TECHNICAL COMMITTEE AGENDA

Thursday 21 March 2019

09:00 am, Council Chamber
Level 2 Philip Laing House, 144 Rattray Street, Dunedin

Membership

Cr Andrew Noone	*(Chairperson)*
Cr Ella Lawton	*(Deputy Chairperson)*
Cr Graeme Bell	
Cr Doug Brown	
Cr Michael Deaker	
Cr Carmen Hope	
Cr Trevor Kempton	
Cr Michael Laws	
Cr Sam Neill	
Cr Gretchen Robertson	
Cr Bryan Scott	
Cr Stephen Woodhead	

Disclaimer

Please note that there is an embargo on agenda items until 48 hours prior to the meeting. Reports and recommendations contained in this agenda are not to be considered as Council policy until adopted.

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1. APOLOGIES

2. LEAVE OF ABSENCE

3. ATTENDANCE

4. CONFIRMATION OF AGENDA

5. CONFLICT OF INTEREST

Members are reminded of the need 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.

6. PUBLIC FORUM

7. PRESENTATIONS

8. CONFIRMATION OF MINUTES

Recommendation

That the minutes of the meeting held on 30 January 2019 be received and confirmed as a true and accurate record.

Attachments

1. Minutes of Technical Committee - 30 January 2019 **[8.1.1]**

9. ACTIONS

Status report on the resolutions of the Technical Committee.

Report	Meeting Date	Resolution	Status
An assessment of the Clean Heat Clean Air program's effectiveness	13/6/18	*That this report be used to inform the review of ongoing financial incentives for Air Quality, proposed for 2018/19 in the 2018-2018 Draft Long-Term Plan*	OPEN
Lake Hayes Restoration	1/8/18	*That the consultant report by Castalia be re-framed into a more public intelligible document.*	IN PROGRESS (Castalia have been briefed)
Lake Hayes Restoration	18/10/18	*Dr Palmer to follow up on receipt of the*	OPEN

		revised Castalia report	
Lake Snow technical workshop recommendations	18/10/18	*The CE engage on the with CEs at the regional CEOs meeting on 8 November 2018 on the primary objectives from the workshop.* *Invite Regional Councils and MPI to formally endorse and support the proposed research programme and to discuss funding arrangements.*	IN PROCESS

10. MATTERS FOR COUNCIL DECISION

10.1. Leith Amenity Enhancement

Prepared for:	Technical Committee
Report No.	EHS1844
Activity:	Environmental: Rivers & Waterway Management
Author:	Scott Fowlds Acting Manager of Engineering Jeff King, Senior Projects Engineer
Endorsed by:	Gavin Palmer, Director Engineering, Hazards and Science
Date:	20 March 2019

PURPOSE

[1] To consider options for improving amenity values in the lower Water of Leith and to gain feedback on council preferences for the options.

EXECUTIVE SUMMARY

[2] Since 2006 Otago Regional Council has constructed six stages of the Leith Flood Protection Scheme. The last flood-related stage under construction (Dundas Street bridge) is due to be completed by August 2019.

[3] The final stage between Forth St and Otago Harbour is to create enhancement of amenity, public access and ecology. The present stream environment in this reach is poor, with hard concrete channel structures and walls, poor ecological environment, and limited access and relationship to the stream.

[4] To evaluate what stakeholders considered would best provide amenity, ORC has undertaken public and stakeholder consultation. The Leith Working Group with Ngai Tahu, Dunedin City Council, Otago Polytechnic and the University of Otago formed and reviewed the needs of major stakeholders; the public / ratepayers of Dunedin, from surveys with the public online, local occupants, businesses and users of the public space.

The consultation has supported development of amenity with overall themes of:

- Re-establishing a natural environment
- Developing a river estuary with access down to tidal flows
- Establishing an accessible and better connection direct to the harbour waters
- Re-colonisation of plants and organisms
- Access down to and along the water both by pedestrians and cyclists.

[5] The Leith Working Group identified three themed areas which are aligned to the three distinct sections from Forth St to the harbour where amenity could be enhanced. This amenity construction would partially infill the water way with sloping and planted embankments, walkways down along near the river water and under existing bridges, infilling the bottom of the bed with more natural rocks, better access for fishing and picnics, planting along top of banks with trees, additional art work, murals, sculptures, and seats.

[6] The Leith Working Group has provided concepts for consideration, which includes a long list of potential enhancements. Council has a list of cost of items to choose from that

sums to a rough order cost of $12,477,000. From this list a range of possible variations of Options could be selected. The long list gives Council choices and flexibility when it comes to implementation. In practice Council will likely implement selected items over a period of time, focussing on those that provide the highest benefit and are the best fit with community values, as identified through the consultation process.

[7] The 2018 / 2019 Annual Plan includes funding of $83,000 and the 2019/2020 Annual Plan includes funding of $870,000; in total $953,000 for amenity improvements. Recommended works with existing funds are the Riego Street to Anzac Avenue site on the right bank outside Otago Polytechnic, where reconstruction of a lowered platform and a walkway down along the river can provide for best immediate amenity outcome. ORC staff recommend these works are commenced. It is proposed Council proceeds to construct these works by the end of September 2020 subject to securing regulatory and landholder approvals and receiving favourable construction tenders.

STAFF RECOMMENDATION

That the Council:

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

2) ***Endorses:***

a. the concepts described in this report for consideration in the development of implementation options in 2020/21 for inclusion in the Draft 2021/31 Long Term Plan,

b. implementation of works on the Riego Street to Anzac Avenue site on the right bank outside Otago Polytechnic, where reconstruction of a lowered platform and a walkway down along the river can provide for best immediate amenity outcome for the estimated sum of $953,000.

3) ***Notes:***

the contributions and efforts of the members and member organisations of the Leith Working Group.

BACKGROUND

How the requirement for understanding Amenity of lower Water of Leith came about

[8] The Leith Flood Protection Scheme started in 2004 building on earlier investigation and works programmes. This was the first comprehensive study which evaluated how to mitigate the flooding risk across the Dunedin Central Business District and North Dunedin flood plain, using detailed technical and statistical analysis. The purpose of the scheme is to convey a 1 in 100 year event (of 171 m^3/second) inside the banks of the river and avoid flooding. In conjunction with the flood protection works, Otago Regional Council for Dunedin community have sought to improve the greater amenity and environmental values of Water of Leith. The two stages where amenity is still to be created are:

- Forth Street to Harbour, and
- A number of locations between Dundas St and Rockside Road

Stages of the flood protection project and construction still underway

[9] The scheme has been constructed in stages (Figure 1).

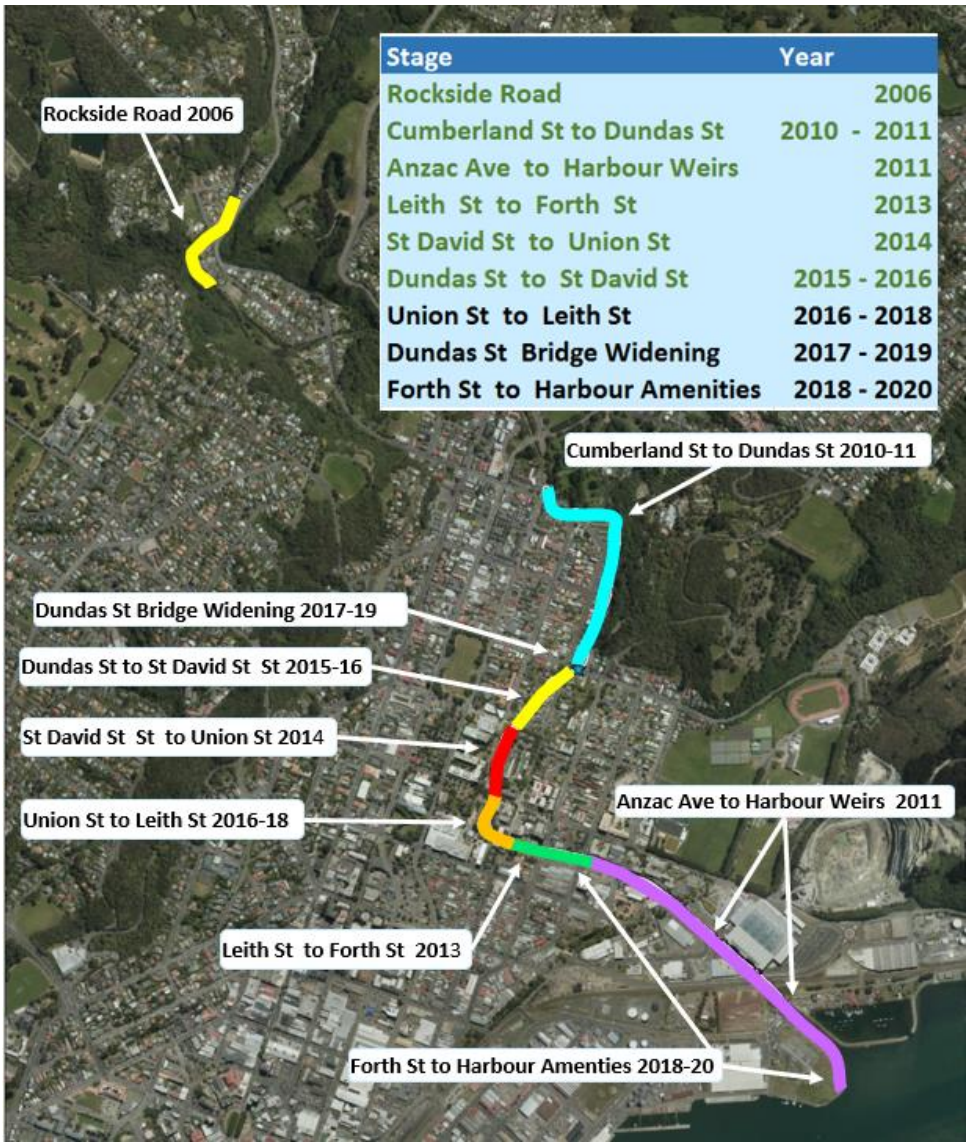

Figure 1: The Leith Flood Protection Scheme in stages

[10] The Union Street to Leith Foot Bridge works are nearing completion[1]. The next stage of construction of a culvert extension at Dundas Street Bridge has commenced and is due for completion before August 2019.

[11] The Final Stage of this flood protection project is consideration of further amenity that would provide best benefit to the wider Dunedin community.

[12] In 2011 Otago Regional Council constructed 3 weirs to improve amenity appearance of the tidal zone between Anzac Ave and the harbour. This has provided a continuous water environment, a habitat conducive to fish and benthic organisms life. (Figures 2 and 3).

[1] Director's Report on Progress, 20 March 2019

Figure 2: Anzac Avenue Bridge to State Highway 88 before installation of weirs in July 2011

Figure 3: Anzac Avenue Bridge to State Highway 88 with weirs in place in October 2011.

Figure 4: New Dunedin City Council Cycleway bridge

[13] Dunedin City Council has recently commissioned a new cycleway and pedestrian bridge downstream of SH88 (Figure 4).

Figure 5: Anzac Avenue Bridge looking upstream towards Forth Street November 2017.

[14] In some parts of the Water of Leith not requiring new flood water retaining structures, amenity to be created had not been defined or consulted on during early scheme development plans prepared in 2005 to 2007. For the Forth Street to Harbour this provided an opportunity for Dunedin stakeholders and the community to evaluate adjustments already made to the river during earlier stages of the scheme, (Figure 6) and to provide their feedback guidance on how the last sections of the river could be best developed for amenity.

Figure 6: Leith Flood Protection Scheme outside University of Otago Registry Building 7th March 2019

[15] The reach of the river between Forth Street to Anzac Avenue is challenging to develop because of the existing channel structure, surrounding buildings and infrastructure, and limitation of being a tidal zone of the foreshore (Figure 5). The present stream environment in this reach is poor, with hard concrete channel structures and walls, poor ecological environment, and limited community access and relationship to the stream and harbour. The twice daily inflow / outflow of tidal water makes construction complex because much of the work needs to be undertaken underwater; this has implications for what is feasible along with construction costs and timeframes.

[16] There is opportunity to further improve the amenity of the river in this area as part of the Leith Flood Protection Scheme once the flood-related works are completed (Figure 1). Council established the Leith Working Group in 2017 to assist in developing ideas and concepts for amenity improvement. A Councillor work shop on 15 May 2018 at Toitu reviewed Concepts identified by the Working Group. Otago Regional Council identified the following goals that were needed for improvement and Amenity: these were supplied on to the public website and to the Working Group for guidance.

- To return the Leith to a more natural state while meeting flood protection, accessibility and health and safety considerations.

- To create an area representing a natural stream and a length of waterway which represents a tidal estuary.
- To improve shared pathway access along the river and increase opportunities to access the water for recreation.
- To enhance the water quality and ecology of the area to encourage more wildlife.

Consultation and community engagement

[17] Consultation was undertaken as widely as possible. ORC formed The Leith Working Group with Ngai Tahu, Dunedin City Council, Otago Polytechnic and the University of Otago to gather a vision from major stakeholders. The group was to consider all public and interested party feedback, so as to provide a vision of development that would best meet collective needs of Dunedin stakeholders.

Public engagement methods

[18] ORC's online consultation platform, YourSay, was used to gain feedback from respondents from February to August 2018. This included:

- Surveys
- Interactive mapping (people could select specific sites around the Leith area and give feedback)
- Storytelling (people could share personal narratives about the Leith)
- Newsfeed (people could comment on the design concepts)

[19] One-on-one engagement was used through:

- Focus groups with key stakeholders such as Fish and Game, Liquigas, Port Otago and Forsyth Bar Stadium - Round 1 consultation
- Public feedback on displays showing the three design concepts (at Otago Polytechnic Hub from 23 July 2018 to 9 August 2018 and Dunedin Public Library from 13 August 2018 to 24 August 2018) (Figure 7).

Figure 7: Public feedback on displays showing the three design concepts at Otago Polytechnic Hub, July and August 2018.

Concept designs for future development

[20] The Working Group established a set of guiding principles to help define what the community wanted to see. These were:

- Consider a holistic view of the project and links to the prior Leith developments
- Aim for creating the most natural state possible
- Provide for enhanced natural planting
- Give access to the harbour
- Improve public access to the waterway
- Create/maintain fish access
- Minimise sediment deposit
- Follow cultural principles

[21] The Working Group then created 12 Design Considerations to provide a practical framework to connect the suggested enhancements and the guiding principles of the ORC requirements of:

1) **Maintain flood protection** while considering sea level rise.

2) **Improvements must be flood resistant**, with minimal post-flood reinstatement costs.

3) Create **natural characteristics and natural habitat** – but may use modern methods.

4) Ensure all enhancements meet **safety, security and regulatory** requirements.

5) **Ecology restoration** is preferred to "landscaping".

6) **Water quality** to be improved.

7) **Access should be provided** along the length of the project, on both banks and ideally this access should reflect the current working agreement between the University, Polytechnic and DCC with the Tertiary Precinct Group (TPG). Any works should integrate with the existing street networks and any TPG proposed upgrades.

8) **Centre island should be removed** unless needed for bridge support.

9) **Consider Leith in three sections and themes:**

- Above Anzac Avenue bridge, design to reflect a stream;
- Below Anzac Avenue bridge, design to reflect an estuary;
- From Forth Street to harbour, design to connect the city to the sea.

10) **Construct project from the top down**, maintaining a continuous improvement flow. The Working Group acknowledged the potential for this to be a project staged over some years.

11) Allow for flexible spaces to be available for **art/ sculpture/ performance/ recreation** development.

12) Project should **link to the Polytechnic's plan** to rebuild the old Teacher's College building.

[22] The Working Group then identified and developed three sections of the Water of Leith with a theme, described in detail in Appendices 1, 2, & 3 of this report.

- Forth St – Anzac Avenue: Natural stream theme
- Anzac Ave – State Highway 88: Tidal estuary theme
- State Highway 88 – Harbour: Connect to the sea theme

Consultation Outcomes

[23] An online survey was conducted to receive feedback about the three design concepts. The survey had 21 respondents. An average of 82% who responded to the survey liked each concept design. Respondents said they wanted greater accessibility to the Leith and for the river to return to a natural state. The full consultation report is presented as Appendix 3, which covers the two rounds of engagement in detail.

[24] In particular, the consultation has supported development of the three areas with overall themes of:

- Re-establishing a natural environment
- Developing a river estuary with access down to tidal flows
- Establishing an accessible and better connection direct to the harbour waters
- Re-colonisation of plants and organisms
- Access down to and along the water both by pedestrians and cyclists

DISCUSSION

[25] The Working Group process has come up with a long list of potential enhancements for consideration. The total estimated rough order cost of these enhancements sum to $12,477,000.

[26] The long list gives Council choices and flexibility when it comes to implementation. In practice Council will likely implement selected items over a period of time, focussing on those that provide the highest benefit and are the best fit with community values, as identified through the consultation process. Not all of the items need to be implemented to achieve significant improvement in amenity. Some works items are best implemented by others. That is, not all of the works should be part of an ORC works programme. They should however be aligned.

[27] The river is a challenging area to undertake and construction is expensive. In general, the capacity of the existing channel is more than sufficient to convey the 100-year flood (Average Recurrence Interval flow) of 171 m^3/s. There is one area of exception; between Forth St and Harbour where there is only enough hydraulic capacity to develop an infill bank and native plantings on one side of the river. Care is needed to develop an implementation plan that addresses all implementation risks and has sufficient flexibility.

IDENTIFIED AMENITY IMPROVEMENTS

[28] The range of possible options / enhancements identified by the Working Group which provides the Community Values (Paragraph 21) are listed in the following three tables.

Forth St to Anzac Ave Reach	Activity	Rough Order Cost
Central Dividing Wall • Forth St to Riego St • Riego St to Anzac Ave	Remove central wall dividing both channels (retaining bridge piers) and make good riverbed to provide a more open space	Allow $1,886,000
Concrete riverbed • Forth St to Riego St • Riego St to Anzac Ave	Remove and replace concrete riverbed with rocks/riprap to provide a more natural environment both visually and for eco-system/habitat value	Allow $2,450,000
Riverbank Improvements – right bank • Forth St to Riego St • Riego St to Anzac Ave	Cut down/demolish right bank wall (retaining bridge abutments), form sloped grassed embankments down to river level, construct river level walkway along entire length of reach, provide ramps and	Allow $1,495,000

	amenity spaces, street furniture	
Riverbank Improvements – left bank • Forth St to Riego St • Riego St to Anzac Ave	Cut down/demolish left bank wall (retaining bridge abutments), form sloped grassed embankments down to river level, construct river level walkway along entire length of reach, provide ramps and amenity spaces, street furniture, service removal/relocation	Allow $1,725.000
Install public artworks	Sculptural, murals	Allow $230,000
Land agreement / acquisition	Provisional cost for access to land: Approach land owners and agree to undertake works:	$300,000
	Total this reach	**$8,086,000**

Table 1: Working Group Options for Amenity, Forth St to Anzac Ave Reach

Anzac Ave to State Highway 88 Reach	**Activity**	**Rough Order Cost**
Central Dividing Wall • Downstream of Anzac Ave bridge (60m)	Remove central wall dividing both channels and make good riverbed to provide a more open space	Allow $420,000
Riverbank Improvements – right bank • from Anzac Ave to tie in with landscaped area adjacent to Gallagher's (approx. 250m)	Cut down/demolish right bank wall down to level of intermediate tiebacks including removal of existing parapet wall. Form sloped grassed embankments down to tieback level and construct additional embankment out into channel down to river level. Construct river level walkway along entire length of reach, provide ramps and amenity spaces, street furniture	Allow $1,012,000
Riverbank Improvements – left bank • Between Anzac Ave and Forsyth Barr Stadium	Cut down/demolish left bank wall down to level of intermediate tiebacks, form low terrace (approx. 60m by 20m) bounded by grassed embankments, provide access ramp and steps plus amenity space, street furniture.	Allow $543,000

Riverbank Improvements – left bank • Forsyth Barr Stadium to SH88 (approx. 230m)	Provide aesthetic improvement to strip between top of river wall and existing balustrading – soft landscaping and planter boxes	Allow $133,000
Install public artworks	Sculptural, murals	Allow $230,000
	In river feature sculptures	Allow $115,000
Land agreement / acquisition	Provisional cost for access to land: Approach land owners and agree to undertake works:	$300,000
	Total this reach	**$2,753,000**

Table 2: Working Group Options for Amenity, Anzac Ave to State Highway 88 Reach

State Highway 88 to Harbour Reach	**Activity**	**Rough Order Cost**
Riverbank Improvements – right bank • from new foot/cycle bridge to harbour(approx. 370m)	Clearing and grubbing, form new gravel footpath, ramp from new bridge, grassing and soft landscaping (screening), access to river, street furniture	Allow $685,000
Riverbank Improvements – left bank • Between New Footbridge and Yacht Club Boundary	Tidy and improve soft landscaping and street furniture.	Allow $35,000
Riverbank Improvements – left bank • Along mole forming left bank boundary with Yacht Club basin	Improve grassing and provide gravel footpath with improved access to river, street furniture (This would be subject to joint access to yacht club, as currently behind fence)	Nominal Allowance $288,000
Install public artworks	Sculptural, murals, light display	Allow $230,000
Land agreement / acquisition	Provisional cost for access to land: Approach land owners and agree to undertake works:	$200,000
	Total this reach	**$1,438,000**

Table 3: Working Group Options for Amenity, State Highway 88 to Harbour Reach

Summary of Costs Working Group Options	Cost
Forth St to Anzac Ave Reach	$8,086,000
Anzac Ave to State Highway 88 Reach	$2,753,000
State Highway 88 to Harbour Reach	$1,438,000
Resource Consent Costs: Estimated on the basis of all consents being obtained at once are approximately $150K. Consent cost maybe higher if consents are obtained for individual sections of the work; allow	$200,000
Total Cost of Working Group Options	**$12,477,000**

Table 4: Cost of Working Group Options

Priority Works

[29] Staff have identified a set of works that could be undertaken while avoiding major structural works with minimal disruption to the existing channel. These are likely to provide the most amenity and are much smaller in scale than the total package identified by the Working Group.

[30] These are summarised in the following table. Images are presented in Appendix 4.

Forth St to Anzac Ave Reach	Activity	Rough Order Cost
Stage 1: Riego Street to Anzac Avenue, Right Bank outside Otago Polytechnic:	Form new embankment, river level walking path, access ramps, soft landscaping, street furniture, and seats	Allow $1,030,000
Stage 2: remove central concrete wall		Allow $1,886,000
Stage 3: line right bank concrete channel bed with bluestone boulders		$1,225,000
Anzac Ave to State Highway 88 Reach	**Activity**	**Cost**
Stage 1: Terraces & River Level Path		$1,555,000
Stage 2: Remove channel centre dividing wall and repair the concrete bed		$420,000
State Highway 88 to Harbour Reach	**Activity**	**Cost**
New Gravel foot path to new picnic spot tables at Mouth of Leith Right Bank point:		$685,000
Other Costs		**Cost**
Land agreement / acquisition	Provisional cost for access to land: Approach land owners	$200,000

	and agree to undertake works:	
Resource Consent Costs: Estimated on the basis of all consents being obtained at once are approximately $150K. Consent cost maybe higher if consents are obtained for individual sections of the work; allow		$200,000
	Total Cost for Priority Works	**$7,401,000**

Table 5: Priority Works (construction works component)

Proposed Initial Program of Work is to undertake construction from Riego Street to Anzac Avenue on the Right Bank in years 2020 – 2021.

[31] The 2018 / 2019 Annual Plan includes funding of $83,000 and the 2019/2020 Annual Plan includes funding of $870,000; in total $953,000 for amenity works.

[32] ORC staff recommend works commence on the Riego Street to Anzac Avenue site on the right bank outside Otago Polytechnic, where reconstruction of a lowered platform and a walkway down along the river can provide for best immediate amenity outcome. This selection of work will achieve the Working Group outcome themes listed in paragraph [21] by:

- converting a concrete wall back to a natural planted environment of a river bank,
- providing access down to and along the water and by pedestrians and cyclists,
- providing access down to tidal flows and fluctuating water levels,
- facilitating a river pathway which with future pathway works can provide a future connection to harbour waters.

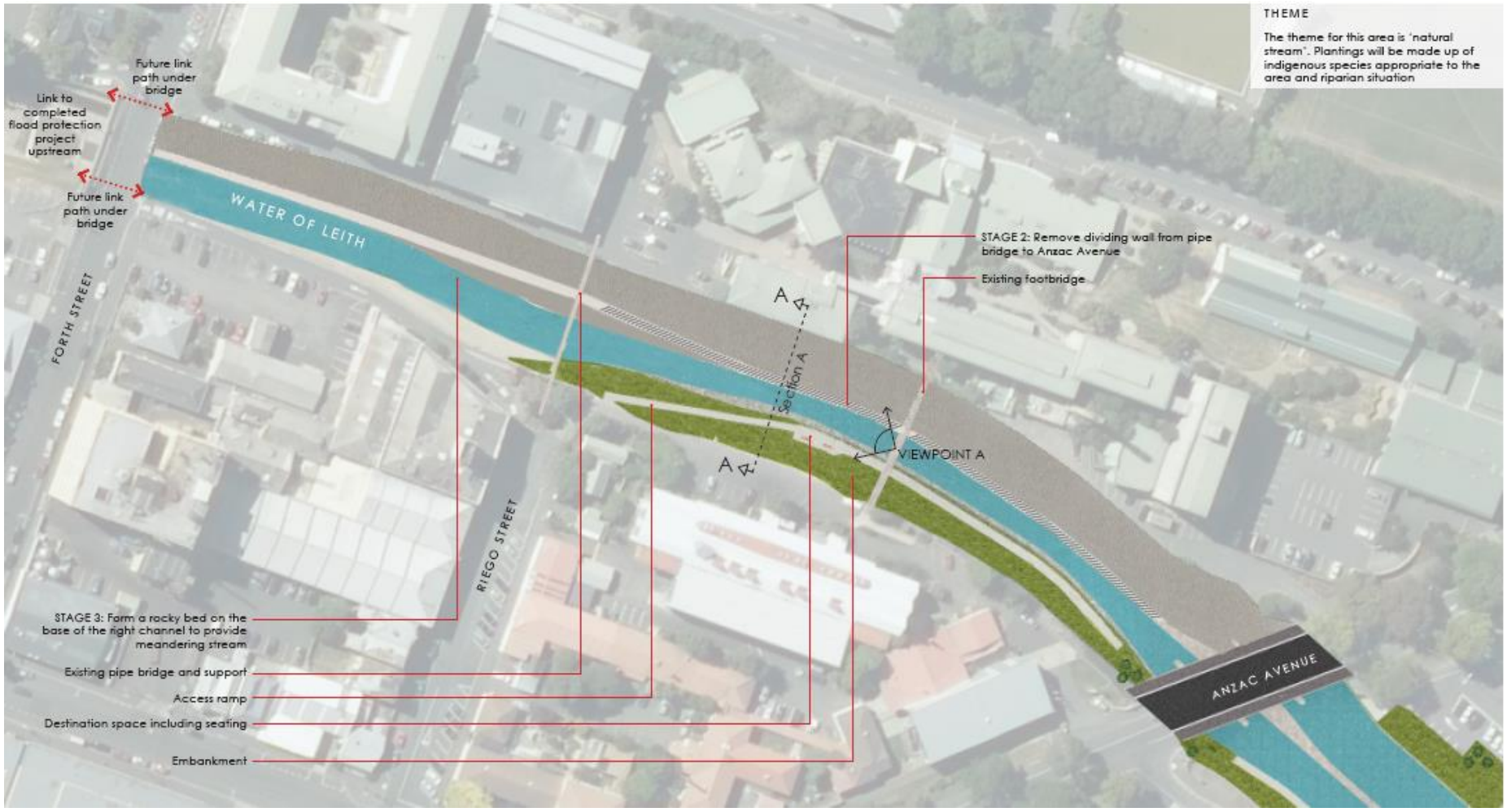

Figure 7: Riego Street to Anzac Avenue on the Right Bank

[33] The estimated cost of Riego Street to Anzac Ave Reach Stage 1 works: Right Bank outside Otago Polytechnic is $953,000. This includes the following works: form new embankment, river level walking path, access ramps, soft landscaping, street furniture, and seats. Resource Consent Costs are estimated to be $50,000. Engineering oversight, supervision and staff time is estimated to be $129,000. It is envisaged access approvals, Resource Consent and Design can be obtained in the next 9 months, subject to land owner and consent authority approvals. Construction would occur February 2020 to September 2020.

NEXT STEPS

[34] It is proposed that implementation of the initial works in the Riego Street to Anzac Avenue road commence. It is noted that implementation timeframes and costs are dependant on regulatory and land owner approvals and also favourable construction tenders.

[35] Council needs to decide which of the other amenity works to proceed with, along with order, timeframes and funding. This detail is best developed during 2020/21 and incorporated into preparation of the next Long Term Plan.

[36] A number of selected amenity development works are best to be integrated over time with refurbishment of channel walls over the next 20 years, and works proposed by others.

[37] It is recommended that Council endorses: the concepts described in paragraphs [16] and [34 to 39] for consideration in the development of implementation options in 2020/21, for consideration by Council for inclusion in the Draft 2021/31 Long Term Plan.

ATTACHMENTS

1. Appendix 1 Images of Working Group Development Concepts A 3 Size **[10.1.1]**
2. Appendix 2 Final Working Group Report **[10.1.2]**
3. Appendix 3 Consultation summary report for rounds 1 and 2 of public engagement **[10.1.3]**
4. Appendix 4. Lesser Range of Works at Lower Cost **[10.1.4]**

10.2. Stock Truck Effluent Disposal Central Otago

Prepared for: Technical Committee

Report No. EHS1847

Activity: Environmental: Land

Author: Gavin Palmer, Director Engineering, Hazards and Science

Date: 20 March 2019

PURPOSE

[1] To consider options for constructing a second new Stock Truck Effluent Disposal facility (STED) in Central Otago as part of the regional network of STEDs.

EXECUTIVE SUMMARY

[2] ORC has proposed constructing two new STEDs in Central Otago as part of a regional network of STEDs[2]. One facility is on SH85 (near Brassknocker Road). That facility is going through the commissioning process.

[3] The Ripponvale Straight on SH6 is the site preferred by ORC staff and the New Zealand Transport Agency (NZTA) for the second new STED. Central Otago District Council (CODC) has expressed concerns about the suitability of that site and has advised that a site on the Lindis side of Tarras is preferred.

[4] ORC must decide whether to construct a second new STED in Central Otago and, if it does wish to construct a STED, whereabouts it should be located. This paper and the report "Stock Effluent Disposal Sites Options Report – Central Otago" prepared by WSP Opus (February 2019) have been prepared to inform that decision.

RECOMMENDATION

That the Council:

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

2) ***Notes*** *the funding implications of proceeding to construct a second new STED in Central Otago.*

3) ***Approves*** *one of the options described in this report.*

BACKGROUND

[5] In response to instances of stock effluent being deposited on roads, Otago Regional Council and Environment Southland (through the Otago/Southland Road Transport Committee) have adopted the strategic approach of installing a network of Stock Truck Effluent Disposal facilities (STEDs) in the lower South Island.

[6] After liaison with interested stakeholders including NZTA, the Road Transport Association and adjacent landowners, two additional sites in the Central Otago district were identified as being highest priority (SH85 at Brassknocker Road and Ripponvale Straight on SH6). Both are within the state highway reserve and therefore attract maximum subsidy from NZTA. NZTA will fund 50% of

[2] *Director's Report on Progress*, Report to Otago Regional Council Technical Committee, 21 March 2018.

the effluent receptor, storage tanks and associated assets, while ORC will fund the remaining 50% of these items. NZTA will fund 100% of the roading components associated with these works.

[7] A business case for part funding of two new STEDs in Central Otago was submitted to NZTA and approved in July 2017. NZTA approved funding of $930,000 for the 2017/18 financial year, for the construction of the two STEDs.

[8] In late 2017 CODC expressed concerns about the suitability of the Ripponvale Straight site. Staff of CODC, NZTA and ORC met on 13 February 2018 to discuss these concerns but did not agree on a site.

[9] On 23 February 2018 tenders were invited to construct a STED on SH85 near Brassknocker Road. The invitation excluded the Ripponvale Straight (SH6) site. However, it did advise tenderers that a second site may be included in the invitation to tender.

[10] On 11 April 2018 Council authorised the Chief Executive to award a contract to Fulton Hogan Ltd for the SH85 site. A contract was awarded on 1 May 2018 for the sum of $693,568.89 (ex GST).

[11] Commencement of construction of the second facility, on Ripponvale Straight (SH6), remained on hold until agreement on location was resolved with CODC. It was intended that, with prior Council approval, construction of the second STED be negotiated as a variation to the contract with Fulton Hogan if agreement could be reached with CODC on the second site in a timely manner.

[12] On 2 May 2018 Technical Committee considered a report[3] on the site selection process to date with supporting information prepared by engineering consultants WSP Opus. The assessment by WSP Opus concluded that SH6 was the preferred site. The committee resolved that "*Central Otago District Council, ORC and NZTA agree the criteria and that Council requests for the Central Otago District Council to formally advise their preferred site, which satisfies the agreed criteria, for the second new STEDs in Central Otago, by 31 July 2018*".

[13] In accordance with the resolution of the Technical Committee, staff of CODC, NZTA and ORC met on 20 June 2018 to discuss and agree site selection criteria. Those criteria are presented in the WSP Opus report dated February 2019 (Appendix A).

[14] On 3 October 2018 CODC staff advised ORC that CODC's "*preference for the preferred site is the one already identified on the Lindis side of Tarras*".

[15] Construction of the facility on SH85 near Brassknocker Road was completed in February 2019 (Figure 1). Commissioning is in progress.

[3] *Stock Truck Effluent Disposal Sites*, Report to 2 May 2018 meeting of the Otago Regional Council Technical Committee, 27 April 2018, 8p.

Figure 1: SH85 near Brassknocker Road

PROPOSAL

[16] ORC must decide how to proceed. That decision-making includes whether to construct a second new STED and, if a second STED is to be constructed, the site for that STED. To assist that decision ORC engaged WSP-Opus to identify and assess options, for consideration by Council. Their report is attached as Appendix A.

[17] WSP Opus has identified five options for consideration by ORC, as follows:

- Option 1 – Do nothing
- Option 2 – SH8 Tarras, Lindis Peaks Straight
- Option 3 – SH6 Cromwell, Ripponvale Straight
- Option 4 – SH6 Gibbston Victoria Flat
- Option 5 – SH8 Gorge Creek Hill (between Alexandra and Roxburgh).

[18] WSP Opus has evaluated the options against the criteria developed jointly with CODC and NZTA in June 2018.

CONSIDERATIONS

Financial Considerations

[19] The STED Facility at SH85 Brassknocker Road is now completed with an estimated final cost of $840,000. Based on the funding assistance rates of 50% and 100% for the effluent facility and access road respectively the NZTA portion comes to $635,000 and the balance $205,000 from ORC.

[20] The NZTA approved funding for the STED Project is $940,000 (for two sites, originally nominated as Brassknocker and Ripponvale), leaving a balance of $305,000 for the second site. NZTA would approve the second site changing from Ripponvale to another option. ORC have allocated a budget of $426,000 for it's share of the STED Project. The ORC balance for the second site is therefore $221,000. The current total funding available for the second site is therefore $526,000. This is significantly below the second STED rough order of costs of between $865,000 to $965,000. Additional funding is therefore required and is summarised in Table 1 below for the different options.

[21] Additional funding can be sought from NZTA through a cost adjustment process to increase the $940,000 currently approved. NZTA have advised that any additional funding would be subject to availability within their current budgets and noted that the project would be competing against multiple projects nationally for this funding. It is therefore recommended that ORC engage with NZTA and commence this process as soon as a decision is made by ORC on the second site.

[22] The current approved funding was sought and approved using a rough order of costs (ROC) prior to the final design of Brassknocker and Ripponvale and based on the cost of the last STED facility developed in Southland by NZTA. It is also assumed that ORC's proportion of the funding would be higher. Preparation of the earlier ROC predates the recent construction increases being experienced across the Central Otago area. The industry is buoyant at present and the market is less competitive due to resource shortages. It is common to only receive a single tender and often at a premium price.

Table 1

Option No	Site	Estimated Project Costs ($)			NZTA Contribution ($) ((a)x50% + (b)x100%)	Balance Approved NZTA Funding ($)	Additional NZTA Funding Required ($)	ORC Contribution ($)	Balance ORC Funding ($)
		STED Receptor Facility	Access Road	Total					
		(a)	(b)	(c)	(d)	(e)	(f) = (d)-(e)	(g) = (c)-(d)	(h)
2	SH8 - Tarras, Lindis Peaks Straight	$380,000	$485,000	$865,000	$675,000	$305,000	$370,000	$190,000	$221,000
3	SH6 – Cromwell, Ripponvale Straight	$360,000	$565,000	$925,000	$745,000	$305,000	$440,000	$180,000	$221,000
4	SH6 – Gibbston Victoria Flats	$380,000	$585,000	$965,000	$775,000	$305,000	$470,000	$190,000	$221,000
5	SH8 – Gorge Creek Hill	$400,000	$515,000	$915,000	$715,000	$305,000	$410,000	$200,000	$221,000

Attachments

1. Stock Effluent Disposal Sites - Options Report Feb 19 Final V 3 **[10.2.1]**

10.3. Lake Hayes Restoration

Prepared for:	Technical Committee
Report No.	EHS1850
Activity:	Environmental: Rivers & Waterway Management
Author:	Ben Mackey, Natural Hazards Analyst
Endorsed by:	Gavin Palmer, Director Engineering, Hazards & Science
Date:	20 March 2019

PURPOSE

[1] A report[4] 'Lake Hayes Restoration' was presented to the Technical Committee on 1st August 2018 outlining three intervention options to address the water quality issues generated by historic phosphorous accumulation in bed sediments in Lake Hayes. Following presentation of that report, the Council requested further information about intervention options through the following resolution:

That staff develop options for consideration by Council on the remediation of Lake Hayes including a comprehensive description and assessment of benefits, effectiveness, precedents, risks, costs, implementation, timelines, and funding.

[2] This report brings together information to address this resolution, and seeks endorsement to consult publicly on technical intervention options.

EXECUTIVE SUMMARY

[3] The ORC is developing a programme to improve the water quality in Lake Hayes, which suffers from periodic algal blooms caused by accumulated phosphorous in lake bed sediments. Work has been undertaken to address the August 2018 Council resolution requesting further information about intervention options at Lake Hayes.

[4] GHC Consulting produced a detailed analysis (Attachment A) of the three intervention methods presented in 2018: Arrow water augmentation, lake destratification, and sediment capping. Two additional intervention methods have been included; no lake intervention (monitor and evaluate), and hypolimnetic withdrawal. GHC's report looks at the costs, risks and practical implications of undertaking the intervention methods.

[5] An assessment of the likely effectiveness of intervention methods, and examples where similar lake remediation work has been attempted, was undertaken by Dr Max Gibbs of NIWA (Attachment B).

[6] Using combinations of the five intervention methods, eight intervention options have been defined, and it is proposed to publicly consult on a range of these options.

RECOMMENDATION

That the Council:

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

[4] Technical Committee report 2018/EHS1824 'Lake Hayes restoration'

2) ***Approves*** *public consultation on technical intervention options for water quality improvement in Lake Hayes.*

BACKGROUND – HISTORIC PHOSPHOROUS AND ALGAL BLOOMS

[7] Human activity has resulted in Lake Hayes becoming enriched in nutrients over the last 70 years. Of particular concern is an accumulation of phosphorous (P) in lake-bed sediments, which in some years can be released into the water column and lead to algal blooms in the lake. Previous reporting[5] has described the nature of the water quality problem in Lake Hayes, and reviewed potential intervention methods.

[8] Intervention methods are primarily focused on interrupting lake processes and preventing legacy phosphorous in lake bed sediments from generating algal blooms. The intervention methods vary in approach from imobilising P in the sediments (sediment capping), preventing anoxic conditions which cause P to be mobilised into the water column (destratification, water augmentation), or removing dissolved P from the lake waters (water augmentation, hypolimnetic withdrawal).

[9] The methods described in this report and the attachments do not explicitly target the ongoing issue of nutrients entering the lake from Mill Creek or other sources. A separate program of work and monitoring is underway by ORC to identify contemporary sources of catchment-derived nutrients entering the lake via Mill Creek.

[10] This monitoring programme involves nine surface water sites, and one groundwater site on a monthly basis, until the end of 2019. Continuous turbidity and nitrate probes have been collecting data at 15 minutes intervals since August 2018, the turbidity probes are located at two sites in Mill Creek (Hunter Road, and just upstream of Lake Hayes) and continuous nitrate at one site (just upstream of Lake Hayes). The automatic sampler has arrived in New Zealand and will be set up in late-March to sample high-flow events which are thought to deliver the bulk of the phosphorous to the Lake. The Lake Hayes buoy is on track to be deployed by the end of April, mooring logistics are being organised.

FURTHER INFORMATION ON REMEDIATION METHODS

[11] NIWA lake scientist Dr Max Gibbs authored the 2018 report[6] for ORC on remediation options for Lake Hayes which was presented to the August Technical Committee. To address questions of precedent and effectiveness requested in the Council resolution, ORC asked Dr Gibbs to expand on his earlier report. Dr Gibbs provided additional information about the remediation options, citing examples where similar approaches have been used elsewhere, and commenting on the likely effectiveness of each method (Attachment 2).

[12] Dr Gibbs proposed an additional method: removing nutrient rich bottom water from the lake via a hypolimnetic withdraw method. The proposed hypolimnetic withdrawal method has been included in the assessment of methods by GHC as outlined below.

[13] Dr Gibbs notes that while remediation techniques have been applied to thousands of lakes globally, none of the lakes are directly comparable to Lake Hayes with regard to size, depth, environmental setting, or degree of degradation. A further point of difference in this project, is that most lake remediation efforts focus on a compromise of making very degraded water better, rather than seeking to achieve a return to very high water quality.

[14] The Arrow augmentation option has little direct precedent, given the small increase in flow compared to the size of the lake. Hypolimnetic withdrawal is used extensively to remove P from lakes overseas, and has been promoted in Europe as an alternative to sediment capping or

[5] Technical Committee report 2018/EHS1824 'Lake Hayes restoration'

[6] Gibbs, M., 2018: Lake Hayes Water Quality Remediation options. NIWA report prepared for ORC.

destratification. Gibbs notes that pairing hypolimnetic withdrawal with Arrow Augmentation has a high probability of successfully improving the long-term water quality in Lake Hayes.

[15] Lake destratification has been used extensively in water reservoirs, and Dr Gibbs argues a correctly designed system would work well in Lakes Hayes, with water quality improving with each year of use. There are risks associated with starting destratification at the wrong time, inadvertently stimulating algal blooms, however this would largely be negated with data from the installed monitoring buoy. Destratification also disrupts a natural lake process; the development of a thermocline in summer months.

[16] Sediment capping has a strong precedent of immediately improving water quality and removing cyanobacteria blooms, resetting the lake to a condition without an internal phosphorous load. However, if phosphorous is continually added to the lake through Mill Creek, the effectiveness of sediment capping will be reduced, requiring retreatment after several years. Gibbs notes sediment capping can be used to provide immediate water quality improvement while other catchment management actions are undertaken to reduce external phosphorous loads going into the lake.

GHC EVALUATION OF INTERVENTION OPTIONS

[17] GHC Consulting have assessed the intervention methods in a framework to address the components of the Council resolution stated above. GHC's report outlines five remediation methods that have been identified as being potentially suitable for Lake Hayes, and these are listed in Table 1.

Table 1. Technical methods considered for the remediation of Lake Hayes water quality.

Method	Description
• No lake intervention (Monitor and evaluate)	Track changes in lake water quality over time, to understand whether any long-term improvement trends are underway.
• Water augmentation	Augment the flow of Mill Creek with water from the Arrow River.
• Destratification	Artificially mix the lake water column, keeping it well oxygenated and preventing thermal stratification from occurring.
• Hypolimnetic withdrawal	Take seasonally nutrient-rich and oxygen-depleted water from the lake bottom, and discharge it into Hayes Creek.
• Sediment capping	Transform dissolved P in the water column into a non-bioavailable form through the addition of chemicals.

[18] For each method, GHC have assessed:
- how each of these methods could practically be implemented,
- the likely capital and operating costs to install and operate the necessary equipment,
- the risks associated with each method, and
- the temporal rate of predicted water quality improvement

[19] Either a single method, or a combination of methods may be used to improve water quality within Lake Hayes. GHC describe eight potential implementation options. Method 1 No Lake Intervention (monitor and evaluate) is included in all implementation options, as water quality monitoring in Lake Hayes, including the pending deployment of a monitoring buoy, is part of an existing work program.

LAKE WATER QUALITY MODELLING AND TESTING MANAGEMENT OPTIONS

[20] ORC engaged the Environmental Research Institute at the University of Waikato to develop a physical-biogeochemical numeric model of Lake Hayes[7]. The purpose of this model is to better understand both natural processes in Lake Hayes, and test the impact of intervention measures on water quality.

[21] The model uses existing environmental data to simulate processes operating in Lake Hayes over a ten year period. Following establishment of a validated model of inflow and lake water quality, a range of management scenarios were tested to evaluate the change on lake dynamics and water quality. The measures used to assess the effectiveness of a change in water quality were changes in nutrient concentrations and the Trophic Level Index (TLI).

[22] ORC has received an advance copy of the report for this committee round (Attachment C). All modelled intervention options showed a net improvement in water quality over the base line (existing conditions). Modelling indicated that a reduction in nutrient load entering Lake Hayes via catchment improvement has the greatest contribution to improved water quality, with the degree of improvement scaling with the relative decrease in nutrient load. A modest reduction in nutrient inflow, combined with Arrow water augmentation, was also promising. Lake aeration and sediment capping were also simulated and showed potential for water quality improvement, although they were subject to greater degrees of model uncertainty.

COSTS AND FUNDING

[23] An economic assessment[8] of the benefits of lake remediation shows that successful remediation generally has a high benefit/cost ratio, largely attributable to the predicted increase in recreational activity as a result of improved water quality.

[24] The costs associated with the expanded monitoring programme have been provided for in the 2018-28 Long Term Plan, and that work will continue independently of any of the intervention methods presented here. Implementation of any of the other methods will incur additional capital and operational costs.

[25] Following the proposed consultation on technical options to improve water quality in Lake Hayes (and identification of a preferred option and cost), it is proposed to have a second period of consultation focussed on identifying a funding mechanism.

DISCUSSION

[26] The information contained in this suite of reports, and previous work, highlight that there are feasible methods to address water quality issues caused by historic accumulation of phosphorous within the bed sediments in Lake Hayes. The assessment by GHC aims to bring together our current understanding of how intervention methods can be implemented, what they will cost, the timeframes of anticipated water quality improvement, and the effect of undertaking an intervention method on the broader Lake Hayes environment.

[27] Of the spectrum of active intervention methods, Arrow water augmentation arguably has the lowest environmental impact as it augments an existing process (Mill Creek inflow to Lake Hayes). It is a long-term option, which will likely be required to operate over many years to have a significant impact on water quality, but pairs well with other intervention methods, particularly

[7] McBride CG, Muraoka K, and Allan MG (2019). Lake water quality modelling to assess management options for Lake Hayes. Client report prepared for Otago Regional Council. *Environmental Research Institute Report.* The University of Waikato, Hamilton. (Subject to review)

[8] Castalia Strategic Advisors: *Economic Assessment of Lake Hayes Remediation*. Report to Otago Regional Council, November 2018.

hypolimnetic withdrawal. Much of the infrastructure to enable the transfer of water from the Arrow Irrigation Scheme to Mill Creek has been constructed, in order to preserve this option ahead of golf course development by Millbrook. This method could readily be implemented, at comparatively low cost, with few adverse effects.

[28] In contrast, lake destratification and sediment capping will likely generate a faster improvement in water quality in Lake Hayes, but are higher risk options in terms of environmental impact, and potential secondary effects. Adding chemicals to a lake, or disrupting natural lake processes, may not be viewed as acceptable to lake users and stakeholders. The cost of these options is also significantly higher that Arrow water augmentation.

[29] With the upcoming deployment of the lake monitoring buoy, Option 1 – No Lake Intervention (Monitor and evaluate) will significantly improve understanding of lake processes. The additional data and understanding of Lake Hayes developed from the ongoing monitoring work, will provide greater certainty about longer term environmental trends in the lake. A period of additional monitoring may allow for more optimised intervention over coming years.

[30] Public consultation on remediation methods will be a valuable test of stakeholder opinion. There is a choice between higher cost, high risk options with some environmental impacts but with a more rapid potential improvement in lake water quality (destratification, sediment capping). At the other end of the spectrum are lower cost, lower impact methods, which are predicted to improve water quality over a longer time period (water augmentation, hypolimnetic withdrawal).

[31] All lake remediation methods need to be paired with efforts to improve water quality in Mill Creek, or the problem of phosphorous accumulating in lake bed sediments will continue.

NEXT STEPS

[32] There is a great deal of public interest in improving water quality in Lake Hayes. The intervention methods presented here have a range of risks and secondary impacts which can impact on Lake Hayes and its environs.

[33] It is proposed to consult publicly on the range of technical intervention options, with an initial focus on describing the intervention options, and explaining the physical rationale, potential effectiveness, implementation practicalities, and environmental impacts of individual methods. Some of the options, destratification and sediment capping, could induce changes to the lake or its surrounding environment which may not be acceptable to lake users and other stakeholders, despite these options potentially having positive effects on water quality.

[34] Public consultation on technical options is proposed to occur over a four-week period during April and May 2019. Consultation will have a digital focus, targeted at the Wakatipu Basin area. Drop in information sessions will be held as stand-alone events, or coordinated with existing ORC outreach programmes in the area. Consultation information will be housed on the 'YourSay' platform, which also has a mechanism to collate feedback. The purpose of the consultation on technical options will be to get community feedback on the preferred options, and in particular gauge whether any of the proposed methods should be discounted. It is proposed to ask a series of questions to quantify the communities preferred option or options.

[35] Pending Council approval, consultation on technical options can occur in the remaining part of the 2018/19 financial year. When a preferred option has been identified, a second phase of public consultation would address funding options early in 2019/20. The combined consultation on technical and funding options will be used to inform year three of the Long Term Plan and beyond.

[36] It is noted that the Government's Freshwater Improvement Fund is currently suspended pending a review of the projects funded. There is no indication when the next funding round will be.

ATTACHMENTS

1. Attachment A - GHC 2019 - Lake Hayes Remediation Options Overview Report 1 a **[10.3.1]**
2. Attachment B - NIWA 2018 - Lake Hayes Water Quality expansion report **[10.3.2]**

11. MATTERS FOR NOTING

11.1. Director's report on Progress

Prepared for: Technical Committee

Report No. EHS1849

Activity: Flood Protection & Control Works

Endorsed by: Gavin Palmer, Director Engineering, Hazards and Science

Date: 20 March 2019

PURPOSE

[1] To update Committee on the following topics:
- Key meetings attended
- Climate Situation and Outlook for Otago
- Leith Flood Protection Scheme

STAFF RECOMMENDATION

That the Council:

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

KEY MEETINGS ATTENDED

[2] 7 February 2019 - Meeting with Simon Drew, Dunedin City Council General Manager Infrastructure

[3] 14 February 2019 - Meeting with Dean Macaulay, University of Otago Property Services Director

[4] 19 February 2019 - Whitestone GeoPark public meeting held in Oamaru

[5] 19 February 2019 - Meeting with Neil Jorgensen, Waitaki District Council Group Manager, Asset Management and Deputy Chief Executive

[6] 22 February 2019 – Regional Council River Manager's Forum Champions Task Group meeting held in Wellington

[7] 25 February 2019 - Meeting with Richard Roberts, Chief Executive of Dunedin Airport

[8] 26 February 2019 - North Island Building Consent Authority and Dam Safety Liaison Group (regional councils and Ministry for Business, Innovation and Employment)

[9] 1 March 2019 - Meeting with Pete Hansby, General Manager, Property & Infrastructure, Queenstown Lakes District Council

[10] 4 and 5 March 2019 – Regional Council River Manager's Forum, Environment Canterbury

CLIMATE SITUATION AND OUTLOOK FOR OTAGO

Otago Low Flow Conditions

[11] Comparisons between the long-term Seven-day Mean Annual Low Flows (7dMALFs) and the current Seven-day Low Flows (7dLFs) for the minimum flow sites in the Regional Water Plan are shown in Table 1. For the current season (Oct 2018 – present), most minimum flow sites recorded

higher 7dLFs than their corresponding 7dMALFs. However, the flow recorders at Waipiata and Tiroiti along the Taieri River, Manuherikia at Ophir, and Pomahaka at Burkes Ford were the four having slightly below normal 7dLFs compared to their 7dMALFs.

Table 1 Comparisons between the long-term Seven-day Mean Annual Low Flows (7dMALFs) and the current Seven-day Low Flows (7dLFs) for the minimum flow sites in the Water Plan

Minimum flow site	Regional Water Plan minimum (instantaneous) flow (m^3/s)	Long-term 7dMALF (m^3/s, Oct-Apr, certified data)	7dLF (m^3/s, Oct 2018 - present, certified + telemetered data)	Lowest recorded instantaneous flows (m^3/s, Oct-Apr)	
				2014/15	2015/16
Welcome Creek	0.6	NA	NA	NA	NA
Kakanui at Mill Dam	0.25	0.437	0.688	0.188	0.230
Kakanui at Clifton Falls Bridge	0.4	0.560	0.667	0.319	0.274
Waianakarua at Browns	0.2 (Oct-Apr) 0.4 (May-Sep)	0.213	0.474	0.052	0.183
Trotters Creek at Mathesons watertake	0.01 (Oct-Apr) 0.035 (May-Sep)	NA	NA	NA	NA
Shag at Goodwood Pump	0.028	NA	NA	NA	NA
Shag at Craig Road	0.15	0.148	0.232	0.046	0.076
Leith at Leith Street	0.094	0.210	0.300	0.186	0.166
Taieri at Patearoa Power Station (below)	0.85	1.019	NA	0.810	NA
Taieri at Waipiata	1	1.425	1.048	0.823	0.761
Taieri at Tiroiti	1.1	1.793	1.596	0.853	0.877
Taieri at Sutton	1.25	1.974	2.311	0.961	1.119
Taieri at Outram	2.5	4.001	4.116	1.412	2.124
Luggate Creek at SH6 Bridge	0.18 (Nov-Apr) 0.5 (May-Oct)	0.199	0.477	NA	0.074
Mill Creek at Fish Trap	0.18	0.275	0.312	0.188	0.156
Manuherikia at Ophir	0.82	2.177	1.825	1.010	1.566
Waitahuna at Tweeds Bridge	0.45	0.723	0.979	0.654	0.571
Pomahaka at Burkes Ford	3.6 (Oct-Apr) 7 (May-Sep)	4.360	3.690	2.775	3.234
Lovells Creek at SH1	0.005	0.019	0.025	0.021	0.018

Total Rainfall

[12] Less rainfall than average was received for most of the region for the last 30 days (to 25 February 2019). The rain gauges in the Taieri catchment, Ida Burn and Pool Burn in the Manuherikia catchment recorded 50% below normal. Dunedin and North Otago received 60% less than normal, while those gauges along the main divide had slightly more rainfall totals than normal between 27 January and 25 February 2019.

[13] The 30-day SPI [9] map up to 25 February 2019 for Otago, as shown in Figure 1 (left), shows that weather conditions ranged from mildly wet for a small part of Central Otago, to moderately dry for some areas within Taieri, Dunedin and Balclutha. Most of the region experienced normal (in the west) and mildly dry (in the east) weather conditions. As for the 90-day SPI map up to 25 February 2019, as shown in Figure 1 (right), weather conditions were drier for Balclutha and slightly drier for Central Otago compared to the 30-day SPI map, and most of the region had normal conditions.

[9] The SPI is a Standardised Precipitation Index (SPI) in the normal distribution domain which is commonly used to indicate the dry/wet weather conditions based on observed rainfalls. Observed rainfalls (rain gauges with less than 10-year record were excluded) around Otago have been utilised to produce the SPI maps shown in Figure 1.

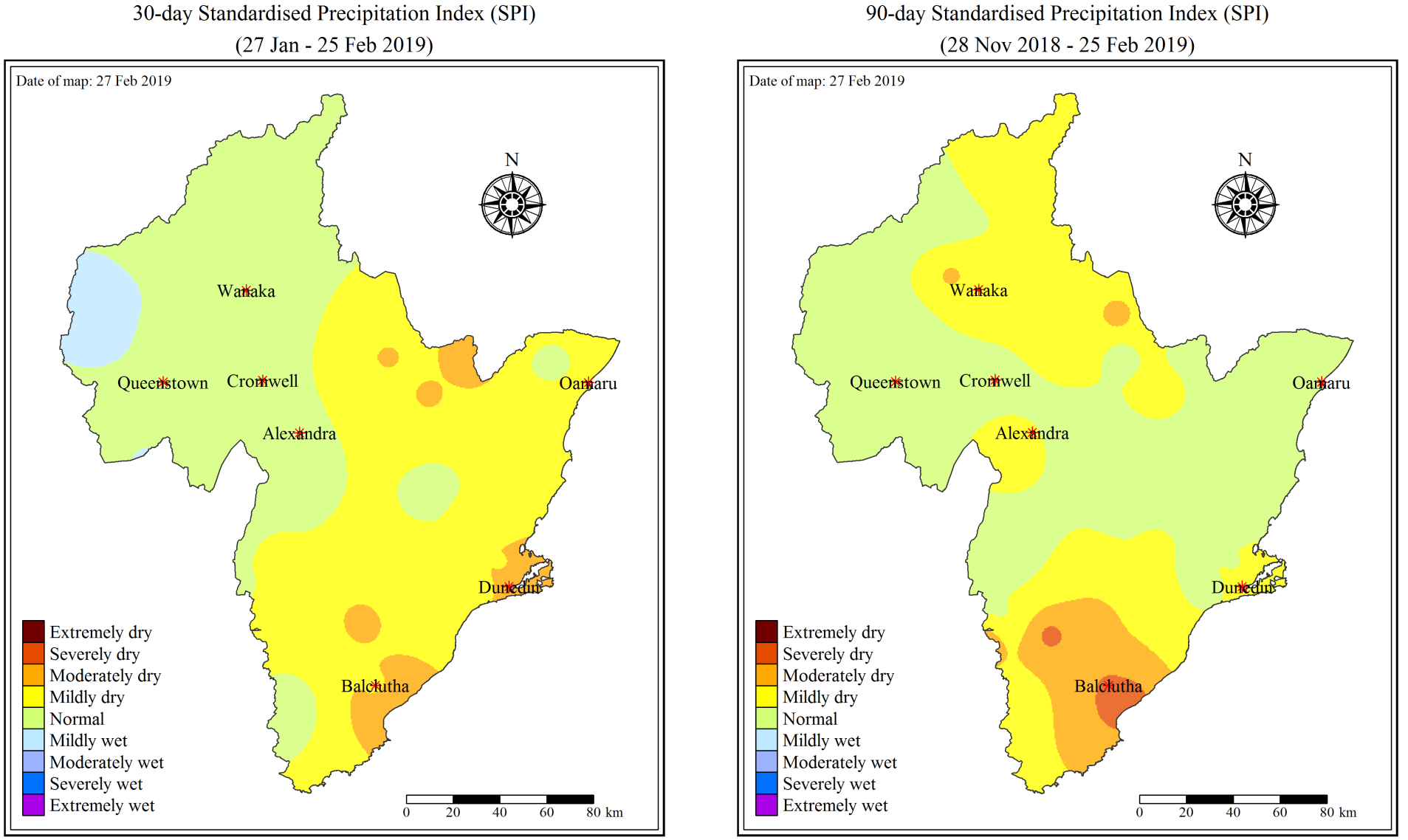

Figure 1: The 30- and 90-day SPI distributions over Otago region up to 25th February 2019

Climate Outlook (February – April 2019)

[14] For this next 3-month period, NIWA predict that temperature through to April 2019 will likely be higher than normal for the whole country. Rainfall from February to April 2019 is expected to be normal or above normal in the west of the South Island and close to normal for Otago.

[15] As shown in Figure 2, NIWA forecasted that temperatures are expected to be above average (50% probability) or near average (40% probability) for Otago. Rainfall totals have a 40% probability to be near normal or 35% probability to be above normal for Inland Otago, and 45% probability to be close to the normal range for East Otago.

[16] Soil moisture levels are likely to be normal (40% probability) for the whole Otago region, while there is 40% probability and 30% probability of being in the below normal range for inland and eastern Otago, respectively.

[17] Conditions for river flows are expected to be similar to rainfall conditions across Otago, as they are a reflection of rainfall. For more details, check *Seasonal climate outlook: February - April 2019* at NIWA.

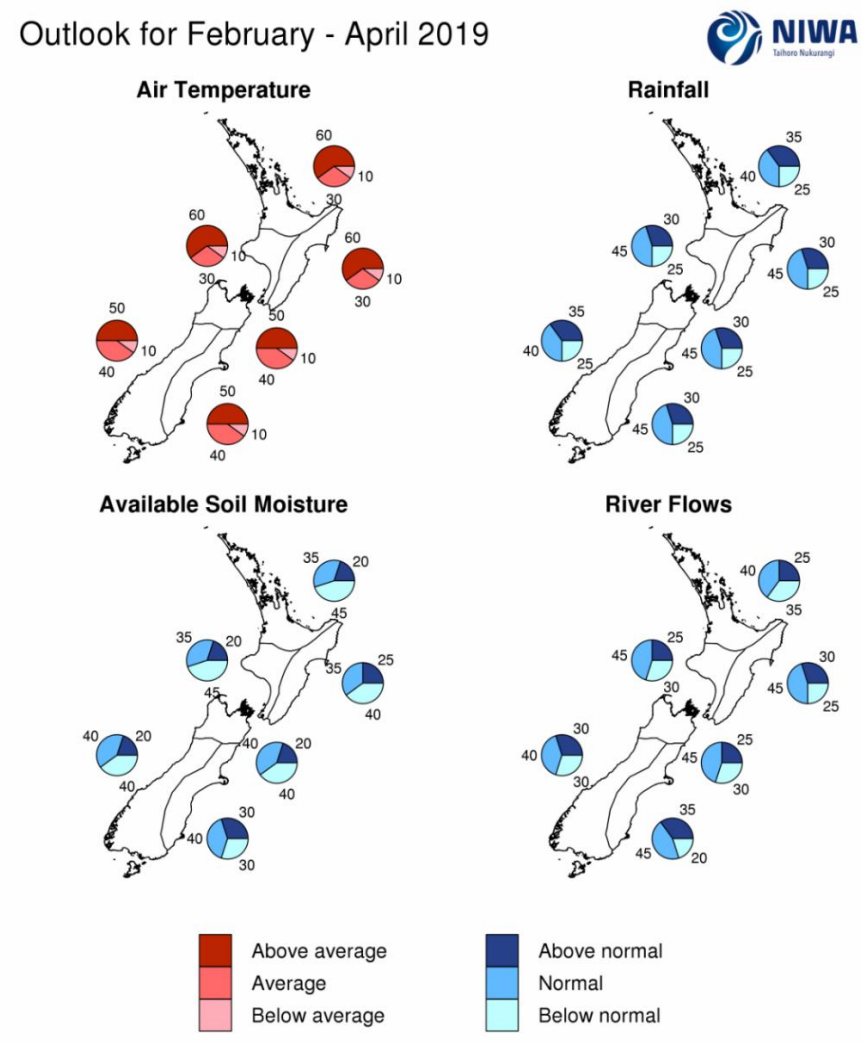

Figure 2: Graphical representation of the regional probabilities (sourced from NIWA)

LEITH FLOOD PROTECTION SCHEME

[18] Works on the Union to Leith footbridge stage were completed on 12 March 2019. The last of the works involved rock riprap being placed in the river bed, upstream of the footbridge, and the last of the weirs being reconstructed. As previously advised to committee, the opportunity is being taken whilst the contractor is on site to do flood-related maintenance repairs immediately downstream of the footbridge. These works and demobilisation of the Union to Leith footbridge site will be completed by the end of March 2019.

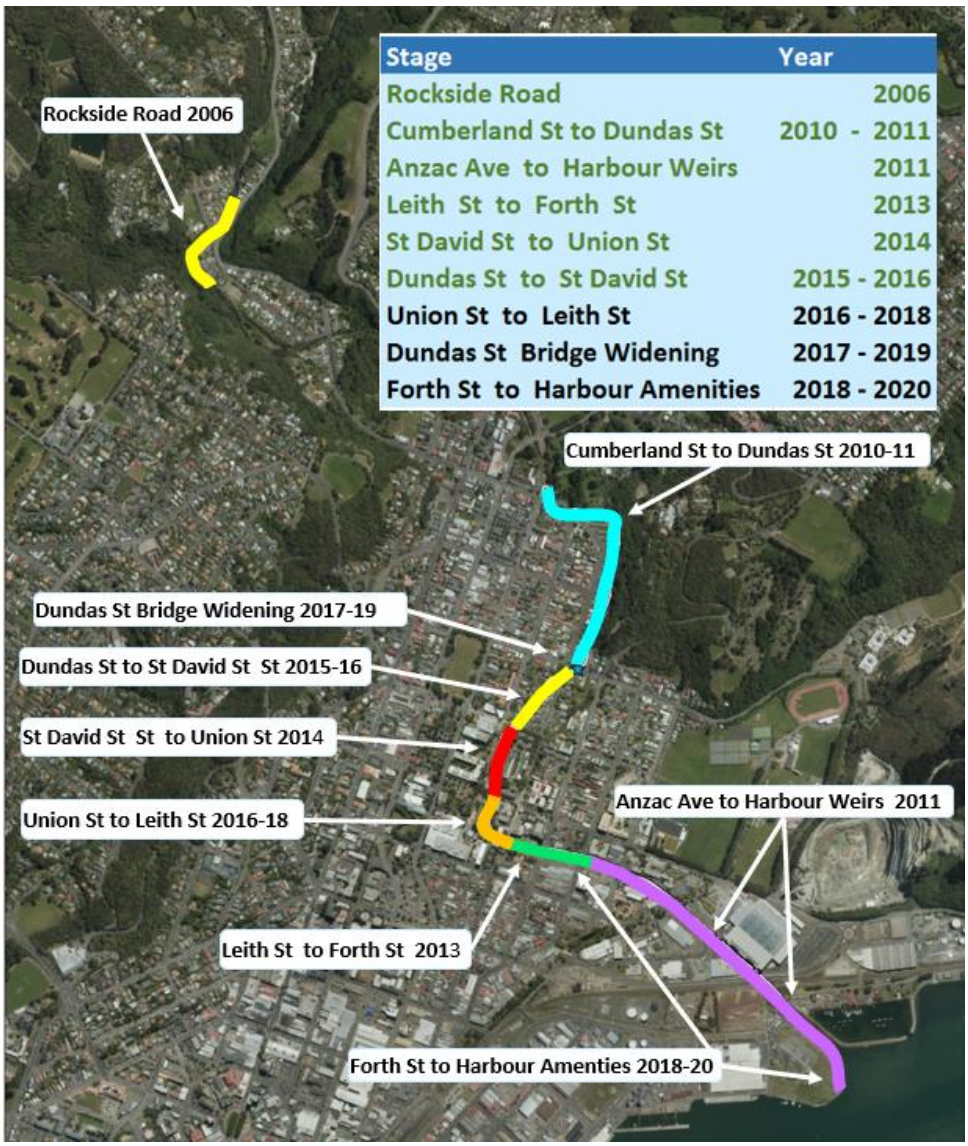

Figure 3: Staging of construction of the Leith Flood Protection Scheme.

[19] Works are underway on the Dundas Street bridge stage (Figures 4 and 5). The bridge was closed to pedestrian and vehicular traffic on Monday 11 February 2019. The bridge is unable to be reopened to vehicles or pedestrians at any time after the works have commenced. That is because of the excavation on the western side for the new culvert, and the excavation on the eastern side that ensures that the bridge is loaded evenly (horizontally) by the ground pressure on each side. Because of the excavations and reduced stability of the bridge there are also load limits on the bridge which preclude it

from being used. The bridge is planned to be reopened in August 2019, but is dependant on the time required to construct additional temporary ground support works.

Figure 4: Dundas Street bridge looking west along Dundas Street, 7 March 2019

Figure 5: Water of Leith looking upstream to Dundas Street bridge, 7 March 2019

[20] ORC has been monitoring the traffic situation, particularly in the vicinity of Clyde and Albany Streets (Figure 6). ORC and DCC staff and the contractor held a workshop on 20 February 2019 to discuss the actions that would be taken by ORC to minimise traffic disruption. They include a temporary roundabout at the intersection of Clyde and Albany Streets that was installed on 25 February 2019. Additional road signage is placed further afield on the days of major events at Forsyth Barr Stadium advising of the bridge closure. Security guards stationed at the bridge on the days of major events are briefed on alternative routes so that they can redirect pedestrians wishing to use the bridge. Additional communications include a joint ORC/DCC media release distributed to media on 21 February 2019 informing the community of what measures have been put in place. Social media accounts have been updated with the bus detours which are helping buses to run more on time and ease congestion through the Clyde/Union St area. Key stakeholders (University of Otago, Otago Polytechnic, Logan Park High School, Dunedin Ventures) are being informed of the measures being put in place.

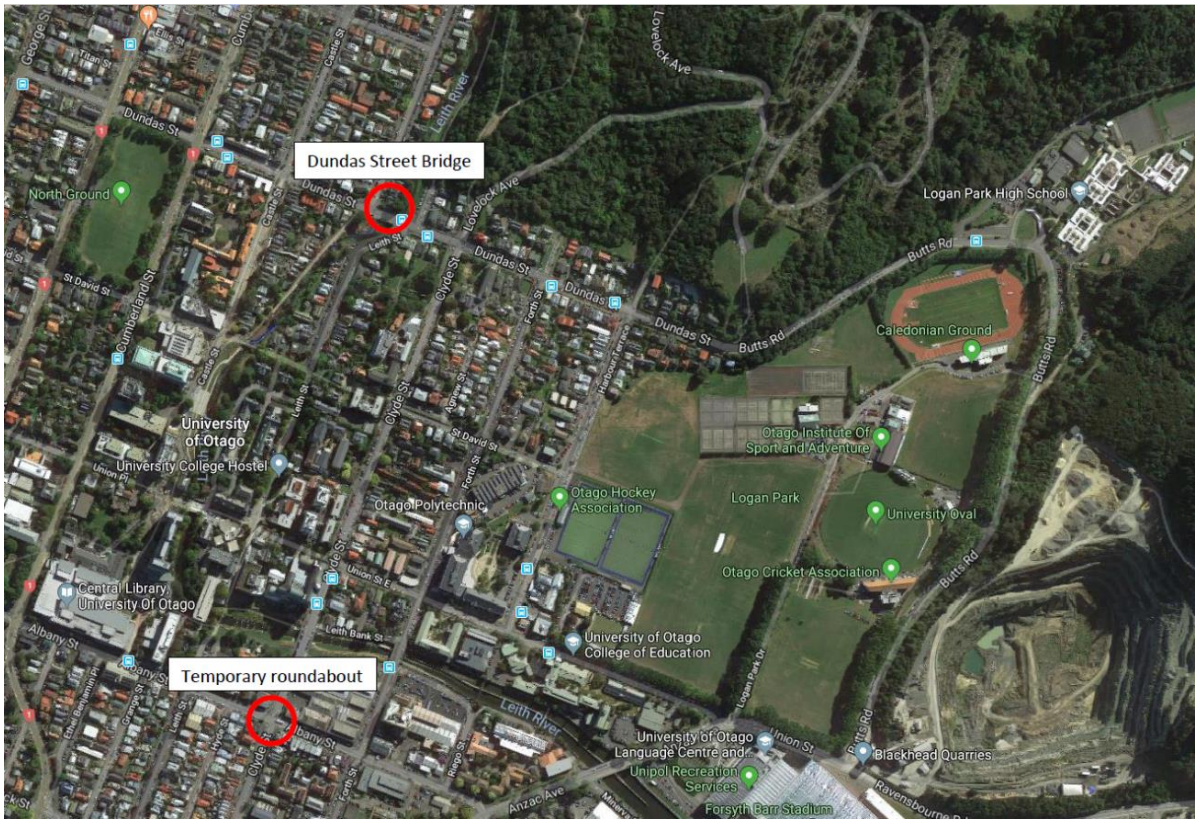

Figure 6: Roads and places in the vicinity of Dundas Street bridge, Dunedin

ATTACHMENTS

Nil

11.2. Active faults in the Queenstown Lakes and Central Otago districts

Prepared for:	Technical Committee
Report No.	EHS1845
Activity:	Safety & Hazards: Natural Hazards
Author:	Ben Mackey, Natural Hazards Analyst
Authoriser:	Gavin Palmer, Director Engineering, Hazards and Science
Date:	20 March 2019

PURPOSE

[1] To notify Committee of the GNS Science review of Active faulting and folding in the Queenstown Lakes and Central Otago districts.

EXECUTIVE SUMMARY

[2] As part of a regional assessment of active faulting commissioned by Otago Regional Council, GNS Science has undertaken a review of the locations and characteristics of active geological faults and folds in the Queenstown Lakes and Central Otago districts.

[3] Forty-eight active or potentially active faults have been identified at the ground surface within the Queenstown Lakes and Central Otago districts. Many of these features have been previously recognised, but this work provides the most up to date information available on faults and folds in these districts.

[4] Three major changes to fault traces or characteristics have been proposed as a result of this investigation. First, the NW Cardrona fault is now mapped to underly Wanaka township. Second, a portion of the Dunstan Fault Zone is mapped to extend southwards towards Clyde. Third, the Moonlight Fault, west of Queenstown, has been assigned a longer recurrence interval than previously estimated.

STAFF RECOMMENDATION

That the Council:

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

BACKGROUND

[5] The Otago Regional Council is undertaking a systematic review of active faults across Otago[1]. Faults in the Waitaki District were assessed in coordination with Environment

[1] The ORC, as an annual plan target under the Natural Hazards activity, is undertaking further investigations to assist in describing the location and characteristics of known active geological faults in Otago.

Canterbury in a 2016 study[1]. Faults in the Central Otago and Queenstown Lakes districts are the focus of the attached report. It is planned to review faults in the Dunedin City and the Clutha districts over the coming year, to complete the regional study.

[6] Much of the existing knowledge of faults in Central Otago and Queenstown Lakes districts stems from the period of hydro-power investigation and development in the 1970's and 1980's. Since that time there have been significant increases in scientific understanding of active faulting, and advances in remote sensing technology such as aerial imagery and LiDaR[2]-derived topographic data. Recent earthquakes in Canterbury (2010-2011) and Kaikoura (2017) highlight seismic hazards in New Zealand, and emphasise the need to better understand the risk earthquakes pose to Otago.

[7] The assessment was undertaken by David Barrell, an Engineering Geologist and geomorphologist based in GNS Science's Dunedin office. Mr Barrell has three decades of experience working in the Otago region, and was also extensively involved in scientific response to the Canterbury and Kaikoura earthquakes.

[8] The scope of the study was to undertake a desk-top review of the locations and characteristics of known or suspected active faults in the two study districts. The primary purpose is to identify locations where active faulting or folding may be a hazard, notably through ground surface rupture or deformation. It is important to note that Otago also faces seismic hazards from faults outside the region, notably the Alpine Fault on the West Coast.

[9] The GNS Science study was reviewed internally by GNS Science. It was also peer reviewed by Golder Associates, who recommended only minor changes, which were incorporated into the final report.

REPORT CONTENT AND STRUCTURE

[10] The report is titled *General distribution and characteristics of active faults and folds in the Queenstown Lakes and Central Otago districts, Otago*[3]. The introduction describes the geologic and seismic setting of the Otago region. It describes how faults and folds are described and classified, adopting a system which aligns with the national active fault database and standard scientific definitions.

[11] The surface trace of each fault has been reviewed, and where necessary fault traces or characteristics have been updated. Fault characteristics include the likelihood of a feature being a fault, rupture recurrence interval, and slip rate. The report includes a discussion of fault activity near major population areas in the Central Otago and Queenstown Lakes districts. A detailed appendix describes each fault, outlining the

[1] Barrell, D.J.A. 2016. General distribution and characteristics of active faults and folds in the Waimate District and Waitaki District, South Canterbury and North Otago. *GNS Science Consultancy Report 2015/166*. 124 p.
[2] Light Detection and Ranging
[3] Barrell DJA. 2019. General distribution and characteristics of active faults and folds in the Queenstown Lakes and Central Otago districts, Otago. Lower Hutt (NZ): GNS Science. 94 p. (GNS Science consultancy report; 2018/207).

justifications for its classification and activity status. Associated with the report is a geodatabase of mapped faults and their attributes intended for use with GIS software.

KEY FINDINGS

[12] There are three major changes proposed in the report compared to prior understanding of active faults in the two study districts. This section highlights these changes.

[13] Running west of Queenstown, the Moonlight Fault is a major regional tectonic feature, previously assigned a recurrence interval of 6,000-7,000 years. This study proposes a recurrence interval of >100,000 years, significantly downgrading its level of activity. This change reduces the seismic hazard in the Queenstown / Wakatipu Basin area.

[14] One of the major findings of this study was a proposed change to the trace of the NW Cardrona Fault. Previously this fault was thought to run down the northwest side of the Cardrona Valley, pass near Albert Town, and continue northeast towards Hawea township (Figure 1).

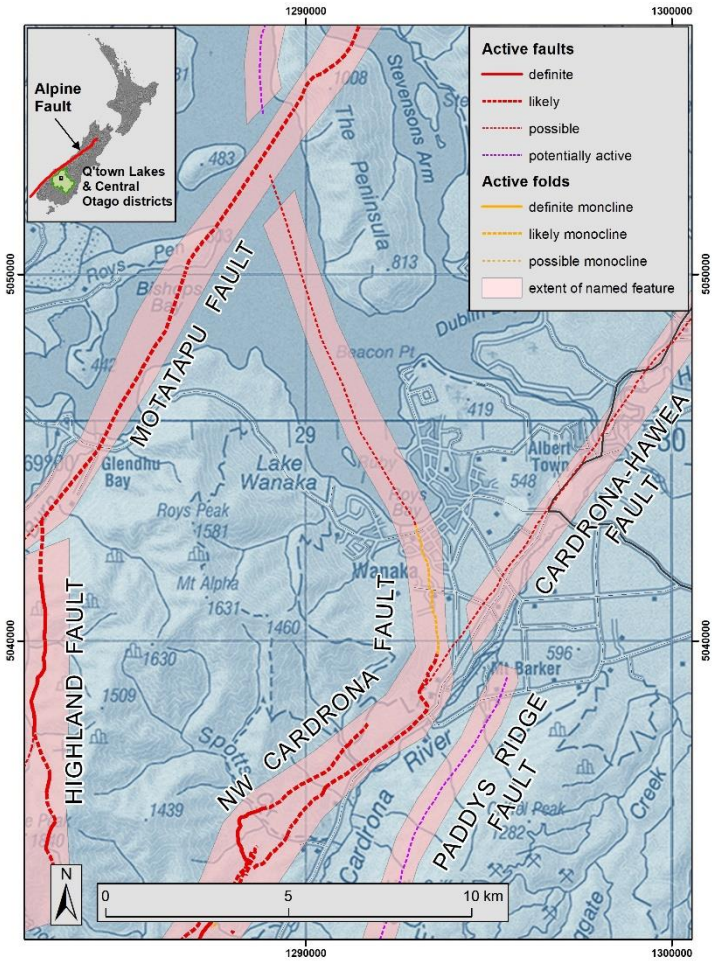

Figure 1. Revised fault map in the Wanaka area showing the NW Cardrona Fault inferred to run through Wanaka township (from Barrell, 2019).

[15] This review suggests the fault instead veers northwest near the foot of Mt Alpha, through part of Wanaka township, and probably continuing under Lake Wanaka. The

basis for this change is analysis of topographic data which indicates that through southern Wanaka, the fault is expressed as a fold, denoted by a 100-200 m wide zone of deformation manifested as a slight tilting of the ground surface. Old shorelines from previous highstands of Lake Wanaka provide a natural (originally horizontal) reference surface, and these features (up to ~18,000-years-old) have been warped 4-5m vertically across the fault zone. Vertical displacement across a fault which does not break the ground surface, but bends the ground surface, is known as a monocline. The previously assumed trace of the NW Cardrona Fault that runs near Albert Town and northeast towards Hawea has been retained as a mapped fault, but renamed the Cardrona-Hawea Fault and assigned a lower rate of activity than previously assumed. Earlier geologic maps[1] inferred the presence of an inactive northwest trending fault running beneath Wanaka township and out into Roys Bay due to changes in rock type across the lake, but this study provides the first evidence of there being an active fault at this location. Further work would be needed to assess hazards and risks to Wanaka from a future rupture of the NW Cardrona Fault.

[16] The third major change is a proposed variation to a trace of the Dunstan Fault, which runs along the eastern side of the Dunstan Mountains. The southern end of this fault was previously inferred to run along the southern margin of the Cairnmuir Mountains, but recent work identifies the fault as a monocline fold in high level river terraces just north of Clyde township (Figure 2). The report notes that the lower terraces upon which Clyde is situated do not have evidence for recent folding, and further work would be needed to determine the hazard and risk to Clyde from a future rupture of the Dunstan Fault.

[1] Turnbull, I.M. 2000 *Geology of the Wakatipu area*. Lower Hutt: Institute of Geological & Nuclear Sciences. Institute of Geological & Nuclear Sciences 1:250,000 geological map 18 72 p.

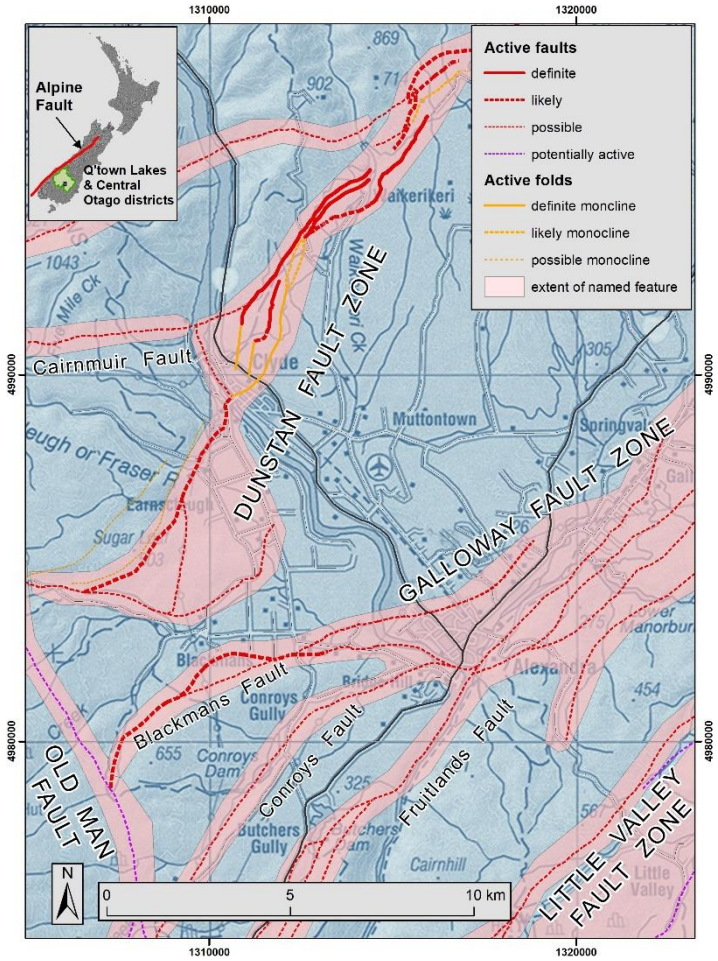

Figure 2. Revised fault map of the Clyde-Alexandra area showing a strand of the Dunstan Fault Zone running through Clyde (from Barrell, 2019).

DISCUSSION

[17] Compared to other regions of New Zealand the seismic hazard from faults within the Central Otago and Queenstown Lakes districts is relatively low, and no faults within these districts have an estimated recurrence interval of less than 5,000 years. This contrasts with the more active Alpine Fault in Westland or Hope Fault in North Canterbury, with recurrence intervals of approximately 300 and 200 years respectively. However, there is evidence for prehistoric but geologically-recent ground deformation from faults in the Central Otago and Queenstown Lakes districts, and these faults are capable of generating large, locally damaging earthquakes.

[18] The major change to local seismic hazard proposed by this review is the revision to the trace of the NW Cardrona Fault, due to the fact it is now mapped to pass beneath southern Wanaka, and is projected to run under Roys Bay beneath Lake Wanaka. It is important to note that the ground shaking hazard facing Wanaka has not changed significantly, as the NW Cardrona Fault was previously mapped to run ~2 km east of the town, a proximity which would generate severe shaking in downtown Wanaka. A new consideration is that properties within the vicinity of the proposed monoclinal fold zone may now experience ground deformation during an earthquake, most likely to be expressed as further tilting of the ground surface.

[19] There are secondary hazards associated with the revised trace of the NW Cardrona fault, notably the potential for a lake tsunami to be generated in a future rupture of the fault, due to vertical uplift of the lake bed west of the fault. The likelihood of an earthquake generated tsunami occurring, or the implications for the Wanaka area, have not yet been assessed. Other secondary hazards, such as co-seismic landslides or rockfall from the hills to the South of Wanaka will also need consideration.

[20] The proposed change to the trace of the Dunstan fault zone potentially has implications for ground deformation near Clyde township. The absence of deformation on the river terraces on which Clyde has been built suggests movement on that strand of the Dunstan Fault is likely to have a long recurrence interval.

[21] The report maps faults and folds which are expressed at the ground surface. There is potential for other faults to exist in the Otago Region. These faults may be 'blind', and not deform the ground surface, or have had previous evidence for surface movement obscured by geomorphic processes such as erosion, glacial activity, or sediment deposition.

NEXT STEPS

[22] The modification to the trace of the NW Cardrona fault changes the nature of the seismic hazards facing Wanaka. In particular, it introduces the potential for ground deformation in parts of urban Wanaka, and an earthquake generated tsunami in Lake Wanaka. It is proposed for ORC's natural hazard group to review the implications of the revised fault mapping in the 2019/20 financial year. ORC natural hazard staff will also continue to assist other organisations (including GNS Science and the University of Otago) with ongoing work looking at earthquake hazards in the Wanaka area and across Otago.

[23] ORC natural hazard and communication staff will work with geologists from GNS Science and QLDC to develop a publicly available package of information to explain the implications of the changed fault mapping.

ATTACHMENTS

1. Attachment A - GNS C R 2018-207 Queenstown Lakes and Central Otago active faults **[11.2.1]**

11.3. Waitaki District Coastal Hazards

Prepared for:	Technical Committee
Report No.	EHS1846
Activity:	Safety & Hazards: Natural Hazards
Author:	Ellyse Gore, Natural Hazards Analyst
Endorsed by:	Gavin Palmer, Director Engineering, Hazards and Science
Date:	20 March 2019

PURPOSE

[1] To notify Committee of the report the Otago Regional Council (ORC) contracted the National Institute of Water and Atmospheric Research (NIWA) to produce on the coastal hazards of the Waitaki District and how ORC is providing technical support to the Waitaki District Council (WDC) in addressing what the report has found.

EXECUTIVE SUMMARY

[2] The Waitaki District coastline is experiencing a long-term state of retreat, due to the erosion of soft sediments/unconsolidated deposits which comprise large sections of the coastline. Recent storm-related erosion events in Oamaru, the high cost associated with the repair and movement of coastal roads and breakwaters near Oamaru has partially driven the focus on coastal hazards in this district. Additionally, there is a need to make changes to the District Plan to bring it in line with the New Zealand Coastal Policy Statement (NZCPS), 2010[1] in which councils are required to identify areas in the coastal environment that are potentially affected by coastal hazards. New requirements include assessing hazard risks over at least 100 years, whilst having regard to the effects of sea level rise. The recent Coastal Hazards and Climate Change (2017) guidance by the Ministry for the Environment (MfE)[2] has been used to consider sea level rise scenarios.

[3] The ORC, as an annual plan target under the Natural Hazards activity, is assisting the WDC with the development of their proposed District Plan[3]. ORC has contracted NIWA to produce a report[4], presented here, detailing the Waitaki District Coastal Hazards (coastal erosion and inundation (storm surge for 20, 50, 100 and 500-year ARI, and seven sea level rise scenarios)), which will assist in this process, see extent of study area in Figure 1. NIWA found that while the erosion hazard is widespread, the inundation hazard only applies to relatively small parts of the district (areas mostly affected are Kakanui Estuary and Oamaru harbour). Areas at risk of coastal hazards have been identified for both inundation and erosion hazards considering a '100 years' planning time frame.

[1] Department of Conservation (2010). New Zealand Coastal Policy Statement 2010. Wellington.

[2] Ministry for the Environment (2017) Coastal Hazards and Climate Change, Guidance for local government. Available on the Ministry for the Environment website: www.mfe.govt.nz.

[3] Director report on progress, Presented to the Technical Committee on Wednesday 31 January 2018.

[4] Bosserelle, C., Hicks, M., Bind, Jo. (2018) Waitaki District Coastal Hazards. NIWA Client Report: 2018035CH. Prepared for the Otago Regional Council, January 2019.

STAFF RECOMMENDATION

That the Council:

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

2) ***Notes*** *this report.*

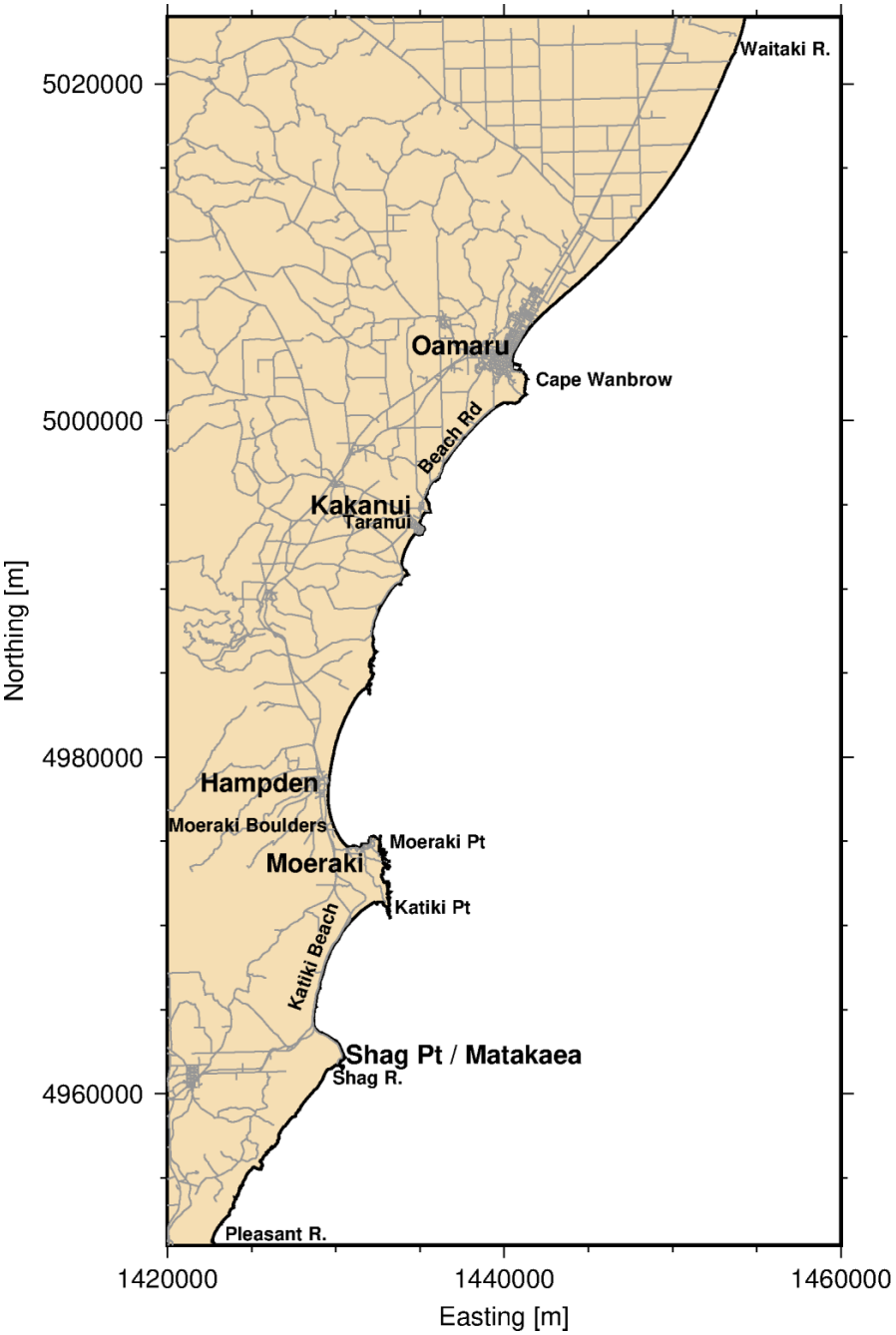

Figure 1. Location of the study area (the entire Waitaki District coastline) from the Northern end at the Waitaki River to Pleasant River in the South, including key areas. Northing and easting in New Zealand Transverse Mercator projection.

OVERVIEW

[4] Coastal erosion around Oamaru has been observed since European settlement (about 170 years ago). Wave climate, longshore drift and the nature of the beach sediment

contributes to a sediment deficit that allows storm waves to break against the foot of the cliff at times, causing erosion.

[5] Previous work[1] by ORC has assessed the effects of tsunami and storm surge events along this coastline. There is a need to update the inundation extents from this previous work with future sea-level rise scenarios that are in-line with the recent MfE guidance. Generally, the Waitaki District coastal communities are located away from low lying areas directly adjacent to the coastline, however key locations such as the Oamaru Harbourfront and sections of Hampden and Moeraki are, and Kakanui has the influence of the adjacent river flowing out to the sea.

[6] This study set about to improve the understanding of the future coastal hazards (erosion and inundation) to meet the NZCPS (2010) requirements. The resultant report does not describe or propose a policy response or opinion on acceptability of natural hazards risks, it is intended as a technical report to inform such matters.

KEY FINDINGS

[7] Inundation depth has been mapped for four locations (Oamaru, Kakanui, Hampden and Moeraki) for four average recurrence intervals (ARIs) of extreme water level and seven sea-level scenarios at each site. The areas mostly affected are Oamaru harbour and Kakanui estuary.

[8] Coastal erosion hazard has been calculated for the entire length of the Waitaki district coast. No new erosion hotspots were identified, with continued erosion expected at the current hotspots of Katiki Beach, Beach Road, Kakanui, North Oamaru, Kaika and Karita settlements. More than 60 per cent of the coast of the Waitaki District is shown to be retreating at a rate of 0.15 m/y or more.

PEER REVIEW

[9] The report has been peer reviewed by Mr Reinen-Hamill, Director of Natural Hazard Resilience at Tonkin and Taylor. NIWA were provided with this review and subsequently made changes to the report. Upon being provided with the amended report Mr Reinen-Hamill has confirmed he is satisfied his comments have been adequately addressed.

NEXT STEPS

[10] There are current and future management decisions that need to be made in relation to the coastal roads, property and infrastructure potentially implicated in this report. ORC is assisting the Waitaki District Council with the technical aspects (related to natural hazards) of the development of their proposed District Plan. This process involves supporting them by providing technical assistance for understanding the natural hazards risk and in applying this coastal report in their planning processes, taking into effect the new MfE guidance on preparing for coastal change. ORC is also providing learnings from

[1] Lane, E., McMillan, H., Gillibrand, P., Enright, M., Carter, J., Arnold, J., Bind, J., Roulston ,H., Goff, J., Gorman, R. (2008) Otago Regional Council Storm Surge Modelling Study. NIWA Client Report: CHC2008-047. Prepared for Otago Regional Council, June 2008.
Lane, E., Walters, R., Wild, M., Arnold, J., Enright, M., Roulston, H., Mountjoy, J. (2007) Otago region hazards management investigation: tsunami modelling study. NIWA Client Report: CHC2007-030. Prepared for Otago Regional Council, September 2007.

other councils around how to adopt coastal reports with the inclusion of affected communities.

[11] ORC is working with WDC to produce a joint media release upon the report being made available to the public.

[12] ORC will work with WDC in their public consultation with affected parties, pre-district plan consultation.

[13] The results and report will be also made public through the web-based ORC Natural Hazards database.

ATTACHMENTS

1. Waitaki District Coastal Hazards NIWA January 2019 **[11.3.1]**
2. NIWA Response to specialist review January 2019 **[11.3.2]**
3. T+ T Specialist Review July 2018 **[11.3.3]**
4. T+ T Specialist Review- Final Assessment March 2019 **[11.3.4]**

11.4. 2018 Air Quality Activities report

Prepared for:	Technical Committee
Report No.	EHS1839
Activity:	Environmental - Ambient Air Quality Monitoring & Reporting
Author:	Deborah Mills, Environmental Scientist
Endorsed by:	Gavin Palmer, Director Engineering, Science and Hazards
Date:	20 March 2019

PURPOSE

[1] In 2018, significant new air quality programme activities included the adoption of a new air quality strategy and implementation plan, inclusion of $PM_{2.5}$ monitoring into the State of the Environment (SoE) network, and working collaboratively with the Cosy Homes Trust (CHT). These activities provide the foundation for future air quality management in Otago.

[2] This annual report highlights these new air quality activities as well as reporting on the State of the Environment and the status of the National Environmental Standard for Air Quality (NESAQ) review.

RECOMMENDATION

That the Council:

1) ***Receives** this report.*
2) ***Considers** the Arrowtown air quality programme be a prototype for the development of future local air quality programmes.*

THE STATE OF ENVIRONMENT

[3] Air in Otago is informed by the current 8-station monitoring network deployed across the region. Sites in the network include: Alexandra, Arrowtown, Clyde, Cromwell, Central Dunedin, Mosgiel, Milton, and Balclutha. Historically, these 8 sites have measured PM_{10}[1]; this year, a $PM_{2.5}$[2] monitor was installed alongside the PM_{10} monitor in Central Dunedin.

[4] The NESAQ (2005, revised 2011) set a standard for PM_{10}; the NESAQ is currently under review. There are also guideline values for PM_{10}. Standards and guidelines consist of several components:

- Averaging period (24-hour and/or annual averages)
- Concentration limit (measured in micrograms per cubic metre of air)

[1] PM_{10} refers to particulate matter in the atmosphere that have an aerodynamic diameter of less than 10 microns.
[2] $PM_{2.5}$ refers to particulate matter in the atmosphere that have an aerodynamic diameter of less than 2.5 microns.

- Number of allowable exceedances of the concentration limit in a 12-month period (only applicable to standards, not guidelines)

[5] NESAQ pollutant guideline values are recommended levels while standards are mandatory environmental regulations. All NESAQ standards and guidelines apply to ambient (outdoor) air. Regional councils have a duty to ensure that standards are met within the region under the Resource Management Act (RMA).

[6] The standards and guidelines for PM_{10} are given in Table 1. (NB: there is currently a standard for daily average PM_{10}, and a guideline for annual average PM_{10}).

Table 2: **Standard and guideline values for PM_{10}.**

Pollutant	Averaging Time	Standard		Guideline	
		Value	Allowable # exceedances	Value	Allowable # exceedances
PM_{10}	24-hour	50	1 per annum		
	Annual Average			20	Not Applicable

[7] Compliance with the NESAQ requires continuous monitoring in those gazetted airsheds where PM_{10} levels are likely to exceed the standards. Public reporting of all exceedances of the standards are also required; this requirement is fulfilled through monthly public notices in the local newspaper.

[8] Other relevant indicators include the winter average PM_{10} value and the 2nd highest daily PM_{10} value. As one daily exceedance is allowed, the 2nd highest day gives some indication of compliance with the standard.

[9] A summary of key indicators of PM_{10} and their comparison to last year's values are given below (Table 2).

Table 3: **Key PM_{10} indicators for 2018 and 2017**

	# Exceedances			2nd highest day			Winter average		Start of continuous record
	2018	2017		2018	2017		2018	2017	
Alexandra – original site[1]	35	43		114	98		42	53	2005
Alexandra – current site	2	3		61	67		23	25	2017
Arrowtown	30	45		104	132		38	47	2007
Clyde	6	23		61	64		22	32	2008
Cromwell	14	41		81	100		27	43	2008
Dunedin	1	0		40	37		15	15	2006
Mosgiel	4	9		62	83		26	26	2005
Milton	16	48		78	137		32	46	2008
Balclutha	5	14		55	69		26	34	2011

[1] These data are modelled using an equation developed from the 2016 co-location of monitors between the original and current site: PM (original site) = 1.886(PM(New site)-0.49).

[10] In virtually every town, air quality was significantly better in 2018 than in 2017. In fact, this year some of the lowest PM_{10} levels were recorded as compared to each site's long-term record (since the start of continuous monitoring).

[11] The cause of this difference between years is attributed to the winter weather last year. According to the National Institute of Water and Atmospheric Research[1], the neutral condition of the equatorial Pacific (neither El Nino or La Nina) influenced jet stream flows across New Zealand in such a way that there were a higher number of north-westerly flows than normal; this flow pattern served to keep the South Island warmer than usual with more unsettled weather. In addition, because the polar jet stream was weaker than normal, there were fewer cold settled periods of weather over the South Island. The result of these patterns is that temperature inversions were fewer and weaker, leading to enhanced dispersion of pollutants.

[12] Four sites operated year-round in 2018, providing data for an annual average: Alexandra, Arrowtown, Dunedin and Mosgiel. These towns reported the following annual average PM_{10}:

Alexandra:	14
Arrowtown:	18
Dunedin:	15
Mosgiel:	19

[13] Based on the monitoring data, all towns met the annual average guideline for PM_{10} (20µg/m^3) recommended in the NESAQ. It is estimated that the original site in Alexandra (the former Girl Guide building at 65 Ventry Street) would have had an annual average of 26µg/m^3, above the guideline value.

NATIONAL UPDATE

[14] This year the Ministry for the Environment (MfE), in conjunction with Stats NZ, released its air quality domain report, Our Air 2018. This second air domain report utilises PM data from airsheds around New Zealand for the years 2014 through 2016, inclusive.

[15] The Our Air 2018 report notes that the 3 New Zealand towns with the greatest number of exceedances of the air quality standards during the 2014-2016 period were all located in Otago: Alexandra (51 days), Arrowtown (48 days), and Cromwell (48 days). These exceedances were all recorded during winter 2014.

[16] Table 3 provides some context with the other years covered in the report, along with the typical number of exceedances.

Table 3: Number of days exceeding the NESAQ

	2014	2015	2016	Typical Year
Alexandra	51	22	38	43
Arrowtown	48	30	32	31
Cromwell	48	27	34	33

[1] NIWA, Climate Summaries, Seasonal, Winter 2018.

[17] The elevated PM levels during 2014 highlights what the report notes about an airshed's climate, topography and geography influencing air quality. All of these towns experience very cold winter climates with weather systems that often lead to strong temperature inversions. PM levels vary year to year depending on the weather; 2014 was obviously an unusual year, as was 2018.

[18] In October, in a statement related to the release of Our Air 2018, Minister Hon. Nanaia Mahuta announced the review of the NESAQ, along with the intention of releasing a consultation document mid-2019. ORC staff have attended several preliminary workshops with MfE related to the review of the NESAQ and have provided feedback to the MfE in response to an initial targeted engagement session held during July 2018. It is still likely a revised NESAQ will include some form of a $PM_{2.5}$ standard.

$PM_{2.5}$ DATA

[19] There are currently no New Zealand standards or guidelines for $PM_{2.5}$. The World Health Organisation (WHO) guidelines for $PM_{2.5}$ are given below:

Table 4: WHO guidelines for $PM_{2.5}$

Averaging period	Guideline value (µg/m3)	Acceptable number of annual exceedances
Daily	25	3
Annual	10	--

[20] In May 2018, a report on the implications of a $PM_{2.5}$ standard on air quality management in Otago was presented to the technical committee.[1] In that paper, ratios of $PM_{2.5}$-to-PM_{10} supplied by MfE were used to model daily $PM_{2.5}$ data to examine what the likely consequences would be in Otago airsheds in terms of compliance with a $PM_{2.5}$ standard. The paper projected that Dunedin would likely not exceed the daily guideline value of 25µg/m^3, but may struggle to meet the average annual value of 10µg/m^3.

[21] In July 2018, an MfE-compliant $PM_{2.5}$ monitor was installed in Dunedin. A graph of average daily PM values (both $PM_{2.5}$ and PM_{10}) from August through the end of the calendar year shows that $PM_{2.5}$ generally comprise about 45% of all PM_{10}. (NB: The MfE ratio was 55% for year-round average).

[1] Paper presented to the Technical Committee, 2 May 2018, #11.1 *Implications of a PM2.5 standard on air quality management*

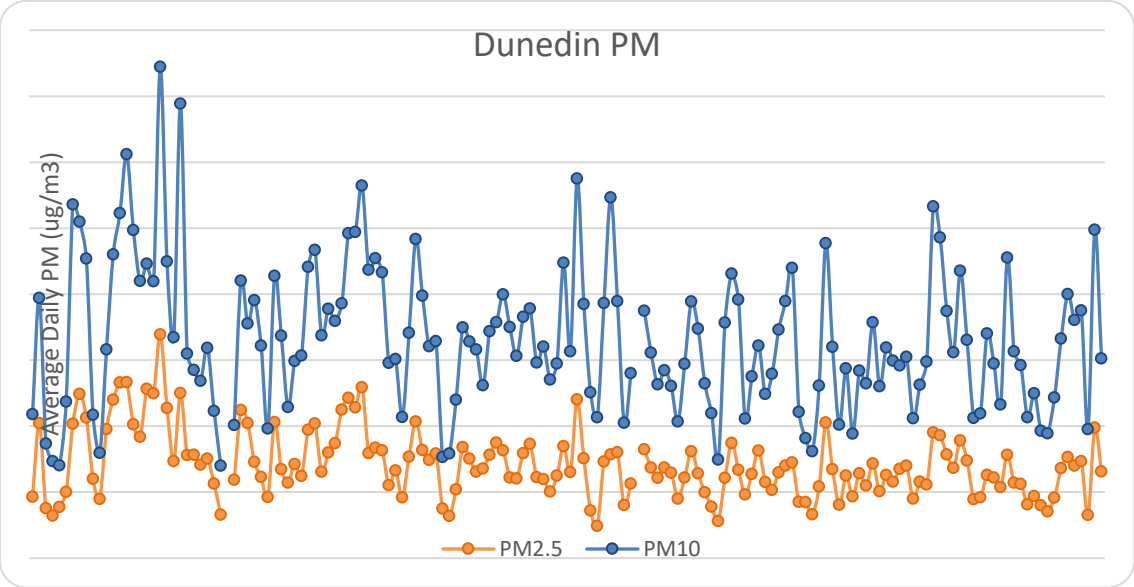

Figure 3: Average daily PM values for $PM_{2.5}$ and PM_{10} in Central Dunedin

[22] To date, the daily $PM_{2.5}$ value has not exceeded the WHO guideline daily value of 25µg/m^3. Data collection is ongoing and a report on annual $PM_{2.5}$ will be presented to council at a later date.

OTHER ACTIVITIES

Burner Replacements

[23] Over FY17/18, a total of 51 non-compliant and/or inefficient solid-fuel appliances were replaced by homeowners through ORC's Clean Heat Clean Air programme. Of those, the breakdown of how many were installed, and their location, follows:

Alexandra:	16
Arrowtown:	3
Clyde:	1
Cromwell:	13
Milton:	18

[24] In each case, the replacement appliance was another solid-fuel wood burner. It is estimated this changeover has the potential to reduce each home's PM emissions by up to 40% - from 300g to 125g a night – if operated correctly and using dry fuel.

[25] There is approximately $200,000 remaining in the reserves for the purpose of upgrading eligible burners. Using the current funding criteria ($1,500 for general application and $2,000 for Community Services Card holder applications), this equates to being able to upgrade approximately 100 burners. It is estimated that there are at least 1000 burners still in need of upgrade in Air Zone 1 and Milton.

[26] This year the criteria for Clean Heat Clean Air funding is under review to ensure that the programme aligns with the new air quality strategy and provides the best value outcome. A paper is being presented to the Financial Committee regarding recommendations at this round.

Collaborative Work

[27] This year the ORC engaged in several collaborative efforts. Two projects involving external stakeholders are a partnership with the Cosy Homes Charitable Trust, and participation in NIWA's "What's in your Air, Alex?", a Ministry of Business, Innovation and Employment-funded Curious Minds programme in Alexandra.

[28] During Long-Term Plan discussions in June 2018, Council decided to fund the Cosy Homes Trust (CHT) for three years ($45,000 per annum) for a coordinator to assist in the delivery of Council's Clean Heat Clean Air programme. In November 2018, a Memorandum of Understanding (MoU) between the two organisations was signed, and work begun on coordination. CHT will apply lessons learned from a previous pilot project run in Milton last year to developing and delivering a work programme in Central Otago towns. Development of these activities is being done in consultation and collaboration with ORC staff and external stakeholders.

[29] Last winter NIWA began a multi-year "What's in your Air, Alex?" programme, a school-based, MBIE-funded project with a focus on air quality. NIWA used a low-cost monitoring network to gain information about the spatial distribution of pollutants across town. In addition, they enlisted primary school students to monitor air quality inside their homes and keep diaries related to perceived air quality and health. ORC staff participated with the launch and wrap-up of the project and has been engaged with NIWA in further project development discussions.

Air Strategy and Implementation

[30] Council adopted a new air strategy in June 2018; the strategy prioritises the adoption of cleaner domestic heating options and reducing reliance on outdoor burning. The mechanisms for achieving these goals centre on:

- Developing tailored local air quality programmes
- Actively engaging with communities and relevant industry sectors
- Working and partnering with city and district councils, and central government
- A full review of the Air Plan

[31] An implementation plan was tabled at the Policy Committee meeting held 29 November 2018. Decisions made at that meeting initiated Option #2, with a review during the FY19/20 Annual Plan process. Option #2 promoted an accelerated implementation with a primary focus on non-regulatory methods.

[32] During 2018, implementation work began on three streams of the strategy:

1. Development of a local air quality programme in Arrowtown. This work is being done in collaboration with community leaders and other external stakeholders.
2. A review of the Clean Heat Clean Air programme is underway with the goal of aligning the subsidy programme with the new air strategy's objectives.
3. Collaboration with stakeholders across several sectors has begun through a series of meetings with the Cosy Homes Trust, the Southern District Health Board, Arrowtown community members, Queenstown Lakes District Council personnel, and NIWA.

[33] A draft of the Arrowtown air quality programme is attached; this work is currently under development and ongoing.

Attachments
Nil

12. NOTICES OF MOTION

13. CLOSURE