Lake Hood. If bioavailable N concentrations were also reduced to less than ~0.530 mg/L in the lake (noting that nitrate-nitrite concentrations have been as high as 6 mg/L in Carters Creek and Wells 1 and 2, Figure 3-11), the risk oftoxic blooms may be further reduced. Targeted mesocosm (e.g., benthic chamber) or laboratory experiments would be needed to confirm P limitation and better define P thresholds to restrict *Dolichospermum* growth in Lake Hood.

5 Cyanobacteria control options

There are many ways to control cyanobacteria and other algae in small lakes; some are cutting edge, and others have been shown to be effective. Based on the data analysis and literature review in previous sections, we recommend focusing on limiting nutrient availability (specifically P) to control cyanobacteria in Lake Hood. Nutrient concentrations in the lake are determined by nutrient loads to the lake. External loads are nutrients entering the lake via river/stream and groundwater inflows or sometimes as atmospheric deposition (usually negligible). The main external loads to Lake Hood are the Ashburton River intake, Carters Creek, and groundwater. The internal load refers to P stored in lake sediments that is released to the lake water column during low oxygen (or high pH) conditions. Identification of the main P load to Lake Hood requires a detailed water balance and nutrient loading calculations, which we were outside the scope of this work but are recommended.

Nutrient loads can be managed at the source upstream in the catchment – not discussed here – or by means of in-lake interventions (Paerl 2014). There are many traditional and novel in-lake methods for preventing nuisance or harmful algal blooms, as described by Hamilton and Patil (2022) with respect to Lake Rotorua. In-lake options for controlling cyanobacteria were categorised into physical, chemical, and biological control methods in the following subsections.

5.1 Physical controls

5.1.1 Hydraulic flushing and inflow diversion

Physical changes to the lake itself could assist with hydraulic flushing or moving water through the lake faster and thus reducing its residence time. This could be achieved by increasing taking more water from the Ashburton River and releasing more water back to the river, to increase flows through the lake. From 8 January 2024 to 8 April 2024, the total water intake volume was 71,743 m^3 with water takes on only eight days in that period. This means that times in between takes were as long as 16 days until mid-February and there were no takes after that (to the end of the record). This lack of flow-through may well have contributed to lake warming, the formation of anoxia, and ultimately cyanobacteria blooms.

A caveat with this option is that while the main lake may benefit from this, the canals may still not have enough water movement and keep blooms trapped in areas with longer water residence times. Increasing inflow and outflow may have a dilution effect and decrease the water residence time in the main lake basin but is unlikely to improve circulation in the canals, given the distance between the intake and the canals. Hydrodynamic modelling would enable quantification of local water residence times, i.e., how long water remains in a canal before it is flushed to the main lake basin.

Diverting inflows from Carters Creek to better flushed parts of the lake or bypassing the lake altogether could remove a large fraction of the overall nutrient load to the lake (e.g., see Spigel and Ogilvie 1985). However, a nutrient-rich diverted inflow could negatively affect the new receiving environment – be that another part of the lake (if this part is not flushed well enough), the Ashburton River, or somewhere else.

Creation of a second outlet to enhance circulation is another option that cannot be well assessed without hydrodynamic modelling of the lake. This may work to enhance circulation and prevent surface scum formation, but this is unlikely to prevent cyanobacteria blooms.

5.1.2 Phytoplankton harvesting by filtration

Water filtration may remove phytoplankton and cyanobacteria, but this may not be cost-effective and will not prevent bloom formation.

Withdrawing water from near the surface rather than the bottom could remove cyanobacteria concentrated at the surface, but the lake is quite shallow and easily mixed by wind, which means that cyanobacteria likely only form surface scums during calm conditions. Withdrawing water from near the surface will not prevent bloom formation but can remove cyanobacteria if water is drawn from the surface in the canals where the blooms are concentrated and removed.

5.1.3 Artificial destratification

Aerators could be installed in the lake to increase vertical mixing and prevent deoxygenation of bottom water. Artificial destratification by aeration has been trialled in Lake Hood and in theory could control cyanobacteria by (a) reducing the P supply by oxygenating the whole lake to allow iron precipitation of P and (b) the critical depth effect, where the cells are circulated deep into the water column and experience light limitation. In Lake Hood, P reduction is likely to have a larger effect than critical depth (Sverdrup 1953) unless there is sufficient algal biomass present to restrict light penetration below 4 m.

However, based on the data provided from the aeration trials in a test canal, it does not appear that the system was able to mix (destratify) the water column (see section 3.3). System modifications (e.g., the type of diffusers and the way they are installed) may lead to improvements but these would have to be tested.

This could be a promising approach but would only affect the P load released from sediments to the lake (i.e., the internal P load). If blooms are primarily fuelled by external nutrient sources (e.g., Carters Creek or groundwater), then this method is unlikely to be effective.

5.1.4 Aeration/oxidation

Effective aeration or oxidation of bottom water (hypolimnion) would provide enough DO to available iron (Fe) to bind PO_4 (the most bioavailable form of phosphorus). This would lock P to the sediments and prevent it from fuelling algal growth.

Unlike circulation and destratification, this technique does not break the thermocline (the boundary between warmer surface and cooler bottom water masses). This is considerably more expensive than destratification.

Oxygenation can be achieved by injecting pure oxygen from a lakeside oxygen plant into the hypolimnion in the form of very fine bubbles, e.g., the Speece cone (Speece et al. 1973). It is a technique used in deeper lakes in the northern hemisphere, where the cooler hypolimnion is important as a habitat for fish and a supply of cold water is required for end users. Lake Hood is probably too shallow to allow this technique to work properly. The running cost could be a major issue as the amount of oxygen required has to match or be greater than the water chemical oxygen demand (COD) and the sediment oxygen demand (SOD). Mixing using aeration only requires enough air to bring the bottom water to the surface where oxygenation occurs as diffusive exchange from the atmosphere.

5.1.5 Nanobubble technology

Nanobubble technology produces very small oxygen bubbles in the water, much smaller than those from the Speece cone. These nanobubbles are claimed to oxygenate and sterilize the water and kill

cyanobacteria. It is also claimed to destroy toxins. The exact process has not been well defined but anecdotal evidence from shallow lake trials and a recent experiment by NOAA (https://coastalscience.noaa.gov/news/nccos-validates-nanobubble-technology-for-remediation-of-harmful-freshwater-algal-blooms/) suggests that it works but is still very much in the development stage. Early versions of the nanobubble devices were relatively expensive with multiple devices required to treat medium size lakes and reservoirs.

The technology is expensive at present, but costs should decrease once the product is widely accepted. To date, there is no peer-reviewed literature available to enable the product to be scientifically evaluated.

5.1.6 Drawdown

Drawdown or a drastic reduction of the lake water volume or even entirely emptying the lake would allow shallow exposed sediment to dry out and thus eliminate seed populations of cyanobacteria that cause harmful algal blooms.

The drying time of exposed lake sediments will depend on sediment depth, weather conditions, and soil composition. Deeper sediments are expected to take longer to dry out than shallow sediments. Dry, warm weather conditions allow sediments to dry quicker than cool, wet weather conditions allow. Fine sediments (e.g., of high clay content) may retain moisture longer than coarser sediments (e.g., sands).

Whether algae seed banks survive drying periods depends on the species' resilience, burial depth, temperature, and nutrient availability. For example, *Anabaena* seed banks were not able to germinate after three days of desiccation at 25°C (Tsujimura 2004). Some species can survive desiccation longer than others (Ellegaard and Ribeiro 2018). Seed banks that are buried deeper within the sediments may be better protected from desiccation than those in surface sediments. Large temperature fluctuations may reduce seed bank survival, while nutrient-rich sediments may prolong survival.

Negative sides of lake draining must also be considered. This approach may be feasible and potentially cost-effective but not aesthetically pleasing and would disrupt recreational use of the lake for weeks to months at a time. This would negatively affect fish, macroinvertebrates, and desirable macrophytes in lake. In addition, there may be a nutrient release pulse not long after refilling the lake, as nutrients released from biomass including phytoplankton, cyanobacteria seed banks, and weeds could in turn fuel new algal blooms (Carmignani and Roy 2017).

5.1.7 Dredging and benthic barriers

Dredging is an option to remove lake sediments that can release P during thermal stratification. There two forms to consider: (a) dry dredging of exposed sediment when the reservoir is low and (b) wet dredging, hydraulic or pneumatic dredging when the reservoir is full. This does not affect external nutrient loading from Carters Creek and groundwater that may fuel blooms.

Benthic barriers are applications of clay, silt, sand, and gravel from external sources to bury the surface nutrient-enriched sediment. This technique has been used for many years in the United States. While these barriers block the release of P from the sediment, they can also cause the sediment beneath the barrier to become strongly anoxic, thereby liberating toxic sulphide ions (e.g., hydrogen sulphide, H_2S), which can sterilize the phytoplankton seed banks in the sediment. Any H_2S released from the sediment is rapidly oxidised to sulphate and therefore is not a significant issue.

5.1.8 Sonication

Sonication breaks algae cells and may thus be used to treat existing blooms, but this does not remove the cause or driver of blooms. New blooms can therefore develop soon after sonication due to the release of nutrients from the decaying phytoplankton cells. This method uses a sonic pressure wave to rupture the gas vacuoles in the cyanobacterial cells, causing them to sink into light limiting conditions. *Dolichospermum* has gas vacuoles, which sonication could rupture and thereby cause the cyanobacteria to sink and potentially clear the local water column. In some studies, sonication has been shown to be highly selective, removing only those species with gas vacuoles.

This treatment has been used successfully in the Te Tahi drinking water reservoir in the Waipa district in Waikato, where sonicators have been used to remove a *Dolichospermum* sp. in bloom and have prevented its re-occurrence. A similar, small study using sonication on *Woronichinia naegeliana* (Bober and Bialczyk 2017) was conducted in Lake Rotoroa (Hamilton Lake). This study showed that sonication had the potential to remove or at least reduce the cyanobacteria population. However, sonication was not as effective on this species as hoped; the sonicators were unable to remove most of a surface scum population in a controlled laboratory environment after four days, although disruption to cells was apparent (Thompson 2011). This technique may be useful in curbing a nuisance bloom but requires a follow-up treatment to control the germination of the seed population being released from the sediments. Collateral damage may include the loss of some beneficial zooplankton grazers, which may also be killed by sonication. A potential downside to sonication is that because it ruptures the cells, it may also release algal toxins and is likely to release the taste and odour compounds otherwise held within the cyanobacteria cells. *Dolichospermum* is known to produce geosmin or 2-methylisoborneol, which are such taste and odour compounds (Bowmer et al. 1992, Blevins et al. 1995). The cost of sonication may be high as the zone of influence is relatively small and would require repeat treatment if seed banks in the sediments promote new blooms of the cyanobacteria fuelled from the sediments.

5.2 Chemical controls

5.2.1 Hydrogen peroxide

Hydrogen peroxide is an effective sterilising agent and would work much the same way as the nanobubble technique, but by applying the treatment as a liquid. This technique has potential as a targeted treatment. A whole lake treatment using hydrogen peroxide at a concentration of 2 mg L^{-1} in Lake Koetshuis, a small (12 ha), shallow (depth 2 m) lake in the Netherlands, was undertaken to control cyanobacteria (Matthijs et al., 2012). Laboratory experiments determined the rate of application as the minimum concentration required to remove cyanobacteria, while not harming zooplankton. After application, the levels of hydrogen peroxide dropped from 2 mg L^{-1} to 0.7 mg L^{-1} after 24 h and were below detection level after two days. There was an immediate decrease in cyanobacteria, with an 18–30% reduction within 3 hours and a 99% reduction within 10 days. Cyanobacterial biomass remained low for 7 weeks after treatment, only increasing after 7 weeks due to an input of water from another lake with the same species of cyanobacteria. Green algae and zooplankton species were not significantly affected by hydrogen peroxide addition.

5.2.2 Flocculation or sediment capping

This technique controls phosphorus release from the sediments during stratification (low oxygen concentrations in the hypolimnion) by means of flocculation and/or sediment capping. For this technique, a metal salt, either aluminium sulphate (alum) or lanthanum chloride (Phoslock®) is used on a bentonite carrier, also known as lanthanum modified bentonite (LMB). Both products have been

used successfully and extensively overseas for limiting sediment P release and thus breaking the cyanobacteria growth cycle. Alum has an additional advantage over LMB in that it can remove a cyanobacteria bloom in a matter of hours by flocking and settling the bloom to the sediment, thereby clearing the water column. Flocculation occurs when a flocculant (or flocking agent, such as alum) causes suspended particles to aggregate and form a floc, which settles out more readily than individual smaller particles. According to a brochure distributed by PET Water Solutions, Phoslock® is effective between pH 5 and 9, effective under anoxic conditions, does not affect water pH and conductivity, increases sediment stability, and its binding capacity does not decrease with time; it thus could be appropriate for use in Lake Hood.

A recent innovation has been the development of the so-called flock-and-lock technique, where P and cyanobacteria are removed from the water column with a flocculant such as polyaluminium chloride and then locked in the sediment with Phoslock® (Lürling and van Oosterhout 2013). Another advantage of alum over Phoslock® that could benefit Lake Hood is that the alum floc on the sediment surface can strongly suppress or prevent germination of the algae seed bank in the sediments. Phoslock® has a weaker effect than alum (Kelly 2007).

This control option does not remove phosphorus, but it locks it in place. Multiple or regular applications may be required.

5.2.3 Phosflow

Phosflow is a pellet or bead form of Phoslock® that can be obtained in 1.8 kg or 3 kg bags from Aquatic Technologies. It is said to reduce phosphorus concentrations by up to 0.2 mg/L treating 450,000 L of water with one 1.8 kg pouch or treating 750,000 L of water with one 3 kg pouch. The pouches would be placed in the inflow and could last up to 2 months. After use, the phosphorus-saturated beads “can be repurposed as slow-release fertilisers or for composting, minimising environmental impact” (aquatictechnologies.com.au).

This could be an option for phosphorus removal in Carters Creek, potentially in the inflow culvert (taking water from the Ashburton River) and in the canals of Lake Hood, but the placement, number of pouches, and the requirements for disposal and replacement must be determined.

5.2.4 Algicides

Algicides are chemical compounds intended to kill unwanted algae. They are usually copper-based and not suitable for a drinking water supply reservoir. There can be unwanted or unintended ecotoxicological effects or secondary pollution (Hamilton and Patil 2022).

5.3 Biological controls

5.3.1 Weed harvesting

Removing invasive weeds can prevent anoxia of bottom waters and release of bioavailable nutrients after weed beds collapse and decay. Native turf communities could then become established, and these are often associated with better water quality. Weed removal can be achieved by using a mechanical weed harvester. Weeds removed from the lake should be appropriately disposed of (e.g., composted).

In 2004, two thousand grass carp were introduced to control weeds, but this control is now considered insignificant (McCracken et al. 2023). A mechanical harvester was hired from the Christchurch City Council for two seasons, but this became untenable as *Egeria* developed in

Christchurch waterways and this was not present in Lake Hood and its introduction to the lake was to be avoided. Thus, weeds in the canals were subsequently sprayed with Diquat starting in 2010, but costs are high and decomposing weeds result in nutrient release and subsequent recycling by aquatic plants and algae. Extensive weed growth in the canals inhibits water movement.

Weed harvesting and removal from the lake has been suggested by Donna Sutherland. This would not only remove the flow-inhibiting weeds in the canals but also prevent the recycling/uptake of nutrient that would be released from decomposing weeds if they were left in the canals. There remains a risk that nutrient loads from inflows and sediments (in anoxic conditions) could fuel algal blooms.

5.3.2 Biomanipulation

High Tech SEBS Bacterial Culture by Bio Control Solutions has been proposed to the Task Force. According to advertising material, the bacterial culture contains more than 5 billion organisms per mL (Figure 5-1). Some of these bacteria not directly target cyanobacteria but could indirectly affect them by altering nutrient dynamics in the lake. Some strains may produce compounds with algicide properties which could inhibit cyanobacteria growth. Introducing these bacteria could potentially alter the nutrient dynamics of the lake, affecting the bioavailability of nitrogen, phosphorus, and other nutrients to algae. These bacteria may compete with each other and with cyanobacteria for nutrient sources and some may consume cyanobacteria or produce compounds that inhibit cyanobacteria growth. The effectiveness of bacterial treatments depends on environmental conditions (pH, temperature, dissolved oxygen levels, nutrient concentrations).

As with any non-native species introductions, the introduction of non-native bacteria to Lake Hood carries risk. Non-native species may become dominant, disrupting native microbial communities, or produce harmful metabolites. Before a decision is made to introduce any bacteria species, we recommend a detailed literature review on the potential unintended consequences, controlled laboratory and field trials, and consultation with regulatory agencies.

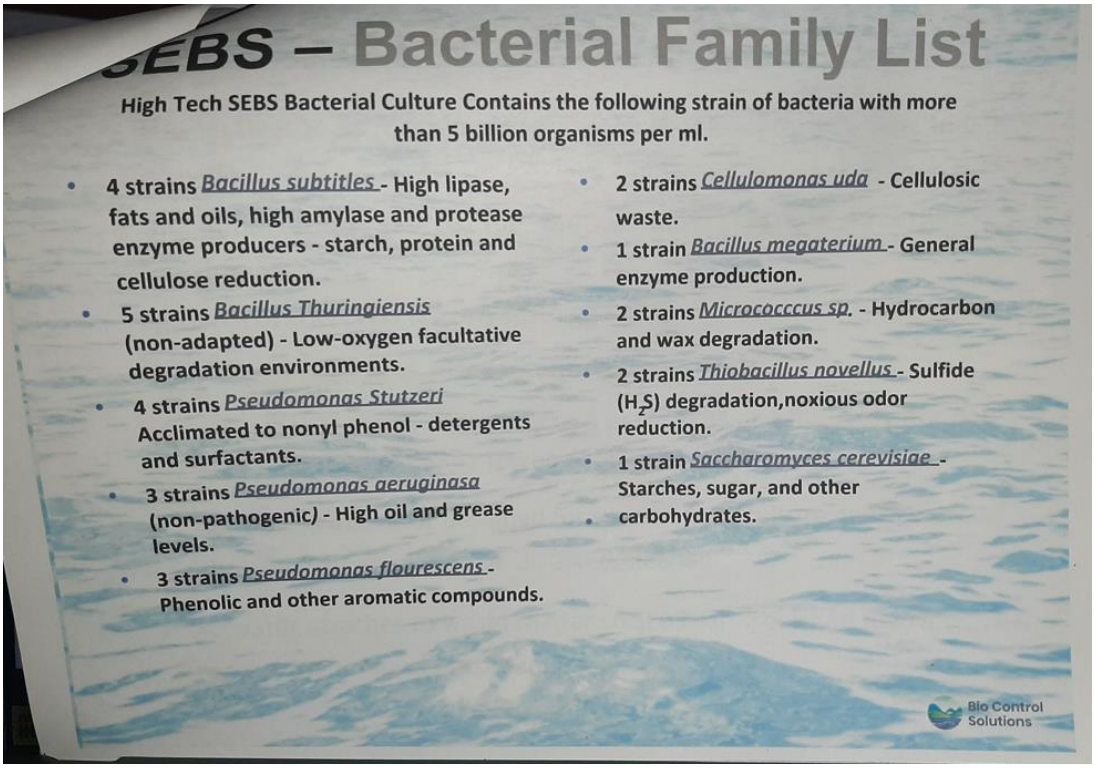

Figure 5-1: Advertising material for a bacterial solution by Bio Control Solutions. Image provided by Les McCracken.

Specific enzyme bacterial solution (SEBS) products to control toxic algae have been developed from natural bacteria which can inactivate cyanobacteria and digest the final, inert biomass. We are aware that two such products have been tested in laboratory trials using lake water from a residential, man-made lake that is affected by cyanobacteria blooms. Two treatments were tested: addition of SEBS AFS630 NZ (a surface biomass treatment) and AIO405 NZ (a water column specific microbial blend). One treatment alone was not as effective as applying the two treatments simultaneously. Sampling on days 7 and 34 after treatment, compared to initial conditions, showed large increases in the number of cyanobacteria species and overall biomass (cells/volume and biovolume) present in the control (untreated) sample, compared to much smaller increases in cyanobacteria in the treated samples. The single SEBS treatment was not as effective as the combination of two SEBS. We note that the results of these trials have not been published.

Bay of Plenty Regional Council (BOPRC) has used MuckBiotics bags (13.6 kg) containing < 3.5×10^{13} bacteria cells and other products from Parklink Ltd (Parklink Ltd - Water and Wastewater Treatment - New Zealand), as long as their application met consent conditions for the amount of bacteria applied (2.1 x 1014 cells per month for six months per year). The types of bacteria were limited to *Bacillus*, *Nitrosomonas*, *Nitrobacter*, and *Pseudomonas* as per the council's resource consent, first issued in December 2015 (pers. comm., Justine Randell). The biotreatment was applied in Ōtautū Bay, Lake Rotoehu, and initiated by the local community for the purpose of improving water quality in the bay. The consent allows for the introduction of bacteria to accelerate natural degradation and thus reduce sludge building up on the sediments and enabling contact recreational use of the bay area. Monthly sediment monitoring indicates that the biotreatment did not affect sediment biota (specifically chironomids). Sediment samples are analysed for N, P, and C content. Records spanning 2010-2023 show significantly lower sediment N, P, and C content since 2016 (Randell, Compliance Summary Report 2022/2023 Resource Consent 68488, Condition 8): TN content decreased from > 1.6 g/100 g dry mass to < 0.2 g/100 g dry mass, TP content decreased from > 0.12 g/100 g dry mass to ~

0.02 g/100 g dry mass, and TC content decreased from > 10 g/100 g dry mass to < 2 g /100 g dry mass. Weekly lake cyanobacteria monitoring in 2020-223 indicated that there were several days when potentially toxic biovolumes were high (> 1.8 mm^3/L, red alert level). The cyanobacteria alert levels are for Lake Rotoehu overall and not specific to Ōtautū Bay. The Water Quality Technical Advisory Group, to whom monitoring results from the biotreatment programme were presented, recommended that the biotreatments are ceased, because there was not enough evidence to suggest that these treatments in a small area of the lake were useful. No control area was monitored for sediment nutrient content, and there are concerns that while the bacteria may accelerate biomass decomposition, this might release nutrients back into the water column where they are available for uptake by cyanobacteria blooms washed into the bay from the open lake. Instead of localised biotreatments, the application of alum to the whole lake is now being considered.

5.3.3 Floating wetlands

Floating wetlands are raft structures that can float on a lake surface and support plant growth which removes nutrients from the lake water. Specifically, nitrogen is removed by denitrification. Well-designed constructed floating wetlands can effectively remove contaminants and enhance biodiversity (Bi et al. 2019). Floating wetlands tend to be bespoke for a given water body and quantification of nutrient removal can be complicated or not feasible (Bi et al. 2019, Hamilton and Patil 2022).

5.4 Other options

Natural lake mixing by wind might be enhanced by removing structures or trees around the lake, enabling wind to vertically mix the lake more frequently. Given that Lake Hood was constructed for residential lakeside properties, this is likely not an option.

Booms or other skimming structures could be constructed in the canals to remove surface scum. This may not be aesthetically pleasing but could be immediately effective in reducing or mostly removing an algal bloom.

If Carters Creek were diverted through a constructed wetland, then natural nutrient removal by wetland organisms could occur before that water enters Lake Hood. This would require significant construction and the effectiveness of nutrient removal could be difficult to quantify. Long hydraulic residence times and potentially a large land area might be required for such a wetland to be effective. This option would require a detailed investigation before construction.

5.5 Application to Lake Hood

Of these techniques, P-inactivation using alum likely has the most promise because it would remove the existing cyanobacteria bloom, inactivate the P being released from the sediment during stratification and cap the seed bank in the sediment. This would allow the implementation of an aeration system without the risk of stimulating an algal bloom when the aerator is turned on.

While a treatment with alum would reset the lake in the very short term, it may not be appropriate as a long-term solution due to cost and the public perception that a chemical is being added to the lake.

If used as described and applied with the correct amount of buffer, alum is harmless but very effective against cyanobacteria and for managing the internal P load of a reservoir. It is the same chemical used in almost every town and city water treatment plant for flocking the suspended solids out of the domestic water supply.

6 Conclusions and recommendations

Cyanobacteria have been observed in Lake Hood in 2023 and 2024. Blooms started in poorly flushed canals on the west side of the lake and were later found in the ski lane on the eastern lake shore (pers. comm., David West and Les McCracken, 19 January 2024). We considered time series of changes in meteorological conditions (i.e., air temperature and wind speed), water temperature and dissolved oxygen profiles and time series, water level, pH, total suspended solids, and nutrient and chlorophyll *a* concentrations at several monitoring locations in and around the lake (surface water, groundwater, sediments, inflows). Our key findings based on the available data are:

- The highest TN concentrations were at Carters Creek and well 2 and the highest TP concentrations were at the lake intake and Carters Creek. In Lake Hood, DRP has been low at the outlet (< 0.005 mg/L) but much higher in the intake and Carters Creek. Sediment samples collected in September 2023 show that total phosphorus content was moderate (highest in lake intake), and total nitrogen content and total organic carbon was low. We did not identify the main contributing nutrient load to the lake, but it appears that the lake intake, Carters Creek, groundwater, and sediments are all relevant nutrient sources. A detailed water balance and assessment of nutrient loads (flows × nutrient concentrations) would be required to determine the dominant nutrient source to the whole lake and/or to specific subbasins like the western canals.
- Profiles of temperature and oxygen show that stratification occurs at least occasionally for short periods in the lake and the dissolved oxygen concentration at the bottom can be close to hypoxic (DO < 2 mg/L). The trial aeration setup did not appear to prevent water column stratification and occurrence of hypoxia.
- A time series of pH shows that pH has increased since 2015, and it was > 10 on several occasions, including at the lake outlet in 2023. The dissolved oxygen concentration has also decreased in the same period. pH >10 or low oxygen concentrations can result in increased phosphorus release from the sediments.
- Mean air temperature has increased significantly since 2007, while there was no significant trend in the mean wind speed, which likely does not affect mixing in the water at sheltered locations. High air temperature can have a strong impact on cyanobacteria population dynamics.
- *Dolichospermum* is the dominant cyanobacteria genus identified in samples collected in 2023 and 2024. These cyanobacteria have been associated with toxins and can regulate their buoyancy to optimise their position in the water column with respect to light and nutrient availability. They fix nitrogen from the atmosphere, which gives them another advantage over other phytoplankton. They also produce seed banks which can survive harsh environmental conditions and seed new blooms.
- The data and literature suggest that the bioavailable P concentration must be at least less than ~0.020 mg/L to reduce growth, but this may not eliminate *Dolichospermum* blooms in Lake Hood. Targeted investigations and experiments would be needed to confirm P limitation and refine the estimated threshold of ~0.020 mg/L P to restrict growth of the *Dolichospermum* species in Lake Hood.

We described several potential mitigation and control options and suggest consideration of the following:

- **Flushing:** Increased water takes from the Ashburton River may reduce the hydraulic residence time and thus flush unwanted algae out of the lake and improve in-lake circulation, but reducing nutrient concentrations in the main water source of the lake (i.e., the Ashburton River) will likely have the greatest positive effect in reducing algal blooms throughout the lake over time, provided that legacy phosphorus stores in the sediments are capped.

- **Reducing inflow nutrient loads:** As previously recommended by Tonkin and Taylor (2008), "Controlling nutrient input loads is likely to represent the best and most sustainable long-term option for maintaining or improving water quality in the extended lake". We agree that increasing flow through the lake and reducing inflow nutrient concentrations or diverting nutrient-rich ground and surface water inflows should help improve the trophic state of the lake, but we also recommend capping the lake sediments to prevent P release during high pH and/or low DO conditions. **Trialling Phosflow in Carters Creek** with control measurements (sampling upstream and downstream of treatment) would allow for an assessment of the effectiveness of the approach.

- **Sediment capping**: Application of a metal salt (alum or Phoslock®) can prevent P release from the sediments. Alum is also a flocking agent that can remove a cyanobacteria bloom in hours by flocculation and settling flocs to the sediment. Alum floc on the sediment surface can strongly suppress germination of algae spores (the "seed bank") in the sediments.

- **Sonication**: Sonicators can be used to break cyanobacteria cells using sonic pressure waves to rupture the gas vacuoles in the cells. This could be very effective in the summer. Reseeding of populations can also be prevented this way.

Based on the currently available data, the main source of phosphorus cannot be identified (i.e., inflow loads vs sediment P flux). Therefore, if the inflow loads are dominant phosphorus capping may not be effective.

Models are important tools that could be developed and used to determine the effects of climate change (e.g., changes in air temperatures and wind speed), changes in nutrient loading, and management options affecting cyanobacteria blooms in Lake Hood. Knowing which of the nutrient loads to the lake is the main contributor to lake water column nutrient concentrations, and in turn the main driver of cyanobacteria blooms, would allow for targeted nutrient management. Predicted outcomes for possible future scenarios allow for effective lake water quality management. Monitoring data are required to calibrate and validate models.

Before implementation of any large-scale control efforts, we recommend the following next steps:

1. Modelling

    a. A **hydrodynamic model** would enable estimation of residence times in different parts of the lake, i.e., the canals and the main lake, which will differ. A key preliminary step is to calculate the lake **water balance** from inflow, outflow, rainfall, and water level data spanning at least one year but ideally several years.

    b. A linked catchment and lake **water quality model** would quantify the nutrient loads from each source and estimate sediment nutrient fluxes over time, allowing for determination of the main nutrient source driving cyanobacteria blooms. A catchment model would estimate daily nutrient loads from external sources (Ashburton River inflow, Carters Creek). A groundwater model or a simpler analysis (groundwater inflow × nutrient concentration) would estimate the groundwater nutrient load to the lake. A lake water quality model with a sediment module would estimate nutrient fluxes from the sediments over time.

    c. **Scenario modelling** using the linked models would allow for testing of different management options (e.g., reduced nutrient loads, sediment capping) before implementation.

2. Data collection for model development

    a. Regular (at least monthly) **water column P and N sampling in the canals** where blooms are most likely to form.

    b. **Field measurements of fluxes of P from the sediment** for comparison with inflow nutrient loads.

    c. Controlled laboratory or mesocosm **experiments** using cyanobacteria from Lake Hood to describe the growth rate as a function of N and P concentration. This information would also help refine suggested lake nutrient concentration targets.

3. Ongoing water quality monitoring is required to determine the effectiveness of any mitigation measures. Current monitoring is unlikely to be adequate for assessing mitigation performance. Any choice of measures must include consideration of regulations, social and cultural values, available funding, long-term feasibility, and desired outcomes.

7 Acknowledgements

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8 Glossary of abbreviations and terms

ADC	Ashburton District Council
BOD	Biochemical oxygen demand
Chl *a*	Chlorophyll *a*
DO	Dissolved oxygen
DIN	Dissolved inorganic nitrogen
DIP	Dissolved inorganic phosphorus
DRP	Dissolved reactive phosphorus
E. coli	*Escherichia coli*
Fe	Iron
MfE	Ministry for the Environment
N	Nitrogen
N_2	Atmospheric dinitrogen
NH_3	Ammonia
NO_3-N	Nitrate nitrogen
NO_2-N	Nitrite nitrogen
P	Phosphorus
PO_4	Phosphate, a readily bioavailable form of phosphorus
SS	Suspended solids
TLI	Trophic level index
TN	Total nitrogen
TP	Total phosphorus

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Appendix 2

Submission

Environment Canterbury Draft Long Term Plan 2024/34

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Background

1. The Lake Hood Water Quality Taskforce ("Taskforce") welcomes the opportunity to comment on Environment Canterbury's draft Long Term Plan 2024/34.
2. Lake Hood is a significant man-made recreational asset for the Ashburton district and wider region, which has been open to the public since 2002. The lake comprises of over 100 hectares of lake bed, surrounding recreational areas and a community of over 200 houses. Rowing, sailing and waterski clubs also have premises at the lake and frequently utilise it for their respective sports. The lake and its surrounds are predominantly owned by Ashburton District Council.
3. In early 2023, Lake Hood experienced a cyanobacteria algal bloom. This resulted in Te Mana Ora issuing a public health notice for Lake Hood, which was in place from 16 March 2023 to 15 May 2023. Now that this particular cyanobacterial species (*Dolichospermum*) has appeared at levels equating to a bloom, recurrences will be more frequent due to the self-seeding nature of this species. A second algal bloom has occurred in the 2023/24 summer, with Te Mana Ora again issuing a public health warning for the lake on 5 January 2024. The public health warning remains in place as at the date of this submission.
4. Contact recreation on the lake must be avoided when the public health warning is in place. This severely restricts use of the lake during the summer which is a devastating blow to residents and other users. Therefore, it is imperative that lake water quality is improved.
5. The Taskforce was set up following the first algal bloom. The Taskforce comprises of representative from Ashburton District Council, Ashburton Aquatic Park Charitable Trust, Lake Hood Extension Project and Huntington Park Property Owners Association.
6. The Taskforce's Terms of Reference require the Taskforce to investigate and report on operational and technical options to prevent and manage seasonal algal blooms in Lake Hood, ensure lake water quality otherwise continually meets resource consent conditions and the lake is of a standard suitable for water contact recreation.
7. The Taskforce supports and endorses the submissions of Ashburton District Council and the Carters Creek Catchment Group, who both cover similar topics to those covered in this submission.

Lake Hood Water Quality

The Issues

8. The Taskforce has been investigating lake management options, drawing on experience and expertise from around the world.

9. A major contributor to the blooms has been the inability to take sufficient water from the Ashburton River under the lake's take and use resource consent, CRC200217. This has been exacerbated in the 2023/24 summer with the new Ashburton River minimum flow restrictions taking effect from 1 July 2023. In the four months to date since the public health warning was issued for Lake Hood in early January 2024, water has only been able to be taken under CRC200217 on eight days. Further, for most of these eight days the river was still on partial restriction, so this severely limited the amount of water that could be taken.

10. Further, high nutrient levels in the lake are another significant contributor to the algal bloom. The Taskforce has been investigating ways to reduce nutrient loads, both external (from nutrients that are entering the lake from surface and groundwater) and internal loads (nutrients that are recycled within the lake). Of note, the highest total phosphorous concentrations are Carters Creek (which flows directly into the lake) and at the lake inlet where water is taken from the Ashburton River. Lake sediment samples show there are significant levels of legacy phosphorous contained in the sediment.

Mitigation Options

11. On recommendation of the Taskforce, Ashburton District Council has contracted with Ashburton Contracting Limited for the purchase and operation of a weed harvester on Lake Hood. The weed harvester will remove lake weed, including flow-inhibiting weeds in the canals and will remove nutrients bound up in those weeds from the lake. The weed harvester will also prevent the recycling/uptake of nutrient that would be released from decomposing weeds if they were left in the lake.

12. Further, the Taskforce recently commissioned a report from NIWA which analysed existing data and literature to provide advice on the cyanobacteria species identified in the lake, outlined the relationship between phosphorus concentrations in the water column and cyanobacteria growth, and reviewed options for the control of cyanobacteria in the lake.

13. NIWA provided several recommendations to improve water quality. Firstly, lake flushing by increasing water taken from the Ashburton River would reduce the hydraulic residence time in the lake and therefore flush unwanted algae out of the lake and improve in-lake circulation. However, NIWA concluded increased flushing needs to occur in conjunction with reducing nutrient concentrations in the intake water source as this will likely have the greatest possible effect in reducing algal blooms over time.

14. NIWA's further recommendation to reduce inflow nutrient loads will likely require a combination of methods, including flocculation or sediment capping and products (such as Phosflow) to control nutrients in the intake culvert and/or Carters Creek inlet to remove phosphorus.

15. Sonication was also recommended, as sonic pressure waves can be used to break cyanobacteria cells. This is a reactive (rather than preventive) measure for blooms, but could be very effective at controlling blooms in the summer months.

Environment Canterbury's Role

16. The work required to improve Lake Hood's water quality will be significant, expensive and complicated. The Taskforce and Ashburton District Council cannot do this work alone and we need support from Environment Canterbury.

17. Given NIWA's advice, one of the Taskforce's priorities is to find a way to increase water flows into Lake Hood from the river. Currently, the ability to take under the existing consent is severely restricted due to the Ashburton River minimum flow restrictions imposed on the water take consent. Obtaining resource consent for an additional consumptive water take is currently a prohibited activity. A non-consumptive take application is theoretically possible given the lake outlet discharges back into the Ashburton River. However, a non-consumptive take application was lodged in 2016/17, but was withdrawn due to the unlikelihood of obtaining consent.

18. The Taskforce therefore requests that Environment Canterbury allocate funding in Year 1 of its LTP to review the appropriateness of the recent Ashburton River consent review and undertake a plan change/further consent review to enable more practical and appropriate restrictions to be set in place. The Taskforce considers that the Lake Hood water take should not be subject to any river flow restrictions, given it is a non-consumptive take.

Carters Creek

19. Carters Creek is an Environment Canterbury managed drain which impacts large numbers of urban and rural households when it overflows. Further, as already noted above, Carters Creek is a large contributor to the poor water quality in Lake Hood due to its phosphorous levels. The Taskforce requests that Environment Canterbury commit funding through its LTP to undertake urgent action to rectify the poor water quality in Carters Creek, either through treatment methods or investigating the diversion of Carters Creek so it no longer enters Lake Hood.

20. The Taskforce supports the proposed maintenance expenditure ($1,500,000 in 2027-2029) and capital expenditure ($1,500,000 in 2028-2030) on Carters Creek. Environment Canterbury's proposed urgent flood investigation for Carters Creek is urgently required and the Taskforce requests that this work is brought forward to Year 1 in the final LTP. It is hoped that this project will have the added benefit of potentially limiting phosphorous enriched water entering Lake Hood.

The Taskforce thanks Environment Canterbury for the opportunity to provide this submission. We do wish to be heard in support of this submission.

David West
Chairperson
Lake Hood Water Quality Taskforce

9. Havelock Street Public Car Park Time Restriction

Author	*Mark Chamberlain; Roading Manager*
Executive Team Member	*Neil McCann; Group Manager Infrastructure and Open Spaces*

Summary

- The purpose of this report is to declare a 120 minute parking restriction in the new Havelock Street public car park adjacent to Te Whare Whakatere.

Recommendation

That Council declares a 120 minute time restriction area for the public car park on Havelock Street adjacent to Te Whare Whakatere.

Attachment

Appendix 1 Plan of Havelock Street carpark

Background

The current situation

1. The new car park constructed adjacent to Te Whare Whakatere on Havelock Street has both public parking area and a gated secure area for Councillors and the executive team.

2. The extent of the parking areas is shown in Appendix 1.

3. To avoid users parking long term/all day, it is proposed to declare the public car park a time restricted parking area.

4. Clause 6.1 of Council's Transportation and Parking Bylaw states:

   No person will stop, stand, or park a vehicle or vehicle combination on any road, public car park, reserve or any other public place in contravention of a restriction imposed by the Council as evidenced by appropriate signs and/or road markings.

5. Clause 8.1 of Council's Transportation and Parking Bylaw states:

   The Council may from time to time amend this bylaw by publicly notified resolution to:

   (a) Declare any road or part of a road to be a metered area or zone parking;

   (b) Declare any piece of land owned or controlled by the Council that is not a road or part of a road, including any parking place or transport station to be a metered area or zone parking;

   (c) Declare the time allowed for parking in such metered areas and areas of zone parking beyond which it will be unlawful to remain parked;

6. It is proposed, in accordance with Clause 8.1 (b) and (c), to declare the public car park a time restricted parking area with a 120 minute time restriction.

Options analysis

Option one – Declare a 120 minute time restriction area for the public car park on Havelock Street adjacent to Te Whare Whakatere (recommended)

Advantages: Manages the parking in the public car park to avoid long term (all day parking). Enables vehicles parked longer than 120 minutes to incur a fine.	***Disadvantages:*** Visitors to Te Whare Whakatere that have appointments longer than 120 minutes will have to find alternative parking further from the building.
Risks: There are not considered to be any risks associated with the time restriction on parking.	

Option two – Have no time restriction on parking in the Havelock Street public car park.

Advantages: Visitors to Te Whare Whakatere for appointments longer than 120 minutes can use the off street parking.	***Disadvantages:*** That some users will park for long periods therefore minimising the availability of the parking spaces for other users.
Risks: There are not considered to be any risks with not having a time restriction on parking.	

Legal/policy implications

Transportation and Parking Bylaw

7. Clause 6.1 of Council's Transportation and Parking Bylaw states:

   No person will stop, stand, or park a vehicle or vehicle combination on any road, public car park, reserve or any other public place in contravention of a restriction imposed by the Council as evidenced by appropriate signs and/or road markings.

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   (a) Declare any road or part of a road to be a metered area or zone parking;

   (b) Declare any piece of land owned or controlled by the Council that is not a road or part of a road, including any parking place or transport station to be a metered area or zone parking;

   (c) Declare the time allowed for parking in such metered areas and areas of zone parking beyond which it will be unlawful to remain parked;

Climate change

9. The time restriction for the parking area in isolation, will have little effect on climate change. If the restriction encourages more cycle or pedestrian activity when visiting Te Whare Whakatere then it may have an impact on reduction of vehicle emissions.

Review of legal / policy implications	
Reviewed by In-house Counsel	Tania Paddock; Legal Counsel

Strategic alignment

10. The recommendation relates to Council's community outcome of a district of great spaces and places because it is part of providing off road public car parking for Te Whare Whakatere.

Wellbeing		Reasons why the recommended outcome has an effect on this wellbeing
Economic	✓	Manages public parking to enable access to Te Whare Whakatere.
Environmental		
Cultural		
Social	✓	Provides public parking for access to Te Whare Whakatere.

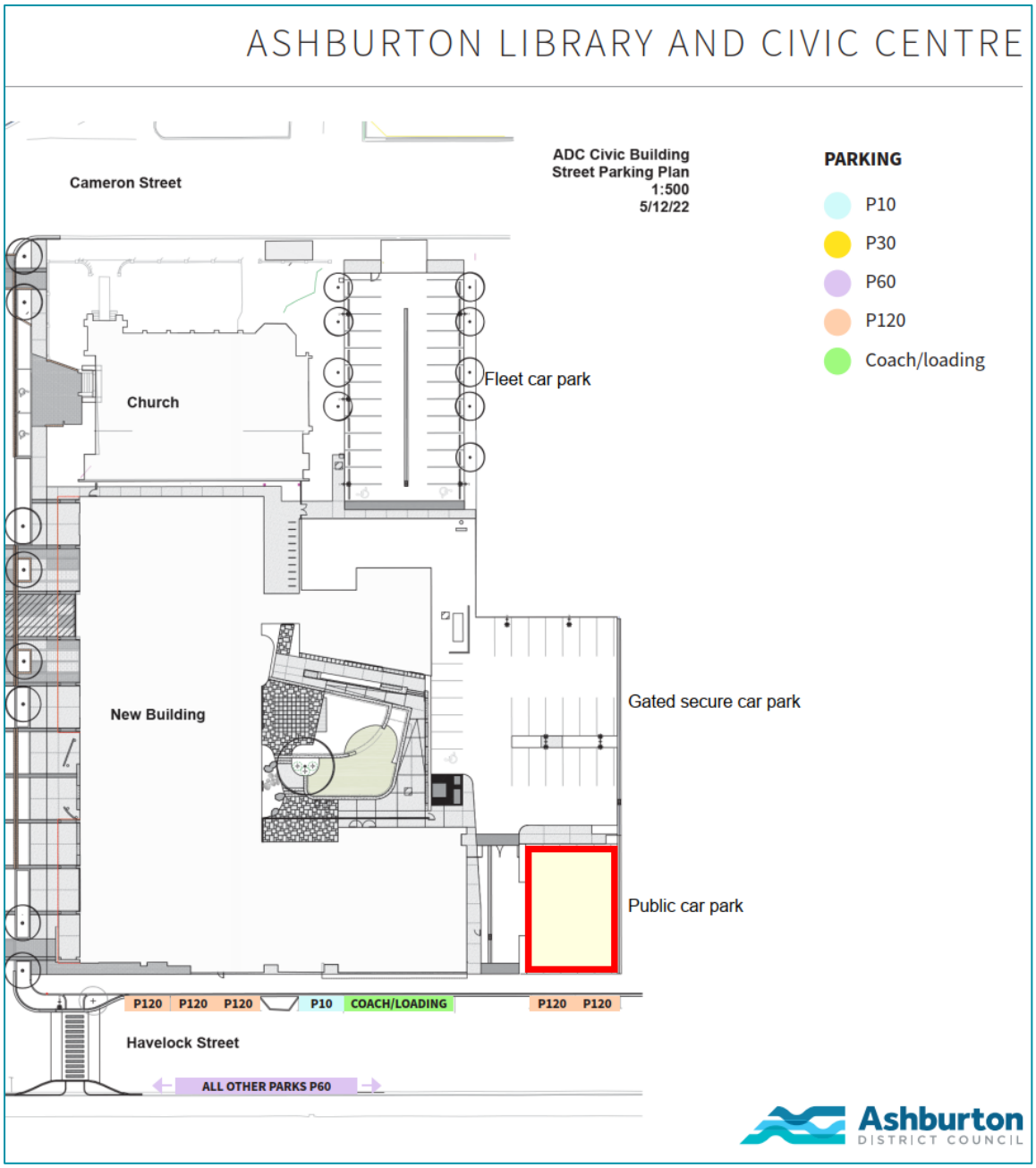
Financial implications

Requirement	Explanation
What is the cost?	$1,000
Is there budget available in LTP / AP?	Yes
Where is the funding coming from?	Funded from the Te Whare Whakatere car park budget
Are there any future budget implications?	No
Reviewed by Finance	Erin Register; Finance Manager.

Significance and engagement assessment

Requirement	Explanation
Is the matter considered significant?	No
Level of significance	Low
Rationale for selecting level of significance	N/A
Level of engagement selected	Inform – one way communication
Rationale for selecting level of engagement	This is an operational matter requiring a Council resolution to enable. No wider engagement is required.
Reviewed by Strategy & Policy	Mark Low; Strategy and Policy Manager

Appendix one – Plan of Havelock Street Car Park



10. Reserve Management Plans (RMP) – approval to publicly notify draft plan

Author	*Nicki Malone, Xyst*
Activity Manager	*Ian Soper; Open Spaces Manager*
Executive Team Member	*Neil McCann, GM Infrastructure and Open Spaces*

Summary

- This report seeks approval from the Council to publicly notify the draft Ashburton Reserve Management Plan and to establish a hearings panel to undertake the hearings process.
- The draft Ashburton District Reserve Management Plan includes most reserves held under the Reserves Act 1977 and some parks held under the Local Government Act 2002 in the Ashburton District area except for a small number of reserves identified as out of scope.
- The draft plan has been prepared with significant input from key stakeholders and manawhenua between April 2023 and April 2024.
- The Ashburton District Reserve Management Plan, once approved, will provide a policy framework to manage use, protection and development of parks and reserves the Ashburton District Council has decision making responsibility for across the District.
- The draft Ashburton District Reserve Management Plan is presented in five volumes, with appendices (see Appendix 2):
    - **Volume 1 – General Policies:** policies that apply to all reserves and open space in the District.
    - **Volume 2 – Ashburton Domain:** is specific to the Ashburton Domain.
    - **Volume 3 - Reserves managed by Reserve Boards:** contains information and policies specific to the reserves managed by Domain Boards.
    - **Volume 4 – Ashburton Reserves:** includes reserves in Ashburton, Tinwald and Lake Hood.
    - **Volume 5** - **Methven, Rakaia and rural reserves**: includes reserves in the rural areas of the District.

- In line with the requirements of the Reserves Act 1977 (RA), public consultation on the draft the Ashburton District Reserve Management Plan will be open for two months, planned from early June to early August 2024. In addition to the requirements of the RA, Council staff are proposing to use Council tools such as our consultation website, social media posts, and inclusion in newsletters to make it easy for members of the public to provide feedback.
- The report recommends that the Council delegates approval of minor amendments to the draft plan prior to public notification to the GM Infrastructure and Open Spaces and Open Spaces Manager.
- This report also recommends the establishment of a hearings panel, consisting of appointed Councillors supported by staff to chair and run the process; this panel would hear submissions, consider amendments, and make recommendations to the Council following the hearings process.
- The decision to approve the final Ashburton District Reserve Management Plan would remain with the full Ashburton District Council.
- The Council appoints all or some of the councillors to hear submissions and makes recommendations to the Council. This would be supported by the Open Spaces Manager, Council's Legal Counsel and Xyst Senior Consultant Nicki Malone – for subject matter advice.
- The **Council** would make the decision whether to accept the recommendations of the hearings panel and approve the final plan.

Recommendations

1. **That** Council approves the draft Ashburton District Reserve Management Plan for public consultation (Appendix 2 to the agenda report, dated 1 May 2024).

2. **That** Council approves the draft Ashburton District Reserve Management Plan Consultation Document for public consultation (Appendix 3 to the agenda report).

3. **That** Council delegates to the GM Infrastructure and Open Spaces and Open Spaces Manager approval of minor amendments to the draft Ashburton District Reserve Management Plan and Consultation Document, prior to public notification for consultation on the Draft plan.

4. **That** Council appoints a hearings panel consisting of appointed Councillors, supported by the Open Spaces Manager, Council's Legal Counsel and Xyst Senior Consultant Nicki Malone – for subject matter advice, to:
   - hear objections and comments from submitters,
   - consider the extent to which objections and comments should be allowed or accepted, or disallowed or not accepted,

Cont'd

- make recommendations to the Council about amendments to the draft Ashburton District Reserve Management Plan following the hearings process.

5. **That** Council notes that the decision to approve the final Ashburton Reserve Management Plan will remain with the full Council.

Appendices

Appendix 1 Process for the development of the RMP

Appendix 2 Ashburton District Reserve Management Plan ***Supplementary documents***

- Volume 1 – General Policies
- Volume 2 – Ashburton Domain
- Volume 3 - Reserves managed by Reserve Boards
- Volume 4 – Ashburton Reserves
- Volume 5 – Methven, Rakaia and rural reserves

Appendix 3 Reserve Management Plans Consultation Document

Background

1. Ashburton District Council (the Council) has delegated decision-making responsibility for 123 parks and reserves across the Ashburton District.

2. The Reserves Act 1977 (the RA) requires a reserve management plan be developed for most types of reserves by the administering body of the reserve. The Council is the administering body for most of the reserves in the District, held under the RA. Other reserve land in the District is administered by the Department of Conservation (DOC).

3. The draft Ashburton District Reserve Management Plan (the draft plan) is a statutory reserve management plan prepared in accordance with section 41 of the RA. The process to develop the plan is outlined in Appendix 1. The process involves two rounds of public consultation, of which the first round was completed in June and July 2023.

4. The timeline below gives an overview of key decisions to date in developing the draft plan:

5. Land in scope of the draft plan is shown in the table below:

In Scope	Out of scope
• Most land held under the Reserves Act 1977 • Some land held under the Local Government Act 2002 if held for open space purpose and/or adjacent to Reserves Act land.	• Local purpose reserves held for gravel, plantation or similar purpose – only by exception included in this plan • Crown managed reserves e.g. Pudding Hill Scenic Reserve • Crown owned land for which there is no management agreement, and the

	council does not wish to advocate for such agreement e.g. marginal strips.

6. The draft Ashburton Reserve Management Plan is presented in five volumes, with appendices as outlined in the figure below:

Volume	Content
Volume 1 – General Policies	Policies that apply to all reserves and open space in the District.
Volume 2 – Ashburton Domain	Contains information and policies specific to the Ashburton Domain.
Volume 3 - Reserves managed by Reserve Boards	Contains information and policies specific to the reserves managed by Domain Boards.
Volume 4 – Ashburton Reserves	Includes reserves in Ashburton, Tinwald and Lake Hood.
Volume 5 – Methven, Rakaia and rural reserves	Includes reserves in Methven and Rakaia and rural areas of the District.

7. The final plan, once adopted:

   - will replace existing reserve management plans for:
     - Ashburton Domain
     - Hinds Domain
     - Mayfield Domain
     - Methven Domain
     - Mount Somers Domain
     - Rakaia Domain, and
     - Tinwald Domain.
   - will provide a policy framework to manage use, protection and development of parks and reserves across the District.
   - ensures Council will comply with the requirements of the RA to have a reserve management plan for most types of reserves held under the Act.

8. This report now seeks approval from the Council to publicly notify the draft plan (see Appendix 2) and make a decision about establishing a hearings panel.

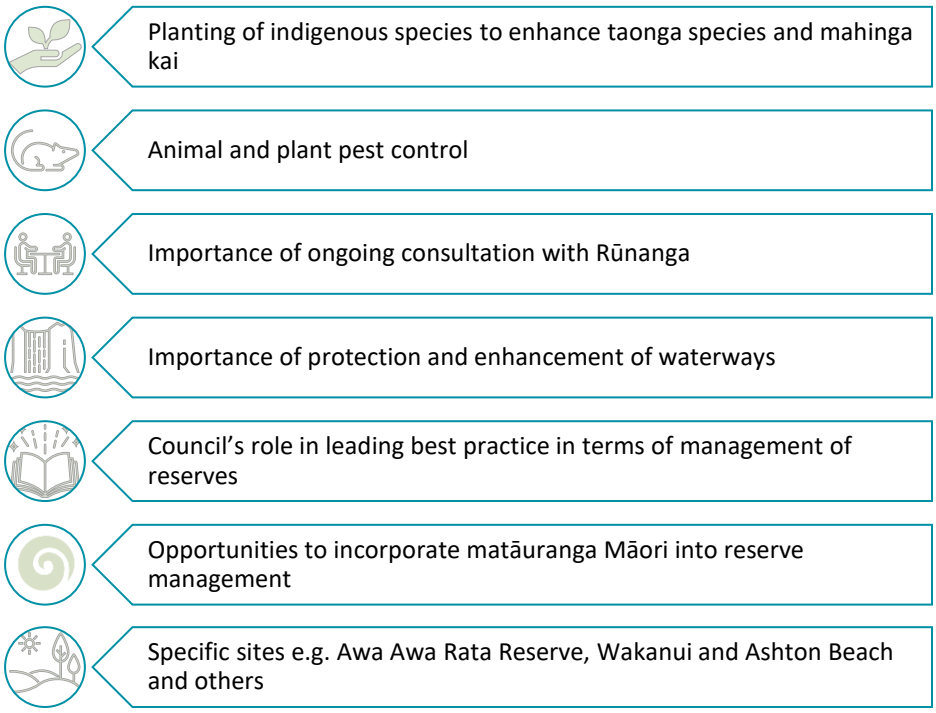
9. We recommend that the Council delegate approval of minor amendments to the draft plan prior to public notification, to the GM Infrastructure and Open Spaces and Open Spaces Manager. Minor amendments may include required updates to maps and imagery, formatting improvements and typos.

Feedback from first round of consultation and engagement with manawhenua

Engagement with manawhenua

10. The Ngāi Tahu Papatipu Rūnanga[1] of Arowhenua and Ngāi Tūāhuriri share manawhenua status and responsibilities in Ashburton District and have been engaged throughout the development of the plan between April 2023 and February 2024.

11. The figure below gives a summary of the key feedback received from Te Rūnanga o Arowhenua:



Engagement with Reserve Boards

12. In addition to being able to provide feedback through public consultation, Reserve Boards were invited to two drop in sessions on 12 and 13 June 2023. This was an opportunity to provide feedback about issues, opportunities and aspirations for the 15 domains managed by the different Boards.

13. The main feedback from Reserve Boards were related to:

- General assistance with managing, maintaining and renewing of the assets, especially mowing and playgrounds.

[1] Papatipu refers to ancestral land. Rūnanga is a tribal council, assembly, board. Local Papatipu Rūnanga has the status of manawhenua with kaitiaki status (guardianship) over land and water within their territory (takiwā).

- The increasing costs, including through rates, and requirements for maintenance were an issue.
- Aging volunteer base was raised as an issue.
- Reserve board members expressed their appreciation of community liaison staff.

Public consultation

14. From the public consultation between 6 June and 7 July 2023, 49 suggestions were received from 43 individuals and 6 organisations. This included one late submission received via email.

15. Suggestions were made for 40 of the 123 reserves. Most comments related to Ashburton Domain (36 mentions), followed by Argyle Park (15 mentions), Tinwald Domain (8 mentions), Ruapuna Domain (6), Mona Square and Clark Park (5 each).

16. The main themes from public feedback included:

- General **support and complimentary comments** to the Council for parks and reserve, their tidiness and level of maintenance.
- Requests to make all parks, and especially playgrounds, more **inclusive** and provide for people with limited abilities.
- Requests to **improve playgrounds**, their maintenance and upgrade and make them more diverse, as well as to provide shade.
- **Dog control** was highlighted as an issue, and conflicts between dogs. This is subject to the Dog Control Policy 2021 and outside the scope of the draft plan.
- Requests for **plantings of more trees**, especially **native** plants.
- Better **promotion** of what parks have to offer and education about history and what is unique and special about different parks was also requested.
- Continued **funding for and investment** in parks to ensure they were well maintained and facilities renewed and upgraded as required.
- Two submitters asked for the development of **walking and cycling pathways to link existing parks** and alluded to the need to implement projects identified in the Ashburton District Council Walking & Cycling Strategy 2020.
- Two submissions spoke to the potential for divestment of some parks, especially in areas that are well served with parks. Reference was also made to the equitable provision of playgrounds in Ashburton (East and West). Provision with parks and playgrounds across the District is subject to the guidance set out in the Ashburton District Council Open Space Strategy 2016 and not in scope of the draft plan.

Options analysis

Hearings and decision-making on the plan

17. In line with section 120 of the RA, each submitter or objector needs to be given the opportunity to appear before the administering body in support of their objection or submission. Council can also determine its own procedure for the hearing in line with section of the RA.

18. Four potential options for how to undertake the hearing and the composition of a hearings panel are outlined below, they include: establishing a committee of Council to hear submissions and approve the plan, or nominate person(s) such some independent commissioners or a set panel made up of councillors, with or without an independent chair:

Option	Description
Option 1 - Appoint a committee to hear submissions and make decisions on the draft plan	The Council appoints a committee and delegates the decision-making on the management plan to that committee. The committee would have a minimum of three members e.g. one from each of the three council wards. The Council could decide whether to have a committee with a commissioner. The **committee** would hear submissions, make decisions on and approve the final plan.
Option 2 – Independent commissioners appointed to hear submissions and make recommendations to the council	The council appoints an independent panel comprising of at least two commissioners to hear and consider submissions and make recommendations to the council. The **Council** would make the decision whether to accept the recommendations of the hearings panel and approve the final plan.
Option 3 - Hearings panel with an independent commissioner as chair	The council appoints a commissioner to chair a panel comprising all or some of the councillors, to hear submissions and make recommendations to the council. The **Council** would make the decision whether to accept the recommendations of the hearings panel and approve the final plan.

Option 4 – Hearings panel made up of councillors only	The Council appoints all or some of the councillors to hear submissions and makes recommendations to the Council. This would be supported by the Open Spaces Manager, Council's Legal Counsel and Xyst Senior Consultant Nicki Malone – for subject matter advice. The **Council** would make the decision whether to accept the recommendations of the hearings panel and approve the final plan.

19. All options except Option 4 would involve the use of commissioners.

20. For options 2 to 4, the decision to approve the final plan would remain with the Council as a whole. For option 1, the decision to approve the plan would be delegated to the committee.

21. The Council uses commissioners in a variety of situations, to provide varying levels of independent consideration of submissions and decision-making, or where specialist advice is required.

22. Under Options 1 to 3, commissioners with knowledge and experience of the RA and te ao Māori could assist in guiding the decision-making for the draft plan.

23. In assessing which of the above option to recommend, staff have considered the following factors:

    - retaining local knowledge, input and decision-making in hearing submissions and approving the final plan
    - ensuring RA expertise on the panel
    - ensuring a level of independence during the hearings process
    - cost.

Option 4 is recommended for the hearings panel

24. Staff recommend that Option 4 is progressed, with appointed Councillors supported by the Open Spaces Manager, Council's Legal Counsel and Xyst Senior Consultant Nicki Malone.

25. The role of the hearings panel is to:

    - hear objections and comments from submitters
    - consider the extent to which objections and comments would be allowed or accepted or disallowed or not accepted
    - make recommendations to the council on amendments to the draft plan following the hearings process.

26. Option 4 is recommended because it retains local knowledge and input into decision making, whilst ensuring RA expertise on the hearings panel.

Legal/policy implications

Reserves Act 1977

27. Ashburton District Council, as the administering body of the reserves included in the draft plan, is required to prepare a reserve management plan in draft form and make this available for public consultation under Section 41 of the RA.

28. Council is required to give public notice in line with section 119 of the RA and provide the public with opportunities to object and make submissions in line with section 120 of the RA.

29. As per the requirements of section 41(6) of the RA, the draft plan will be open for public consultation for a period of at least two months. Public consultation is planned to start on 4 June 2024 and close on 4 August 2024, subject to approval of the draft plan by the council.

30. As a minimum requirement set out in the RA, a public notice, complying with section 119 of the RA will be published in the Ashburton Guardian at the beginning of the public consultation period.

31. Each submitter or objector needs to be given the opportunity to appear before the administering body or committee thereof, or person nominated by the administering body in support of their objection or submission in line with section 120 (1)(c) of the RA.

32. Prior to making a decision on a plan or proposal in a plan, an administering body shall give full consideration to every objection or submission in line with section 120 (1)(d) of the RA.

33. In addition to the requirements for consultation outlined in the RA, Council staff are proposing to use the following engagement approach and tools for public consultation on the draft plan:

    - Website pages using tools from Council's consultation website
    - Social media promotion
    - Newspaper advertising
    - Advice to those interested in the plan, stakeholders and other interested parties.

34. The following table outlines other relevant risks and mitigations:

Risk	Risk Level	Mitigation
IF The draft plan is a high-level plan that does not contain the same level	LOW	This risk could be mitigated by including information in the consultation material about the

of detail as previous reserve management plans. THEN The community perceives the management plan does not contain sufficient detail to inform park management in the future.		benefits of having a district wide plan such as consistency and ease of decision-making for parks across the district.
IF There is a lack of awareness of the public consultation taking place or potential submitters being discouraged from making a submission by the size of the document. THEN A low number of submissions are received.	LOW	This risk could be mitigated by working with the Council's communications and engagement staff to let people know that the consultation is happening. We can encourage feedback by offering different ways to do this e.g., paper, online, email, drop-in sessions, open days.
IF Independent commissioners are selected for the hearings panel. THEN The hearings panel is perceived as having high independence but lacking local knowledge.	LOW	This risk could be mitigated by including information in the consultation material about the Council's role approving the final plan. Public submissions will contribute local knowledge to the hearings process and will help inform the hearings panel's recommendations to the Council.

Climate change

35. The decisions in this report are largely administrative with low likelihood of direct impact on greenhouse gas emissions. However, the management direction set in the future RMP could emphasise the role of parks in climate change mitigation and adaptation. This aspect aligns well with the Council adopted Climate Resilience Plan 2022.

36. Volume 1 of the draft plan includes a climate change and natural hazards policy, which sets objectives to manage parks in a way that minimises and mitigates the impacts of climate change and improves the resilience of parks by adapting to the effects of climate change, especially in coastal areas.

37. Other policies which aim to manage the impacts of climate change are:

- Access and parking - by not providing for peak use parking and encouraging active forms of transport.
- Biodiversity - by encouraging native plantings to increase urban canopy cover and manage riparian margins.
- Sustainability - by encouraging use sustainable management practices in design, construction and operation of reserves, including using renewable and reusable materials, energy efficient devices, etc.

Strategic alignment

38. The recommendation relates to Council's Community Outcomes of 'a balanced and sustainable environment', 'a district of great spaces and places' and 'residents are included and have a voice'.

39. The Council has an adopted Open Spaces Strategy produced in 2016 and the development of overarching RMPs is defined as an action in the strategy.

40. From an operational perspective, having a complete suite of RMP's enables staff to manage all open spaces and address concerns in a consistent way, with a set of policies that apply across the district. This avoids reactive and inconsistent decision-making.

Wellbeing		Reasons why the recommended outcome has an effect on this wellbeing
Economic	x	No direct impact
Environmental	✓	**A balanced & sustainable environment** Preparation of RMPs ensures that reserves are administer, manage and control in a way to protect, preserve and as appropriate and resources allow develop reserves for public use and enjoyment. The draft plan includes policies that support sustainable management of parks and incorporate considerations to mitigate the impact of climate change.
Cultural	✓	**A district of great spaces and places** Development of an omnibus RMP provides an opportunity to recognise and celebrate cultural values present in parks and make them more visible for all.
Social	✓	**Residents are included and have a voice** The development of the RMP involves two round of public consultation and opportunities for the public to have a say on the future management of all reserves in the District. The number of people responding to opportunities for engagement can be a good measure of active citizenship and connectedness. Council complying with its legislative requirements and upholding the law builds trust.

Financial implications

Requirement	Explanation
What is the cost?	This report has no significant financial implications for the Council. The costs for public notices and gazette notices for the classifications will be covered through existing departmental budgets.
Is there budget available in LTP / AP?	Yes, there is a sum included in the draft 2024-34 LTP for work identified through the RMP process. This was as a provisional sum due to the RMP still being under development when LTP forecasts were collated.
Where is the funding coming from?	The funding is sitting in the cc164 account
Are there any future budget implications?	The final RMP outcomes, following public consultation will encapsulate the future actions required. Any additional funding requirements to the above mentioned provisional sums allocated in the 2024-34 LTP shall be dealt with via an annual plan request to the Council or in the 2027-37 LTP process.
Reviewed by Finance	Erin Register; Finance Manager.

Significance and engagement assessment

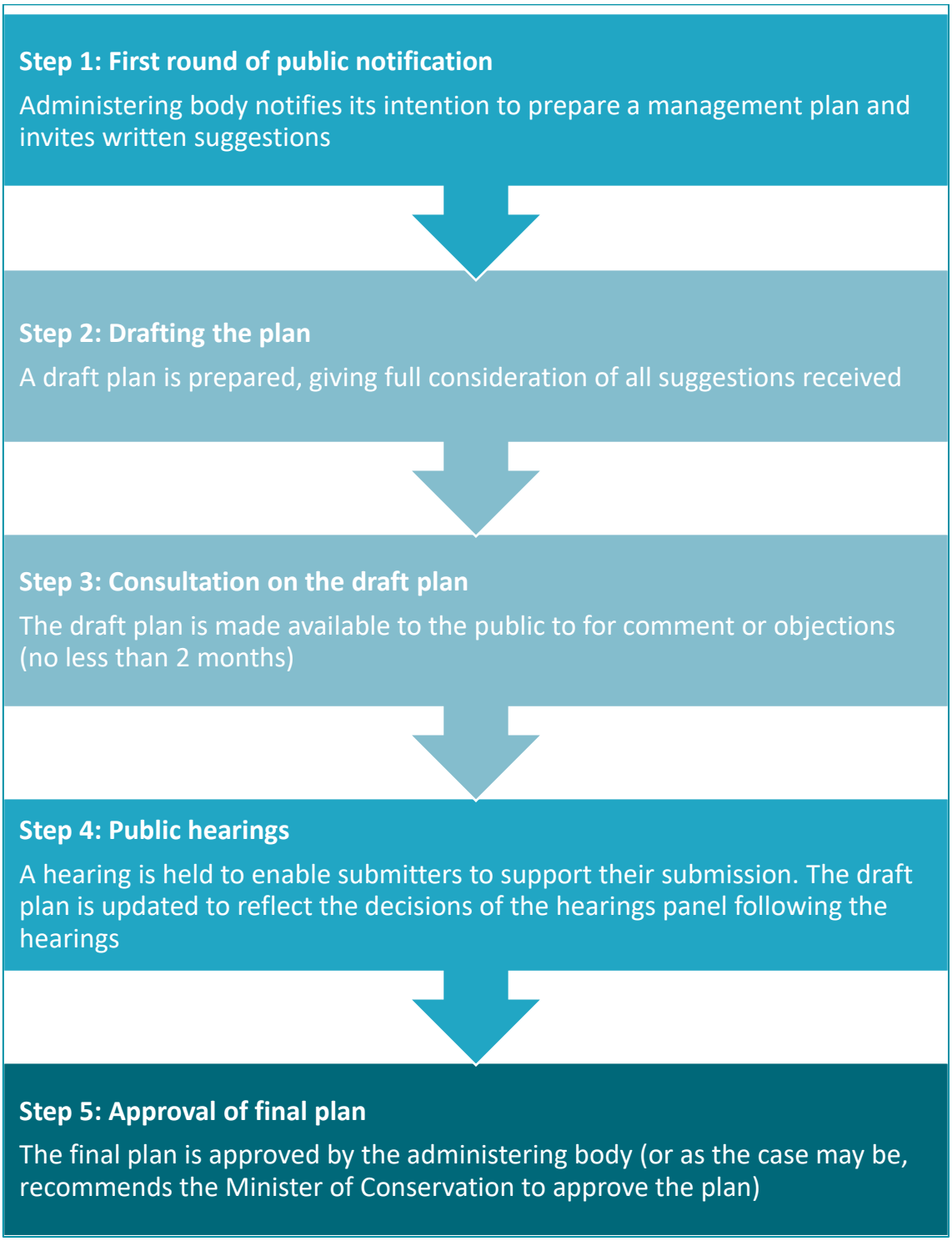
41. The proposal to publicly notify the draft plan has been assessed against Council's Community Engagement Policy and does not trigger high significance.

Requirement	Explanation
Is the matter considered significant?	No
Level of significance	Medium
Rationale for selecting level of significance	Likely medium interest from tangata whenua and the community. The draft Plan requires consultation under the Reserves Act.
Level of engagement selected	Consult – formal two way communication.
Rationale for selecting level of engagement	The Reserves Act requires the draft plan is formally consulted on for two months, including a public hearings process.
Reviewed by Strategy & Policy	Mark Low; Strategy and Policy Manager

Next steps

42. Subject to approval from the Council to notify the draft plan:
    - The GM Infrastructure and Open Spaces and Open Spaces Manager will receive the final draft plan with minor amendments for approval prior to public notification.
    - Public consultation is anticipated to start on 4 June 2024 and will be open for two months in accordance with the RA.
43. Subject to making the decision about the hearings panel, as outlined in this report, the Mayor and Deputy Mayor will receive a shortlist of commissioners with the required expertise to select from.
44. It is anticipated that the hearing will be held in late August or early September 2024 and the final plan expected to be approved in October/November 2024.

Appendix 1 – Process for the development of the RMP



Appendix 2 – Draft Ashburton District Reserve Management Plan

Volume 1 – General Policies
Volume 2 – Ashburton Domain
Volume 3 - Reserves managed by Reserve Boards
Volume 4 – Ashburton Reserves
Volume 5 - Methven, Rakaia and rural reserves

Refer to Supplementary documents circulated with this agenda

Appendix 3 Draft Consultation Document

Love Your Parks

Draft Ashburton District Reserve Management Plan Consultation

Parks and reserves play an invaluable role in enhancing the quality of life of our community. From small neighbourhood parks to our large domains, these green spaces provide places for our residents to relax and play. They offer opportunities for active recreation such as sports and walking, and serve as social gathering places for whanau and community groups.

Some also hold immense ecological value, helping to preserve the district's biodiversity, and protect our flora and fauna. They can also reduce harmful carbon pollution that is driving climate change.

When managed well, our parks and reserves provide a balance between nature, recreation, and community well-being.

Over the last year, we have been working to prepare a management plan for our parks and reserves. The draft Reserve Management plan covers 121 parks and reserves across the Ashburton district. The Plan will help ensure parks and reserves are protected, maintained and able to be enjoyed safely by everyone.

We want to hear your thoughts on the draft plan.

Your feedback and ideas will help us finalise a combined plan for managing the Ashburton District parks and reserves for the next 10 years.

We are accepting feedback until 5pm, Sunday 4 August 2024.

Why do we need a Reserve Management Plan?

The Ashburton District Reserve Management Plan is being prepared according to the Reserves Act 1977. A Reserve Management Plan (RMP) contains details of how a park or reserve should be managed, what activities it should cater for and what facilities will be provided. It helps ensure that the park or reserve is managed, protected, developed and maintained in a way that preserves its values, while enabling people to use and enjoy the space.

We are following the process outlined under section 41 of the Act to prepare a combined plan for 121 parks and reserves in Ashburton District that require a management plan. We currently have individual plans for seven of our reserves: Hinds Domain, Mayfield Domain, Mt Somers Domain, Methven Domain, Rakaia Domain, Tinwald Domain, and Ashburton Domain and Gardens. However, they're now over 10 years old and due for review.The new plan replace all existing plans.

How has the Ashburton Reserve Management Plan been prepared?

We have prepared this draft plan incorporating the thoughts and ideas we received from the community, reserve boards, Council and the Methven Community Board (MCB) during our first round of consultation between June and July 2023. Since then, we have gathered further information and research and drafted the plan. We are now ready to present this to the community.

So, what is in the Reserve Management Plan?

The draft plan that we are consulting on has five volumes.

Volume 1 – General Policies:

This contains an introduction to the reserve management plan, including overarching strategic goals, purpose and objectives and general policies around recreation and use, development, and administration of all parks and reserves in the district.

Volume 2 – Ashburton Domain & Gardens:

This volume details a management plan for Ashburton Domain and Gardens. It highlights historical, natural, cultural, recreational, and amenity values attached to this reserve and how council intends to continue with the ongoing and future management of the Ashburton Domain and Gardens.

Volume 3 – Reserves Managed by Reserve Boards (15 sites):

This volume covers the remaining domains of the district including Methven, Tinwald, Alford Forest, Greenstreet, Highbank, Mayfield, Mount Somers, Raupana, Chertsey, Dorie, Ealing, Hinds, Pendarves, Rakaia, and Seafield. These domains are managed by Reserve Boards and are administered by Ashburton District Council. The volume covers key issues, specific policies, and development opportunities for individual domains.

Volume 4 – Ashburton Reserves (63 sites):

This volume covers neighbourhood parks and reserves in Ashburton, Tinwald, and Lake Hood. It details the history, purpose, specific policies, and development opportunities related to individual parks or reserve in these areas.

Volume 5 – Methven, Rakaia and Rural Reserves (43 sites):

The last volume covers parks and reserves in Methven, Rakaia and reserves in other rural areas of the district. This volume also includes cemeteries across the district.

You can view maps of our parks and read more about the development of the Reserve Management Plan at itsourplace.nz

How can I get more information?

Go to itsourplace.nz to view information from the plan in your local neighbourhood.

You may want to read the full draft reserve management plan. This is available at itsourplace.nz. Copies can be referred to or obtained at Te Whare Whakatere, Ashburton District Council, during normal office hours.

About this consultation

Under the Reserves Act we are required to consult on the plan for two months.

Between early to mid September 2024, submitters will have the opportunity to present their views to Council in person at the hearing, after which Councillors will consider and deliberate on all the submissions received.

Tuesday 04 June – Sunday, 4 August 2024
Community Consultation

Early to Mid September 2024
Submission hearings and deliberations

September 2024
Reserve Management Plan finalisation

October 2024
Final Reserve Management Plan Adoption

Frequently Asked Questions

Why is a Reserve Management Plan important?

Preparing a Reserve Management Plan is a statutory requirement under the Reserves Act 1977.

We are following the process outlined under section 41 of the Act to prepare a combined plan for 121 parks and reserves in the Ashburton District that require a management plan.

We currently have individual plans for seven of our reserves: Hinds Domain, Mayfield Domain, Methven Domain, Mt Somers Domain, Rakaia Domain, Tinwald Domain, and Ashburton Domain and Gardens. However, some of them are now over 10 years old and due for review.

Council has decided to prepare a single management plan that will encompass all of our district's parks and reserves. This has several benefits:

- It will be up to date and fit for purpose; and
- It will include all the district's parks and reserves; and
- It will ensure consistent management approach across the district.

Won't this cost a whole lot of money?

Compared to preparing and maintaining individual reserve management plans, developing a combined plan encompassing all parks and reserves of the district is the most cost efficient way of fulfilling our statutory obligation.

What does the plan include?

The plan will include set policies and objectives that are common to all reserves administered by the Ashburton District Council. This is to ensure a simple and consistent approach to management decisions and compliance with the Reserves Act requirements.

What is not included in the plan?

The plan is focused on objections, policies, and day to day management of district-wide parks and reserves and does not include actions and implementation plans.

Which takes precedence - general policies or any park or reserve specific policies?

If an issue is addressed in both the general policies and a park or reserve specific policies then the policies in the specific reserve or park with take precedence.

Have another question? Go to itsourplace.nz

Have Your Say

Please note all submissions are public documents and will be made available on Council's website with the names of submitters included.

Submissions presented in the form of a petition or accompanied by multiple signatures will be processed as a single submission.

The easiest way to provide your feedback is to complete the online submission form at itsourplace.nz

Alternatively, complete the attached form and return it by: 4 August 2024

Freepost to	Ashburton District Council
	Freepost 230444
	PO Box 94
	Ashburton 7740
Email to	submissions@adc.govt.nz
Hand in to	Council reception, 2 Baring Square West, Ashburton.

You have until 5pm, Sunday 4 August 2024 to provide your feedback.

Share your thoughts.

Share your thoughts on how Ashburton district parks and reserves can be managed now and in the future. You can submit on any or all questions and can comment on any aspect of the draft Ashburton District Reserve Management Plan.

1. **What is your overall opinion of the draft Ashburton District Council Reserve Management Plan?**
   Support Do not support
   Please Explain:

2. **Please indicate what you think about the general policies in the plan, and why?**
   Please refer to Volume 1 of the draft management plan to read the general policies.

	General Objectives and Policies (Section 3.2 in draft plan)	Support	Do not support	Don't know
1	3.2.1 Manawhenua partnerships			
2	3.2.2 Cultural and historic heritage			
3	3.2.3 Biodiversity			
4	3.2.4 Specimen Trees			
5	3.2.5 Climate Change and Natural Hazards			
6	3.2.6 Sustainability			
	Recreational Use Policies (Section 3.3 in draft plan)	**Support**	**Do not support**	**Don't know**
1	3.3.1 General Recreational Use and Enjoyment			
2	3.3.2 Access			
3	3.3.3 Sports and Active Recreation			
4	3.3.4 Play			
5	3.3.5 Authorisation and Approvals			
6	3.3.6 Commercial Use			

7	3.3.7 Events and Firework Displays			
8	3.3.8 Camping			
9	3.3.9 Drones and Remotely Piloted Aircraft Systems			
10	3.3.10 Occupation Agreements (Leases, Licenses, & Easements, other than Grazing)			
11	3.3.11 Grazing Licences			
12	3.3.12 Public & Private Utilities			
	Development Policies (Section 3.4 in draft plan)	**Support**	**Do not support**	**Don't know**
1	3.4.1 General Reserve Development			
2	3.4.2 Buildings and Structures			
3	3.4.3 Car Parking			
4	3.4.4 Lighting			
5	3.4.5 Reserve Furniture			
6	3.4.6 Signs & Interpretation			
7	3.4.7 Fencing			
	Administration Policies (Section 3.5 in draft plan)	**Support**	**Do not support**	**Don't know**
1	3.5.1 Naming of Reserves			
2	3.5.2 Gifts & Memorials			
3	3.5.3 Commemorative Trees			
4	3.5.4 Encrochments			
5	3.5.5 Public Art			
6	3.5.6 Public Health & Safety			
7	3.5.7 Ashes & Whenua (Placenta)			

8	3.5.8 Fire Control			
9	3.5.9 Bylaws & Enforcement			
10	3.5.10 Waste Management			

3. **If you would like to give feedback on individual reserve(s) please use the section below.**

Please refer to Volumes 2 to 5 of the draft management plan to view the information and policies for individual reserves.

If you need more space, you can copy/attach extra pages. Please include your name on each page and tell us which reserve you are giving feedback on.

4. **Do you have any other feedback on the draft Ashburton District Council Reserve Management Plan?**

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5. **Hearings**

Let us know if you want to speak to your submission at a Hearing. Hearings are likely to take place in September 2024. We will contact you at least 10 working days prior to the hearing date to let you know when and where this will take place.

Do you wish to speak about your submission at a hearing?

☐ Yes ☐ No If yes, please provide an email and/or phone number so we can contact you about this:

Your details

Name

Organisation (if appropriate)

Address

Please provide an email address if you'd like to be notified when the next stage of consultation opens.

Email

Is your feedback on behalf or an organistation? (If yes, please confirm you have authority to submit on the organisation's behalf)

☐ Yes ☐ No Name of organisation:

Thank you for taking the time to share your thoughts with us.

11. Councillor Reports

Deputy Mayor *Liz McMillan*

11.1 Regional landfill joint committee

8 April – Christchurch City Council

Items discussed included;

- Transwaste Canterbury Ltd half yearly report
- Transwaste Canterbury Ltd - Draft Statement of Intent 2024/25

11.2 Canterbury Waste joint committee

8 April – Christchurch City Council

Items discussed in open meeting were;

- Regional Waste Data Collection
- Ōtautahi Christchurch Regional Organics Processing Facility Update
- Waste Minimisation Grant promotional material

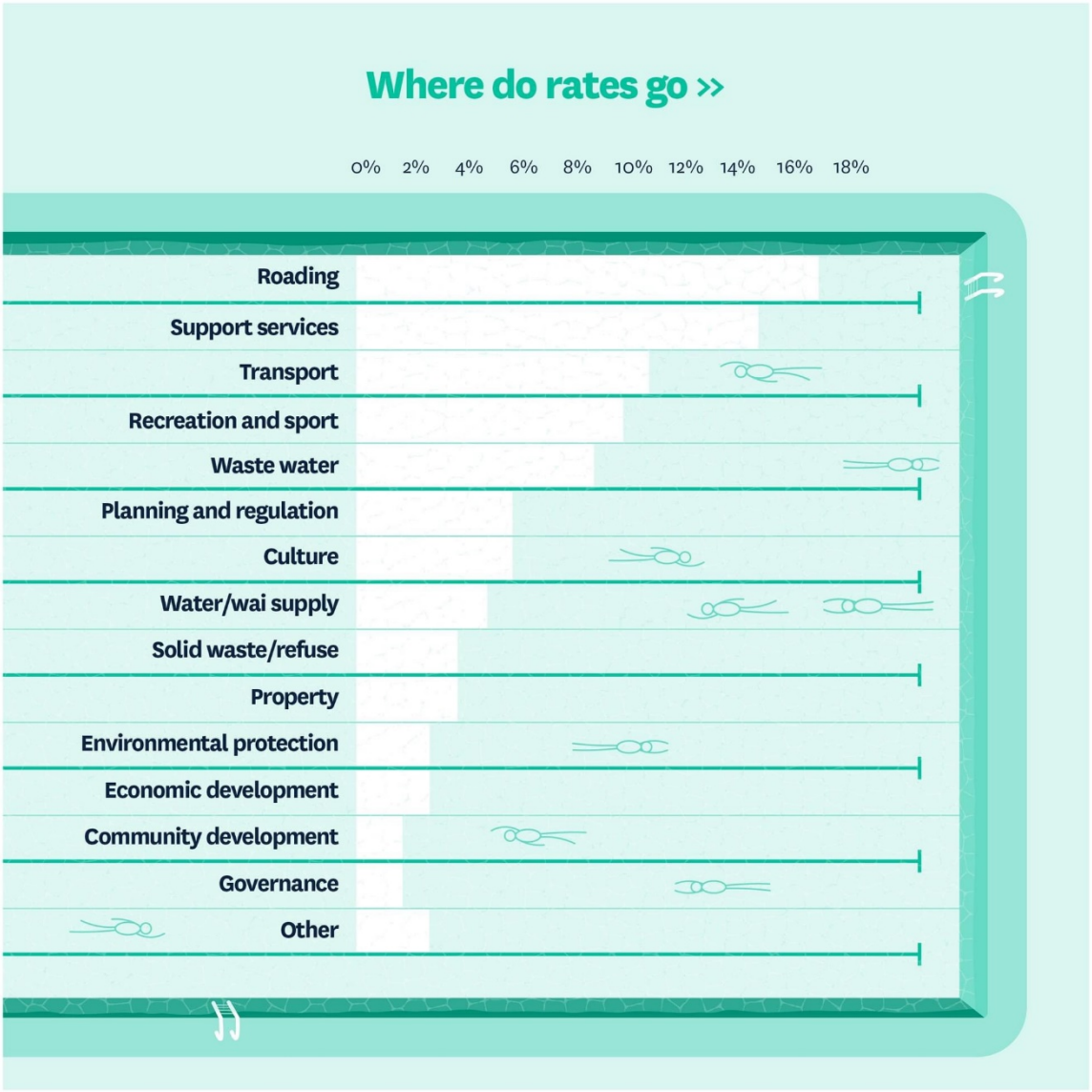
11.2 LGNZ Combined Sectors meeting

11 April – Wellington

We heard from the following speakers.

- Mayor Andy Burnham, Greater Manchester Combined Authority
- Susan Freeman-Greene on the launch of LGNZ's refreshed strategy. LGNZ_advocacy_work_programme_-_A3.pdf (d1pepq1a2249p5.cloudfront.net)
- Hon Matt Doocey, Minister for Tourism & Hospitality
- Geoff Cooper, General Manager – Strategy, Infrastructure Commission
- Fast track consenting: what it means for councils and their communities.
- Brad Olsen, Chief Executive and Principal Economist, Infometrics

To help people understand about the rate rises this year, LGNZ have produced a visual summary which I've attached to this report.



11.3 Local operators networking event

16 April – Wakanui room.

Event with local tourism operators to discuss how they could work together to promote the district.

11.4 Climate Action Reference Group

18 April – via MS teams

Discussed the options for implementation of the Canterbury Climate Partnership Plan and the Communications plan going forward.

12. Mayor's Report

12.1 Local Government New Zealand

- **Conference and Annual General Meeting**

The LGNZ Conference – *SuperLocal24*, will be held at the Tākina Wellington Convention & Exhibition Centre from 21-23 August 2024. The AGM is taking place, in person, on Wednesday 21 August (also at Tākina Convention Centre) prior to the conference opening later that afternoon.

- **Remit process**

LGNZ have invited member authorities to submit proposed remits for consideration ahead of the AGM. The application form (attached) includes information about the remit process and criteria. The list of frequently asked questions explains this further.

Notice is being provided now to allow members of zones and sectors to gain the required support necessary for their remit. Remit applications are due on 18 June 2024. We note that remits must be supported either by a zone, sector or by five councils.

- **Conference delegates**

I will be attending the Conference this year along with the Chief Executive. Council's guidelines for attending conferences provide for an additional two elected members to attend conferences held in the North Island.

Recommendation

That the Mayor and Chief Executive, along with Councillors _____ and _____ be appointed as Ashburton District Council's 2024 LGNZ Conference delegates.

- **Zone 5 & 6 meeting**

The next Zone 5&6 meeting is scheduled to be held in Dunedin, 24/25 October. I am planning to attend along with the Chief Executive. If any Councillors are interested in attending, please let me know.

12.2 Meetings

- **Mayoral calendar**

May 2024

- 2 May: Mel Brooks (MHV Water) and Rebecca Whillans (Ashburton Lyndhurst) re Water Infrastructure, with CE Hamish Riach

- 2 May: Fiona Pimm (Arowhenua Chair) and Jen Crawford (RDR)
- 3 May: The Breeze radio interview
- 3 May: EA Networks shareholders committee
- 3 May: Mayors and CEs Hui at Arowhenua Marae
- 6 May: Mayors Taskforce for Jobs/MSD update via MS Teams
- 7/8 May: RDR meeting
- 9 May: The Breeze radio interview
- 9 May: David West, Lake Hood, with CE Hamish Riach
- 9 May: Ruth Kibble,Te Whatu Ora with Deputy Mayor Liz McMillan, Cr Carolyn Cameron and CE Hamish Riach
- 9 May: Advance Ashburton Charitable Foundation Investment Committee
- 10 May: James Meager, MP for Rangitata, with Deputy Mayor Liz McMillan
- 10 May: Mid Canterbury Sports Awards
- 11 May: Wheelchair Basketball
- 13 May: LTP Submission hearings
- 13 May: Biodiversity Advisory Group
- 13 May: Alister Lilley and Gary Casey, ACL, with CE Hamish Riach
- 13 May: Rural Transport AGM
- 14 May: Hokonui radio interview
- 14 May: LTP Submission hearings
- 15 May: LTP Submission hearings
- 15 May: Council meeting

Recommendation

That Council receives the Mayor's report.

Neil Brown
Mayor

Appendix 1

REMIT APPLICATION FORM

How to submit a remit/

Remits are positions or policies put to LGNZ's AGM for a vote.

Any remit needs the support of either an LGNZ Zone, Sector or five councils.

LGNZ reviews all proposed remits to ensure they meet the criteria below.

If your council wants to propose a remit for consideration by the 2024 AGM, please complete this form and email it, along with any supporting information, to agm@lgnz.co.nz by Tuesday 18 June, 2024.

If you have any questions about the remit process, or want help completing your application, please contact Simon Randall, Policy and Advocacy Manger.

Criteria for remits/

1. The remit is relevant to local government as a whole, not just a single Zone, Sector or council;
2. The remit relates to significant matters, including constitutional and substantive policy, rather than matters that can be dealt with administratively;
3. The remit concerns matters that can't be addressed through channels other than the AGM.
4. The remit does not deal with issues that are already being actioned by LGNZ. This covers work programmes underway as part of LGNZ's strategy.

The process from here/

Once LGNZ receives your proposed remit, it will be considered by our Remit Screening Committee. This Committee is made up of LGNZ's President, Vice-President, Chief Executive and Director of Policy and Advocacy. The Remit Screening Committee will determine whether your proposed remit satisfies the criteria above, and whether or not to put it forward to the 2024 AGM.

We will let you know whether your remit is going forward to the AGM by Tuesday 2 July 2024.

REMIT APPLICATION FORM

Council proposing remit:

Contact name(s):

AGM speaker:

This person must attend the AGM and be registered as a delegate.

Phone:

Email:

Remit subject:

Remit:

That LGNZ

Starting with “That LGNZ”, this is a statement of the specific position or action to be progressed by LGNZ.

Who supports the proposed remit?

Remits must be endorsed by either an LGNZ Zone, Sector Group, or five councils.

Why is this remit important?

Briefly describe what the issue is and why it requires action.

Max. 150 words

Background and context:

You may wish to include:

> What has caused this issue?
> Relevant legislation, policy or practice
> Key statistics to show the scope of the issue
> An outline of what your council/others have already done to address this issue or bring about the proposed change.

Max 500 words

How does this remit relate to LGNZ's current work programme?

Briefly describe how the proposed remit aligns with LGNZ's Strategy and policy priorities but does not duplicate existing or planned work.

Approx. 150 words

How will your council help LGNZ to make progress on this remit?

Briefly describe the steps that your council would be prepared to take to assist LGNZ to progress the remit

100 – 300 words

Supporting information and research

Please attach to your email:

> A copy of this application form.
> Evidence of support from an LGNZ Zone or Sector Group or five councils. This could be in the form of emails, letters or Zone/Sector Group meeting minutes or resolutions.
> Any further contextual/background information you'd like to share, combined in a single word or PDF file.