Data and Information Committee Agenda
9 March 2022

Meeting held in the Council Chamber, Lvl 2 Philip Laing House
144 Rattray St, Dunedin (Councillors and staff only)
Members of the public may view the meeting live at: Otago Regional Council YouTube Channel

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

Senior Officer: Sarah Gardner, Chief Executive

Meeting Support: Liz Spector, Governance Support Officer

09 March 2022 10:00 AM

Agenda Topic — Page

Minutes of a meeting of the Data and Information Committee held in the Council Chamber on Wednesday 8 December 2021 at 2:00 PM

Membership

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

Welcome

Co-Chair Alexa Forbes welcomed Councillors, members of the public and staff to the meeting at 02:05 pm. Staff present included Sarah Gardner (Chief Executive), Nick Donnelly (GM Corporate Services), Gwyneth Elsum (GM Strategy, Policy and Science), Gavin Palmer (GM Operations), Richard Saunders (GM Regulatory and Communications), Liz Spector (Governance Support), Jean-Luc Payan, Tim von Woerden, Garry Maloney, and Julian Phillips.

1. APOLOGIES
There were no apologies. Cr Deaker attended the meeting electronically.

2. PUBLIC FORUM
There was no request to address the Committee during Public Forum.

3. CONFIRMATION OF AGENDA

Resolution: Cr Hope moved, Cr Noone seconded
That *the agenda be confirmed as published.*

MOTION CARRIED

4. CONFLICT OF INTEREST
No conflicts of interest were advised.

5. CONFIRMATION OF MINUTES
Resolution: Cr Hope Moved, Cr Wilson Seconded
That the minutes of the meeting held on 8 September 2021 be received and confirmed as a true and accurate record.

MOTION CARRIED

Cr Calvert joined the meeting at 02:06 pm.

6. ACTIONS
Open actions of previous Committee resolutions were reviewed. No updates were made.

7. MATTERS FOR CONSIDERATION

7.1. Clutha Delta and Molyneux Bay coastal morphology and natural hazards
This report informed the Committee of the findings of an investigation of coastal morphology and hazards at the Clutha Delta - Molyneux Bay which was conducted by Jacobs (New Zealand) Ltd. Tim von Woerden (Hazards Analyst), Jean-Luc Payan (Manager Natural Hazards), and Gavin Palmer (GM Operations) were present to respond to questions about the report. Also present via electronic link was Derek Todd of Jacobs (New Zealand) Ltd.

Mr Todd reviewed a detailed presentation of the investigation conducted by Jacobs (New Zealand) with the Committee members which was followed by questions from Councillors. Questions focused on how to use the results of the investigation and how to disseminate the information to stakeholders and the community. It was noted that the report was currently on the website as part of the meeting's agenda. Dr Palmer said that the investigation results would give staff data to build understanding of the situation existing in the area to then allow planning for further investigation and preparation for adaptation.

Following further discussion, Cr Robertson moved:

Resolution DAIC21-113: Cr Robertson Moved, Cr Hope Seconded
That the Committee:

1) ***Receives*** *this report by Jacobs (New Zealand) Ltd; Molyneux Bay and Clutha Delta Morphology Investigation, dated July 2021.*
2) ***Notes*** *the changes to the Molyneux Bay-Clutha Delta coastal environment expected to occur as a result of coastal erosion and sea level rise processes.*
3) ***Notes*** *the information the report provides for building understanding, planning for further investigation, and preparation for adaptation.*
4) ***Endorses*** *the report and the presentation and dissemination of this information to the public and stakeholders.*

MOTION CARRIED

7.2. Queenstown and Dunedin 2021/22 Quarter 1 Patronage Report

This report updated the Committee on the performance of its public transport and total mobility services for the first quarter of the 2021/22 financial year. Julian Phillips (Implementation Lead - Transport), Garry Maloney (Manager Transport) and Gavin Palmer (GM Operations) were present to respond to questions.

Following questions about the report, Cr Kelliher moved:

Resolution DAIC21-114: Cr Kelliher Moved, Cr Laws Seconded
That the Committee:

1) ***Notes*** *this report.*

MOTION CARRIED

Cr Laws left the meeting at 03:02 pm.
Cr Laws returned to the meeting at 03:03 pm.
Cr Malcolm left the meeting at 03:04 pm.
Cr Malcolm returned to the meeting at 03:08 pm.
Cr Scott left the meeting at 03:11 pm.
Cr Scott returned to the meeting at 03:12 pm.

8. CLOSURE

There was no further business and Co-Chair Alexa Forbes declared the meeting closed at 03:15 pm.

_____ _____
Chairperson Date

OPEN ACTIONS OF COMMITTEE RESOLUTIONS – DATA AND INFORMATION COMMITTEE

Meeting Date	Item	Status	Action Required	Assignee/s	Action Taken	Due Date
09/06/2021	SPS2132 Coastal Monitoring Programme	In Progress	Present a paper to the Strategy and Planning Committee in 2022 outlining monitoring options for a State of the Environment network and seek Council approval to implement the programme. **Res DAIC21-103**	General Manager Strategy, Policy and Science, Manager Science	**9/12/2021 General Manager Strategy, Policy and Science** On track. **19/01/2022 Governance Support Officer** Gwyneth Elsum: The Science Team are doing work such as coastal mapping that will provide input into the development of a coastal monitoring programme.	30/06/2022
09/06/2021	HAZ2106 Active faults in the Dunedin City and Clutha Districts	In Progress	Provide a report to the Strategy and Planning Committee by 31/12/2021 on options for incorporating the GNS Science active fault report and other fault information held by ORC into planning frameworks across Otago. **DAIC21-106**	General Manager Operations	**2/11/2021 Governance Support Officer** Dr Palmer advised the report will go to 9 December 2021 Council Meeting. **25/11/2021 Governance Support Officer** Dr Palmer advised the report will go to the 9 March 2022 Data and Information Committee meeting. **23/02/2022 Executive Assistant** A workshop on possible options has been held with the territorial authorities. Options are being developed to be reported to the April 2022 meeting of the Strategy and Planning Committee.	31/12/2021

7.1. Annual Air Quality Report 2021

Prepared for:	Data and Information Committee
Report No.	SPS2203
Activity:	Governance Report
Author:	Sarah Harrison, Scientist – Air Quality
Endorsed by:	Gwyneth Elsum, General Manager Strategy, Policy and Science
Date:	9 March 2022

PURPOSE

[1] This annual report discusses the results of the State of the Environment (SoE) monitoring for air quality for the year 2021. Also included are details on the recent updates of the World Health Organisation's air quality guidelines. The data corrections for the new instruments of the SOE network upgrade and the high concentration particulate matter recorded in Central Dunedin are also discussed.

EXECUTIVE SUMMARY

[2] Monitoring of PM_{10} (particulate matter with a diameter of less than 10 micrometres) was undertaken in the Alexandra, Arrowtown, Central Dunedin, Cromwell, Milton and Mosgiel airsheds during 2021. Five of these sites recorded exceedances of the NESAQ (National Environmental Standards for Air Quality, the limit for PM_{10} is 50 $\mu g/m^3$ over a 24-hour average) during the winter months.

[3] Of the 45 exceedances that occurred, the majority (22) were recorded at the Arrowtown site. Eleven occurred in Cromwell, nine in Milton, two in Mosgiel and one in Alexandra. The annual averages recorded were compliant with the annual guideline of 20 $\mu g/m^3$.

BACKGROUND

[4] Otago has several towns where air quality is considered degraded during winter, namely Alexandra, Arrowtown, Clyde, Cromwell and Milton. Under the Resource Management Act (RMA, 1991) regional councils are required to monitor and improve air quality where necessary. The main pollutant of concern is particulate matter, PM_{10} and $PM_{2.5}$, which are products of combustion. In Otago the main source of PM_{10} is home heating emissions in winter (Wilton, 2019). Long term exposure to PM_{10} and $PM_{2.5}$ (particulate matter with a diameter of less than 2.5 micrometres) contribute to the risks of developing and exacerbating existing cardiovascular and respiratory conditions, which makes fine particulates a serious threat to human health (WHO, 2005). Furthermore, recent research provides evidence that air pollution is dangerous at lower concentrations than previously thought, and supports the lowering of existing guidelines (WHO, 2021).

[5] ORC has an SOE monitoring network to monitor PM_{10} and report exceedances of the NESAQ (50 $\mu g/m^3$, 24-hour average). This network is currently being upgraded to include monitoring for $PM_{2.5}$. The upgrade process includes a period of co-location and subsequent equivalence testing of the new instruments compared to the existing ones.

Details and status of the network upgrade have previously been described to the Strategy & Planning Committee (2021a), and further monitoring is still required to be able to correct for the new instruments and accurately report some of their data.

[6] In the past, ORC has implemented a work programme as part of the Air Quality Strategy 2018 to help Otago residents meet the Regional Air Plan rules in order to improve air quality in targeted towns. This has led to the long-term reduction in concentrations in Alexandra, Arrowtown, Cromwell, Clyde, and Milton (ORC, 2021b). Significant reductions in emissions are still required to meet the NESAQ for PM_{10}.

RECOMMENDATION

That the Data and Information Committee:

1) ***Notes*** *this report.*

AIR QUALITY ASSESSMENT FRAMEWORK

[7] Under the RMA, councils are required to monitor air quality and work towards meeting the standards of the NESAQ. The NESAQ is currently being updated to include limits for $PM_{2.5}$, and proposed limits were released in 2020. The relevant standards and guidelines are given below (Table 1).

[8] Table 1 Standards and guidelines for PM_{10} and $PM_{2.5}$

Pollutant	Averaging Time	NESAQ Standard 2004		Proposed NESAQ Standard 2020	
		Value (µg/m³)	Allowable exceedances	Value (µg/m³)	Allowable exceedances
PM_{10}	24-hour	50	1 per year	50	1 per year
	Annual	20*	NA*	NA	NA
$PM_{2.5}$	24-hour			25	3 per year
	Annual			10	NA

*AAQG limit and NESAQ guideline

[9] The air quality results can also be categorised according to the MfE (Ministry for Environment) Environmental Performance Indicators (EPI), outlined in the AAQG (2002). The EPI categories indicate an appropriate action according to the concentrations (Table 2).

[10] Table 2 MfE Environmental Performance Indicators for air quality

Category	Monitoring result compared to guideline	Description
Action	Exceeds the guideline	Unacceptable and action is required to reduce emissions

Alert	66-100%	Warning level which could lead to exceedances if trends are not curbed
Acceptable	33-66%	Maximum values might be a concern in sensitive locations, urgent action is not warranted
Good	10-33%	Peak measurements not likely to affect air quality
Excellent	0-10%	Not recommended for PM_{10} monitoring, PM_{10} in this range is classified as good instead

WORLD HEALTH ORGANISATION UPDATE

[11] In September 2021 the World Health Organisation released updated Air Quality Guidelines (AQG) which recommend new, and often stricter limits for the classical[1] pollutants for the protection of human health. This was the output of a systematic review of the evidence that had accumulated since the release of the 2005 guidelines. The advances in health evidence since 2005 include:

- Health effects of air pollution have now been studied in most of regions the world.
- More health conditions that are negatively impacted by air pollution have been identified.
- It has been identified that primary combustion particles[2] and secondary inorganic and organic particles[3] should be the main focus of toxicity studies.
- Collaborations between countries and continents have emerged which has strengthened and standardised the health evidence; methods of assessment have become more refined.

[12] Of particular importance to Otago is the recommendation that the 24-hour average guidelines for PM_{10} and $PM_{2.5}$ have decreased from 50 to 45 µg/m³ and 25 to 15 µg/m³ respectively. Likewise, the annual limits were reduced for both pollutants (Table 3, WHO, 2021).

[1] Classical pollutants refer to PM, SO_2, CO, NO_x and ozone
[2] Primary pollutants are emitted directly from the source
[3] Secondary pollutants form in the atmosphere via chemical reactions

[13] Table 3 WHO guidelines 2021 compared to WHO guidelines 2005 and NESAQ

Pollutant	Averaging time	NESAQ/AAQG (µg/m³)	WHO 2005 (µg/m³)	WHO 2021 (µg/m³)
PM_{10}	24-hr [a]	50	50	45
	annual	20	20	15
$PM_{2.5}$	24-hr [a]	25	25	15
	annual	-	10	5
Nitrogen dioxide (NO_2)	24-hr [a]	100	-	25
	Annual	-	40	10
Ozone (O_3)	8-hr	100	100	100
	Peak [b]	-	-	60
Carbon monoxide [c] (CO)	24-hr [a]	-	-	4
Sulfur dioxide (SO_2)	24-hr [a]	120	20	40

[a] 99th percentile, means there will be some allowable exceedances per year
[b] calculated using 8-hour means during the highest six-month running average
[c] mg/m³

NATIONAL UPDATES

[14] In December 2021 the MfE and Stats NZ released the air quality report, Our Air 2021. This will be followed up by the updated results of the Health and Air Pollution New Zealand (HAPINZ) model later this year. The Our Air 2021 report notes that the New Zealand town with the greatest number of PM_{10} exceedances of the air quality standards during the 2017-2020 period was Arrowtown, with 30 days on average (MfE & Stats NZ, 2021). The towns with the second-greatest number of exceedances were Invercargill and Timaru with 12 days on average each.

[15] In July 2020 the ORC made a submission to MfE on the proposed NESAQ update. The updated NESAQ has not yet been released and may be subject to further changes due to the WHO AQG updates.

SOE MONITORING RESULTS

[16] PM_{10} was monitored at six sites across the region in 2021: Alexandra, Arrowtown, Central Dunedin, Cromwell, Milton and Mosgiel. A summary of the key PM_{10} monitoring indicators for 2021 are given in Table 4. The highest frequency of exceedances occurred in Arrowtown, with 22. Arrowtown also had the highest winter mean of 32 µg/m³ as well as the highest recorded daily concentration of 104 µg/m³. Cromwell and Milton had 11 and 9 exceedances respectively, and similar winter means (23 and 24 µg/m³), however Milton had the second highest maximum concentration of 99 µg/m³. The recorded annual means for Alexandra, Central Dunedin and Mosgiel were compliant with the AAQG, however Mosgiel exceeded the WHO guideline of 15 µg/m³.

[17] Figure 1 compares the 24-hour average PM10 data for all sites with the NESAQ and the WHO guidelines. This graph shows it is possible to have more frequent exceedances of

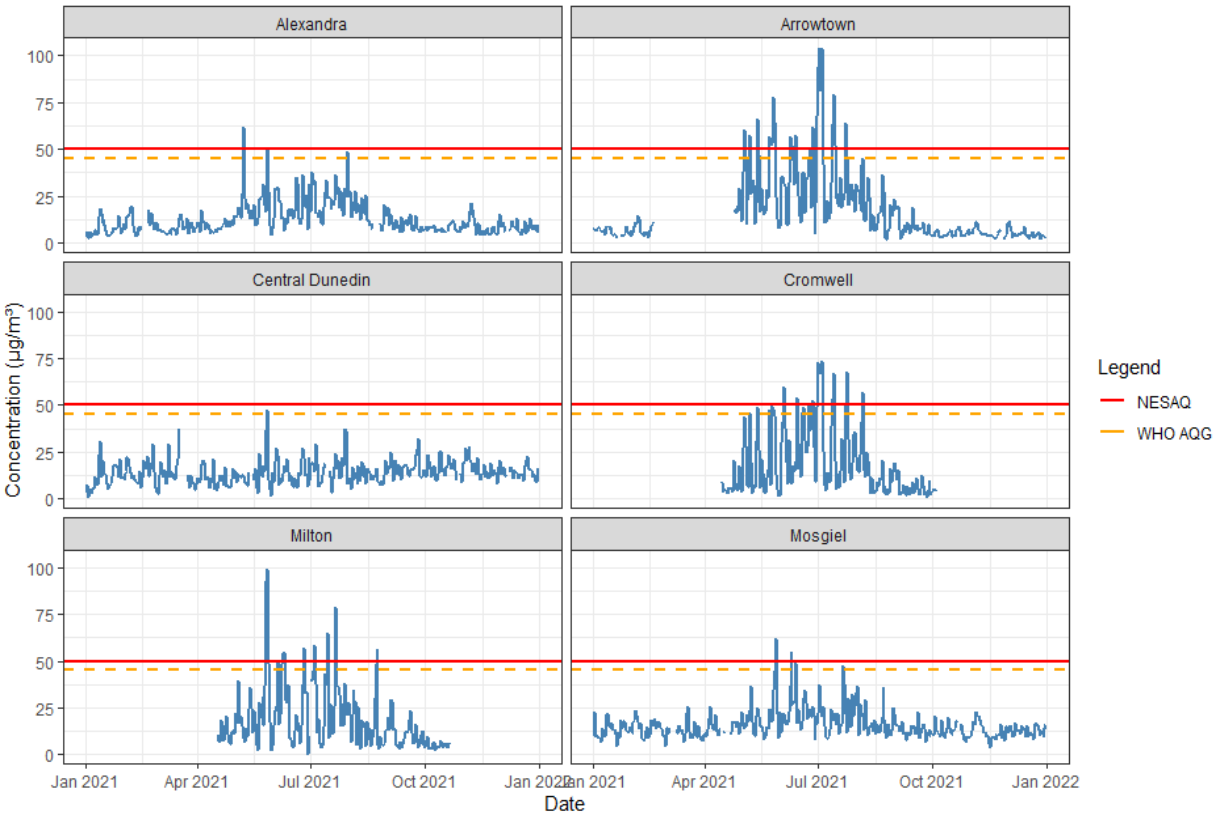
the WHO guideline of 45 µg/m³ than the NESAQ, and this is shown in the Alexandra, Central Dunedin and Mosgiel sites especially. All sites have a seasonal pattern of high winter concentrations indicating a typical home-heating signature source of emissions except for Central Dunedin (Figure 1).

[18] Table 4 Key PM_{10} indicators for 2021

Site	Annual mean (µg/m³)	Winter mean (µg/m³)	Maximum daily concentration (µg/m³)	2nd highest daily concentration (µg/m³)	Number of NESAQ exceedances
Alexandra	13	20	62	50	1
Arrowtown	- [2]	32	104	104	22
Central Dunedin	14	14	48	37	0
Cromwell[1]	NA	23	74	73	11
Milton[1]	NA	24	99	93	9
Mosgiel	16	21	62	55	2

[1] Cromwell and Milton were monitored only during the winter months of May – September
[2] Due to the site upgrade data capture for Arrowtown was 81%

[19] Figure 1 PM_{10} concentrations for Otago towns 2021 (24-hour average)



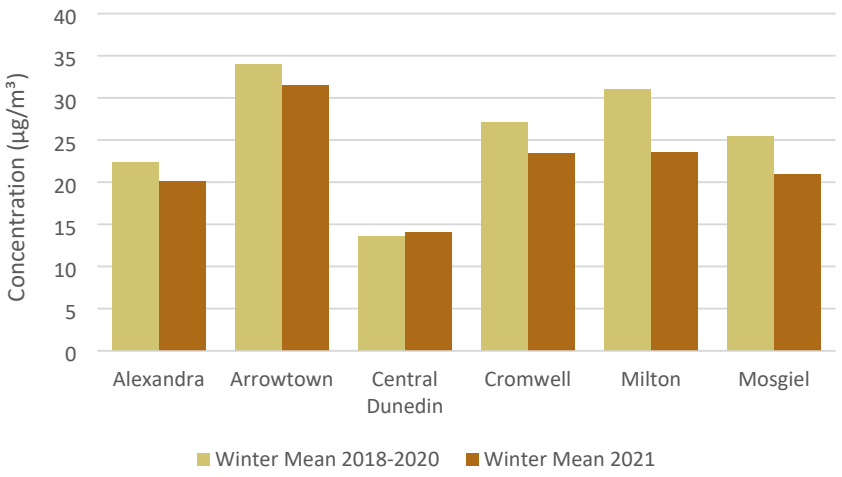
[20] The data for winter 2021, as categorised into MfE air quality indicator categories is shown in Figure 2. Alexandra, Central Dunedin and Mosgiel have high (>85%) of their winter concentrations within the "good" (under 17 µg/m³) and "acceptable" (between

17 and 33 µg/m³) categories for 2021. For Arrowtown, Cromwell and Milton between 30-40% of data is in the "alert" (between 33 and 50 µg/m³) or "action" (over 50 µg/m³) categories. This graph highlights Central Dunedin as having the best air quality in winter, with over 70% within the "good" category.

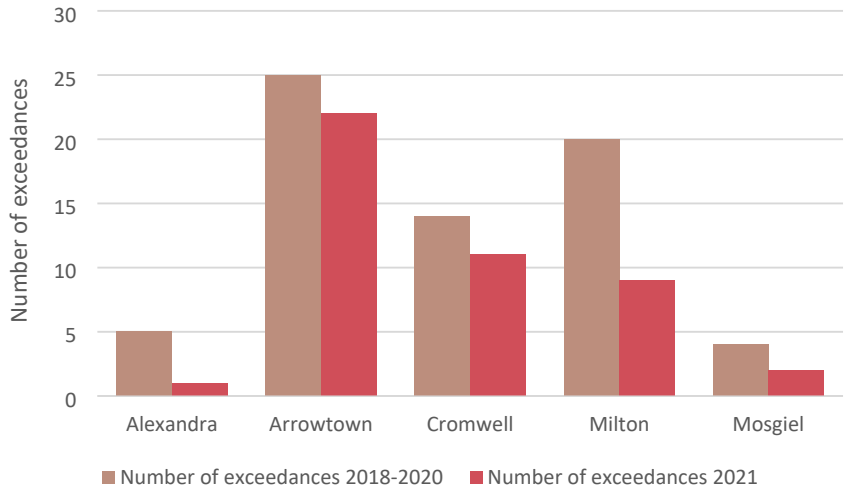
[21] **Figure 2 PM_{10} winter 2021 concentrations relative to air quality indicator categories**

[22] When comparing the data to previous years, the winter mean is used as a more appropriate indicator as exceedances only occur in winter. The below graphs show how 2021 compares to the average of the previous three years in terms of winter mean and number of exceedances (Figures 3 and 4). Winter means are lower in comparison to the previous three years for all sites except for Central Dunedin. The number of exceedances is also less frequent for 2021 compared to the previous years, and Milton has less than half the amount of the previous years' average (9 compared to 20).

[23] **Figure 3 Winter means of 2021 compared to 2018-2020**



[24] **Figure 4 Number of exceedances of 2021 compared to 2018-2020**



[25] The NIWA Climate summary for 2021 (NIWA, 2022) reports that 2021 was the warmest year on record, with several months within the year the warmest months on record for much of the country. While Otago experienced a near average (within -0.5°C to +0.5°C of average) annual temperature, it experienced comparatively warm winter months. Despite this Alexandra experienced over 30 days where hourly temperatures were below 0°C for several hours. Rainfall was variable across Otago during winter, and there were periods of high snowfall in June and August in the Central Otago and Queenstown Lakes Districts.

NEW INSTRUMENT DATA CORRECTION

[26] Air quality monitoring methods and instrument types vary, which can produce different results when they are compared to each other. When replacing an instrument or upgrading a monitoring site, this issue can be addressed by obtaining a site-specific adjustment factor via the co-location of two instruments. Robust adjustment factors require at least one year of co-location data (Bluett *et al*., 2007).

[27] Two types of new instruments have been installed in Otago so far: Arrowtown and Central Dunedin have a T640x, and Clyde, Cromwell and Milton have an ES642. The T640x is considered an equivalent method[4], however, results from studies undertaken in Australia and New Zealand have indicated that the T640x instruments read higher concentrations than other monitoring methods for both $PM_{2.5}$ and PM_{10}. These differences increase at higher concentrations; however, they are systematic and can be corrected for. One study recommends an appropriate correction factor for the T640x PM_{10} is the 24-hour concentration divided by 1.35, which produces a gravimetric[5]-equivalent concentration (Coulson *et al*., 2021).

[28] The network upgrade in Arrowtown commenced in late February 2021, however due to instrument failure of our existing instrument we were unable to begin the co-location at that time. The new T640x has been successfully installed and recorded data from April onwards. The co-location monitoring will now run until November 2022, after which the relationship between the BAM1020 (existing instrument) and the T640x will be determined. This will allow us to apply a correction to the T640x data, allowing for the continuity of data; that is, the ability to compare different years and undertake long term trend analyses across this transition.

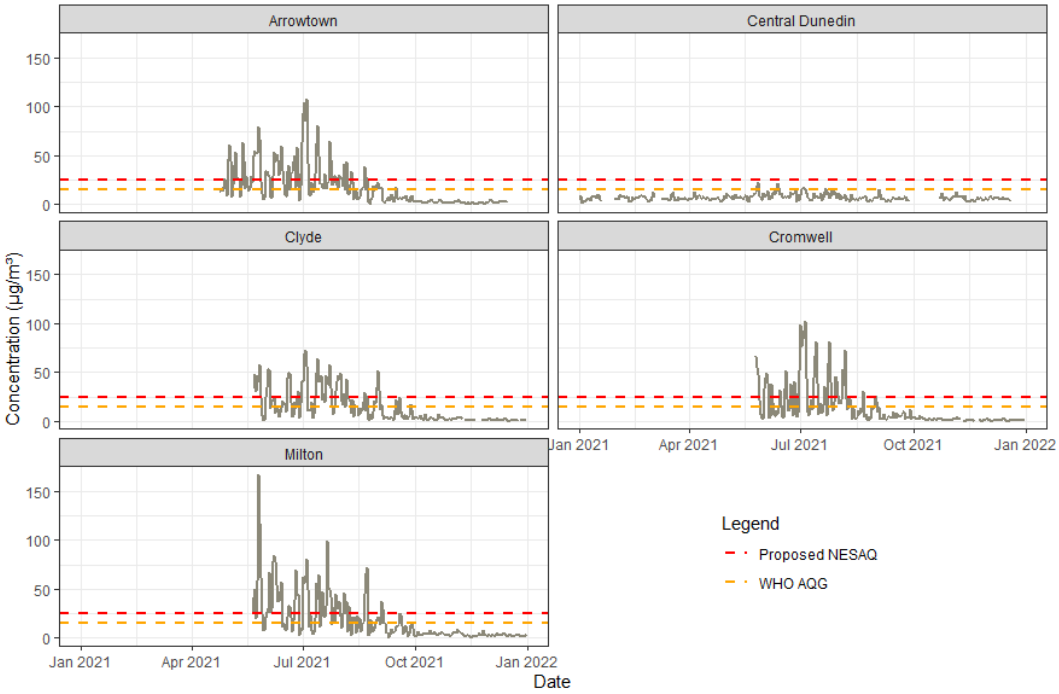
[29] To provide the interim statistics for the annual report for 2021, the correction factor from Coulson *et al*. (2021) was applied to the Arrowtown T640x data. This correction factor was derived from a co-location study undertaken in Reefton and is similar to a correction factor obtained in Timaru. These towns have similar emission compositions to Arrowtown (home-heating based), therefore at this time, this correction factor is the best we have on hand.

[30] The $PM_{2.5}$ data recorded by the ES642s at Clyde, Cromwell and Milton do not yet have correction factors. Instrument comparisons undertaken during 2022 will result in the applications of appropriate correction factors for reporting at a later date. The provisional $PM_{2.5}$ data recorded for 2021 is shown below in Figure 5, and plotted with the proposed NESAQ limit of 25 µg/m³ and the WHO guideline of 15 µg/m³.

[4] The NESAQ requires that PM_{10} is monitored in accordance with the relevant ASNZS standard. The standard for PM_{10} specifies that the US EPA designation of instruments is appropriate for monitoring in New Zealand. The Teledyne T640x was deemed by the US EPA as an equivalent method and is therefore compliant with the ASNZS standards.

[5] Reference method for PM_{10}

[31] Figure 5 $PM_{2.5}$ concentrations for Otago towns 2021 (24-hour average)



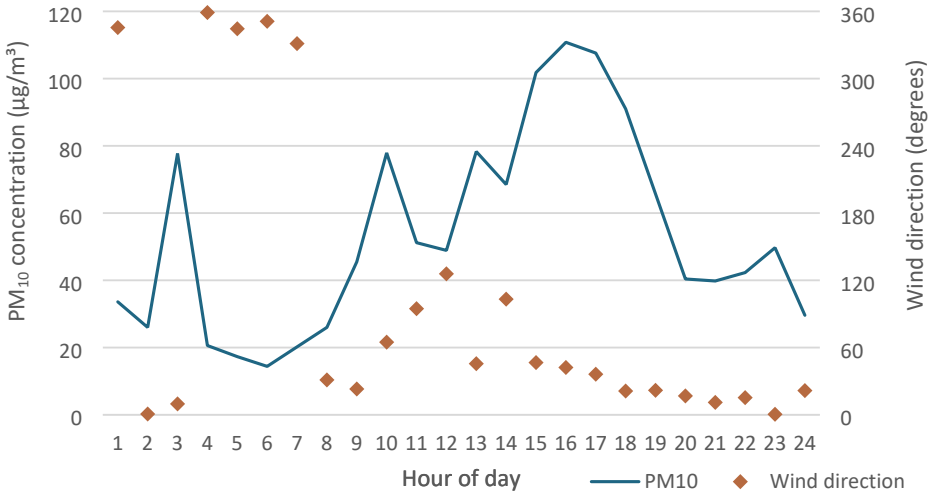
HIGH CONCENTRATION IN CENTRAL DUNEDIN

[32] On 27 May 2021 the Central Dunedin site recorded a raw PM_{10} concentration of 54 µg/m³. The potential source of the 27 May 2021 high concentration value was investigated and is described below. This data is still being assessed will be confirmed as to whether it is an exceedance of the NESAQ at a later date. Dunedin no longer typically records high concentrations nor is classified as polluted under the NESAQ. The last exceedance (51 µg/m³) occurred on 18 July 2018.

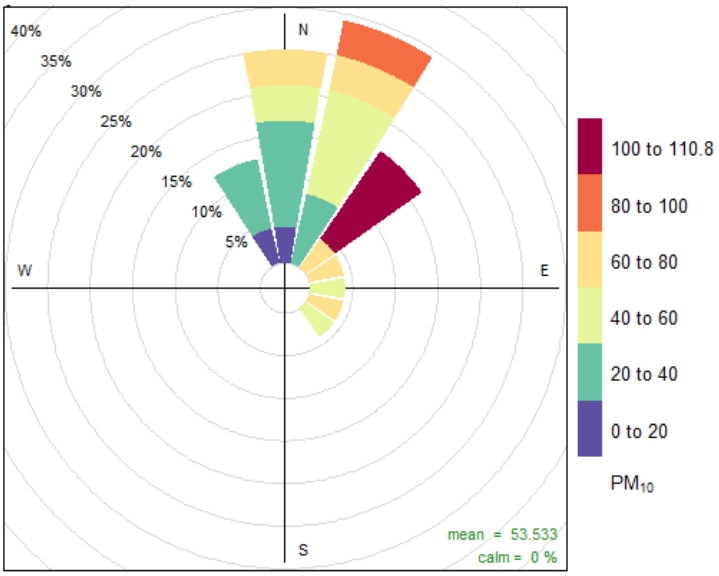
[33] The Central Dunedin monitor is located within an area of significant urban development. Construction is currently occurring on the property adjacent to the site and for this reason a new location for the monitor has been secured and is due for commissioning during 2022.

[34] The amount of rainfall (9.6 mm) during the week prior to the high concentration meant that ground conditions were not particularly dry or conducive to excessive entrainment of dust, nor were there any exceptional emissions events. The neighbouring construction site manager and the local discharge to air permit holders were contacted but nothing out of the ordinary was reported. On 27 May wind speeds were low (majority below 1 m/s), and the wind directions were mostly north-easterly. Elevated PM_{10} concentrations (>80 µg/m³) occurred during the hours of 15:00 to 18:00 (Figure 6). The pollution rose indicates these concentrations were coming from the north-northeast and northeast directions (Figure 7).

[35] Figure 6 Central Dunedin PM_{10} and wind direction for 27 May 2021



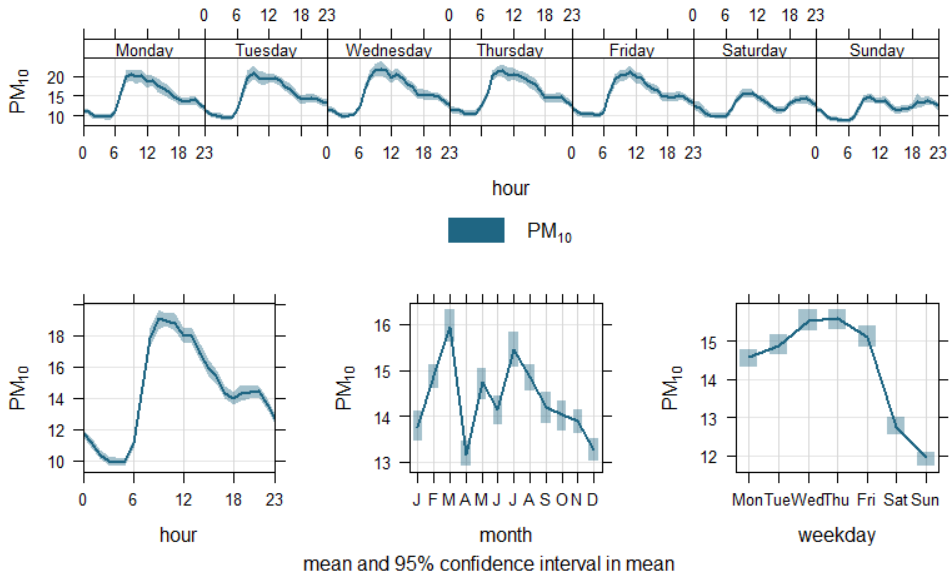
[36] Figure 7 Central Dunedin pollution rose for 27 May 2021



Frequency of counts by wind direction (%)

[37] Analysis of data for the previous seven years indicates that higher PM_{10} concentrations occur during the weekdays and are lowest on Sundays. On a daily basis, PM_{10} becomes elevated in the morning and declines during the evenings. Both these patterns indicate that the PM_{10} sources are from human activity, including traffic and industrial emissions. (Figure 8).

[38] Figure 8 Time variation for Central Dunedin PM_{10}



[39] The percentages of the fine ($PM_{2.5}$) and coarse ($PM_{10\text{-}2.5}$) particulate matter for 27 May were 39% and 61% respectively. This is slightly lower than the average, which is about 44% fine and 56% coarse. This means the high concentrations were unlikely to be related to a combustion source, and more likely to be soil and/or dust related sources and/or sea salt. Significantly, both the harbour and the closest discharge to air activities lie to the north-east of the monitoring site.

[40] Further work to investigate Dunedin's emission sources should include a source apportionment study, which would identify the main sources of the fine and coarse PM, as well as the relative influence of each source. The last source apportionment study was undertaken in 2011, during a period of significant construction in the area and when emissions from industry were higher than present. It would be beneficial to update this study to further understand the current sources of PM in Central Dunedin.

CONSIDERATIONS

Strategic Framework and Policy Considerations

[41] The work outlined in this paper contributes to the following elements of ORC's Strategic Direction:

a. Monitoring air quality in the region and investigate pollution sources
b. Provide best available information on Otago's air quality

Financial Considerations

[42] N/A

Significance and Engagement Considerations

[43] N/A

Legislative and Risk Considerations

[44] N/A

Climate Change Considerations

[45] N/A

Communications Considerations

[46] Air quality communications will continue as usual for winter 2022.

NEXT STEPS

[47] A $PM_{2.5}$ monitoring campaign was undertaken in winter 2021. Data was collected from 14 airsheds around Otago. This information will be reported later this year and will be used to inform the Air Plan review.

[48] The monitoring site upgrades will continue in 2022.

REFERENCES

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APPENDIX

Exceedance table 2021

Site	Alexandra	Arrowtown	Central Dunedin	Cromwell	Milton	Mosgiel
Date	Concentration (µg/m³) 24-hour average					
2/05/2021		60				
7/05/2021		57				
8/05/2021	62					
13/05/2021		66				
22/05/2021		51				
23/05/2021		57				
24/05/2021		52				
25/05/2021		53				
26/05/2021		78			93	
27/05/2021		65			99	
28/05/2021						62
3/06/2021				60		
8/06/2021		57			54	
9/06/2021					55	55
10/06/2021		53				
13/06/2021		57				
14/06/2021				54		
25/06/2021					57	
26/06/2021		62		52		
30/06/2021		68				
1/07/2021		94		73		
2/07/2021		104		69		
3/07/2021		82		67		
4/07/2021		104		74	58	
12/07/2021		63		53		
13/07/2021		80		67		
14/07/2021		53			65	
21/07/2021					78	
23/07/2021		64				
24/07/2021				68		
6/08/2021				57		
23/08/2021					56	
Total number of exceedances	1	22	0	11	9	2

ATTACHMENTS

Nil

7.2. Annual Water Quality and Biomonitoring Results (SoE Report Card)

Prepared for:	Data and Information Committee
Report No.	SPS2206
Activity:	Environmental: Water
Author:	Rachel Ozanne, Environmental Resource Scientist - Freshwater
Endorsed by:	Gwyneth Elsum, General Manager Strategy, Policy and Science
Date:	9 March 2022

PURPOSE

[1] This report card presents State of Environment (SoE) monitoring results to assess Otago's water quality compliance with the Regional Plan: Water for Otago (Regional Plan Water, 2004), Schedule 15 numerical limits and targets.

[2] The report also presents SoE monitoring undertaken to inform attribute tables in Appendix 2A and Appendix 2B in the National Policy Statement-Freshwater Management (NPSFM, 2020). The report card is attached in the appendix.

EXECUTIVE SUMMARY

[3] The Otago Regional Council (ORC) monitors the water quality of a selection of Otago rivers and lakes through long-term State of the Environment (SoE) monitoring programmes.

[4] Schedule 15 of the Water Plan sets out the numerical limits for water quality for catchments in the Otago region. Otago's water quality is assessed against Schedule 15 limits. A water quality index is used to grade sites into four categories (excellent, good, fair, poor).

[5] In the 2016-2021 period, 41 (38%) river sites were classified as 'excellent', 32 (30%) as 'good', 17 as 'fair' (16%) and 17 sites as 'poor' (16%). Of the eight lake sites, four were classified as 'excellent', two as 'good' and two as 'poor'.

[6] ORC monitor the attributes requiring limits on resource use (Appendix 2A, NPSFM, 2020). The attributes requiring limits on resource use include phytoplankton (trophic state), periphyton (trophic state) and cyanobacteria (planktonic).

[7] ORC also monitor the attributes requiring action plans (Appendix 2B, NPSFM, 2020). The attributes requiring action plans included in this report are macroinvertebrates, deposited sediment and ecosystem metabolism.

[8] Understanding the current state of water quality is key information for the Land and Water Regional Plan (LWRP) as well as upcoming action plans.

RECOMMENDATION

That the Committee:

1) ***Notes*** *this report.*

BACKGROUND

[9] ORC monitors 107 rivers and eight lakes across the Otago region as part of its long term SoE monitoring programme for surface water quality.

[10] A set of physicochemical and microbiological water quality variables is measured monthly at each site, including parameters that inform Schedule 15 (RPW, 2004).

[11] Schedule 15 sets out numerical limits for receiving water to achieve 'good water quality' in Otago rivers and lakes, with target dates to meet them. These limits apply to five variables: nitrate-nitrite nitrogen (NNN), dissolved reactive phosphorus (DRP), ammoniacal nitrogen (NH4-N), E. coli and turbidity (Turb), assigned to five Receiving Water Groups

[12] A water quality index is used to classify rivers and lakes. Sites are graded into four categories (excellent, good, fair, poor) depending on how many of the five variables comply with the limit or target in Schedule 15.

[13] **Table 1 Water quality index**

Grade	Number of parameters complying with Schedule 15 limits and targets (June 2016 to July 2021)
Excellent	All five parameters comply
Good	Four (of the five) values comply
Fair	Three (of the five) values comply
Poor	Two or fewer (of the five) values comply

[14] Each table of Appendix 2 of the NPSFM 2020 defines the ranges for numeric attribute states as four (or five) attribute bands, which are designated A to D/E. The attribute bands represent a graduated range of support for environmental values from high (A band) to low (D/E band). For most attributes, the D band represents an unacceptable condition (with the threshold between the C and the D band being referred to as 'bottom line').

[15] Each site that has been monitored for macroinvertebrates, periphyton, phytoplankton, deposited sediment, or ecological processes has been graded according to the relevant attribute table and calculation guidance in Appendix 2 of the NPSFM.

[16] **Table 2 Details of the NOF attributes used to grade the state of the river and lake monitoring sites**

NPS-FM Reference – NOF Attribute	Water body type	Calculation guidance	Numeric attribute state description	Units
A2A; Table 1 – Phytoplankton	Lakes	Annual median	Median of phytoplankton chlorophyll-*a*	mg chl-a m^{-3}
A2A; Table 1 – Phytoplankton	Lakes	Annual maximum	Annual maximum of phytoplankton chlorophyll-*a*	mg chl-a m^{-3}
A2A; Table 2 – Periphyton	Rivers	Minimum of 3 years of monthly data	92nd percentile of periphyton chlorophyll-*a* for default river class[2]	mg chl-a m^{-2}
A2B; Table 14 - Macroinvertebrates	Rivers	State calculated as 5 year median	MCI score	-
A2B; Table 14 - Macroinvertebrates	Rivers	State calculated as 5 year median	QMCI score	-
A2B; Table 15 - Macroinvertebrates	Rivers	State calculated as 5 year median	ASPM score	-
A2B; Table 16 - Deposited Sediment	Rivers	Median of 5 years of at least monthly samples (at least 60 samples)	% fine sediment cover	%
A2B; Table 21 - Ecosystem metabolism	Rivers	Annual median	% cotton tensile strength loss per degree day (%CTSL dd-1)	%

DISCUSSION

[17] The report attached as Appendix 1 shows that in the 2016-2021 period, 41 river sites were classified as 'excellent', 32 as 'good', 17 as 'fair' and 17 sites as 'poor'. Of the eight lake sites, four were classified as 'excellent', two as 'good' and two as 'poor'.

[18] Water quality results are shown in Appendix 1, Figure 1. The map shows that water quality in rivers across Otago has a clear spatial pattern related to land use. Water quality is best ('excellent' or 'good') at river reaches in high or mountainous elevations under predominantly native cover. These sites tend to be associated with the upper catchments of larger rivers (e.g., Clutha River/Matau-Au) and the outlets from large lakes (e.g., Hawea, Wakatipu and Wanaka). Water quality is degraded ('fair' or 'poor') at river reaches in urban areas and intensified catchments.

[19] Macroinvertebrate results were graded according to attribute bands (NPSFM 2020, Appendix 2B, Tables 14-15) for the Macroinvertebrate Community Index (MCI), Quantitative Macroinvertebrate Community Index (QMCI) and Macroinvertebrate Average Score Per Metric (ASPM). The sites with the best macroinvertebrate communities across all three metrics were the Dart, Blackcleugh Burn, the Arrow River and Dunstan Creek. The sites in urban settings had the poorest macroinvertebrate communities; the Kaikorai Stream and Oamaru Creek.

[20] Periphyton results were graded according to attribute bands (NPSFM 2020, Appendix 2A, Tables 1-2). Of the river sites monitored, 16 sites were A band; ten sites were band B, three sites had moderate nutrient enrichment at band C, and five sites (Kakanui, Kaikorai, Oamaru, Shag River, Waianakarua) fell below the national bottom line which reflects high nutrient enrichment. Of the lake sites monitored, all but Lake Hayes, Lake Tuakitoto and Lake Waihola met the A band over both metrics monitored, reflecting healthy and resilient lake ecological communities.

[21] ORC monitors deposited sediment at 35 sites, and all sites obtained an A band reflecting a minimal impact of deposited fine sediment on instream biota, other than the Matukituki River (C band), the Tahakopa River (B band), Waitahuna River (B band) and the Waipahi River at Waipahi (B band).

[22] ORC measures ecological processes by using cotton strip assays. The cotton strips were installed at 34 sites. Of the 34 sites, three sites were an A band, five sites a B band, ten sites a C band and the remaining sites were below the national bottom line, achieving a D band. A 'D band' shows that river ecological processes are unhealthy and significantly impacted by nutrient levels elevated above reference conditions.

OPTIONS

[23] Not applicable. Noting paper only.

CONSIDERATIONS

Strategic Framework and Policy Considerations

[24] Issues with Otago's current planning approach for land use and freshwater management will be addressed, as far as practicable, through the new LWRP.

Financial Considerations

[25] In the future, further investment is required to ensure the SoE Water Quality monitoring network is compliant with national direction and is representative of FMUs. A review of

the monitoring network will be completed as scheduled in the proposed long-term plan for the 2023/2024 financial year.

Significance and Engagement Considerations

[26] Not applicable.

Legislative and Risk Considerations

[27] Monitoring networks must comply with national legislation and effectively evaluate objectives in regional plans. However, as policies can change rapidly, there is generally a lag for implementing network changes and then further delay until sufficient data is collected to enable analysis.

Climate Change Considerations

[28] The state of the environment monitoring for surface water quality may provide useful data in the future to demonstrate the effects of climate change on our rivers and lakes.

Communications Considerations

[29] The report will be available on the ORC website https://www.orc.govt.nz/plans-policies-reports/reports-and-publications/water-quality/annual-water-quality-reports

NEXT STEPS

[30] The next annual report card will cover July 2017 to June 2022.

[31] Comprehensive State of the Environment reporting is undertaken once every five years. This five-yearly report provides a detailed review of water reporting on regional state and trends in river and lake health, performance against the National Policy Statement for Freshwater Management (NPSFM), and the effectiveness of the Water Plan. This report was last presented to Committee on 14 April 2021 https://www.orc.govt.nz/news-and-events/events/2021/april/council-meeting-14-april.

ATTACHMENTS

1. WQ SOE Report Card 2016-2021 Final [**7.2.1** - 16 pages]

Water Quality Ecological Assessments 2016 to 2021

Otago Regional Council

Introduction

The Otago Regional Council (ORC) is responsible for managing Otago's surface-water resources. ORC carries out regular water-quality monitoring and ecological assessments, as part of its State of Environment (SoE) programme. This report card is a snapshot of monitoring undertaken between July 2016 and June 2021. Discussion of results is presented in regular State of Environment reports. The last report can be found here: https://www.orc.govt.nz/media/9781/state-and-trends-of-lake-and-river-water-quality-in-the-otago-region-2000-to-2020.pdf

Water quality (Water Plan, Schedule 15)

Schedule 15 of the Regional Plan: Water for Otago sets out the numerical limits and targets for achieving acceptable water quality for all catchments in the Otago region. The receiving water limits and targets (outlined in Table 1) are applied as five-year, 80th percentiles, when flows are at or below median flow.

Table 1: Water quality limits and targets (five-year, 80th percentiles, when flows are at or below median flow)

Schedule 15	Nitrite-nitrate nitrogen mg/l	Dissolved reactive phosphorus mg/l	Ammoniacal nitrogen mg/l	*Escherichia coli* cfu/100ml	Turbidity NTU	Total nitrogen mg/l	Total phosphorus mg/l
Group 1	0.444	0.026	0.10	260	5		
Group 2	0.075	0.010	0.10	260	5		
Group 3	0.075	0.005	0.01	50	3		
Group 4			0.10	126	5	0.55	0.033
Group 5			0.01	10	3	0.10	0.005

115 SoE sites were monitored every month, with six sites monitored monthly by NIWA (as part of the National River Water Quality Network). ORC uses a water quality index to classify each site into one of four groups (Table 2). Figure 1 shows the results.

- **Nutrients:** Nitrite-nitrate nitrogen (NNN) and dissolved reactive phosphorus (DRP) are the biologically available nutrients used for algae and plant growth. NNN is a form of nitrogen, mainly derived from land drainage, and DRP is a form of phosphorus, primarily sourced from effluent and fertiliser. Ammoniacal nitrogen (NH_4-N) can indicate the presence of effluent in water. Total nitrogen (TN) and total phosphorus (TP) are the nutrients used when monitoring eutrophication potential in lakes.
- ***Escherichia coli*** (*E. coli*) are a bacterium used to indicate the presence of harmful micro-organisms in water (e.g., human or animal faeces). This indicator is used to gauge whether water is suitable for stock water, swimming, surfing or other recreational activities.
- **Turbidity:** Turbidity is a measure of the cloudiness of water and assesses how much light is scattered by suspended particles. Streams with 'high turbidity' often have high suspended sediment loads. High turbidity can reduce light penetration and affect photosynthesis. High sediment loading also can smother the streambed, which reduces macroinvertebrate and fish-spawning habitat.

Table 2. Water quality index

Grade	Number of parameters complying with Schedule 15 limits and targets (June 2016 to July 2021)
Excellent	All five parameters comply
Good	Four (of the five) values comply
Fair	Three (of the five) values comply
Poor	Two or fewer (of the five) values comply

Water quality results

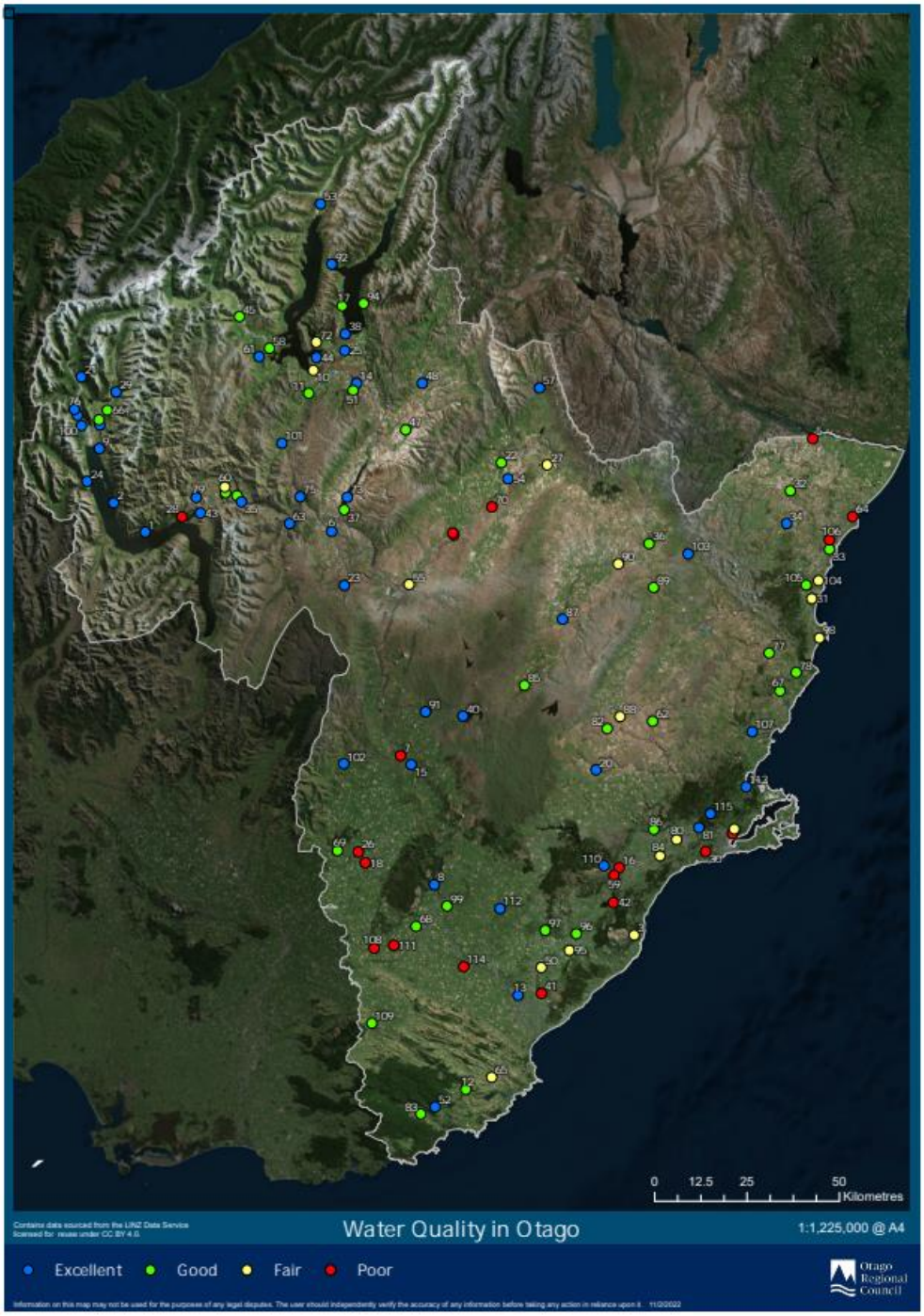


Figure 1: Results of SoE water-quality monitoring (2016 -2021). Site numbers refer to sites in Tables 3-7.

Water quality results

Table 3: Water quality results for Group 1 sites. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with an '*' have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an' N'.

Site #		Name	Grade	NH4-N	E.Coli	DRP	NNN	Turb
				mg/l	cfu/100ml	mg/l	mg/l	NTU
		Schedule 15 limit or target		**0.1**	**260**	**0.026**	**0.444**	**5**
8	*	Blackcleugh Burn at Rongahere Road	Excellent	0.0025	20	0.0194	0.0674	0.59
12		Catlins at Houipapa	Good	0.0120	204	0.0150	0.4950	3.80
13	N	Clutha at Balclutha	Excellent	0.0050	101	0.0020	0.0856	4.29
18		Crookston Burn at Kelso Road	Poor	0.0298	1300	0.0419	1.4890	5.26
26		Heriot Burn at Park Hill Road	Poor	0.0239	1012	0.0409	1.5950	5.30
30		Kaikorai Stream at Brighton Road	Poor	0.0209	4411	0.0160	0.5420	8.42
46		Leith at Dundas Street Bridge	Poor	0.0121	1553	0.0271	0.5930	2.86
49		Lindsays Creek at North Road Bridge	Fair	0.0120	1320	0.0231	0.8320	3.62
50		Lovells Creek at Station Road	Fair	0.0160	590	0.0142	0.7200	3.00
52	*	Maclennan at Kahuiku School Road	Excellent	0.0098	178	0.0120	0.0312	2.10
65		Owaka at Katea Road	Fair	0.0120	354	0.0201	1.2120	2.24
68		Pomahaka at Burkes Ford	Good	0.0160	154	0.0124	0.5750	3.63
83	*	Tahakopa at Tahakopa	Good	0.0090	700	0.0081	0.3480	3.77
95		Tokomairiro at Blackbridge	Fair	0.0357	3514	0.0257	0.3390	5.57
96	*	Tokomairiro at Lisnatunny	Good	0.0173	381	0.0216	0.1260	3.99
97		Tokomairiro at West Branch Bridge	Good	0.0130	367	0.0119	0.1418	2.37
99		Tuapeka at 700m u/s bridge	Good	0.0101	268	0.0240	0.1727	3.50
108		Waipahi at Cairns Peak	Poor	0.0209	558	0.0169	0.7170	5.07
109		Waipahi at Waipahi	Good	0.0120	229	0.0229	1.1430	2.49
111		Wairuna at Millar Road	Poor	0.0594	919	0.1326	1.3960	14.48
112		Waitahuna at Tweeds Bridge	Good	0.0130	365	0.0159	0.1489	3.50
113	*	Waitati at Mt Cargill Road	Excellent	0.0035	190	0.0081	0.0982	1.34
114		Waiwera at Maws Farm	Poor	0.0179	330	0.0403	1.0500	2.90

Kaikorai Stream

Water quality results

Table 4: Water quality results for Group 2 sites. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with an '*' have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an' N'.

Site #		Name	Grade	NH4-N	E.Coli	DRP	NNN	Turb
				mg/l	cfu/100ml	mg/l	mg/l	NTU
		Schedule 15 limit or target		**0.1**	**260**	**0.01**	**0.075**	**5**
3	*	Akatore Creek at Akatore Creek Road	Fair	0.0079	251	0.0058	0.4760	14.36
4	*	Arrow at Morven Ferry Road	Good	0.0025	66	0.0017	0.1134	3.36
5		Awamoko at SH83	Poor	0.0132	579	0.0844	0.6990	1.96
6		Bannockburn at Lake Dunstan	Excellent	0.0041	132	0.0062	0.0014	3.86
7		Benger burn at SH8	Poor	0.0141	373	0.0162	0.2830	1.42
11		Cardrona at Mt Barker	Good	0.0047	162	0.0030	0.0753	1.89
14	N	Clutha at Luggate Br.	Excellent	0.0068	4	0.0005	0.0428	1.09
15	N	Clutha at Millers Flat	Excellent	0.0040	33	0.0009	0.0442	3.30
16		Contour Channel at No. 4 Bridge	Poor	0.0702	883	0.0371	0.2880	6.94
20		Deep Stream at SH87	Excellent	0.0035	227	0.0038	0.0018	0.87
22		Dunstan Creek at Beattie Road	Good	0.0046	169	0.0040	0.1005	1.15
23	*	Fraser at Old Man Range	Excellent	0.0025	13	0.0031	0.0116	0.49
25		Hawea at Camphill Bridge	Excellent	0.0023	9	0.0030	0.0200	0.60
27	*	Hills Creek at SH85	Fair	0.0025	438	0.0037	0.1315	1.44
31	*	Kakaho Creek at SH1	Fair	0.0771	195	0.0543	0.1843	4.42
32		Kakanui at Clifton Falls Bridge	Good	0.0034	699	0.0028	0.0595	0.40
33		Kakanui at McCones	Good	0.0080	133	0.0033	0.7150	0.50
34		Kauru at Ewings	Excellent	0.0042	202	0.0033	0.0265	0.34
35		Kawarau at Chards (NIWA)	Excellent	0.0130	13	0.0020	0.0282	4.38
36		Kye Burn at SH85 Bridge	Good	0.0040	212	0.0047	0.1031	1.17
47		Lindis at Ardgour Road	Good	0.0052	161	0.0030	0.0935	1.43
48		Lindis at Lindis Peak	Excellent	0.0036	108	0.0040	0.0191	1.84
51		Luggate Creek at SH6 Bridge	Good	0.0037	181	0.0109	0.0070	1.30
54		Manuherikia at Blackstone Hill	Excellent	0.0040	232	0.0050	0.0059	4.61
55		Manuherikia at Galloway	Fair	0.0070	300	0.0186	0.0625	2.55
56		Manuherikia at Ophir	Poor	0.0171	729	0.0303	0.1378	3.56
57	*	Manuherikia downstream of Fork	Excellent	0.0025	39	0.0060	0.0039	0.35

Arrow River

Water quality results

Table 4 continued. Water quality results for Group 2 sites. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with '*' have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an' N'. Sites with '*' were originally monitored by NIWA before ORC took on the sampling responsibility. ***There is an exemption for turbidity for the Shotover.**

Site #		Name	Grade	NH4-N	E.Coli	DRP	NNN	Turb
				mg/l	cfu/100ml	mg/l	mg/l	NTU
		Schedule 15 limit or target		**0.1**	**260**	**0.01**	**0.075**	**5**
59	*	Meggat Burn at Berwick Road	Poor	0.0110	448	0.0103	0.1200	3.65
60		Mill Creek at Fish Trap	Fair	0.0150	313	0.0060	0.4300	4.10
62		Nenthorn at Mt Stoker Road	Good	0.0077	219	0.0174	0.0031	1.67
63		Nevis at Wentworth Station	Excellent	0.0027	65	0.0045	0.0026	0.94
64	*	Oamaru Creek at SH1	Poor	0.0219	613	0.3900	0.6920	3.04
67	*	Pleasant at Patterson Road Ford	Good	0.0080	72	0.0034	0.0250	6.23
69		Pomahaka at Glenken	Good	0.0050	318	0.0083	0.0313	1.58
70	*	Poolburn at Cob Cottage	Poor	0.0117	359	0.0570	0.1098	2.45
73	*	Quartz Reef Creek at SH8	Excellent	0.0025	220	0.0025	0.0123	2.80
75	*	Roaring Meg at SH6	Excellent	0.0025	48	0.0081	0.0295	0.94
77		Shag at Craig Road	Good	0.0043	98	0.0039	0.1449	0.71
78		Shag at Goodwood Pump	Good	0.0087	226	0.0059	0.2870	0.73
79	N	Shotover at Bowens Peak	Excellent	0.0042	7	0.0003	0.0164	4.81
80		Silverstream at Taieri Depot	Fair	0.0205	579	0.0082	0.7540	0.91
81	*	Silverstream at Three Mile Hill Road	Excellent	0.0025	69	0.0024	0.0234	0.83
82	***	Sutton Stream at SH87	Good	0.0045	609	0.0075	0.0102	1.58
84		Taieri at Allanton Bridge	Fair	0.0175	508	0.0099	0.0774	3.97
85		Taieri at Linnburn Runs Road	Good	0.0050	296	0.0039	0.0043	1.54
86	***	Taieri at Outram	Good	0.0065	112	0.0112	0.0495	2.10
87		Taieri at Stonehenge	Excellent	0.0060	144	0.0080	0.0149	1.51
88		Taieri at Sutton	Fair	0.0071	821	0.0123	0.0632	3.86
89	***	Taieri at Tiroiti	Good	0.0070	181	0.0221	0.0630	4.01
90		Taieri at Waipiata	Fair	0.0100	303	0.0363	0.0466	3.51
91	*	Teviot at Bridge Huts Road	Excellent	0.0051	109	0.0015	0.0075	4.23
93		Thomsons Creek at SH85	Poor	0.0259	1920	0.0982	0.3490	7.81
98		Trotters Creek at Mathesons	Fair	0.0376	312	0.0043	0.4870	2.98
101	*	Upper Cardrona at Tuohys Gully Road	Excellent	0.0025	237	0.0010	0.0185	1.57
102	*	Upper Pomahaka at Aitchison Runs Road	Excellent	0.0025	92	0.0064	0.0212	0.87
103	*	Upper Shag at SH85 Culvert	Excellent	0.0030	115	0.0023	0.0410	0.29
104		Waianakarua at Browns	Fair	0.0050	337	0.0034	0.3750	0.42
105	*	Waianakarua at South Branch SH1	Good	0.0057	218	0.0018	0.6170	0.36
106		Waiareka Creek at Taipo Road	Poor	0.0125	492	0.2550	0.9250	2.45
107		Waikouaiti at Confluence d/s	Excellent	0.0046	79	0.0045	0.0642	1.20
110		Waipori at Waipori Falls Reserve	Excellent	0.0057	34	0.0033	0.0561	1.73
115	*	Whare Creek at Whare Flat Road	Excellent	0.0025	37	0.0029	0.0445	1.26

Water quality results

Table 5. Group 3 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets. Sites with an '*' have been monitored for less than five years, therefore the grade is interim. Sites monitored by NIWA are shown with an' N'. ***There is an exemption for turbidity for the Dart and Matukituki

Site #		Name	Grade	NH4-N	E.Coli	DRP	NNN	Turb
				mg/l	cfu/100ml	mg/l	mg/l	NTU
		Schedule 15 limit or target		**0.01**	**50**	**0.005**	**0.075**	**3**
1	*	12 Mile Creek at Glen-Queenstown Rd	Excellent	0.0025	6	0.0027	0.0059	0.26
2	*	25 Mile Creek at Glen-Queenstown Rd	Excellent	0.0025	6	0.0028	0.0061	0.27
9	*	Buckler Burn at Glen-Queenstown Rd	Excellent	0.0025	5	0.0018	0.0311	2.28
10	*	Bullock Creek at Dunmore Street	Fair	0.0025	846	0.0015	0.7650	0.49
17	*	Craig Burn at SH6	Good	0.0025	55	0.0033	0.0086	0.95
19		Dart at The Hillocks	Good	0.0039	9	0.0030	0.0357	10.76
21	*	Dundas Creek at Mill Flat	Excellent	0.0025	2	0.0029	0.0410	0.55
24	*	Greenstone at Greenstone Station Road	Excellent	0.0025	22	0.0019	0.0221	0.48
28	*	Horn Creek at Queenstown Bay	Poor	0.0145	318	0.0096	0.1655	3.35
29	*	Invincible Creek at Rees Valley Road	Excellent	0.0025	2	0.0007	0.0104	1.77
45	*	Leaping Burn at Wanaka Mt Aspiring Rd	Good	0.0013	196	0.0015	0.0300	0.57
53	*	Makarora at Makarora	Excellent	0.0025	28	0.0022	0.0594	1.47
58		Matukituki at West Wanaka	Fair	0.0093	34	0.0040	0.0803	3.16
61	*	Motatapu at Wanaka Mt Aspiring Road	Excellent	0.0025	31	0.0010	0.0436	1.14
66	*	Ox Burn at Rees Valley Road	Good	0.0025	6	0.0019	0.0260	4.61
71	*	Precipice Creek at Glenorchy Paradise Rd	Excellent	0.0025	15	0.0017	0.0094	0.54
72	*	Quartz Creek at Maungawera Valley Road	Fair	0.0025	89	0.0027	0.1392	0.51
74	*	Rees at Glenorchy Paradise Road Bridge	Good	0.0025	10	0.0018	0.0176	10.01
76	*	Scott Creek at Routeburn Road	Excellent	0.0025	11	0.0021	0.0317	0.75
92	*	The Neck Creek at Meads Road	Excellent	0.0025	10	0.0019	0.0066	0.42
94	*	Timaru at Peter Muir Bridge	Good	0.0013	7	0.0050	0.0154	24.90
100	*	Turner Creek at Kinloch Road	Excellent	0.0025	9	0.0024	0.0531	0.28

Table 6. Group 4 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets.

Site #	Name	Grade	NH4-N	E.Coli	Turb	TP	TN
			mg/L	cfu/100ml	NTU	mg/L	mg/L
	Schedule 15 limit or target		**0.1**	**126**	**3.00**	**0.0330**	**0.5500**
39	Lake Hayes	Good	0.0423	3	3.68	0.0536	0.4260
40	Lake Onslow	Excellent	0.0075	11	4.95	0.0270	0.3000
41	Lake Tuakitoto	Poor	0.0760	125	8.91	0.1494	1.4370
42	Lake Waihola	Poor	0.0240	97	17.55	0.0776	0.6400

Table 7. Group 5 sites showing water quality results. The orange cells show where the 80th percentile below median flow exceeded the Schedule 15 limits and targets.

Site #	Name	Grade	NH4-N	E.Coli	Turb	TP	TN
			mg/L	cfu/100ml	NTU	mg/L	mg/L
	Schedule 15 limit or target		**0.01**	**10**	**3.00**	**0.0050**	**0.1000**
37	Lake Dunstan	Good	0.0039	9	1.08	0.0060	0.0946
38	Lake Hawea	Excellent	0.0025	0.5	0.72	0.0015	0.0400
43	Lake Wakatipu	Excellent	0.0025	0.5	0.61	0.0020	0.0645
44	Lake Wanaka	Excellent	0.0013	0.5	0.53	0.0020	0.0630

Water quality results

Table 8 shows the variation in water quality grades over the years. In 2016-2021 69% of the SoE sites are classified as having 'excellent' or 'good' water quality. Most of the sites with 'excellent' river water quality were in Central Otago and the upper Clutha. In these areas, land-use tends to be low-intensity sheep farming and/or dominated by tussock lands. Poorer water quality was found in river catchments with higher-intensity farming or in streams draining urban environments.

Table 8. Summary of results showing variation in water quality grades across three five year periods.

RIVERS	2014-19	2015-20	2016-21	LAKES	2014-19	2015-20	2016-21
Excellent	37	37	41	Excellent	3	3	4
Good	32	34	32	Good	2	3	2
Fair	18	19	17	Fair	0	0	0
Poor	19	16	17	Poor	3	2	2
TOTAL	106	106	107	TOTAL	8	8	8

Compared to 2021-2021 water quality results, 98 sites retained the same grade, eight sites improved by one grade, one site improved by two grades and eight sites degraded by one grade.

In Group 1, four sites (of 23) had 'excellent' water quality (Clutha Mata/Au at Balclutha, Blackcleugh Burn, Maclennan River and Waitati River); eight had 'good' water quality (Catlins River, Pomahaka River at Burkes, Tahakopa River, Tokomairiro at Lisnatunny, Tokomairiro at West Branch Bridge, Tuapeka River and Waipahi River); four had 'fair' water quality, and 7 sites had 'poor' water quality. The sites graded 'poor' included the tributaries of the Pomahaka River, Dunedin urban streams, the Waiwera River. Schedule 15 limits were most often exceeded for *E. coli* and NNN.

For Group 2, 22 sites (out of 61) had 'excellent' water quality. Most of these were upper catchment sites spread widely across Otago, including the Taieri, Manuherekia, Pomahaka, Lindis and Waikouaiti in the Taieri and Clutha river catchments. Eighteen sites had 'good' water quality, twelve had 'fair' water quality, and another nine were classified as 'poor' water quality. The parameter that most often exceeded the Schedule 15 limit in this category was NNN.

Of the 23 sites in Group 3, 15 had 'excellent' water quality, six had 'good' water quality, one site had 'fair' water quality, and one site (Horn Creek) had 'poor' water quality. Horn Creek was the only site in Otago to exceed the Schedule 15 limit for ammoniacal nitrogen. Water quality grades for Timaru Creek, the Dart River and the Buckler Burn improved, while Quartz Creek dropped from good to fair.

For Group 4 lake sites, Lake Hayes had 'good' water quality, Lake Onslow had 'excellent' water quality, and Lake Tuakitoto and Lake Waihola had 'poor' water quality. All but Onslow exceeded Schedule 15 limits for turbidity total phosphorus (TP). None of the Group 4 lakes exceeded the *E. coli* limit.

The lake sites in Group 5 sites had excellent water quality, except for Lake Dunstan which recorded total phosphorus above the Schedule 15 limit.

Macroinvertebrates (NPSFM 2020, Appendix 2B, Tables 14 and 15)

Macroinvertebrates are important in streams and rivers because they aid ecosystem processes and provide food for fish and some birds. As macroinvertebrates have a relatively long life-span, they are good indicators of environmental conditions over a prolonged period.

Macroinvertebrates are included in the NPSFM 2020 as attributes requiring an action plan (NPSFM 2020, Appendix 2B, Tables 14-15). The NPSFM has attribute states for Macroinvertebrate Community Index (MCI) score; Quantitative Macroinvertebrate Community Index (QMCI) score and Macroinvertebrate Average Score Per Metric (ASPM). ORC has traditionally monitored SQMCI

Macroinvertebrate Community Index (MCI): The MCI is based on the tolerance or sensitivity of species (taxa) to organic pollution and nutrient enrichment. For example, mayflies, stoneflies and caddis flies are generally sensitive to pollution. They are only abundant in clean and healthy streams, whereas worms and snails are more tolerant and found in polluted streams. Most benthic invertebrate taxa have been assigned a tolerance value ranging from 1 (very tolerant) to 10 (very sensitive). Higher MCI scores indicate better stream conditions at the sampled site. Table 11 shows that *MCI scores were highest at the Dart, Blackcleugh Burn and Arrow River and lowest in the Kaikorai Stream, Oamaru Creek and Waipahi at Waipahi.*

Semi-Quantitative Macroinvertebrate Community Index (QMCI): A more cost-effective variant of the QMCI is called the Semi-Quantitative Macroinvertebrate Community Index, or SQMCI (Stark 1998). The SQMCI uses a five-point scale of coded abundances (i.e., Rare, Common, Abundant, Very Abundant, Very Very Abundant). This index produces values very similar to the QMCI. The SQMCI uses the same tolerance scores as the MCI but uses the relative abundance of macroinvertebrates to determine an index of stream health. The SQMCI is considered more sensitive to subtle changes in water quality and stream health because it shows changes in the relative proportions of different species rather than the presence or absence. SQMCI scores range from 0 to 10. Table 11 shows that *SQMCI scores were highest at 12 Mile Creek, Manuherekia at Galloway and the Dart River and lowest in the Kaikorai Stream, Kakanui River at McCones and the Silverstream.*

Average Score Per Metric (ASPM): The ASPM index aggregates three other metrics that are averaged to indicate stream health. The component metrics are the MCI, the richness of Ephemeroptera, Plecoptera and Trichoptera (EPT taxa) and %EPT abundance. Table 11 shows that *ASPM scores were highest in Dunstan Creek, Manuherekia at Galloway and the Arrow River and lowest in the Kaikorai Stream, Oamaru Creek and Silver Stream*.

Common Invertebrates (https://www.landcareresearch.co.nz)

Smooth Cased Caddis - Olinga caddis larve construct smooth mobile cases that lack sand grains

Deleatidium Mayfly. Single, leaf-like gills.

Macroinvertebrate results

	Macroinvertebrate Community Index (MCI) score; Quantitative Macroinvertebrate Community Index (QMCI) score		
	Description	QMCI	MCI
A	Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat.	≥6.5	≥130
B	Occasional blooms reflecting low nutrient enrichment and/or alteration of the natural flow regime or habitat	≥5.5 and <6.5	≥110 and <130
C	Periodic short-duration nuisance blooms reflecting moderate nutrient enrichment and/or moderate alteration of the natural flow regime or habitat.	≥4.5 and <5.5	≥90 and <110
	National bottom line	4.5	90
D	Regular and/or extended-duration nuisance blooms reflecting high nutrient enrichment and/or significant alteration of the natural flow regime or habitat	<4.5	<90

	Macroinvertebrate Average Score Per Metric (ASPM)	
	Description	ASPM
A	Macroinvertebrate communities have high ecological integrity, similar to that expected in reference conditions.	≥6.5
B	Macroinvertebrate communities have mild-to-moderate loss of ecological integrity.	≥5.5 and <6.5
C	Macroinvertebrate communities have moderate-to severe loss of ecological integrity.	≥4.5 and <5.5
	National bottom line	4.5
D	Macroinvertebrate communities have severe loss of ecological integrity.	<4.5

Table 10: Median macroinvertebrate results, taken from five years of monitoring between 2016 to 2021. Results at sites marked with an '*' are interim as they have been monitored for less than five years.

Site	MCI 5 year median	SQMCI 5 year median	ASPM 5 year median
12 Mile Creek at Glenorchy Queenstown Road*	112.50	7.45	0.56
25 Mile Creek at Glenorchy Queenstown Road*	110.83	4.01	0.43
Akatore Creek at Akatore Creek Road*	100.77	6.15	0.48
Arrow at Morven Ferry Road*	121.05	6.33	0.57
Blackcleugh Burn at Rongahere Road*	124.44	5.79	0.56
Bullock Creek at Dunmore Street Footbridge*	102.00	4.80	0.37
Cardrona at Mt Barker	104.44	3.91	0.46
Dart at The Hillocks*	125.14	7.29	0.56
Dunstan Creek at Beattie Road	120.00	7.22	0.65
Greenstone at Greenstone Station Road*	116.36	6.23	0.56
Kaikorai Stream at Brighton Road	68.00	2.15	0.13
Kakanui at McCones	87.69	3.10	0.31
Kye Burn at SH85 Bridge	102.73	6.70	0.52
Lindis at Ardgour Road	102.00	4.77	0.42
Luggate Creek at SH6 Bridge	106.32	5.52	0.50
Manuherikia at Blackstone Hill	100.00	5.67	0.53
Manuherikia at Galloway*	105.26	7.37	0.57
Manuherikia River at Ophir*	110.26	5.93	0.54
Matukituki at West Wanaka Station*	107.50	6.94	0.36
Motatapu at Wanaka Mt Aspiring Road*	111.11	5.98	0.54
Oamaru Creek at SH1*	81.11	4.23	0.19
Owaka at Katea Road*	93.85	4.31	0.52
Precipice Creek at Glenorchy Paradise Road*	110.91	4.55	0.39
Shag at Goodwood Pump	87.62	5.43	0.41
Silverstream at Taieri Depot	90.43	3.25	0.28
Tahakopa at Tahakopa*	107.14	5.43	0.56
The Neck Creek at Meads Road*	108.75	5.17	0.45
Tokomairiro at West Branch Bridge	104.67	5.52	0.53
Turner Creek at Kinloch Road*	117.50	3.44	0.39
Upper Pomahaka at Aitchison Runs Road*	116.36	5.72	0.56
Waianakarua at Browns	106.09	5.74	0.50
Waipahi at Waipahi	84.62	4.57	0.30
Waitahuna at Tweeds Bridge	100.00	5.64	0.49

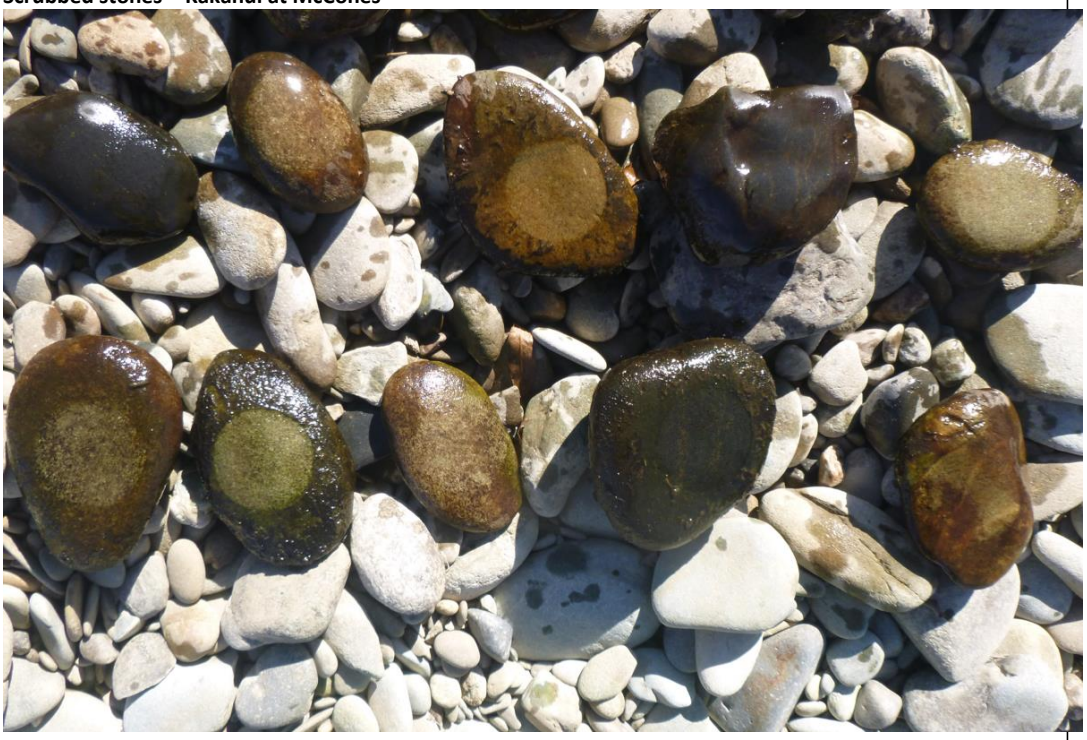
Periphyton (Chlorophyll *a*) (NPSFM 2020, Appendix 2A, Table 2)

Chlorophyll-*a* (Chla) is a common method for estimating stream periphyton biomass because all types of algae contain Chla, this metric reflects the total amount of live algae in a sample. The trophic state of a water body is the amount of living material (biomass) that it supports. The NPSFM 2020 specifies attributes for trophic state based periphyton biomass in rivers (Table 10). Chla is the measure of biomass that the NOF periphyton attributes are based on, and the results are shown in Table 12.

The periphyton monitoring programme includes 34 sites sampled monthly between February 2019 and June 2021. Periphyton sampling was undertaken with one composite sample collected from each site. Samples were collected using the Quantitative Method 1b (QM-1b) described by the Ministry for the Environment (Biggs and Kilroy 2000). A stone was randomly chosen at 20 points from each site, and a predetermined area of the stone surface was scrubbed with a small brush into a tray and rinsed with river water. The scrubbings from the 20 stones were pooled and transferred to a sample container using river water. The total chlorophyll a was calculated using a standard formula (Biggs and Kilroy, 2000) and scaled to the number of milligrams of chlorophyll a per m2 of the stream bed.

The 28 months of monitoring falls short of the 3 years required by the NPSFM. The results presented in Table 13 are therefore interim. Of the sites monitored, 16 sites had negligible nutrient enrichment and met the A band requirements, ten sites had low nutrient enrichment and were band B, three sites had moderate nutrient enrichment and met were band C, and five sites fell below the national bottom line with 8% of samples exceeding 200 mg chl-a/m^2 reflecting high nutrient enrichment.

Scrubbed stones – Kakanui at McCones



Periphyton (Chlorophyll *a*) results

Table 12: Periphyton trophic state NPSFM 2020, Appendix 2A, Table 2

	mg chl-a/m2 (milligrams chlorophyll-a per square metre)	
	Description	Numeric attribute state
A	Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat.	≤50
B	Occasional blooms reflecting low nutrient enrichment and/or alteration of the natural flow regime or habitat	>50 and ≤120
C	Periodic short-duration nuisance blooms reflecting moderate nutrient enrichment and/or moderate alteration of the natural flow regime or habitat.	>120 and ≤200
	National bottom line	200
D	Regular and/or extended-duration nuisance blooms reflecting high nutrient enrichment and/or significant alteration of the natural flow regime or habitat	>200

Table 13: Attribute bands for Periphyton, based on chlorophyll *a* average score (mg per m2) at each site for months monitored between February 2019 and June 2021

			Exceeded no more than 8% of samples			
Site	# samples	Attribute Band	% samples ≤50 mg chl-a/m2	% samples >50 - ≤120 mg chl-a/m2	% samples >120 - ≤200 mg chl-a/m2	% samples >200 mg chl-a/m2
12 Mile Creek at Glen-Queenstown ad	28	A	100	0	0	0
25 Mile Creek at Glen-Queenstown Rd	28	A	100	0	0	0
Akatore Creek at Creek Road	26	B	73	19	0	8
Arrow River at Arrow Gorge Track	27	A	100	0	0	0
Arrow River at Morven Ferry Road	23	A	96	4	0	0
Blackcleugh Burn at Rongahere Road	25	B	88	8	0	0
Bullock Creek at Dunmore Street	27	B	70	26	0	4
Cardrona River at Mt Barker	25	A	100	0	0	0
Dart River at The Hillocks	22	A	100	0	0	0
Dunstan Creek at Beattie Road	24	A	96	4	0	0
Greenstone River at Greenstone Station Rd	28	A	100	0	0	0
Kaikorai Stream at Brighton Road	26	D	4	23	15	58
Kakanui River at McCones	25	D	12	20	24	44
Kye Burn at SH85 Bridge	22	A	95	5	0	0
Lindis River at Ardgour Road	21	B	57	38	5	0
Luggate Creek at SH6 Bridge	27	B	81	19	0	0
Manuherikia River at Blackstone Hill	21	B	81	14	5	0
Manuherikia River at Galloway	25	B	84	12	4	0
Manuherikia River at Ophir	24	B	83	13	4	0
Matukituki River at West Wanaka	24	A	96	4	0	0
Motatapu River at Wanaka Mt Aspiring Road	26	A	92	8	0	0
Oamaru Creek at SH1	27	D	0	11	26	63
Owaka River at Katea Road	21	C	48	33	19	0
Precipice Creek at Glenorchy Paradise Road	28	A	100	0	0	0
Shag River at Goodwood Pump	27	D	26	26	33	15
Silver Stream at Taieri Depot	26	C	50	38	12	0
Tahakopa River at Tahakopa	22	A	95	5	0	0
The Neck Creek at Meads Road	26	A	96	4	0	0
Tokomairaro River at West Branch Bridge	25	B	88	4	8	0
Turner Creek at Kinloch Road	28	B	86	14	0	0
Upper Pomahaka River at Aitchisons Run Rd	24	A	100	0	0	0
Waianakarua River at Browns	27	D	44	22	22	11
Waipahi River at Waipahi	19	C	84	5	11	0
Waitahuna River at Tweeds Bridge	22	A	95	5	0	0

Deposited Sediment (NPSFM 2020, Appendix 2B, Table 16)

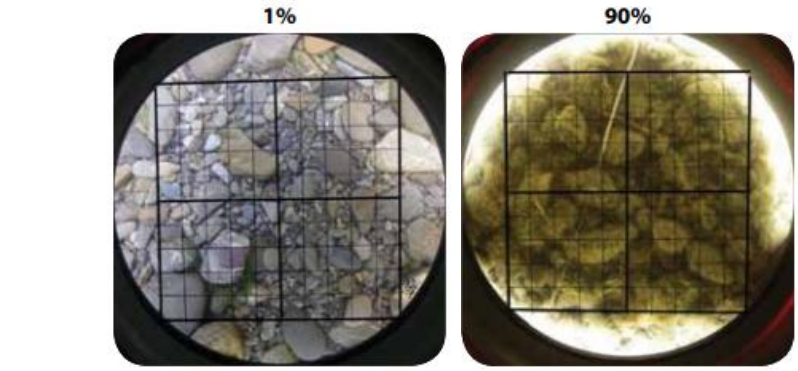
Excess sediment directly affects the health of a waterway, decreasing its mauri or life-supporting capacity. Deposited fine sediment occurs naturally in the beds of rivers and streams. It usually enters a stream because of terrestrial weathering processes or bank erosion and in-stream fluvial processes. Because sediment is naturally transported longitudinally through a river network, its state at any given point will be influenced by climate, geology, topography, and current velocity. Human activities can affect this natural sediment cycle by accelerating sediment delivery to streams and increasing the quantity of smaller particle sizes. The effect of excess in-stream sedimentation is recognised as a major impact of changing land use on river health. In particular, sediment alters the physical habitat by clogging interstitial spaces used as refugia by benthic invertebrates and fish, altering food resources, and removing sites used for egg-laying. As such, sediment can affect the diversity and composition of biotic communities. Excess sediment can also affect the aesthetic appeal of rivers and streams for human recreation.

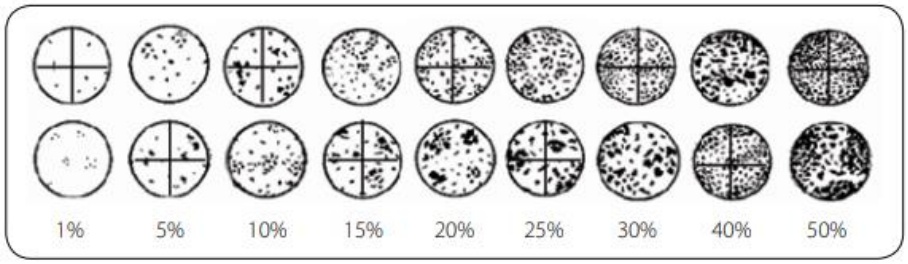
The sediment cover assessment programme comprised 35 sites sampled monthly. The indicator score is the percentage cover of the streambed in a run habitat determined by the instream visual method, SAM2, as defined in Clapcott *et al.*, 2011.

The NPSFM 2020 specifies attributes for deposited fine sediment (Table 16). The 24 months of monitoring falls short of the five years required by the NPSFM. The results presented in Table 17 are therefore interim. Each site was graded according to its median score over 24 months and its deposited sediment class (NPSFM, 2020 Table 24).

All sites obtained an A grade, other than the Matukituki River (C grade), the Tahakopa River (B grade), the Waitahuna River (B grade) and the Waipahi River at Waipahi (B grade)

Real examples of percent cover of sediment on the streambed as seen through an underwater viewer and examples of percent cover of sediment on the streambed as seen through an underwater viewer (Clapcott et.at., 2011)





Deposited sediment results

Table 16: Deposited fine sediment NPSFM 2020, Appendix 2B, Table 16

		% fine sediment cover			
	Description	Numeric attribute state by deposited sediment class			
		1	2	3	4
A	Minimal impact of deposited fine sediment on instream biota. Ecological communities are similar to those observed in natural reference conditions.	≤7	≤10	≤9	≤13
B	Low to moderate impact of deposited fine sediment on instream biota. Abundance of sensitive macroinvertebrate species may be reduced	>7 and ≤14	>10 and ≤19	>9 and ≤18	>13 and ≤19
C	Moderate to high impact of deposited fine sediment on instream biota. Sensitive macroinvertebrate species may be lost.	>14 and ≤21	>19 and ≤29	>18 and ≤27	>19 and ≤27
	National bottom line	21	29	27	27
D	High impact of deposited fine sediment on instream biota. Ecological communities are significantly altered and sensitive fish and macroinvertebrate species are lost or at high risk of being lost.	>21	>29	>27	>27

Table 17: Deposited sediment median result and interim grade at each site, for months monitored between July 2019 and June 2021.

Site	# samples	Deposited Sediment Class (NPSFM)	Median % fine sediment cover
12 Mile Creek at Glenorchy Queenstown Road	20	4	0.25
25 Mile Creek at Glenorchy Queenstown Road	20	4	3.25
Akatore Creek at Akatore Creek Road	19	3	1.75
Arrow at Morven Ferry Road	16	3	0.00
Arrow River at Arrow Gorge Track	20	3	5.75
Blackcleugh Burn at Rongahere Road	15	4	0.65
Bullock Creek at Dunmore Street Footbridge	19	3	4.48
Cardrona at Mt Barker	17	2	3.63
Dart at The Hillocks	12	4	0.20
Dunstan Creek at Beattie Road	18	4	3.10
Greenstone at Greenstone Station Road	20	4	0.00
Kaikorai Stream at Brighton Road	19	3	0.00
Kakanui at McCones	18	2	0.00
Kye Burn at SH85 Bridge	16	2	6.13
Lindis at Ardgour Road	13	2	0.50
Luggate Creek at SH6 Bridge	18	4	0.00
Manuherikia at Blackstone Hill	15	2	5.05
Manuherikia at Galloway	12	2	0.55
Manuherikia at Ophir	13	2	2.40
Matukituki at West Wanaka Station	15	4	16.88
Motatapu at Wanaka Mt Aspiring Road	17	4	4.50
Oamaru Creek at SH1	19	3	0.10
Owaka at Katea Road	12	2	2.00
Precipice Creek at Glenorchy Paradise Road	19	4	3.05
Shag at Goodwood Pump	19	2	0.33
Silverstream at Taieri Depot	19	2	4.50
Tahakopa at Tahakopa	13	2	10.35
The Neck Creek at Meads Road	19	4	2.38
Tokomairiro at West Branch Bridge	17	2	1.63
Turner Creek at Kinloch Road	20	4	0.50
Upper Pomahaka at Aitchison Runs Road	16	4	1.35
Waianakarua at Browns	19	2	0.00
Waipahi at Waipahi	13	3	8.75
Waitahuna at Tweeds Bridge	14	2	8.00

Ecological Processes (NPSFM 2020, Appendix 2B, Table 21)

The NPS-FM 2020 introduced ecosystem metabolism (gross primary production and ecosystem respiration) as an action-planning attribute to assess the ecological processes component of the compulsory ecosystem health value in rivers. To measure ecosystem metabolism, the NPS-FM requires the deployment of a logger to continuously record dissolved oxygen and temperature for at least 7 days during the summer period. In the ecosystem health framework (Clapcott *et al*., 2018), alternative measures of ecological processes are recommended, including a cotton strip assay (CSA). The CSA provides an estimate of organic matter processing and is less resource intensive to measure than ecosystem metabolism. However, the same as for ecosystem metabolism, there are currently no national guideline values (within the NPS-FM) for assessing ecological processes using this method. Cawthron explored the development of attribute bands for ORC to support the application of the CSA as an alternative action planning attribute (Wagenhoff *et al*., 2020), the attribute bands are shown in Table 17.

Otago Regional Council initially deployed strips in February 2020, but because strips could not be retrieved due to Covid-19 restrictions, no data was generated. The assay was repeated in May–June 2020, when cotton strips were deployed for an average of 28 days at 34 sites. The 34 sites were spread across the FMUs.

Results are shown in Table 18. Of the 34 sites, three sites achieved an A band (Motatapu River, Silverstream and Waianakarua River), five sites a B band (Bullock Creek, Cardrona River, Dunstan Creek, Manuherekia at Blackstone Hill and The Neck Creek), ten sites a C band and the remaining sites were below the national bottom line, achieving a D band.

Cotton strip deployment, Tahakopa River, Catlins

Ecological processes results

Table 18 Interim organic matter processing attribute table for regional and national application.

	Percent cotton tensile strength loss per degree day (%CTSL dd-1)	
	Description	**Numeric attribute state**
A	River ecological processes are healthy and resilient, like natural reference conditions.	≤0.12
B	River ecological processes are slightly impacted by nutrient levels that are elevated above natural reference conditions and/or by altered flows/habitat due to land use impacts	>0.12 and ≤0.24
C	River ecological processes are moderately impacted by nutrient levels that are elevated above natural reference conditions and/or by altered flows/habitat due to land use impacts.	>0.24 and ≤0.37
	National bottom line	0.37
D	River ecological processes are unhealthy and significantly impacted by nutrient levels that are elevated above natural reference conditions and/or by altered flows/habitat due to land use impacts.	>0.37

Table 19 Percent cotton tensile strength loss per degree day (%CTSL dd -1) May-June 2020.

Site	%ctsl/dd	Site	%ctsl/dd
12 Mile Creek at Glenorchy Queenstown Road	0.357	Motatapu at Wanaka Mt Aspiring Road	0.118
25 Mile Creek at Glenorchy Queenstown Road	0.563	Oamaru Creek at SH1	0.454
Akatore Creek at Akatore Creek Road	0.501	Owaka at Katea Road	0.554
Arrow at Morven Ferry Road	0.250	Precipice Creek at Glenorchy Paradise Road	0.297
Arrow River at Arrow Gorge Track	0.244	Shag at Goodwood Pump	0.413
Blackcleugh Burn at Rongahere Road	0.616	Silverstream at Taieri Depot	0.117
Buckler Burn at Glenorchy Queenstown Road	0.342	Tahakopa at Tahakopa	0.475
Bullock Creek at Dunmore Street Footbridge	0.209	Taieri at Outram	0.557
Cardrona at Mt Barker	0.169	Taieri at Sutton	0.400
Dart at The Hillocks	0.422	Taieri at Waipiata	0.735
Dunstan Creek at Beattie Road	0.232	The Neck Creek at Meads Road	0.262
Greenstone at Greenstone Station Road	0.405	Tokomairiro at West Branch Bridge	0.473
Luggate Creek at SH6 Bridge	0.319	Turner Creek at Kinloch Road	0.361
Manuherikia at Blackstone Hill	0.195	Upper Pomahaka at Aitchison Runs Road	0.271
Manuherikia at Galloway	0.374	Waianakarua at Browns	0.094
Manuherikia at Ophir	0.625	Waipahi at Waipahi	0.374
Matukituki at West Wanaka Station	0.276	Waitahuna at Tweeds Bridge	0.526

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7.3. SoE Monitoring Biannual Update

Prepared for:	Data and Information Committee
Report No.	SPS2209
Activity:	Environmental - Water
Author:	Simon Wilson, Manager Regulatory Data and Systems and Susan Wells, Team Leader Data Systems
Endorsed by:	Richard Saunders, General Manager Regulatory and Communications
Date:	9 March 2022

PURPOSE

[1] This paper informs council about the extent and quality of data captured by the environmental monitoring network operated by the ORC Environmental Monitoring team. The report covers the period 1 July 2021 – 31 December 2021.

EXECUTIVE SUMMARY

[2] The Environmental Monitoring team currently maintains a hydrological network of 202 sites, of which there are 137 State of the Environment (SoE) sites and 65 project sites. This report focuses on continuous data sets captured by the network. These data sets are made up of a mix of telemetered data and data which is recorded continuously and downloaded during a visit by field staff. The report does not cover discrete water quality samples collected by field technicians. The monitoring network includes surface water hydrography, water temperature, rain fall, ground water and dissolved oxygen.

[3] This paper is designed to inform Council about the performance of the hydrological network. It does not outline change to individual environmental parameters and thus does not describe the state of the environment in Otago or any environmental changes.

RECOMMENDATION

That the Committee:

1) ***Notes*** *this report which provides an SoE Monitoring Biannual Update.*

BACKGROUND

[4] Environmental monitoring is a core function of the ORC and forms the basis for environmental analysis, planning, compliance monitoring, flood prediction and flood monitoring. Data is also used by a range of external stakeholders.

[5] The monitoring network operates 365 days a year and relies strongly on continuous on-line field measurements, that are telemetered back to the office. This is complemented by manual in-field validation measurements. In addition to telemetered sites, a wide range of parameters such as water temperature or level in some groundwater bores are downloaded from deployed sensors during field visits and verified during additional manual measurements.

[6] The monitoring network is differentiated into standard SoE sites and project sites. Project sites are installed based on requests from other teams (mainly the Science team) and are generally designed for temporary investigations. However, these sites frequently become a permanent part of the network.

[7] Data quality is coded against National Environmental Monitoring Standards. Quality codes range from 600 to 100. QC600 (good quality) and QC500 (fair quality) both describe a high level of accuracy and differ operationally. Further codes are QC400 (poor), QC300 (synthetic), QC200 (raw data), and QC100 (missing data). Telemetered data enters the Council systems as QC200 until it is checked by the Environmental Monitoring Field Team against measurements taken in the field and graded. This grading is then checked and approved by members of the Environmental Monitoring Data Team.

DISCUSSION

Surface Water Hydrography:

[8] A key component of SoE reporting is data on river level (stage) and flow (discharge) which are produced from a combination of telemetered sites continuously measuring the water level in the rivers and rating curves verified by field measurements undertaken by Environmental Monitoring staff. The quality control target for SoE surface water measurements is QC500 or better, depending on site and installation type. 78% of the captured stage data was at QC500 level or higher. Of the flow data, 85% of the captured data was QC500 or higher.

Rainfall:

[9] For the SoE rainfall sites, 60% of data was reported as QC600, while 14% was coded to OC500. 22% of the captured data remain unverified (QC200).

Groundwater:

[10] The groundwater sites performed well, with 77% complying with the set target of QC500.

Water quality:

[11] 73% of the water temperature data collected has been graded QC500 or QC 600. A further 23% is currently graded as QC200. Data quality of the deployed oxygen sensors was 77% QC500 or higher with the remaining fraction largely yet to be processed (QC200).

General trend in data quality:

[12] Data capture and quality produced of the ORC environmental monitoring network are of a high standard overall. The last update to Council identified a backlog in grading data as a result of the move to Aquarius. This backlog has now been resolved. The data captured in the 2021 calendar year saw slight increases in the proportion of data graded as QC500 and QC600.

CONSIDERATIONS

Strategic Framework and Policy Considerations

[13] Data from the SoE monitoring network are used for strategic planning and policy development.

[14] The SoE and project sites are being used to support the development of the Land and Water Plan. The SoE Network also supports air quality modelling in compliance with the National Environmental Standard and Regional Air Plan. It will inform the Regional Air Plan Review planned in 2022.

Financial Considerations

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

Significance and Engagement Considerations

[16] The Environmental Monitoring team is an essential service provider to ORC internal and external stakeholders, as well as to the public in general, and to Civil Defence. Data produced are of direct importance for guidance and decision making for public health and safety, environmental and cultural values, and the Otago economy.

Legislative and Risk Considerations

[17] Data reported to the highest quality standard are essential for natural resource management. For example, highly accurate river level and flow data are crucial for irrigation take allocations. This data is frequently scrutinized and challenged by stakeholders. Flood monitoring and modelling/prediction strongly depend on uninterrupted accurate data flow. Compromises in data quality and data capture can have adverse effects on Civil Defence decisions.

Climate Change Considerations

[18] Data from the SoE network monitoring network can be used to inform Climate Change Considerations.

Communications Considerations

[19] Data from the SoE network monitoring network are used to inform ORC internal and external stakeholders, as well as the public in general, and Civil Defence. Data are publicly available through the ORC-Water Info website (https://www.orc.govt.nz/managing-our-environment/water/water-monitoring-and-alerts). Flood alerts are available through region specific Twitter alerts. Water quality and air quality data are available through the LAWA website (https://www.lawa.org.nz/explore-data/otago-region/). Reports of historic data are frequently produced by the EM data team on request. – A new public data portal is under development.

NEXT STEPS

[20] The ORC SoE monitoring network will be reviewed following the introduction of the new Land and Water Plan.

[21] An update of data capture and data quality of State of the Environment and project hydrological monitoring will be provided to Data & Information Committee meeting. On a 6 monthly basis.

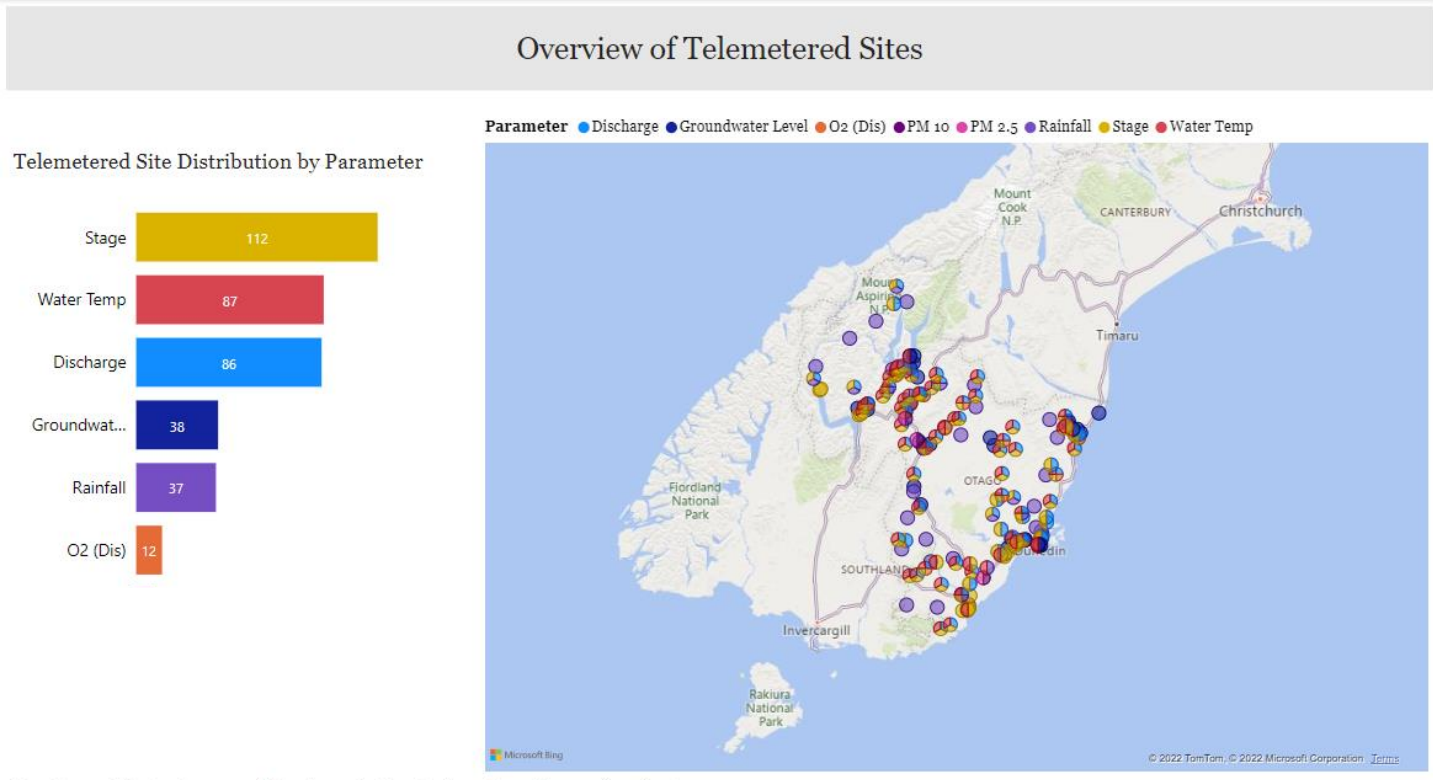
ATTACHMENTS

1. Biannual SoE Data Report [**7.3.1** - 7 pages]

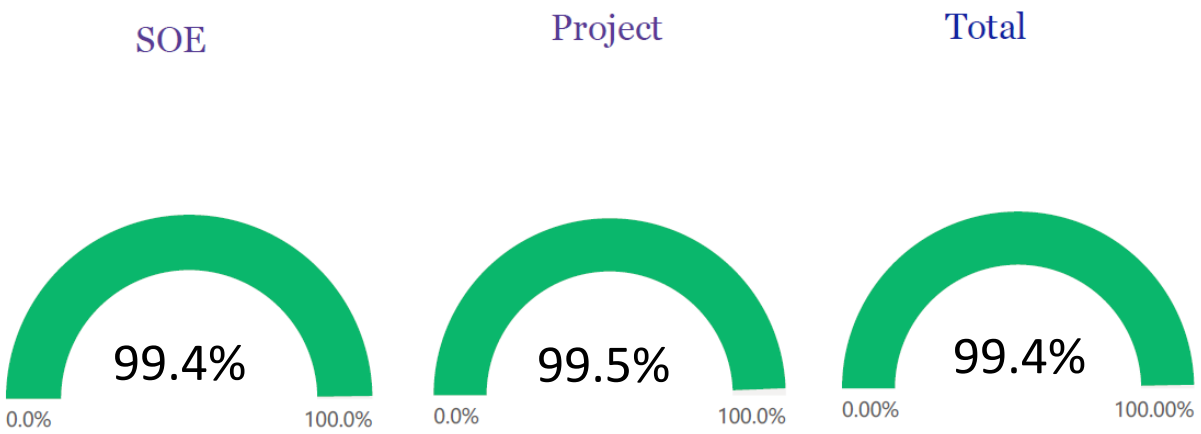
Environmental Data Report

Environmental Monitoring Team

01/07/2021 – 31/12/2021

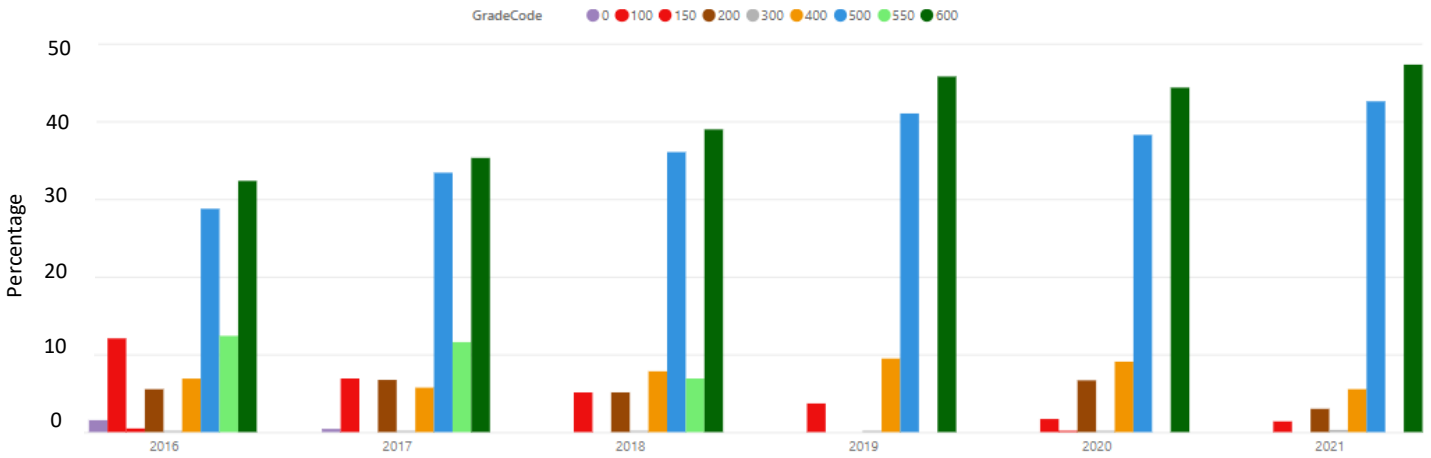

Overview of Telemetered Sites
Telemetered Site Distribution by Parameter
Stage 112
Water Temp 87
Discharge 86
Groundwat... 38
Rainfall 37
O2 (Dis) 12
Parameter Discharge Groundwater Level O2 (Dis) PM 10 PM 2.5 Rainfall Stage Water Temp
Mount Cook N.P
CANTERBURY
Christchurch
Timaru
Fiordland National Park
OTAGO
SOUTHLAND
Invercargill
Rakiura National Park
© 2022 TomTom, © 2022 Microsoft Corporation Terms

Percent of data captured during period of 01/07/2021 to 31/12/2021

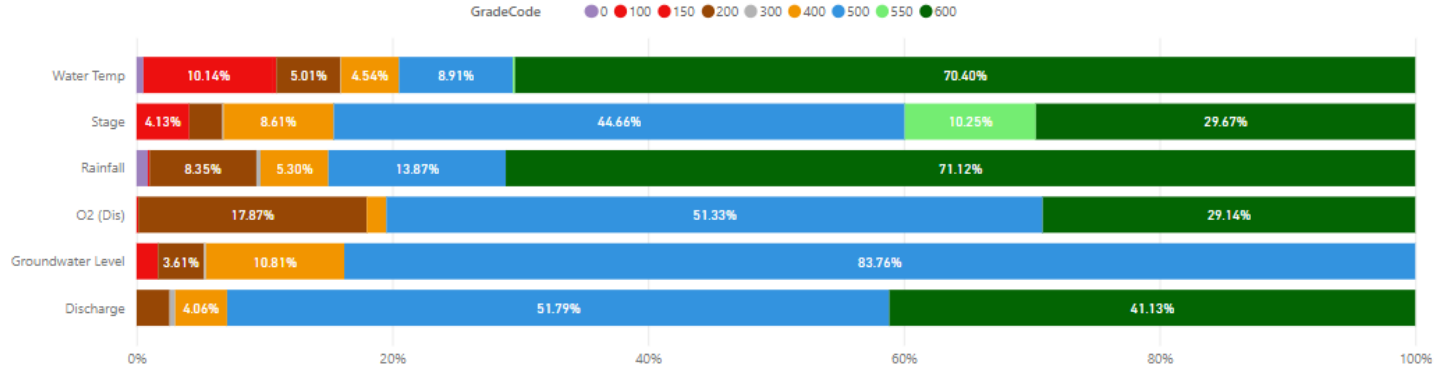


Data quality trends 2016-2021

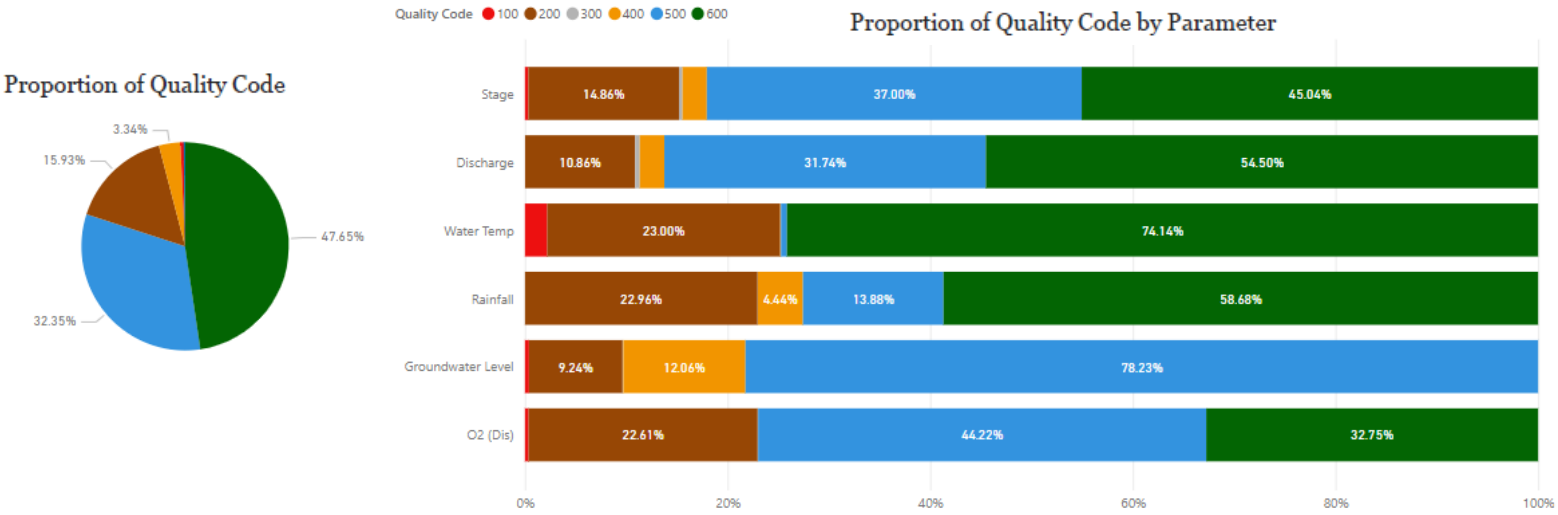
Proportion of quality code by year (2016-2021)



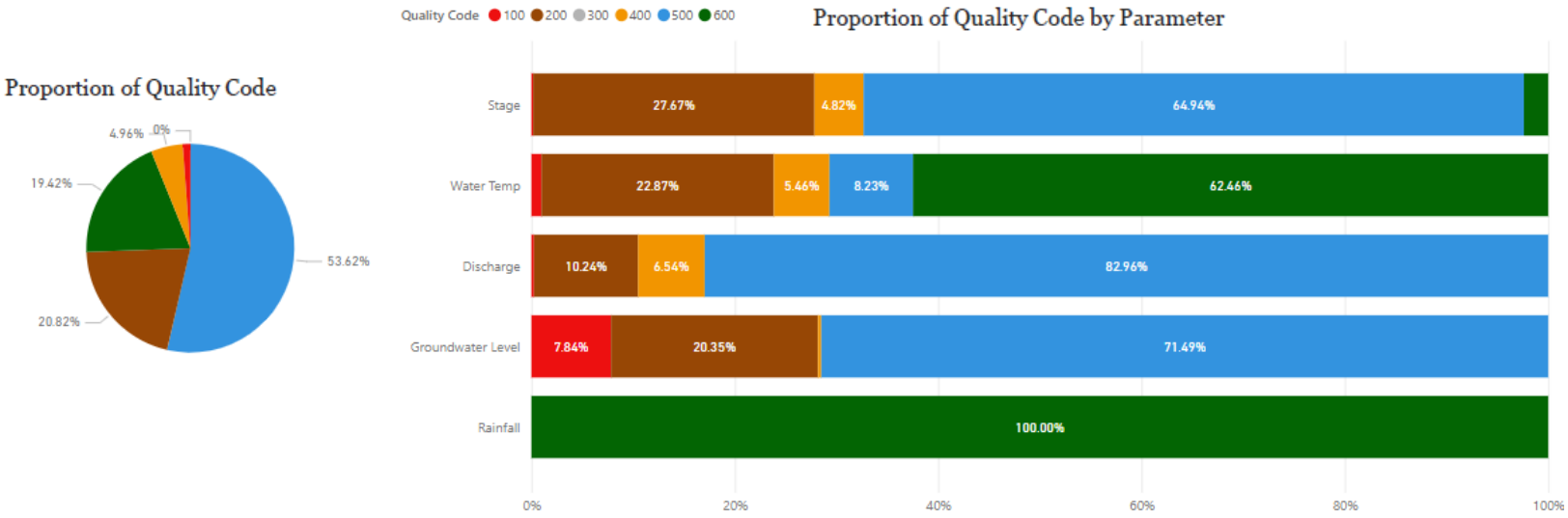
Proportion of quality code by parameter (2016-2021)



SoE site data quality during 01/07/2021 – 31/12/2021

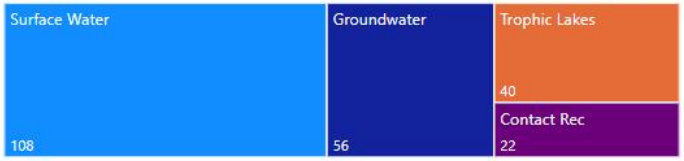


Project site data quality during 01/07/2021 – 31/12/2021

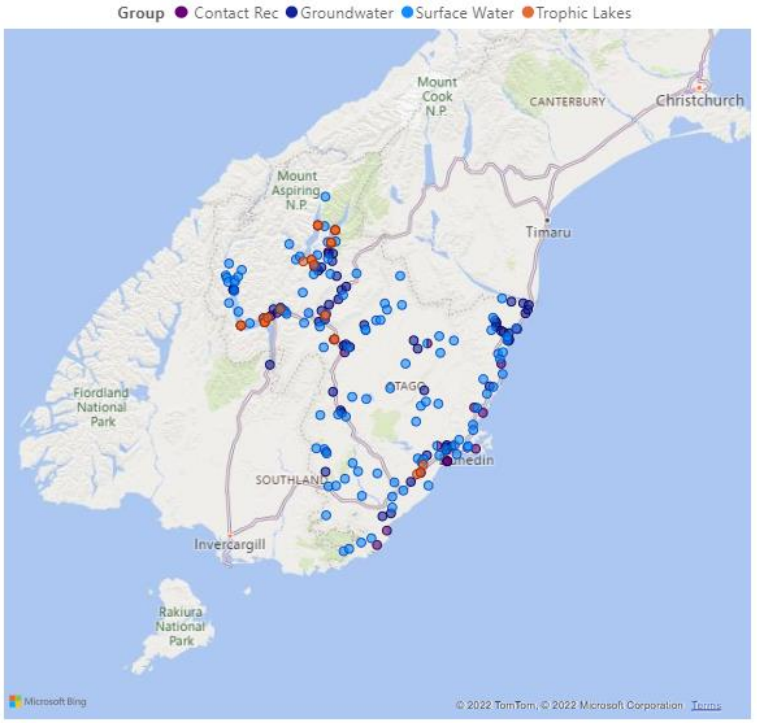


Overview of Water Sampling Sites and Runs

Site Count by Group (226 in total)



Distribution of Otago Water Sampling Sites



7.4. Quarterly Monitoring Report - Urban Development

Prepared for:	Data and Information Committee
Report No.	SPS2208
Activity:	Governance Report
Author:	Kyle Balderston, Team Leader Urban Growth and Development
Endorsed by:	Gwyneth Elsum, General Manager Strategy, Policy and Science
Date:	9 March 2022

PURPOSE

[1] To note the quarterly monitoring report, up to and including, December 2021, as required by Clause 3.9 of the National Policy Statement on Urban Development 2020.

EXECUTIVE SUMMARY

[2] This report presents the Quarterly Monitoring Report (QMR) to December 2021 (Appendix 1) as required by the National Policy Statement on Urban Development 2020 (NPSUD). The report covers the period up to and including the last quarter of 2021 and updates the last presented QMR which was to March 2021.

[3] This report builds upon the previous Quarterly Monitoring Reports and includes some new datasets and newly published data that extends the compulsory indicator timeseries data published in the last report. New datasets include Building Consent data showing new dwellings consented by generalised location and over time across the region.

[4] To avoid repetition, this quarterly update does not provide an equivalent depth of explanation or analysis to that provided in the initial two quarterly monitoring reports where timeseries data has been expanded by a few months, unless significant trend variations are noted.

[5] Of note is despite significant ongoing consenting activity and national negative net migration, prices (and rents) have risen at record rates nationally (to December 2021).

RECOMMENDATION

That the Committee:

*1) **Notes** this report and the Quarterly Monitoring Report up to and including December 2021.*

DISCUSSION

Housing Indicators Update

[6] The report covers a range of key NPSUD price and market efficiency indicators, at a high level and mostly looks backwards over the last 10 to 20 years. The NPSUD requires that the reports cover the following indicators:

i. The demand for dwellings
ii. The supply of dwellings
iii. Prices of, and rents for dwellings
iv. Housing affordability
v. Housing capacity realisation in greenfields and brownfields areas, and
vi. Available data on business land

[7] Data from the Ministry of Housing and Urban Development (MHUD) and the Ministry for the Environment (MfE) Dashboard, Statistics NZ and other sources have extended previously reported data series and only covers items i. though iv. inclusive.

Housing capacity realisation in greenfields and brownfields areas

[8] How to record, report, and analyse data on capacity realisation in green and brownfields areas is still being developed by the Tier 2 Territorial Authorities (TAs). This requires relatively sophisticated systems and records to first identify capacity at a site scale and categorise it to 'greenfields' or 'brownfields', and access to site specific consenting data to compare plan enabled capacity with take up, which would then need to be aggregated in some way and reported. Data will be reported when available.

Data on business land

[9] This data set is also underdevelopment as Tier 2 TAs start to implement Business Capacity Assessments to complement the Housing Capacity Assessments undertaken last year to inform the Future Development Strategy process. Data will be reported when available.

New Data: New Dwellings Consented Maps

[10] The *new dwellings consented* maps highlight the locations of new dwellings 'supplied' over the last 10 years. This will also reflect demand (as anticipated by developers and revealed by owner occupiers), to a greater or lesser degree modified by the opportunities available for development created by planning and infrastructure.

[11] Locations of consistent and concentrated high development interest are the Dunedin and Mosgiel urban areas, Queenstown, Wanaka and Central Otago. In contrast, areas of particularly low dwelling consenting numbers include the Strath Taieri, Inch Clutha, Palmerston, and Waikouaiti.

OPTIONS

[12] This report is for noting and reports publicly available data. No options have been identified.

CONSIDERATIONS

Strategic Framework and Policy Considerations

[13] This report is required under the NPSUD 2020 and provides a general overview of some key datasets to support evidence-based decision making around housing and development summarised to the TA or regional level.

[14] The report also supports ORC's Strategic Directions. In particular, it provides a sound evidence base of contextual information that supports ORC's role in contributing towards sustainable urban development. The information and analysis provided in Quarterly Monitoring Reports helps identify regional urban issues and challenges and enables ORC to work to address and overcome these. This includes working collaboratively with TAs to ensure integration of urban planning, infrastructure planning and environmental management.

Financial Considerations

[15] There are no financial considerations.

Significance and Engagement Considerations

[16] This does not trigger the Significance and Engagement Policy.

Legislative and Risk Considerations

[17] This report is required under the NPSUD 2020, a regulation of the Resource Management Act 1991. There are no risk considerations.

Climate Change Considerations

[18] There are no direct climate change considerations relevant to this report. However, projected population growth and housing demand has the potential to impact Otago's greenhouse gas emissions and development needs to be assessed in light of climate hazards such as flooding.

Communications Considerations

[19] There are no communications considerations.

NEXT STEPS

[20] Ongoing discussions are occurring with the region's TAs, particularly Tier 2 (Dunedin and Queenstown-Lakes who are also required to publish QMR reports, the other TAs are 'strongly encouraged' to do so) on how best to share data, insights and practice to ensure the QMRs provide actionable insightful information for decision making and decision makers at a range of scales and for a range of responsibilities.

ATTACHMENTS

1. 2021 Q4 Urban Development QMR [**7.4.1** - 23 pages]

Quarterly Monitoring Report, to Q4 2021

National Policy Statement on Urban Development

Otago Regional Council

Contents

Figures

Data Sources, Coverage and Time

[1] Most data are provided at the district level for all districts in the region. The report includes Clutha District, which is not subject to the monitoring requirements of the NPSUD; and all of Waitaki District, of which part is in Canterbury Region. As such, regional figures may vary between the 'sum of TAs' (i.e. including all of Waitaki) and 'regional' figures (including only part of Waitaki) but this has very limited impact on overall housing related patterns at the regional level. Data reported is to the end of December 2021, where available.

[2] Provision of a regional overview, complementing more specific and targeted local monitoring undertaken by TAs is considered appropriate given ORC's limited role in the day-to-day urban planning and consenting processes (acknowledging ORC's limited functions in these spaces, relative to the TAs), and ORC's regional 'big picture' perspective and regional function. This regional information will also provide local authorities, developers and other stakeholders with a regional benchmark, enabling more targeted actions to be taken where required.

[3] The regional quarterly monitoring reports will focus on providing a longer term, regional baseline at the district level and overview for the limited number of key public and compulsory datasets, and highlight the availability of new or particularly relevant data where and when it becomes available.

[4] More detailed (higher spatial resolution and some commentary) information for the regions Tier 2 urban environments is available for Dunedin and Queenstown via the respective territorial authority quarterly monitoring reports.

a. Dunedin City provides a 'live' data site that is updated when data comes to hand: https://www.dunedin.govt.nz/council/district-plan/monitoring-and-research/monitoring-and-research-housing-market-and-population-trends
b. Queenstown-Lakes District produces quarterly reports: https://www.qldc.govt.nz/your-council/council-documents/national-policystatement-urban-development-2020-nps-ud#quarterly-reports

[5] Ministry for the Environment (MfE) and Ministry for Housing and Urban Development (HUD) also jointly publish the urban development dashboard, which contains some key inputs (market indicators and price efficiency indicators) required to be monitored, and also analysed and considered during the development of FDS and HBAs, available here: https://huddashboards.shinyapps.io/urban-development/

Dwelling Demand

[6] The previous report included a detailed discussion of long term demand based on overall quantum and demographic makeup changes projected by Statistics NZ for the region and its TAs. Each TA also commissions regular updates and customised spatial area relevant to their area (for example, QLDC includes short term visitor projections) that can vary from SNZs coarser resolution and less regularly updated 'sub-national' figures. ORCs own non-financial forecasts for the LTP encompass the sum of the TAs projections.

[7] This report focusses on more recent changes to net national migration data from SNZ. The headline figure is that national net migration has been very low, and last month dipped negative. However, parts of Otago are possibly growing as a result of internal migration even as national net migration has dropped below zero. The data does not provide reasons for this but this will be a result of a relative changes in the strength of pre-existing 'push' and 'pull' factors, the relevance of which will vary from person to person and household to household. Globally, Covid has resulted in many people considering what is important to them and making changes in their lives, living situations and work, to increase personal and family wellbeing.

[8] Push factors may include:

a. Rapid price escalation on top of already high prices in locations such as Auckland and Wellington affecting relative affordability particularly for public sector workers (who may receive similar pay irrespective of location);
b. A desire for more internal and external space (for working/schooling from home and the opportunity for greater self-sufficiency) and a converse reduction in the attractiveness of more intensive living;
c. Reduced attractiveness of busy urban places (covid hesitancy)

[9] Pull factors may include:

a. High sales prices in other areas enabling dwelling quality upgrades in other areas
b. Relative housing affordability (slightly lower percentage price increases on a much lower base);
c. Pre-existing amenity and attractiveness of Otago region - for example, anecdotally Queenstown has seen an influx of early retirees effectively replacing younger working travellers, effectively people have accelerated existing plans to move on retirement;
d. Significant employment opportunities at similar pay rates (or at least relative to living costs) to elsewhere

[10] Understanding the push and pull factors will be key in addressing any consequential impacts on future growth in terms of overall quantum, and demands for particular locations and dwelling types as result - for example these factors may reveal as increased demand for larger dwellings and/or sites, such as more suburban or lifestyle blocks less efficiently served by infrastructure including public transport for higher paid remote workers, at the same time as affordability concerns increase demand for more intensive developments close to workplaces or key services for other market sectors.

[11] Figure 1 below shows the components of national net migration showing that the negative net migration of non-citizens has outweighed the positive net migration of NZ citizens:

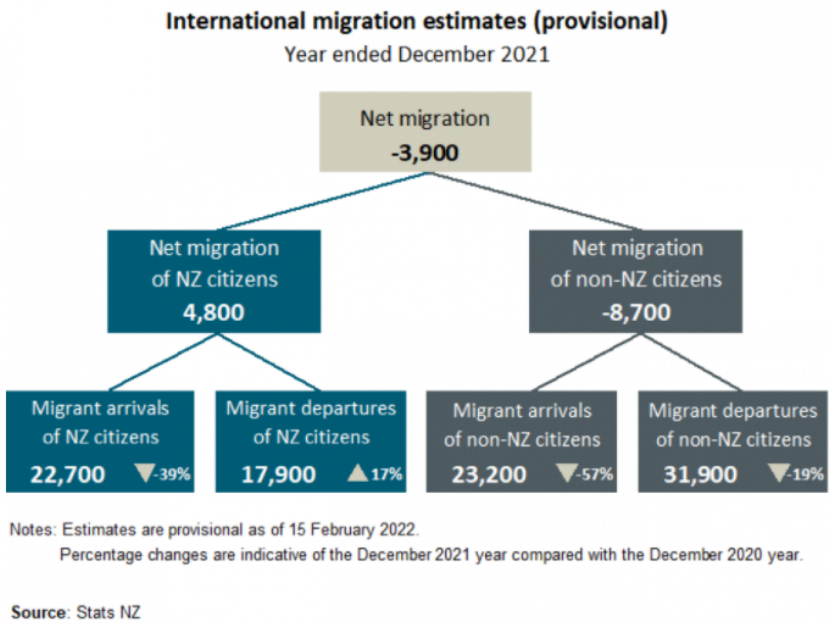


Figure 1: Provisional international migration estimates – year end December 2021: Statistics NZ

[12] Long term migration data for NZ highlights the impact of closed borders on net international migration, a key source of population growth in New Zealand, as illustrated in Figure 4. Otago's population growth is dominated by the impact of net migration, which includes international movements as well as internal migration which has been less restricted particularly in lower Covid-19 alert levels. Of note is the change from a long term ~10000 monthly net migration, a pre-covid peak (in both arrivals and departures) followed by nearly 2 years of near zero migration driven population change.

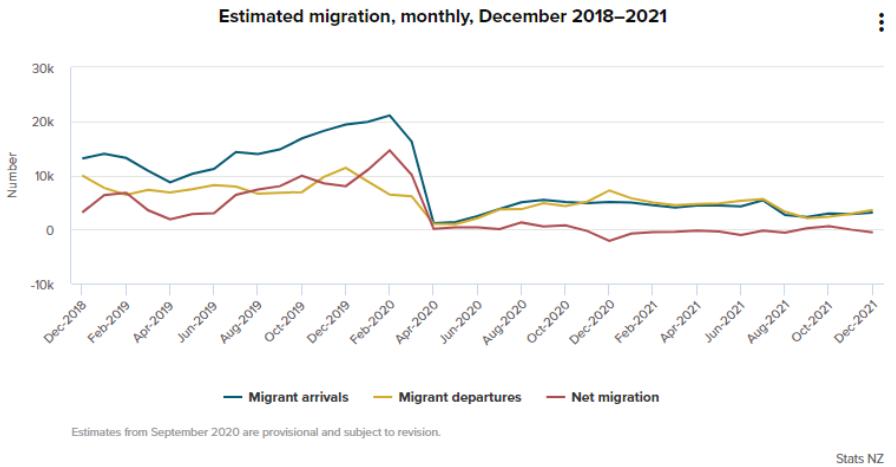
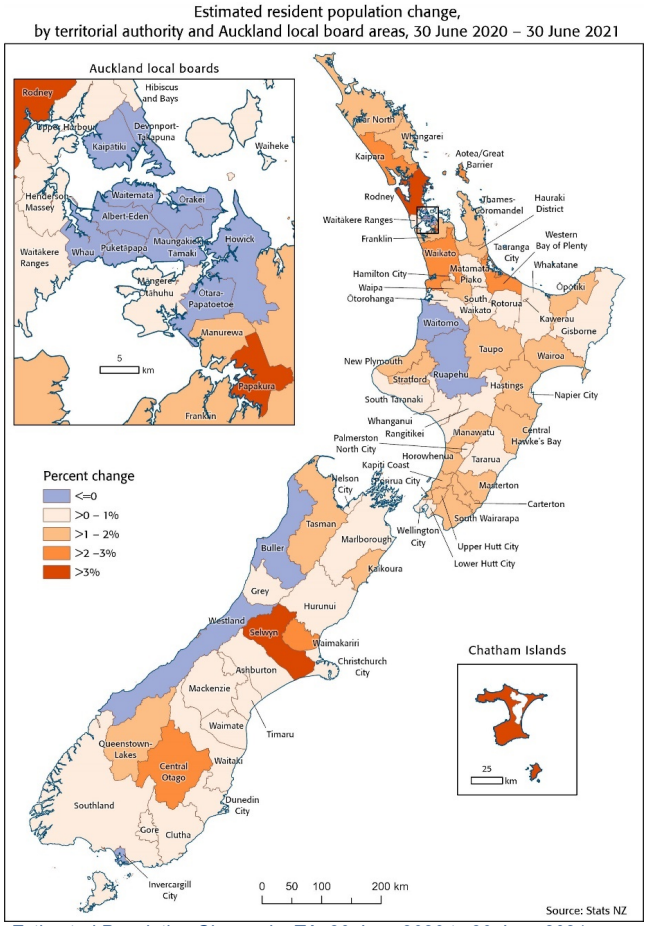


Figure 2: Monthly Net Migration, Dec 2018 to Dec 2021, Statistics NZ

[13] Figure 3 below shows more detail how these headlines have played out across the country. The TA level population estimates provides some detail of estimated resident population changes with Queenstown-Lakes and Central Otago showing 1 to 3% population growth in the June 20-21 year and many Auckland local boards also showing their first ever recorded population decline (along with the Auckland region as a whole).



[14]

Figure 3: Estimated Population Change by TA, 30 June 2020 to 30 June 2021

[15] It is also suggested that post-covid environment has seen a shift in people's preferences towards a desire for more internal space (for work and schooling from home) and external space (for separation/safety and self-sufficiency) which is more costly on a like for like basis. Combined with rising prices in Auckland and Wellington along with rapid changes in workplace acceptance of remote working (particularly for corporate and government jobs which tend to be higher paying) this has lead to significant reported

interest for properties in the region from the rest of New Zealand. This is most notable in Queenstown, where despite the near collapse of the tourism dominated economy, house price rises have accelerated even faster.

[16] Another factor underlying the acceleration of existing trends is the impact Covid has had on workplace attitudes to flexible working. This may play out not just inter-regionally (why battle traffic daily in Auckland when I can zoom in from Queenstown?) but also in terms of within and around cities and towns as previously 'unacceptable' daily commutes become tolerable when undertaken less frequently (e.g. coming into the Dunedin office from Lawrence once a week is more doable, rather than taking the same commute daily). This may imply increasing growth in smaller towns and increasing pressure for rural lifestyle and potentially, a reduction in demand for more intensive developments from buyers who no longer require physical proximity to their workplaces[1].

[17] Figure 4 below also shows a significant net migration loss in Auckland and Wellington and a gain in Dunedin - net migration comprising some 20% of growth. The more detailed tables shows that over 70% of Central Otago's growth was from internal migration, and the area was also one of the fastest growing areas in the country with its estimated population growing by 580 persons, or 2.4% (or ~1 new resident for every 40 existing residents), which is more in total than Dunedin (which has a much larger existing population).

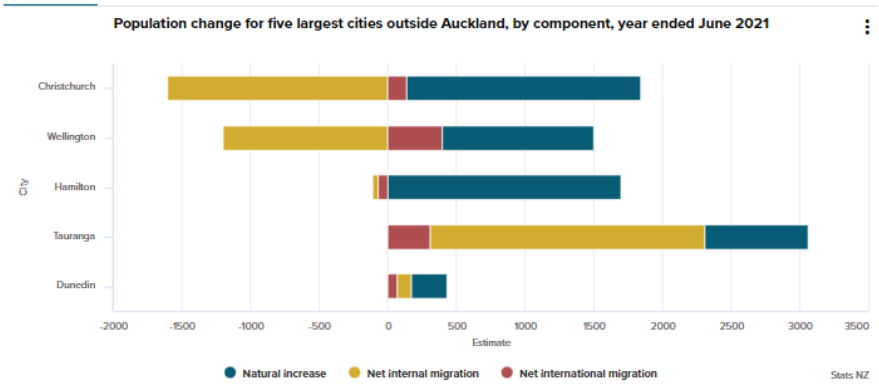


Figure 4: Population Change by Component for 5 largest cities outside Auckland

1 https://www.nzherald.co.nz/lifestyle/the-spinoff-everything-you-need-to-know-about-apartments-and-omicron/ZQGZVBHLL5CWICYNQLUAG7IEIU/

Dwelling Supply:

[18] Dwelling supply is typically measured by Building Consents, as all new residential buildings require a Building Consent under the Building Act 2004. A building consent provides a leading indicator of a very strong intention to develop given the time and costs involved in preparing the documentation needed, over and above council fees. A high proportion of building consents granted are ultimately commenced. We are not currently monitoring completion rates (this would involve Certificate of Code Compliance tracking), but once commenced an even higher proportion of commenced projects are ultimately completed, using Auckland data as a guide, generally within 24 months of the issue of the building consent, albeit with significant project specific variation.

[19] New Dwelling Consented Numbers: Data for new dwellings consented on a quarterly basis for the last 10 years upto Q4 2021 for each TA in the region is shown in Figure 5 below. Data is sourced from Statistics NZ Infoshare tables.

[20] All TAs show a small decline in Q4 2021 relative to Q3 2021, but numbers remain above the longer term average.

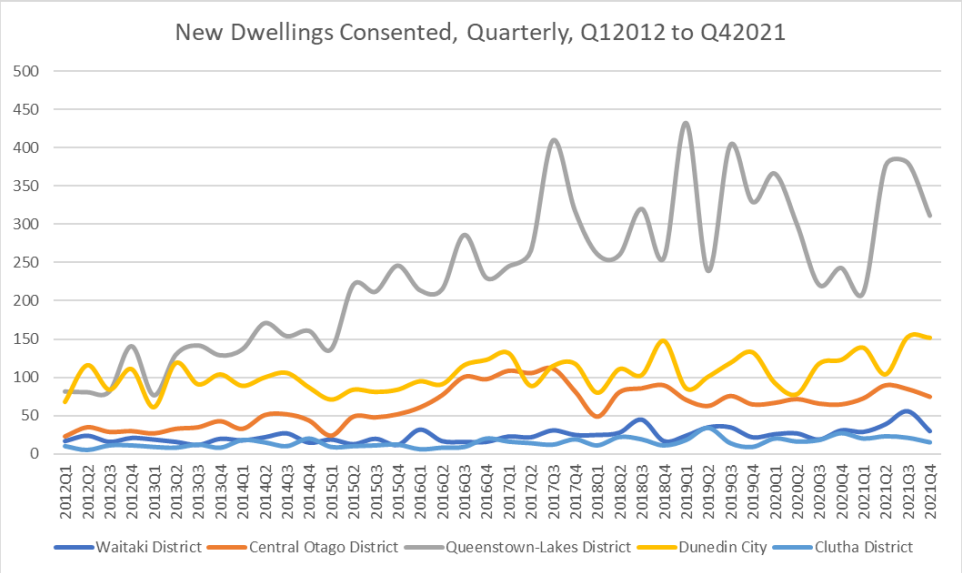


Figure 5: New Buildings Consented byt TA, by Quarter, last 10 years, Q12012 to Q4 2021 inclusive

[21] **New Dwelling Consented Types**: Data for the same period as Figure 5 is shown in Figure 6 below. This graph indicates the proportion of new dwellings consented that are Houses, or detached. The inverse of this measure is the proportion of dwellings that are 'attached', either townhouses, flats or other dwellings (which typically share a common wall, attached horizontally); apartments (attached vertically); or retirement village

units[1]. In effect this graph shows the level of more intensive development in the region indicating both revealed preferences and developer supply intentions.

[22] All TAs show a long term trend towards more intensive development over the 10 year period covered here (the linear trend for the regional proportion is indicated, dropping from 75% houses to 60%). Dunedin City in particular shows a larger than usual proportion consented in the last two quarters with less than 50% of the dwelling consented being houses for the first time in the last 10 years.

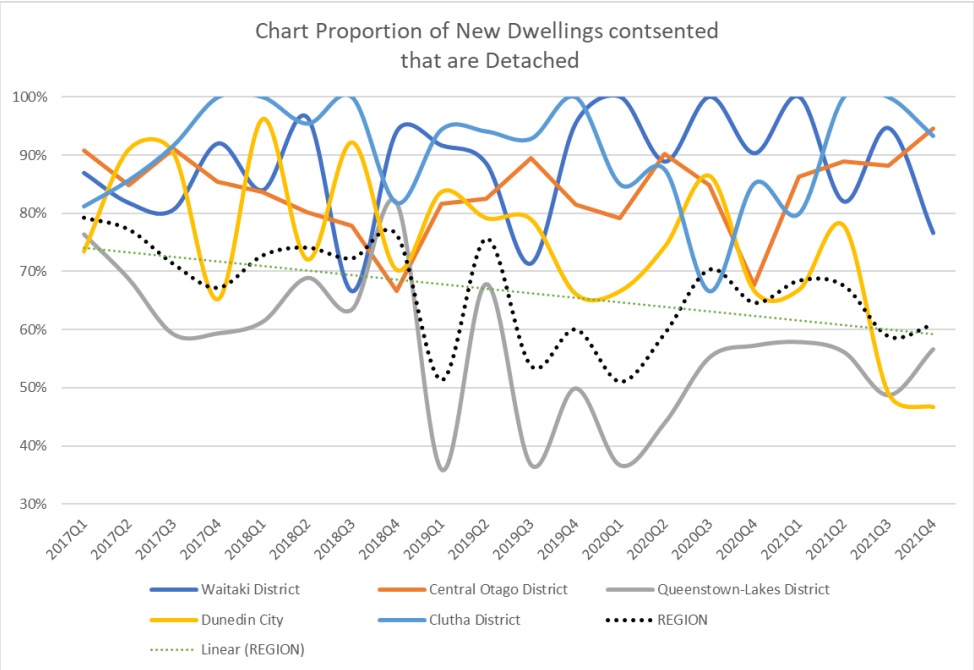


Figure 6: Proportion of New Buildings Consented by TA that are houses, by Quarter, last 10 years, Q12012 to Q4 2021 inclusive

[23] Figure 7 below shows the total proportion of dwellings consented that are houses over the last 10 years, with a low of 57% in Queenstown-Lakes, 75% in Dunedin, and conversely some 91% of consented dwellings in Clutha District were houses.

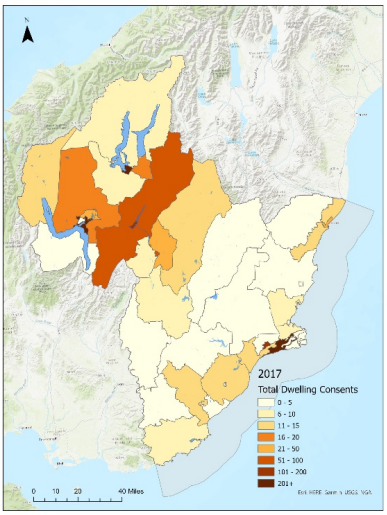
Proportion of new dwellings that are Houses (2012-2022)	Waitaki District	Central Otago District	Queenstown -Lakes District	Dunedin City	Clutha District	REGION
	88%	84%	57%	75%	91%	67%

Figure 7: Proportion of Dwellings Consented by TA that are Houses over the last 10 yeaRS

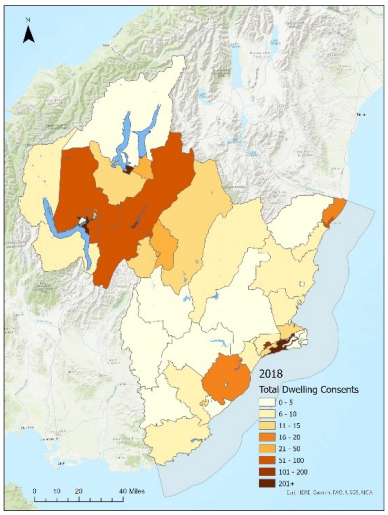
New Dwellings Consented by Location:

[24] Newly purchased long term building consent data from Statistics New Zealand allows the mapping of consents by location to census meshblock scale[1]. This allows us to identify where development has occurred in the past and track where it is occurring going forwards. The maps below highlight the last 4 years of new dwellings consented. Meshblocks have been aggregated to enable visualisation at the regional scale.

All Dwelling Consents - Otago



All Dwelling Consents - Otago



[1] This dwelling type category may not always be 'attached' to other units, but by definition are an integrated part of a comprehensive single site development and are typically more intensive.
[1] Unfortunately site or location specific data is not available other than to the TAs that supply the raw data to SNZ.

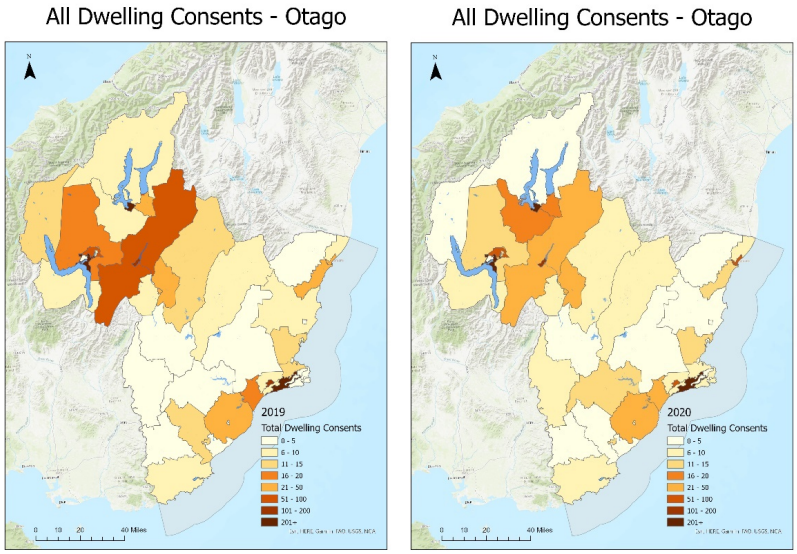


Figure 8: New Dwellings Consented, by year, 2017, 2018, 2019, 2020

[25] The below map shows the cumulative location of consents over the last 20 years from 2000 to 2020. The locations of past revealed preference provide a reasonable starting point for assumptions about where future demand is also likely to exist.

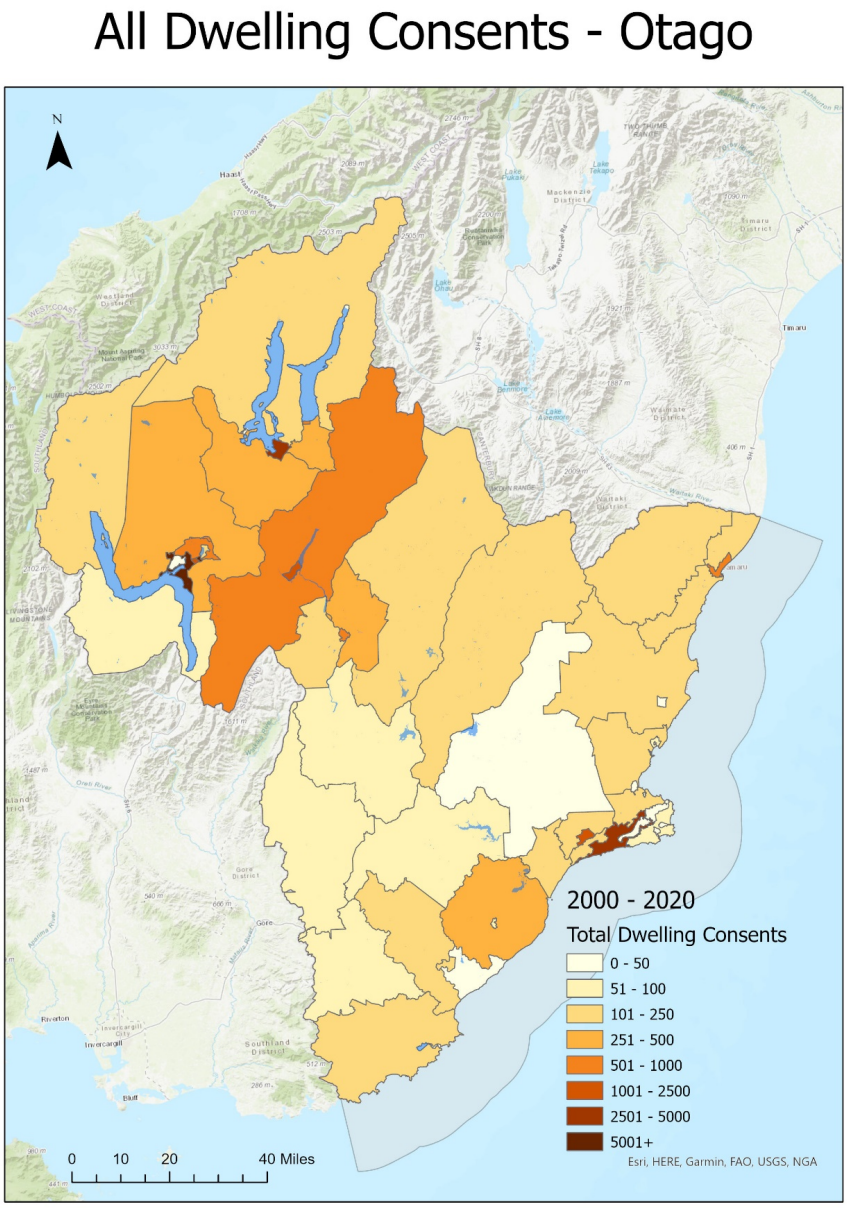


Figure 9: New Dwelling Consented, 2000-2020

[26] In addition to new dwellings, the data includes a wide range of other consents information. As a potentially useful example, the map below shows the cumulative unadjusted (nominal) value of works of consented farm buildings at the mesh block scale (rural meshblocks are larger so don't need aggregation for this purpose) highlighting where this investment has cumulatively occurred over time. Unsurprisingly these areas

appear to strongly corelate with areas of known more intensive farming activity, albeit the very low level of recorded investment in some areas is surprising.

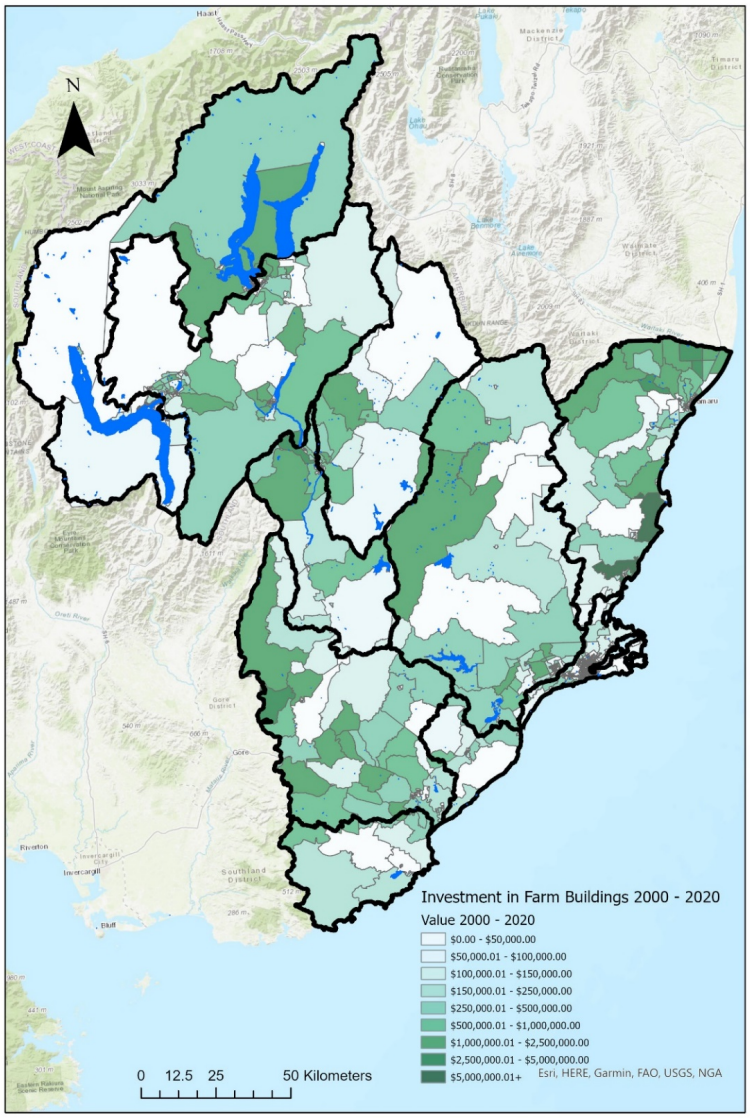


Figure 10: Cumulative Nominal Value of Works for Farm Buildings by Meshblock, 2000-2020

How responsive is housing supply to demand?

[27] Relationships between demand and supply responsiveness can be considered in many ways, the most simplistic by comparing dwellings consented (as a proxy for dwelling supply) with estimated household growth (as an proxy for demand a 1hh needs 1 dwelling basis).

[28] Figure 11 below shows the long run difference between annual estimated resident population change (dotted line) and 12 month rolling average building consents, lagged by 6 months (solid line).

[29] Ideally both lines will closely follow each other with any period where demand exceeds supply offset by a period of oversupply. Of particular note is the step drop in population change for Dunedin and Queenstown (compare previous notes re population change) not being matched (in Dunedin) with a decline in consents to date (there was an extended period of undersupply previously), however QT has dropped from a long period of record supply to a level not seen since 2017 but remains ahead of household growth.

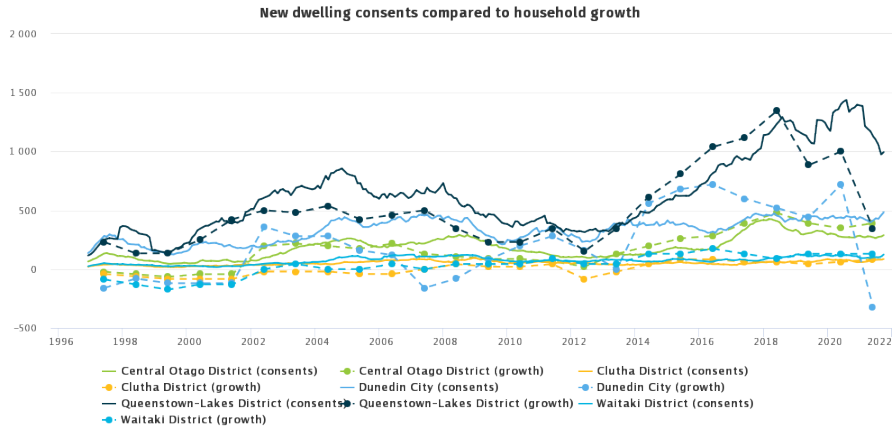


Figure 11: Supply Responsiveness - new dwellings consented to household growth

[30] Consents to Households Data Notes:

a. Source: https://huddashboards.shinyapps.io/urban-development/#
b. The number of new dwelling building consents is lagged by six months (presented as a 12 month rolling average), to account for the time taken from consenting to completion. It is not adjusted for non-completions, or for demolitions. It is used as a proxy for supply.
c. The most recent resident population, divided by the local average housing size, is used as a proxy for demand. Both sets of data are sourced from Statistics New Zealand.
d. The subnational population data is spurious and has been removed after 2013, outside of the 2013 and 2018 census. This is due to be reviewed by Statistics New Zealand late in October 2020.

Dwelling Prices and Rents

[31] Dwelling prices and rents reflect the point of intersection between demand and supply for housing. Price series reflect the average (or indexed) purchase price (or estimated overall value based on actual sales) of arms length sales of residential properties in a given time period, and rent is the average (or indexed) weekly rental payments made by new residential tenancies in order to live in houses owned by others (typically calculated from new bond lodgements).

[32] Because house prices and rents reflect different market segments, participants and motivations, the relationship between the two in the same market can often be as or more informative than considering either one alone. For example, where house prices are rising but rents are stable (or falling) could indicate a speculative asset boom fuelled by low interest rates, rather than a shortage of housing needed for household occupation. Where both are rising, particularly at increasing rates, this is more likely to indicate underlying housing shortages relative to demand.

[33] **Dwelling Prices:** Figure 12 shows 12 month rolling dwelling prices by TA. All areas have seen rapid acceleration in prices starting in 2016, and more noticeably a further step change in rate of increase since early 2021.

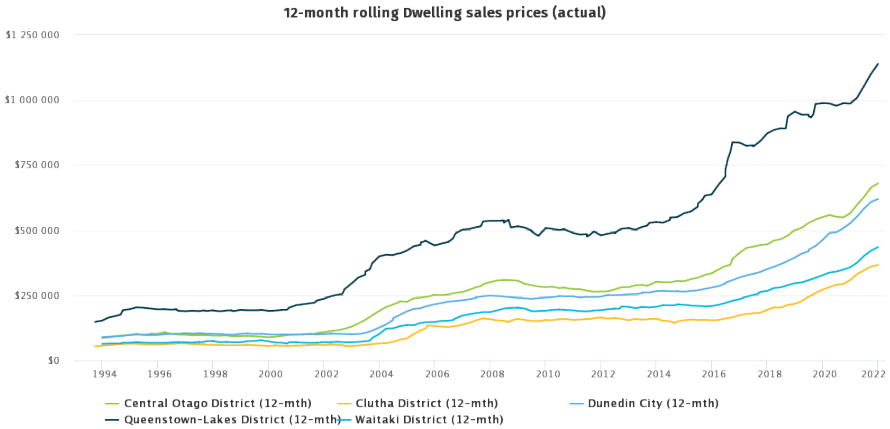


Figure 12: Dwelling Sale Prices by TA

[34] Dwelling Sales Prices Data notes:

a. Source: https://huddashboards.shinyapps.io/urban-development/#
b. This indicator shows the nominal median prices of residential dwellings sold in each quarter. This median price series is not adjusted for size and quality of dwellings.
c. 'Residential dwellings' include Houses, Apartments, Flats, and Townhouses only; and 'Sales' are those classified as 'market'.
d. Data is recorded from settlement date, and therefore lag unconditional sales (as reported by REINZ). The recent quarter's results should be considered 'weak' or 'provisionary' as there are administrative lags between sales and data collection.
e. Data is sourced from CoreLogic.

[35] **Dwelling Rents:** Figure 13 shows dwelling rents based on bond lodgements for new tenancies.

[36] All areas show relatively steady rises, particularly since 2016, without the significant jump seen in prices from 2021. Of particular note is the slower rate of rise compared to dwelling prices, and a significant drop in rents in Queenstown since 2020 most likely reflecting the combined effect of a Covid related drop in demand from tourism and tourism related workers, and the associated limitations on weekly rent from renters weekly incomes (limitations that do not play out in quite the same way in dwelling sales price indicators). The series does also show a slight uptick in the most recent data for Queenstown, but month to month changes should be treated with caution.

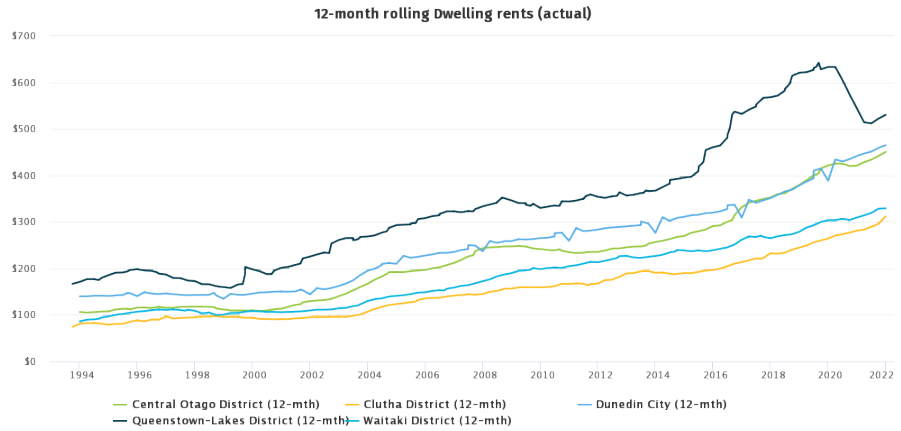


Figure 13: Dwelling Rents (Actual)

[37] Dwelling Rents data notes:

a. Source: https://huddashboards.shinyapps.io/urban-development/#
b. This indicator reflects nominal geometric mean rents as reported in new private rental bonds of Houses, Apartments, and Flats (not single rooms or Boarding Houses) that are lodged with Tenancy Services. The reason for using this mean is that rents cluster around round numbers, and tend to plateau for months at a time (spiking up by say $10 or $20 at a time). This makes analysis of time series difficult and using the geometric mean is a way of removing this clustering effect.
c. The recent quarter's results should be considered 'weak' or 'provisionary' as there are administrative lags between sales and data collection.
d. Data is sourced from Tenancy Services

[38] **Dwelling Rent to Price Ratio**: Figure 14 shows the ratio of dwelling sales price to rents. This indicator provides an indication of the relative balance between buying and rental markets. Significant variation from a long term trend or a nominally 'normal' value could indicate issues in one aspect of the market. The number on the Y axis is an indication of the number of years the median rent paid would take to pay for the median dwelling.

[39] Typically a 20 year repayment (or alternatively framed, a 5% yield, being that the rent received in a year is 5% of the property value) is considered a reasonable working average or 'normal' for commercially focused property investing. In this case a 'higher' number indicates prices are significantly higher than rents, and a lower number indicates rents are giving good returns to owners. The ratio on its own does not necessarily indicate that it is 'better' to rent or own, without consideration of the contributing price or rent. For example, it could be argued that a higher value is 'better' for renters rather than owners, particularly in the short term, but may also indicate a longer term reduction in rental provision. A consistent 5% average may hide significant rapid acceleration in both variables. Significant variation from 5% or long-term trends are indicative of relative shifts in one or other of the contributing variables.

[40] Of note is that most TAs were consistently operating within a 20 year ratio till 2020 when all show a noticeable increase in the ratio - as prices rose much faster than rents. Queenstown and Central Otago are both operating at a consistently higher ratio than the other TA areas probably reflecting the seasonal nature of peaky or seasonal tourism and worker demand, high proportions of holiday homes, and the potential effect of competition and options for landlords/property owners from higher priced short term rentals (e.g. Airbnb and similar) relative to longer term rentals. The >33% escalation of the already high ratio in Queenstown from 30 years (3.3% yield) pre 2020 to over 40 years (<2.5% yield) by end 2021 is particularly striking. This rapid change largely reflect rapid price acceleration above rents, with all TAs results indicating demand for houses to own (or invest in) significantly exceeds demand for houses to rent, noting also the stronger limits imposed on the potential for rent increases imposed by renters incomes.

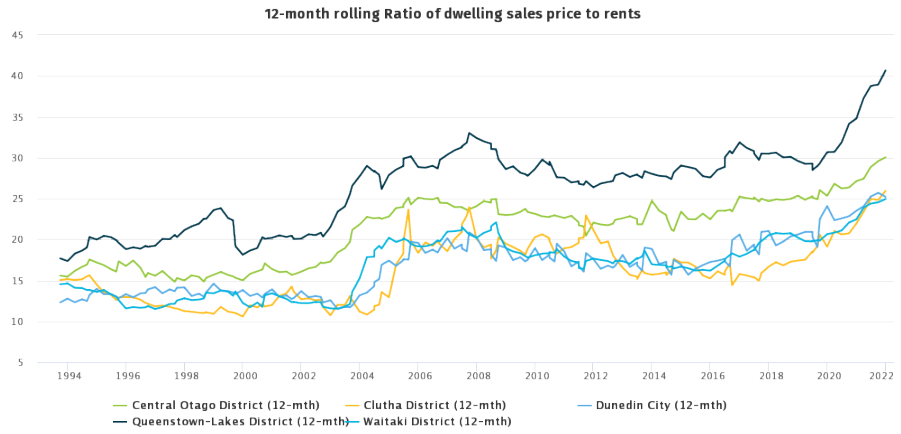


Figure 14: Dwelling sale price to rents ratio

[41] Dwelling price to rent ratio date notes:

a. Source: https://huddashboards.shinyapps.io/urban-development/#
b. This is a ratio describing the relationship between the median market Rent and the median Sales Price of residential properties, at a given time.
c. It depicts how many years of Rent would be required to meet the Sales Price.

Sales Volumes (Stocks and Flows)

[42] Sales volumes provide an indication of churn in the market.

[43] Figure 17 shows the 12-month rolling total for the total number of monthly sales. Sales are dominated by Dunedin, as it has the largest pool of houses.

[44] At this scale there does not seem to be a perceivable change in the general trends apart form an increase in volume over 2021, followed by a drop (noting most recent sales data is likely to be underreported and revised upwards in future updates)

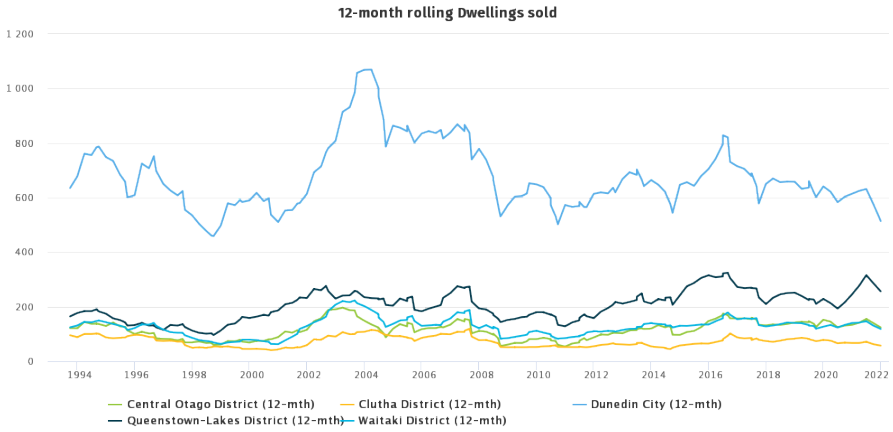


Figure 15: 12 month rolling total dwelling sold.

[45] Sales volume data notes:

a. This is the quantity of all dwellings sold.
b. The latest quarter of data is likely to be underestimated due to a lag between sales and data collection.
c. Data is sourced from CoreLogic

Housing Affordability

[46] Housing affordability measures are essentially ratios between a household's ability to pay and the price they pay for housing. There are a wide range of potential housing affordability measures from the simplistic "gross annual income to sales price ratio" measures that are useful for over time and across multiple locations comparisons, to more complex analyses better reflecting the reality of how people pay for housing and the money they have available to spend on it.

[47] The Ministry for Housing and Urban Development publish various Housing Affordability Measures (HAMs) on the Urban Development Dashboard but the data has not been updates beyond Mid 2019. New data will be presented if an when an update is made by MHUD.

[48] Despite the lack of MHUD Data the house price and rent graphs show rapidly increasing rent, and prices accelerating even faster. Incomes have not increased at the same rates, and it reasonable to assume that affordability is unlikely to have materially improved over the past 2 years particularly for lower income households.

Housing Capacity Realisation

[49] No reportable data at time of writing.

[50] Both DCC and QLDC are starting to improve internal capability to calculate and record capacity at the parcel level. Further work is also required to be able to track development (from building and or resource consents) against these site values particularly for brownfields areas. Greenfields developments are slightly simpler as predevelopment yields provided by applicants can be compared with consents received from those areas over time.

Recent Government Housing Policy Announcements

[51] On 20 December, the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021 was passed into law.

[52] This Act does two key things:

a. requires tier 1 councils in Auckland, and greater Hamilton, Tauranga, Wellington and Christchurch to change their planning rules so most of their residential areas are zoned for medium density housing.
b. creates a new streamlined planning process so these councils can implement the NPS-UD's intensification policies faster.

[53] The Medium Density Residential Standards (or MDRS) can be summarised as allowing upto three dwellings, 3 storeys high on most residentially zoned properties in a given urban environment, and include HIRB, coverage and some other common residential zoning rules.

[54] Changes to give effect to these provisions are called an Intensification Planning Instrument (or IPI) and must follow the Intensification Streamlined Planning Process (or ISPP). Tier 1 local authorities *must notify an IPI* (by August 2022) which is a year sooner than the NPSUD required.

[55] The Minister may also *require* a Tier 2 local authority to do so (this applies to Dunedin City and Queenstown-Lakes District) based on the Minister being satisfied that the district is experiencing an 'acute housing need' based on the medium multiple (median house price divided by median gross annual income) and any other relevant information.

[56] Tier 3 Local Authorities (Waitaki District and Central Otago District) may also make *a request* to the Minister based on an assessment of 'acute housing need'.

[57] Of particular interest is the use of median multiples despite this being dismissed as a useful metric for NPSUD reporting as the relationship between incomes and house prices is a poor proxy for measuring household level affordability particularly at a fine temporal or spatial scales and affordability is a function of many other factors (mortgage interest rates, deposit size and equity etc). This possibly reflects the politically driven bipartisan approach to the very speedy amendment with very limited consultation timeframes, rather than the more considered, and public approach taken with ministry driven initiatives.

[58] The median multiple is generally considered only as a useful indicator of *relative* housing affordability (for first home buyers particularly) between disparate locations over time. Nevertheless, the choice of the median multiple measure as a trigger does have some implications for the region, as Queenstown's median house prices are consistently the highest in the country and incomes are generally lower, resulting in a high median multiple.

[59] Data from interest.co.nz median multiple tracker shows for example that Dunedin with a median house price of $670k and an income of $85k has a ratio of 7.85 in Jan 2022, but Queenstown with a much higher mean house price of $1,302k, but slightly lower income of $75k has a ratio of 17.29, which is significantly higher than all other reported

ratios including Tier 1 areas (the next highest figure reported is 12.69 in the Manukau area of Auckland ($1,200k/$95k).

[60] Figure 16 below compares Queenstown and Dunedin ratios with other available South Island centres, NZ and Auckland over the last 2 years.

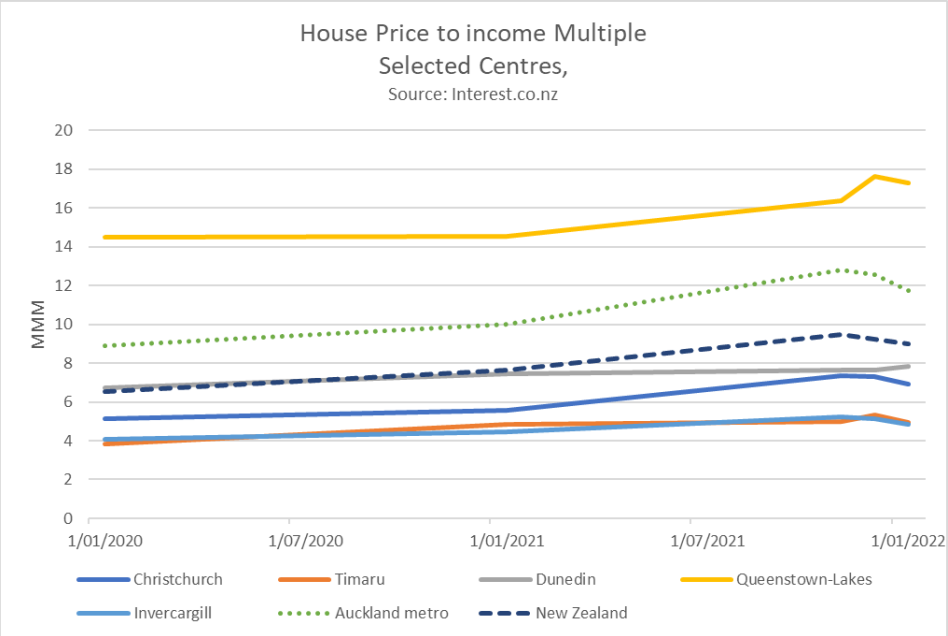


Figure 16: Median Multiple for selected South Island centres, NZ and Auckland

[61] House Price to income multiple data notes:

a. Source: https://www.interest.co.nz/property/house-price-income-multiples
b. Median house price: Median house prices are as reported by the Real Estate Institute of New Zealand. Although the REINZ series is more volatile than the QV equivalent, there is a highly positive correlation between the two series. The REINZ series is more current and offers an earlier indication of market trends. Unfortunately, the new RBNZ-REINZ stratified house price index series does not have enough detail to be used in this analysis.
c. Median household income: The household income for a standard household is made from one full time male median income, 50% of one female median income, both in the 30-34 age range, plus the Working For Families income support they are entitled to receive under that program. This standardised household is assumed to have one 5 year old child. Incomes are before tax and retrieved from the Statistics NZ / IRD LEEDS income series. LEEDS data are subject to revision. Work continues to more exactly match median incomes to local authority boundaries.

Business Land Data

[62] No reportable data at time of writing.

7.5. Queenstown and Dunedin Patronage Report

Prepared for:	Data and Information Committee
Report No.	PPT2202
Activity:	Transport: Public Passenger Transport
Author:	Julian Phillips, Implementation Lead - Transport
Endorsed by:	Gavin Palmer, General Manager Operations
Date:	9 March 2022

PURPOSE

[1] To update the Committee on the performance of its public transport (bus and ferry) and total mobility services for the first and second quarters of the 2021/22 financial year.

EXECUTIVE SUMMARY

[2] In Dunedin, 2021/22 patronage, year-to-date January 2022, is lower, at 1,308,550 trips (-17% overall) than the corresponding 2020/21 period, largely due to the impacts of COVID-19 restrictions through August and September 2021 which have negatively impacted patronage.

[3] Fare-free travel in July and August 2020 resulted in exceptional levels of patronage during those months, returning to typical levels in September and October 2020. Comparing year-to-date January 2021/22 data, with pre-COVID year-to-date January 2018/19 data, patronage has decreased by 9% and this figure is a more realistic indication of the impact of COVID restrictions on boardings.

[4] Fare revenue for Dunedin for the same period is significantly higher (+33%), despite the continuation of the $2 fare trial. This is due to fare-free travel through July and August 2020, with the Bee Card introduced in Dunedin on 1 September 2020, alongside the introduction of the $2 flat fare trial.

[5] Queenstown public transport activity remains significantly affected by COVID-19. For the 2021/22 financial year to date, patronage is lower, at -16% overall, compared to 2020/21.

[6] Fare-free travel in July, August and up to 15th September 2020 (Bee Card launch date for Queenstown) resulted in higher levels of patronage during those months than might be expected for the period, decreasing in September and October 2020. However, even during the fare-free 2020 period, patronage in Queenstown was significantly down from previous years due to the border closure.

[7] Comparing year-to-date January 2021/22 data, with pre-COVID year-to-date January 2018/19 data, Queenstown patronage has decreased by 44% and this figure is a more realistic indication of the impact of COVID restrictions on boardings.

[8] 657 complaints were received for the period July 2021 - January 2022, across both the Dunedin and Queenstown networks, equating to 0.04% of the trips taken for this period, and an average of 94 complaints per month [1]. This compares to an average of 120 complaints per month in the previous financial year.

[9] At 22 February 2021, Otago has 58,525 registered Bee Card users. Of these active cards, 53.3% are registered. The Waikato region is of a similar size with approximately 30 buses more than Otago; their registration rate is slightly lower at 51%.

[10] On 17th November 2021, Otago had 54,364 registered Bee Card users, meaning that registrations are tracking at c.1,387 per month since the previous report.

[11] 109,736 cards have been issued and distributed in Otago, which equates to a little more than three quarters of the combined population of Dunedin and Queenstown.

[12] The accuracy of Real Time Tracking (RTI) in Queenstown has been increased with the data feed now being derived from a hierarchy of on-bus devices, with the primary source now being the Bus Driver Console (RITS ticketing device), followed by E-Road and Wi-fi hardware. This hierarchy is now being tested in Dunedin and will be introduced once testing is successfully completed. The completion of this will also result in RTI data being displayed at Bus Hub e-stops.

[13] The Queenstown Ferry service is included in this report for the first time. YTD fare revenue and patronage have both increased for financial year 2021/22.

[14] Fare revenue has increased by 8% from $149,325 to $161,217.

[15] Patronage has increased by 20% from 27,004 to 32,405.

[16] For Total Mobility, there was a decrease of 17.2% (10,896) in trips for Otago for YTD (July-October 2021) compared to YTD 2020 (July-October 2020) and an 18.4% (1,556) decrease in hoist trips for the same comparative period.

RECOMMENDATION

That the Data and Information Committee:

1) ***Notes*** *this report.*

BACKGROUND

[17] The Council (ORC) contracts public transport services in Dunedin and Queenstown to two transport operators; Ritchies and Go Bus. Network coverage is shown in Figures 1 and 2 (larger versions are in Attachments).

[18] Each Transport Operator is contracted to operate 'PTOM Units' (each unit being a collection of routes contracted to an operator, as defined by the 2014 Regional Public Transport Plan. PTOM stands for Public Transport Operating Model).

[19] There are 7 Units in total, 2 in Queenstown, both operated by Ritchies; and 5 in Dunedin, operated by both Ritchies and Go Bus.

[20] As can be seen in Figure 1, the Dunedin network comprises 23 routes that extend to Palmerston in the north and Mosgiel in the west. For the 2020/21 financial year, the Dunedin network carried 2,706,470 passengers; in the 2019/20 financial year, it was 2,199,254 passengers and 2,548,330 for 2018/19, noting that 2018/19 is the last full financial year where patronage was not affected by COVID restrictions.

[21] For the 2021/22 year to date, the Dunedin network has carried 1,308,550 passengers. This is 17% lower than the previous financial year (1,580, 465) and 9% lower than the last pre-COVID financial year 2018/19 (1,439,161). The 2021/31 LTP has a target to increase in patronage for 2021/22.

[22] The Queenstown network comprises five routes that extend to Arrowtown in the east to Jack's Point in the south (see Figure 2). For the 2020/21 financial year, the Queenstown network carried 889,063 passengers; in the 2019/20 financial year, the Queenstown network carried 1,249,503 passengers and 1,468,057 in 2018/19, noting that 2018/19 is the last full financial year where patronage was not affected by COVID restrictions.

[23] For the 2021/22 year to date, the Queenstown network has carried 465,514 passengers. This is 16% lower than the previous financial year (553,691) and 44% lower than the last pre-COVID financial year 2018/19 (836,477).

a. The LTP targets an increase in patronage for 2021/22.

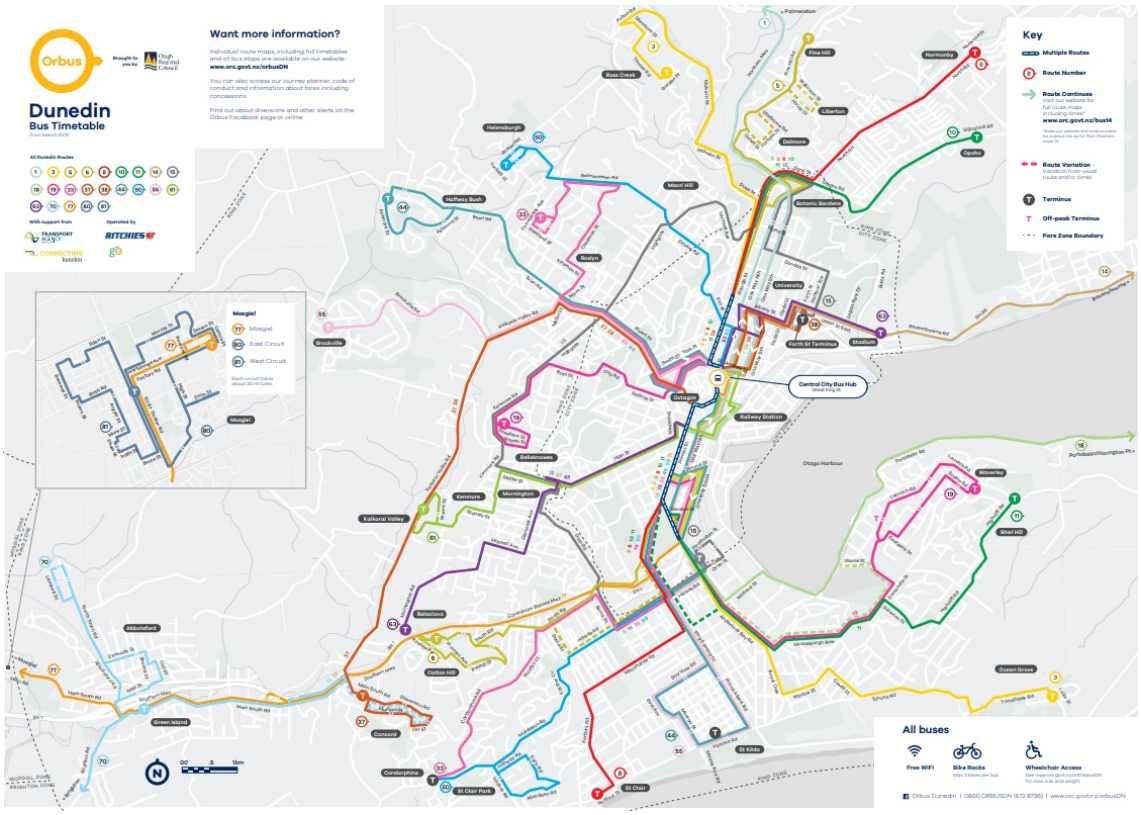


Figure 1: Dunedin network

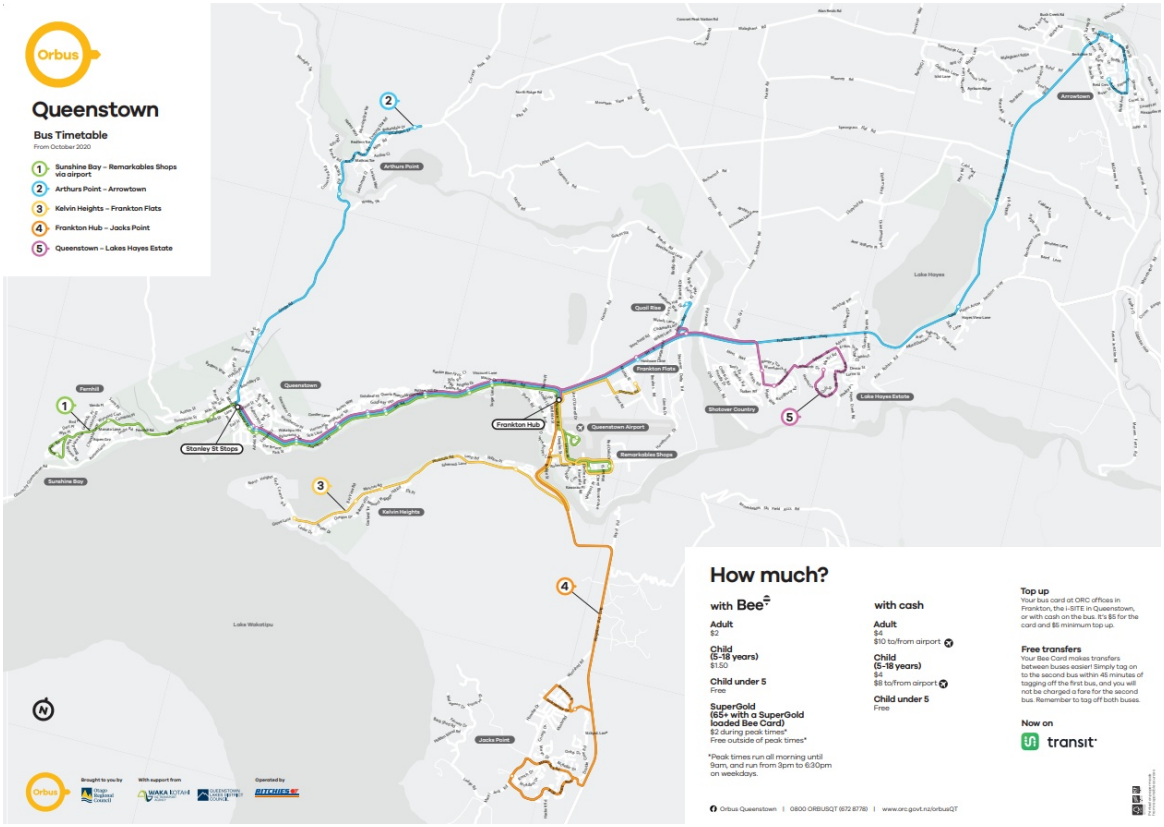


Figure 2: Queenstown network

[24] The following report summarises patronage trends across both networks, comparing the YTD Financial Year 2021/22 to the same comparative period in 2020/21, together with a comparison to the last full pre-COVID Financial Year, which is 2018/19. Monthly statistics comparing the previous years are also provided. It also addresses customer complaints and provides information on the Total Mobility scheme and use of the Real Time information system.

DISCUSSION

PUBLIC TRANSPORT – DUNEDIN

[25] In Dunedin, the impacts of COVID-19 restrictions continue to affect patronage, although it is is recovering.

[26] Patronage for the months prior to November 2021 impact the overall YTD comparison. These preceding months were affected by the Level 2, 3 and 4 lockdowns. Lockdown level 3 continued to 7th September 2021 and level 2 until 1st December 2021, superseded by the COVID-19 Protection Framework which remains in place at the time of writing.

[27] Year to date, Dunedin is tracking at 83% of the previous financial year, noting that in July and August 2020 travel in Dunedin was fare-free and therefore patronage was atypically higher for this reason.

[28] Comparing YTD 2021/22 against YTD 2018/19, the last full pre-COVID-19 Financial Year, Dunedin is tracking at 91%. This can be considered a more realistic measure of the effects of COVID restrictions on Dunedin's performance, being a comparison with a year unaffected by COVID-19 restrictions.

Dunedin	July	August	September	October	November	December	January	February	March	April	May	June	Totals
2018/19 Patronage	195,272	235,930	221,438	212,965	223,894	177,520	172,142	213,992	246,593	198,745	245,477	204,362	**2,548,330**
2020/21 Patronage	293,294	278,162	209,278	224,799	223,263	190,821	160,848	201,611	250,266	195,795	243,550	234,783	**2,706,470**
2021/22 Patronage	231,082	144,505	170,397	196,538	223,952	185,219	156,857						**1,308,550**

Figure 3: Dunedin patronage statistics Financial Year 2018/19 to 2021/22

[29] The chart below (figure 4) shows the annualised effect of the varying COVID-19 alert levels on patronage for Dunedin, together with the increases in patronage associated with pre-Bee Card fare-free travel periods:

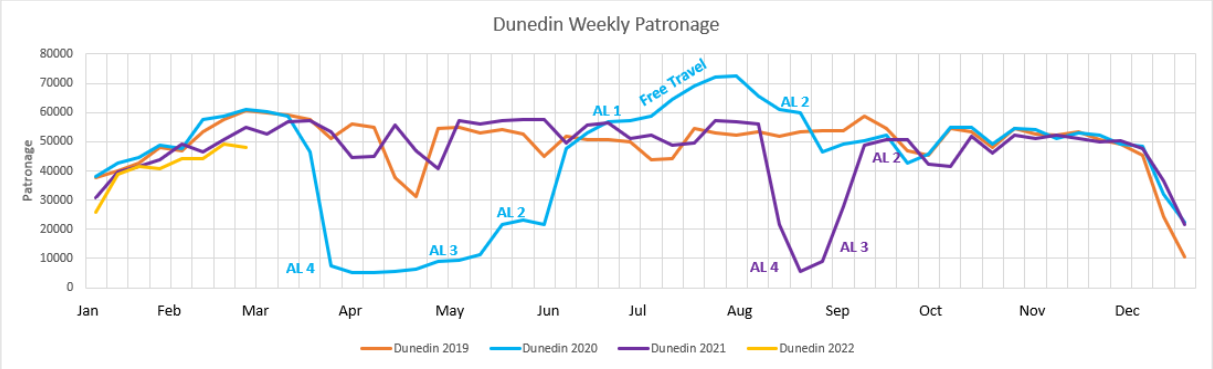


Figure 4: Effect of COVID-19 alert levels on patronage

Note on PTOM units

[30] Figures 5, 6 and 7 for Dunedin, and 10,11,12 for Queenstown, detail YTD patronage and revenue, including at a PTOM Unit level.

[31] PTOM refers to the Public Transport Operating Model, under which Government Legislation mandates all Public Transport services in New Zealand are operated.

[32] A unit, under PTOM, is a group of routes contracted to one operator and contains all of the timetabled services applying to the route or routes within that unit.

[33] A unit must be exclusive (so that the operator has full responsibility and market access on those routes 24 hours per day, on any given day).

[34] The unit also needs to be a 'marketable whole'; meaning they need to be a commercially viable unit.

[35] The benefit of exclusive units is that operators are motivated to grow and develop their patronage without the risk of sharing patronage (and revenue) with another operator.

[36] There will be roads where more than one route and operator will share patronage. The key requirement here is to coordinate timetables to optimise frequencies and to prevent uneven opportunities for patronage and revenue.

[37] ORC manages six units for public transport in Otago:

a. Unit 1, Ritchies (route 1 Palmerston, 14 Port Chalmers, 18 Peninsula, 63 Balaclava/Logan Park)
b. Unit 2, Go Bus (8 St Clair/Normanby, 33 Corstorphine/Wakari, 50 St Clair Park/Helensburgh)
c. Unit 3/Transitional, Ritchies (15 Ridge Runner, currently the only route in Unit 3 and routes 5/6 Pine Hill/Calton Hill, 10/11 Shiel Hill/Opoho and 37/38 University/Concord, which are 'transitional' contracts expiring in 2022 and becoming part of Unit 3)
d. Unit 4, Go Bus (3 Ocean Grove/Ross Creek, 19 Waverley/Belleknowes, 44/55 St Kilda/Halfway Bush/Brockville, 61 Kenmure)
e. Unit 5, Go Bus (70 Brighton/Abbotsford/Green Island, 77 Mosgiel, 80/81 Mosgiel Central)
f. Unit 6, Ritchies (1 Fernhill/Remarkables, 4 Jacks Point, 5 Lake Hayes)
g. Unit 7, Ritchies (2 Arrowtown/Arthurs Point, 3 Kelvin Heights/Frankton)

[38] This report charts YTD unit revenue and patronage as well as detail on the most recent month's data.

[39] Revenue and budgeting assumptions for the network overall, as well as by individual unit, are significantly and negatively impacted by:

a. The effects of COVID and border closures on patronage and therefore revenue;
b. The ongoing $2 fare trial in Dunedin.

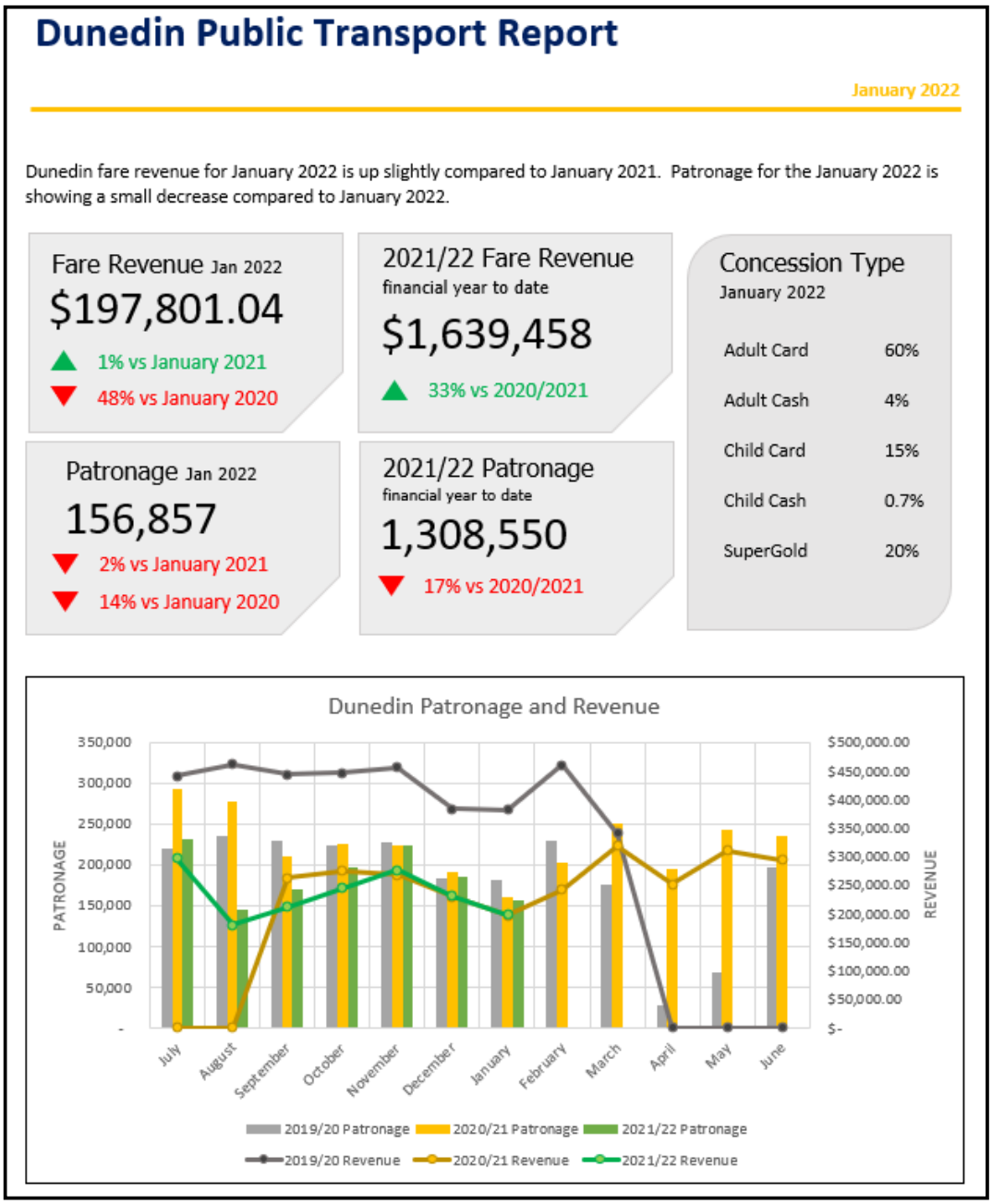


Figure 5: Dunedin Patronage and Revenue, FY 2021/22

Figure 6: Dunedin weekly patronage, Unit Revenue and Unit Patronage

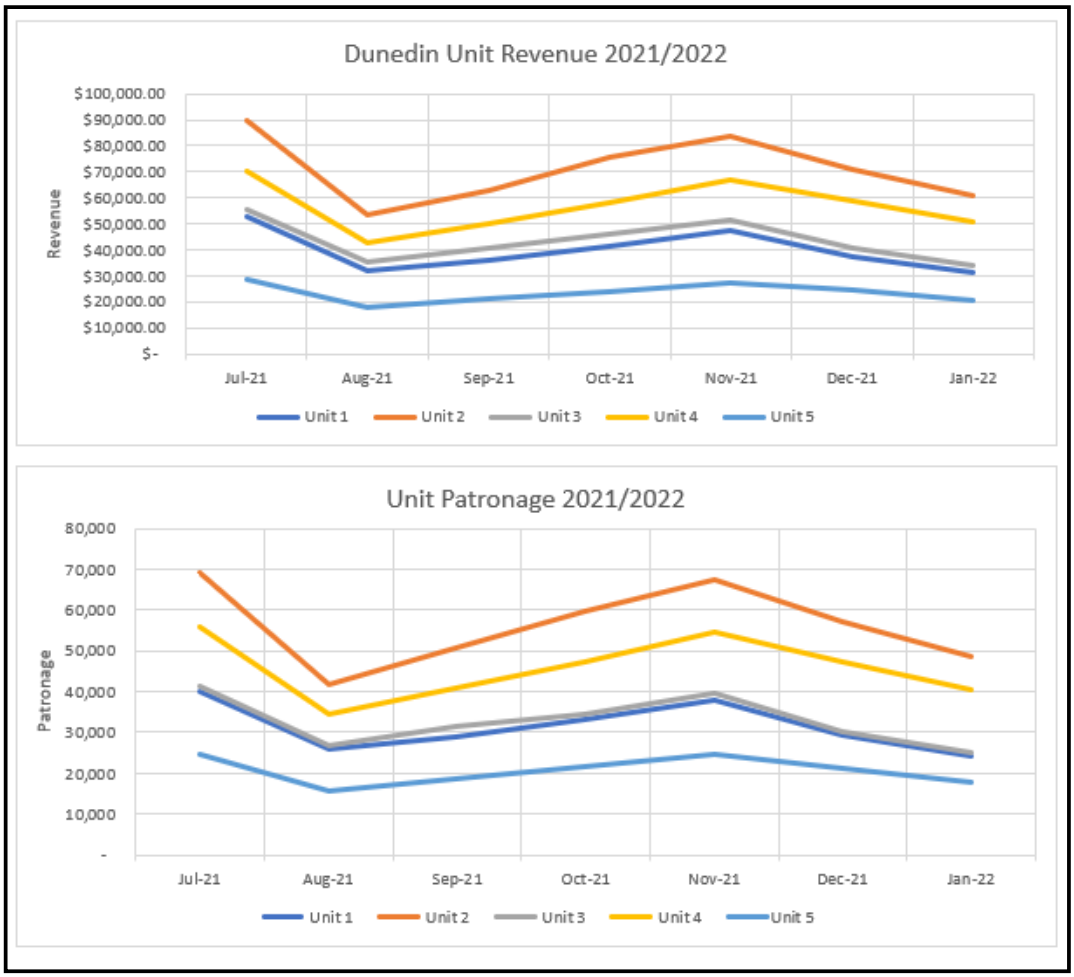


Figure 7: Dunedin Unit Revenue and Patronage

PUBLIC TRANSPORT – QUEENSTOWN

[40] For Queenstown, patronage and revenue continue to be low, a significant impact being measures implemented to address COVID-19, especially the border closure. However, the patronage recovery rate has slowly been increasing from October to date.

[41] Year to date, Queenstown is tracking at 84% of the previous financial year, noting that from July 2020 to 15th September 2020, travel in Queenstown was fare-free and patronage atypically higher for this reason.

[42] Comparing YTD 2021/22 against YTD 2018/19, the last full pre-COVID-19 Financial Year where patronage was significantly higher, Queenstown is tracking at 56%. This can be considered a more realistic measure of the effects of COVID restrictions on Queenstown's performance, being a comparison with a year unaffected by COVID restrictions. This also reflects the impact on the border closure that has affected Queenstown to a far greater extent than Dunedin.

Queenstown	July	August	September	October	November	December	January	February	March	April	May	June	Totals
2018/19 Patronage	122,752	117,442	103,974	111,657	125,600	118,997	136,055	129,439	134,084	125,244	118,077	124,736	**1,468,057**
2020/21 Patronage	100,951	98,102	72,143	73,385	71,464	69,096	68,550	60,717	62,613	65,928	66,863	79,251	**889,063**
2021/22 Patronage	95,248	51,010	51,987	66,690	64,895	66,507	69,147						**465,484**

Figure 8: Queenstown patronage statistics Financial Year 2018/19 to 2021/22

[43] The chart below (figure 9) shows the annualised effect of the varying COVID alert levels on patronage for Queenstown, together with the increases in patronage associated with pre-Bee Card fare-free travel periods:

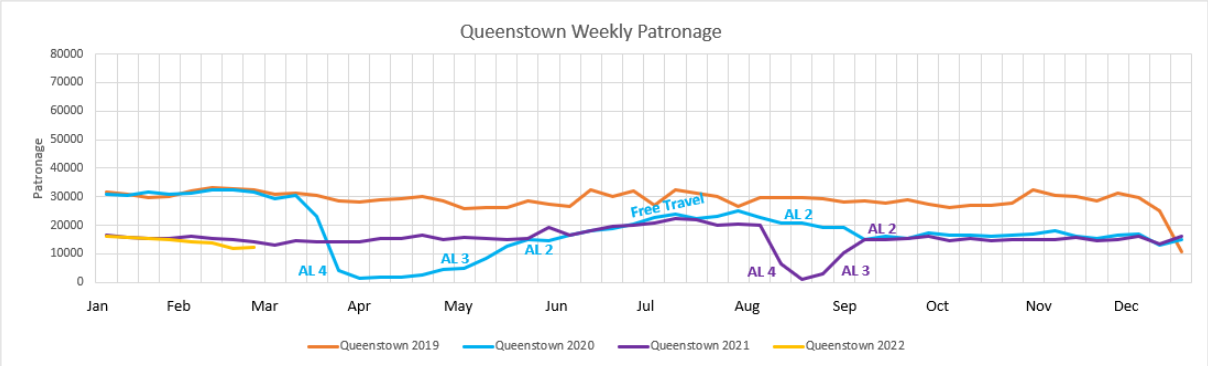


Figure 9: Effect of COVID-19 alert levels on patronage

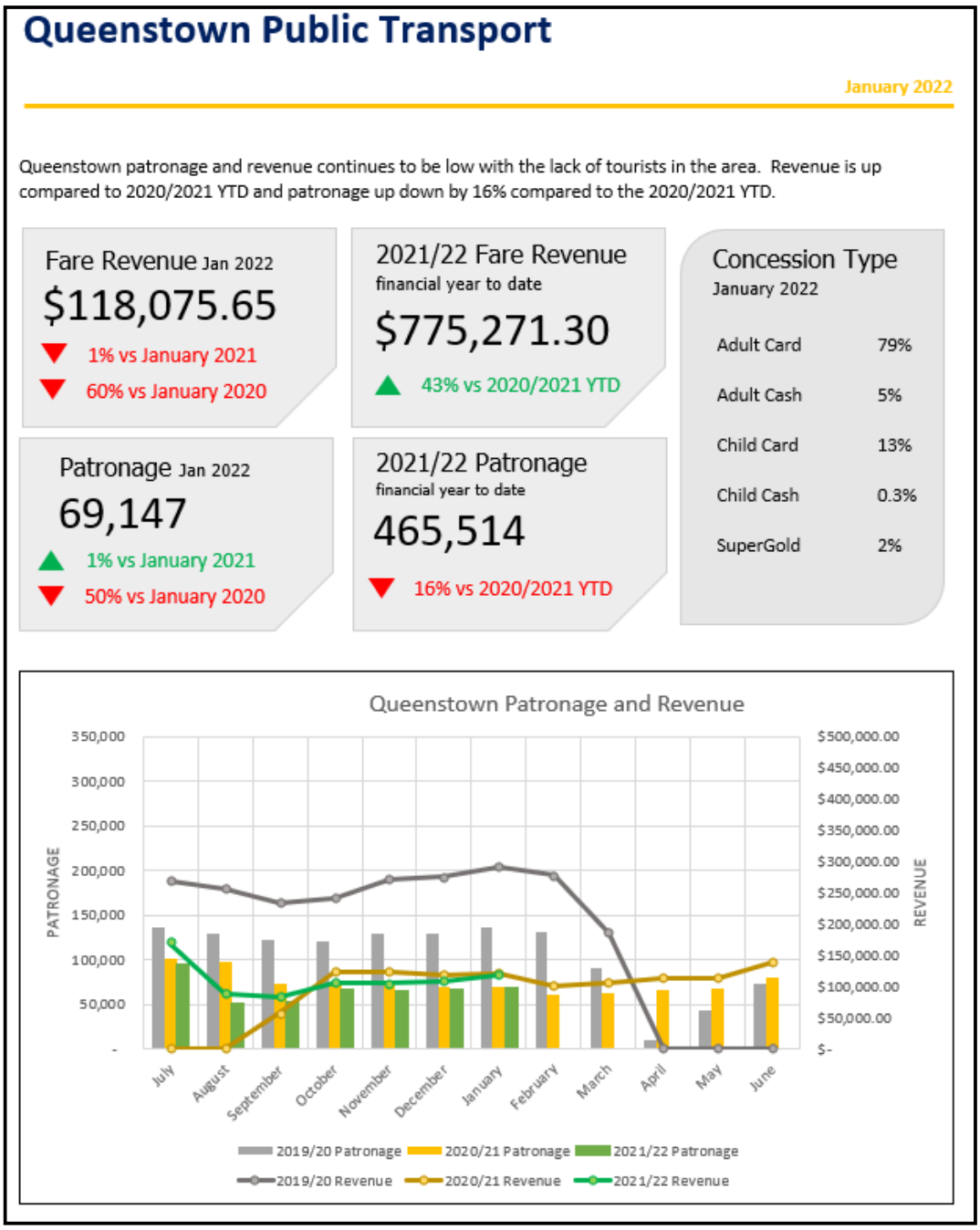


Figure 10: Queenstown Patronage and Revenue, FY 2021/22

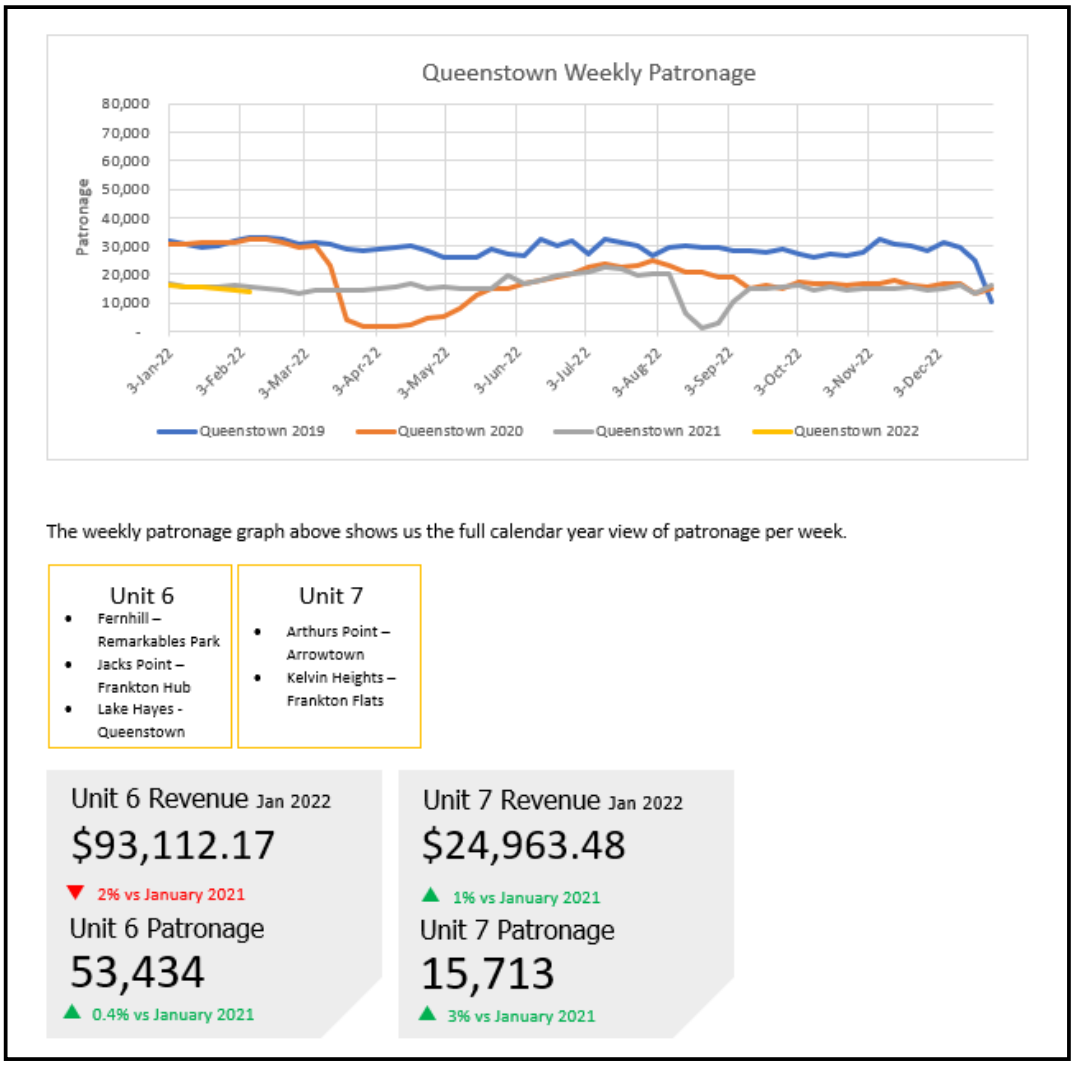


Figure 11: Queenstown weekly patronage, Unit Revenue and Unit Patronage

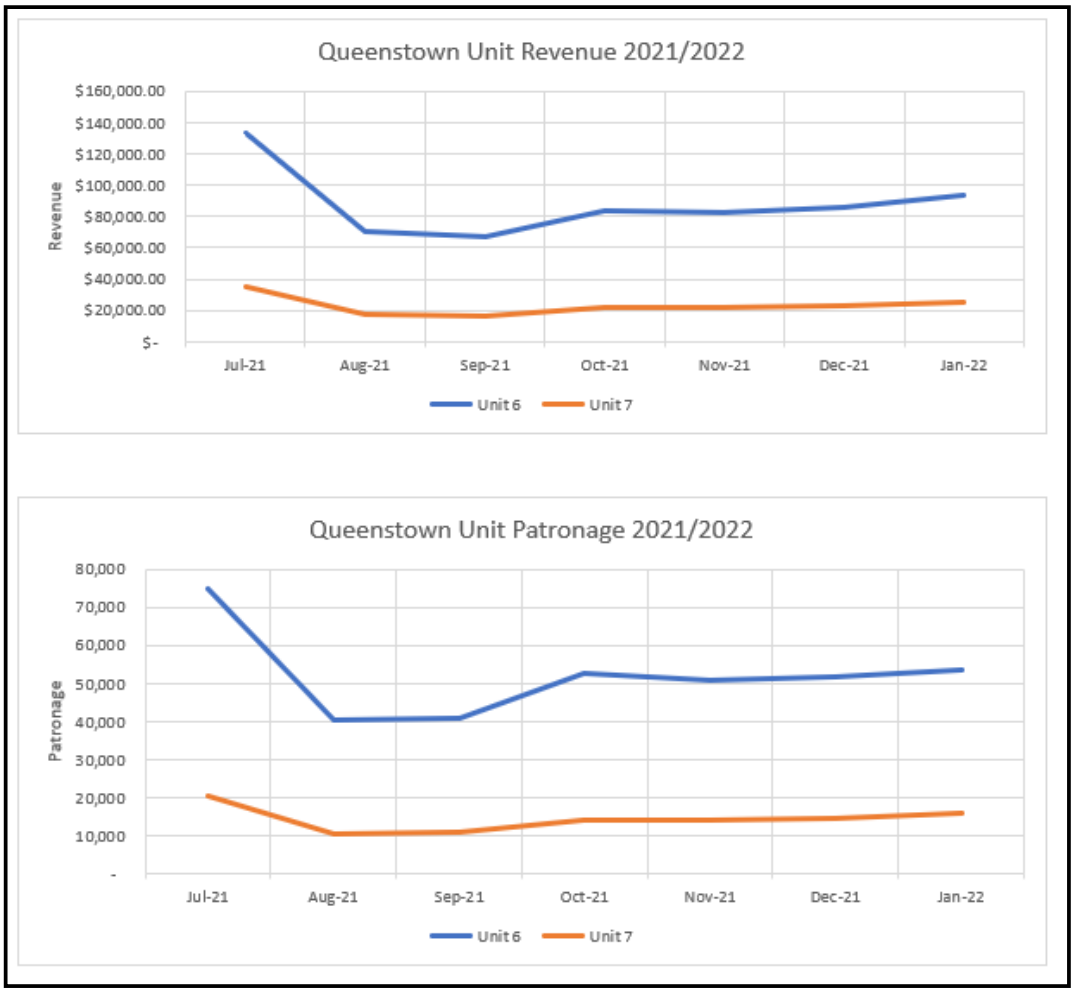


Figure 12: Queenstown Unit Revenue and Patronage

QUEENSTOWN FERRY

[44] The Queenstown Ferry service provides a daily timetabled ferry service on Lake Wakatipu.

[45] The ferry services Queenstown Bay (Steamer Wharf), Queenstown Marina, the Hilton Hotel and Bayview (Kelvin Heights), between 7:30am and 10:30pm.

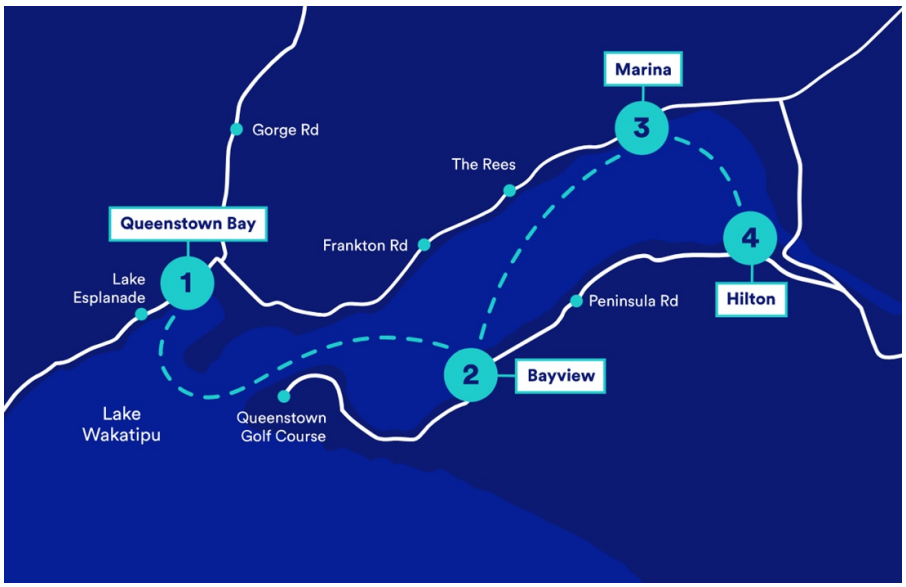


Figure 13: Lake Wakatipu Ferry Route Map

[46] Year to date, Fare Revenue has increased by 8% and patronage by 20% on the Queenstown Ferry service compared to the same period in FY 2020/21.

a. Fare revenue has increased by 8% from $149,325 to $161,217.
b. Patronage has increased by 20% from 27,004 to 32,405.

[47] Queenstown water ferries are significantly affected by seasonal/holiday travel patterns, which continue to be affected by COVID 19 restrictions.

[48] Ticketing equipment has been ordered and GPS mapping completed for implementation of the Ferry Service into the Bee Card system and realtime tracking service.

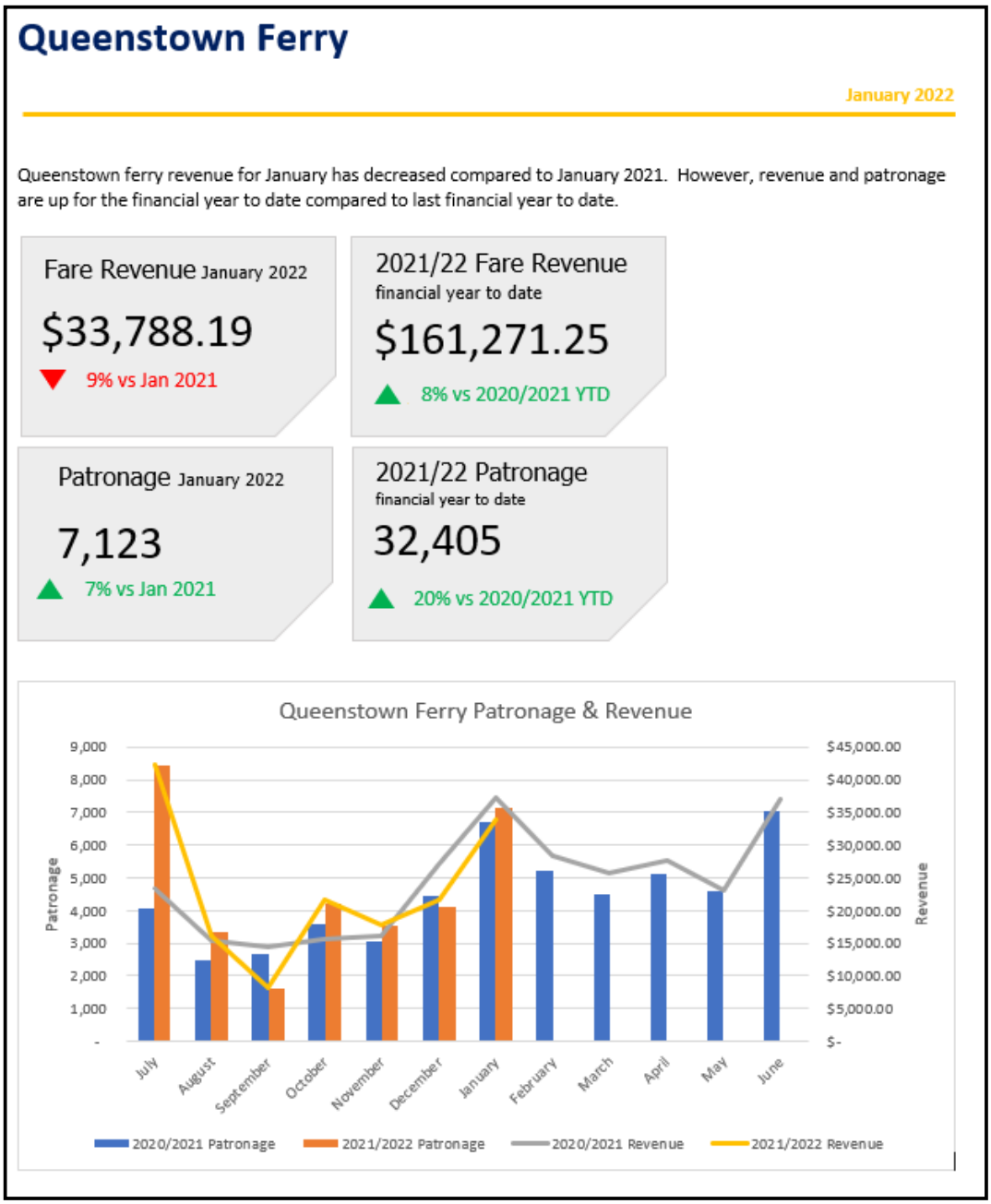


Figure 14: Lake Wakatipu Ferry Revenue

BEE CARD STATISTICS

[49] At 22 February 2022, Otago has 58,525 registered Bee Card users.

a. In the previous report to this Committee, it was noted that at 17th November 2021, Otago had 54,364 registered Bee Card users; meaning that 4,161 Bee Cards have been registered over the past 3 month (c.1,387 per month on average).

[50] The Waikato region is of a similar size with approximately 30 buses more than Otago; their registration rate is slightly lower at 51%.

[51] 109,736 cards have been issued and distributed in Otago, which equates to a little more than three quarters of the combined population of Dunedin and Queenstown. Of these active cards, 53.3% are registered.

CUSTOMER FEEDBACK AND COMPLAINTS

[52] Figures 15 and 16 below capture feedback and complaints data, segregated by enquiry type, from November 2020 (when data collection began in this format) to January 2022.

[53] The table also provides for measurements against contractual (annual) KPI's, being:

a. Less than 1 complaint per 1,000 trips regarding vehicle cleanliness and comfort.
b. Less than 1 complaint per 3,000 trips regarding punctuality and driver behaviour.
c. Less than 1 complaint per 3,000 trips regarding incorrect fares.

[54] These are highlighted in yellow in the table and are tracking well within targets.

[55] For the period November 2020 to Jan 2022, 4,019,478 trips were recorded. 1,622 complaints were recorded, equating to 0.034% of the trips taken for this period.

[56] For YTD financial year 2021/22 (July 2021 to January 2022) 1,774,064 trips were recorded. 657 complaints have been recorded for this period, representing 0.04% of trips taken.

[57] Staff continue to follow up all complaints and take operational action where required. Recent activity has included:

a. Reviewing a Disability Awareness course for driver-trainers with Managers for both contracted bus operators; delivered by an accredited Barrier-Free assessor, to encourage greater understanding of issues faced by passengers with less-identifiable disabilities;
b. Working with QLDC, implementing safety improvements for narrow sections of residential roading for Route 1 in Queenstown;
c. Reinforcing messaging, QR codes and other matters related to COVID 19;
d. Working closely with operators to manage increased levels of school children using public transport services.

																November 2020 - January 2022			
Complaints breakdown:	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Total	% trips	Rate per 1,000	Rate per 3,000
Complaints related to the Bus Hub	2	1	1	2	0	-	-	-		2	-	-	-	-	-	8	0.020%	0.001990308	0.005970925
Complaint about cost	1	1	0	5	2	-	-	1			1	-	-	-	-	11	0.027%	0.002736674	0.008210021
Complaints about drivers	39	28	39	43	55	41	46	38	51	47	33	38	37	50	44	629	1.565%	0.156487982	0.469463945
Complaint about passenger behaviour	1	0	0	5	3	2	5	1		1	2	-	2	1	1	24	0.060%	0.005970925	0.017912774
Complaints about routes and times	17	8	29	24	3	3	5	1	8	3	2	2	4	2	3	114	0.284%	0.028361892	0.085085675
Complaints about ticketing	4	0	5	4	2	8	2	2	10	8	1	3	3	1	1	54	0.134%	0.01343458	0.040303741
Complaints about on-street infrastructure	10	2	6	14	1	7	9	5	9	8	1	2	3	11	9	97	0.241%	0.024132487	0.072397461
Complaints about timeliness	23	20	14	62	40	15	27	24	32	16	13	18	55	17	13	389	0.968%	0.096778736	0.290336208
Complaints about timetables/schedules	11	2	7	5	0	10	5	1	7	7	1	1	2	1	-	60	0.149%	0.014927311	0.044781934
Complaint about on-bus wi-fi	1	0	1	0	0	1	-	-	1		-	-	1	-	-	5	0.012%	0.001243943	0.003731828
Complaints related to other unclassified issues	18	13	34	18	5	7	2	-	14	9	4	9	3	-	3	139	0.346%	0.034581605	0.103744815
Complaints about cleanliness/condition of bus	-	-	-	6	2	2	3	2			1	1	2	2	-	21	0.052%	0.005224559	0.015673677
Complaints about transfers	-	-	-	4	0	-	-	-			-	-	-	-	-	4	0.010%	0.000995154	0.002985462
Complaints about Information/comms	-	-	-	10	2	5	17	1	2	5	-	2	1	5	1	51	0.127%	0.012688215	0.038064644
Complaints related to app/website	-	-	-	4	0	1	5	2	2		1	1	-			16	0.040%	0.003980616	0.011941849

Figure 15: Customer Feedback, November 2020-January 2022

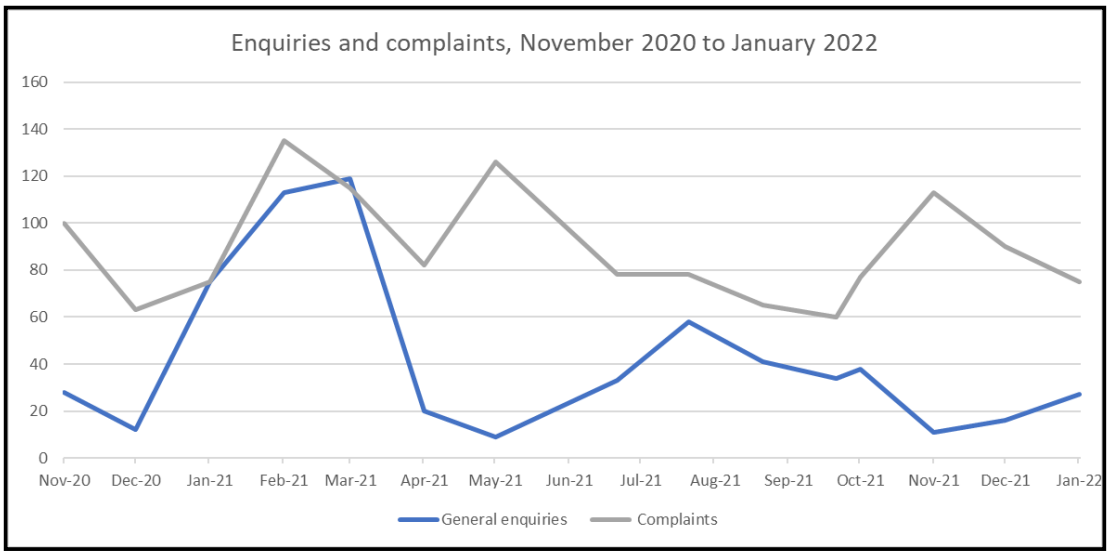


Figure 16: Customer feedback, charted, November 2020 – January 2022

REAL TIME INFORMATION (RTI)

[58] The accuracy of RTI in Queenstown has been increased with the data feed now being derived from a hierarchy of on-bus devices, with the primary source now being the Bus Driver Console (RITS ticketing device), followed by E-Road and Wi-fi hardware.

[59] This hierarchy is now being tested in Dunedin and will be introduced once testing is successfully completed. The completion of this will also result in RTI data being displayed at Bus Hub e-stops.

[60] The device hierarchy means that if one device does not deliver an accurate signal, or fails, the system defaults to the next device in the hierarchy, meaning increased continuity of tracking and significantly less likelihood of unsuccessful vehicle tracking. Previously, the data feed was derived solely from on-bus wi-fi hardware.

[61] Transit, the real time tracking app, remains popular – despite COVID restrictions - following a promotional campaign carried out by the Communications team. In the

period October 2021 to January 2022, passengers used the app nearly 333,000 times (280,035 user sessions in Dunedin and 52,874 in Queenstown).

[62] Figures 17 and 18 show Transit app usage for the period October 2021 to January 2022 for Dunedin and Queenstown:

a. 'Monthly Active Users' refers to the number of active users in that particular month. This means opening and the action of using the app, not just having it installed on a device;
b. 'Views refers to the number of times passengers opened Transit in that month;
c. 'Downloads' is the number of new downloads of the app each month;
d. 'Most Popular Lines' are the most popular routes, i.e. the routes for which the most people are using the Transit app;
e. 'Go Trips' refer to passengers utilising additional functionality in the app. The 'GO' feature enables users gets step by step navigation while helping to improve real-time vehicle locations;
f. 'Service alert subscribers' is the total number of users receiving alerts for individual routes (events, delays, roadworks, etc).

	DUNEDIN					
Month	Monthly Active Users	Sessions	Downloads	Most popular lines	Go Trips	Service Alert Subscribers
Oct-21	2,820	71,970	329	8, 63, 3	1,567	973
Nov-21	2,942	77,695	337	8, 63, 3	1,667	1,054
Dec-21	2,825	63,947	272	8, 19, 63	1,361	1,105
Jan-22	2,722	66,423	351	8, 63, 3	1,539	1,182

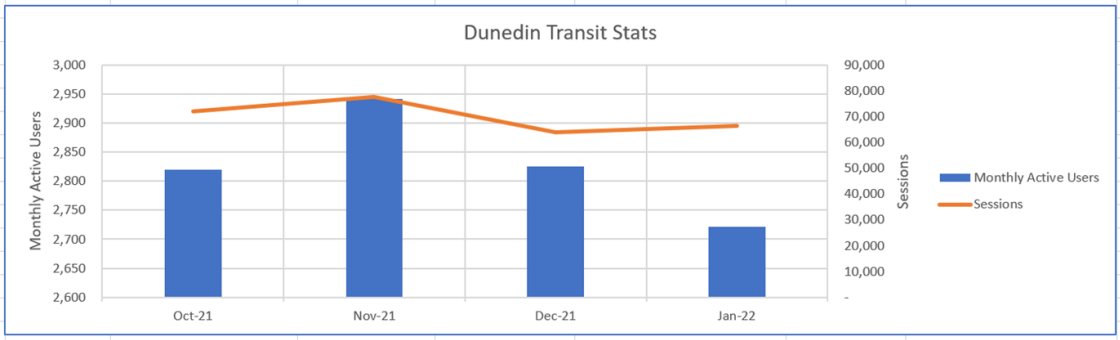


Figure 17: Transit app usage, October 2021 – January 2022, Dunedin

	QUEENSTOWN					
Month	Monthly Active Users	Sessions	Downloads	Most popular lines (taps)	Go Trips	Service Alert Subscribers
Oct-21	697	13,581	135	1, 2, 5	203	86
Nov-21	635	11,733	100	1, 2, 5	178	90
Dec-21	717	14,270	130	1, 2, 5	232	102
Jan-22	691	13,290	138	1, 5, 2	235	110

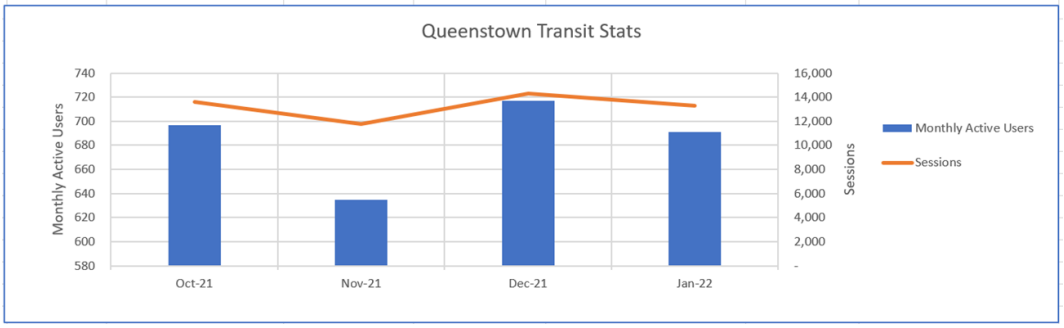


Figure 18: Transit app usage, May-October 2021, Queenstown

TOTAL MOBILITY

[63] Total Mobility is a nationwide scheme, administered by Regional Councils, that provides subsidised travel to help people who are otherwise unable to access public transport. It does this by providing a swipe card which subsidises taxi travel by 50%, to a maximum of $25 subsidy in Otago.

[64] The percentage of trips operating within the $25 maximum subsidy is 96.05%, with remaining 3.95% of trips resulting in the $25 subsidy being less than 50% of the total trip value. Figure 19 below shows the number of trips split by price range:

Trip Count per Price Range 1 July 2021 -28 February 2022

Price Band	$0-$10	$11-20	$21-$30	$31-$40	$41-$50	$51-$60	$61-$70	$71-$80	$81 +
Number of trips	30,109	48978	18713	6672	4062	1634	1774	687	366
	96.05% of trips subsidised by 50%					3.95% of trips subsidised at less than 50%			

Figure 19: Total Mobility trips by price band

[65] Figure 20, below, shows 2021/22 patronage, whereby 'Trips' includes 'Hoist' trips. 'Hoist' refers to those customers that require a wheelchair accessible vehicle to travel, for which suppliers receive a separate reimbursement.

[66] For the 7 months shown below, the mean monthly number of trips per month was 7,611 and, on average, 1113 required the use of a hoist.

[67] 82.9% of trips take place in Dunedin and Mosgiel, followed by 12.4% in Oamaru, 3.33% in Wanaka and 1.4% in Queenstown.

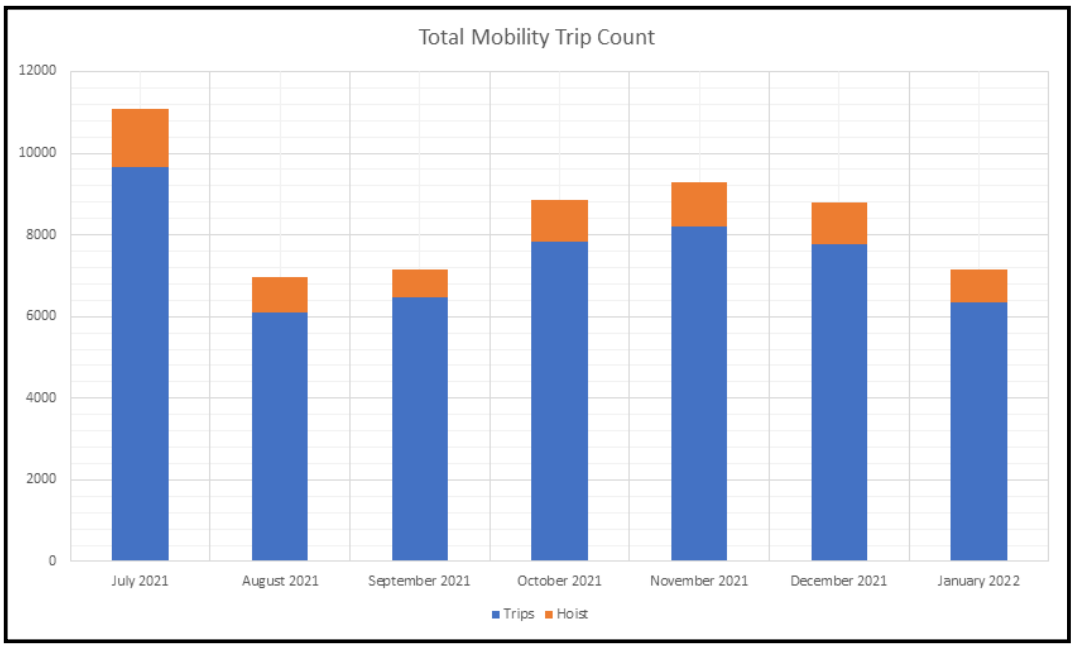


Figure 20: Total Mobility trip statistics

[68] There has been a decrease of 17.2% (10,896) in trips for Otago for YTD (July 2021 – January 2022) compared to YTD 2020 (July 2020 - January 2021);

a. Within this figure there is an 18.4% (1,556) decrease in hoist trips for the same period.

CONSIDERATIONS

Strategic Framework and Policy Considerations

[69] Not applicable.

Financial Considerations

[70] Not applicable.

Significance and Engagement Considerations

[71] Not applicable.

Legislative and Risk Considerations

[72] Not applicable.

Climate Change Considerations

[73] Not applicable.

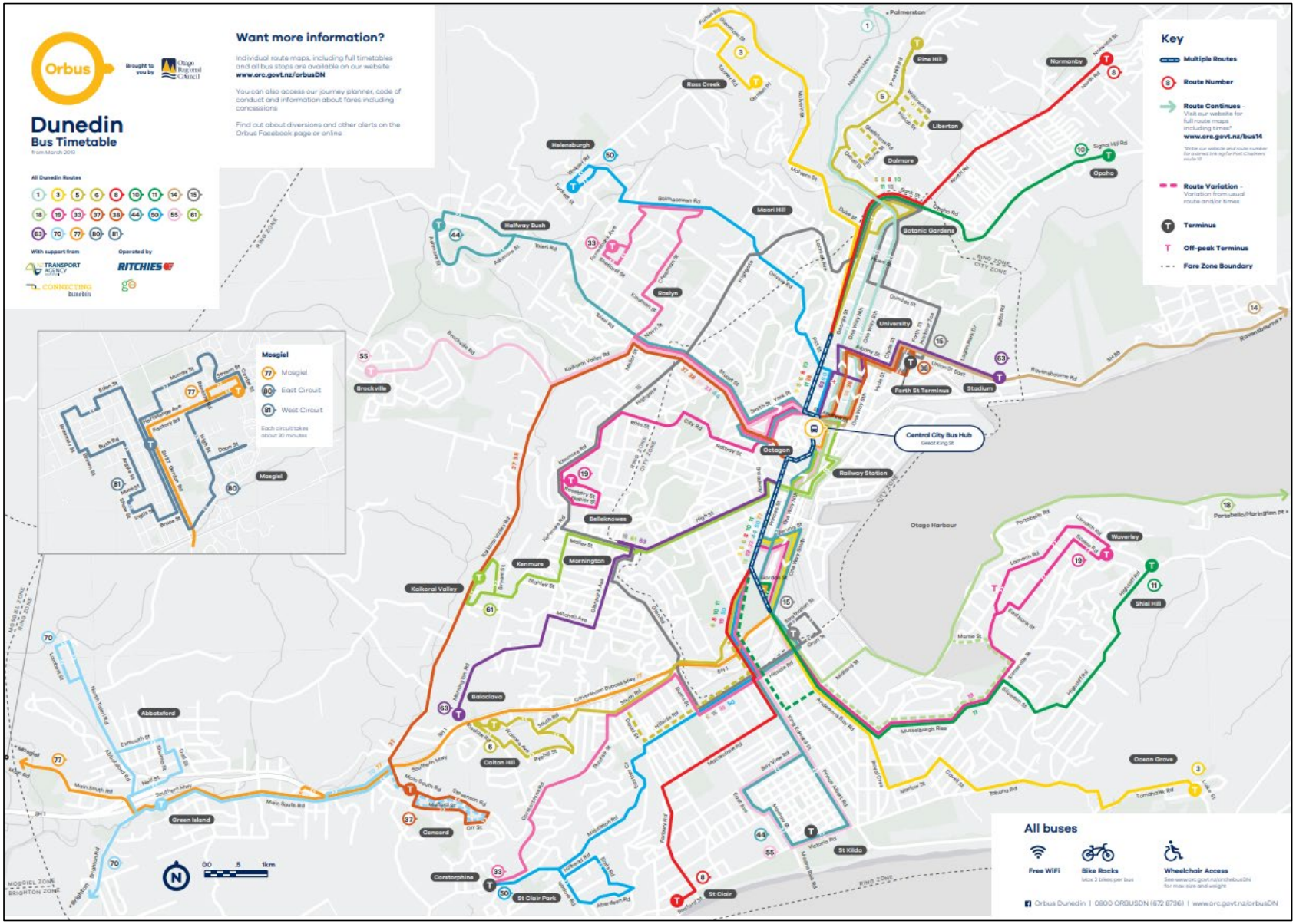
Communications Considerations

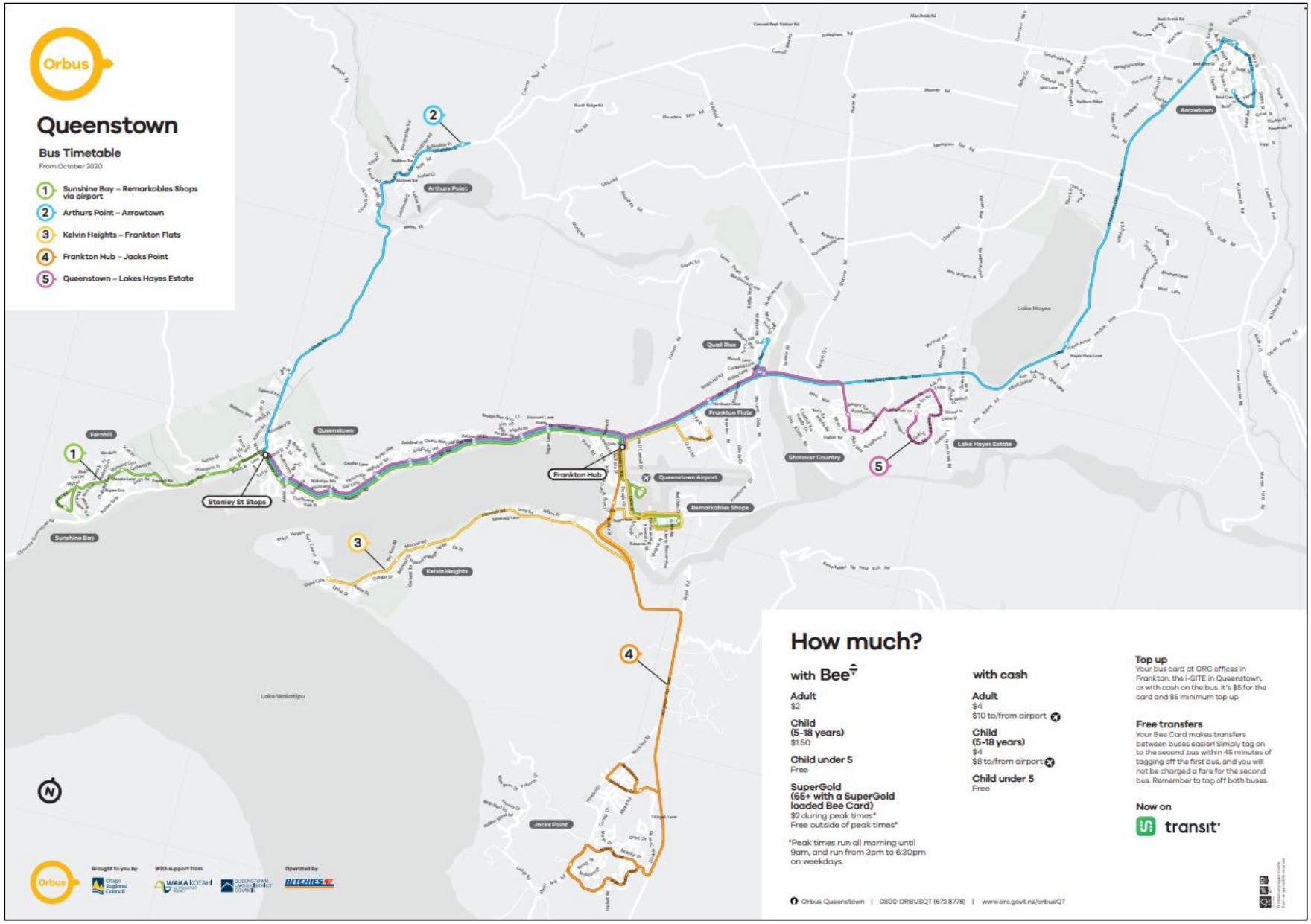
[74] Not applicable.

NEXT STEPS

[75] Provide an update to the next Data and Information Committee on patronage and revenue for Dunedin and Queenstown.

ATTACHMENTS
1. Dunedin Network Map [**7.5.1** - 1 page]
2. Queenstown Network Map [**7.5.2** - 1 page]


Orbus
Brought to you by Otago Regional Council
Dunedin
Bus Timetable
from March 2019
All Dunedin Routes
1 3 5 6 8 10 11 14 15
18 19 33 37 38 44 50 55 61
63 70 77 80 81
With support from
Operated by
RITCHIES
Want more information?
Individual route maps, including full timetables and all bus stops are available on our website www.orc.govt.nz/orbusDN
You can also access our journey planner, code of conduct and information about fares including concessions
Find out about diversions and other alerts on the Orbus Facebook page or online
Mosgiel
77 Mosgiel
80 East Circuit
81 West Circuit
Each circuit takes about 30 minutes
Key
Multiple Routes
Route Number
Route Continues - Visit our website for full route maps including times* www.orc.govt.nz/bus14
Route Variation - Variation from usual route and/or times
Terminus
Off-peak Terminus
Fare Zone Boundary
Central City Bus Hub
Forth St Terminus
Stadium
Octagon
Railway Station
University
Botanic Gardens
Maori Hill
Dalmore
Liberton
Pine Hill
Normanby
Opoho
Halfway Bush
Helensburgh
Ross Creek
Brockville
Roslyn
Belleknowes
Mornington
Kenmure
Kaikorai Valley
Balaclava
Calton Hill
Concord
Corstorphine
St Clair Park
St Clair
St Kilda
Otago Harbour
Waverley
Shiel Hill
Ocean Grove
Portobello/Harington pt
Abbotsford
Green Island
All buses
Free WiFi
Bike Racks
Max 2 bikes per bus
Wheelchair Access
Orbus Dunedin | 0800 ORBUSDN (672 8736) | www.orc.govt.nz/orbusDN


Orbus
Queenstown
Bus Timetable
From October 2020
1 Sunshine Bay – Remarkables Shops via airport
2 Arthurs Point – Arrowtown
3 Kelvin Heights – Frankton Flats
4 Frankton Hub – Jacks Point
5 Queenstown – Lakes Hayes Estate
Arthurs Point
Arrowtown
Lake Hayes
Quail Rise
Frankton Flats
Lake Hayes Estate
Shotover Country
Fernhill
Queenstown
Frankton Hub
Queenstown Airport
Remarkables Shops
Stanley St Stops
Sunshine Bay
Kelvin Heights
Lake Wakatipu
Jacks Point
How much?
with Bee
Adult
$2
Child
(5-18 years)
$1.50
Child under 5
Free
SuperGold
(65+ with a SuperGold loaded Bee Card)
$2 during peak times*
Free outside of peak times*
*Peak times run all morning until 9am, and run from 3pm to 6:30pm on weekdays.
with cash
Adult
$4
$10 to/from airport
Child
(5-18 years)
$4
$8 to/from airport
Child under 5
Free
Top up
Your bus card at ORC offices in Frankton, the i-SITE in Queenstown, or with cash on the bus. It's $5 for the card and $5 minimum top up.
Free transfers
Your Bee Card makes transfers between buses easier! Simply tag on to the second bus within 45 minutes of tagging off the first bus, and you will not be charged a fare for the second bus. Remember to tag off both buses.
Now on
transit
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