Infrastructure Committee

13 March 2025

Report for Agenda Item | Rīpoata moto e Rāraki take [1]

Department: Property & Infrastructure

Title | Taitara: September / October 2024 Weather Event

Purpose of the Report | Te Take mō te Pūroko

The road network sustained damage during a period of wet weather in September / October 2024 and the purpose of this report is to present the impacts, provide an update on the repairs and cost, and note any ongoing works.

Recommendation | Kā Tūtohuka

That the Infrastructure Committee:

1. **Note** the contents of this report; and

2. **Endorse** the approach to continue with works to reinstate the roading network.

Prepared by:

Ben Greenwood

Name: Ben Greenwood
Title: Roading Operations & Contracts Manager
14 February 2025

Reviewed and Authorised by:

Name: Tony Avery
Title: General Manager, Property & Infrastructure
16 February 2025

Context | Horopaki

1. A significant weather event occurred during September and October 2024. While there was no particular period of intense rain, the persistent rain over a sustained length of time led to saturation of the ground. For example, Metconnect Queenstown Aerodrome Weather Station reported 203mm of rainfall for September 2024 and a further 139mm in October. This is against historical averages for these months of 57mm and 58mm respectively, and a previous historical record for September of 171mm in 1970. The impact of this historically wet period has been the occurrence of a number of slips and slumps around the road network.

2. The scope of the damage is across fourteen roads, and repairs are estimated to cost $1.922m, detailed in Attachment A. However, it must be noted that this is a rough order cost estimate presented without a contingency allowance and based on conceptual design information. It is likely that the scope of works will change as designs are developed. Equally, savings can be expected in some areas as details are worked through. Queenstown Lakes District Council (QLDC) is looking to prioritise funding for higher traffic volume roads like Crown Range Road and further works beyond the initial response are unlikely to progress on Kinloch Road or Von Road under this work programme. In addition, officers are exploring a funding agreement with the landowner at 205 Chard Road as a key stakeholder and benefactor of any solution implemented on Chard Road.

3. Attending to slips and reinstating the roads after weather events is business as usual for a roading maintenance contract, however, in this case the scale of damage and as such cost of the repairs exceeds the typical quantum (average $755k per year for the past 5 years).

4. The roading contract contains a small budget of $150k for Minor Events and does not budget for any Emergency Works. This means that when an emergency occurs, there is a shortfall against existing budgets for the full cost of the work, and a typical approach is officers commence repair work to restore the roading network while in tandem seeking a source of funding. This report has been written with the purpose of giving the Infrastructure Committee a briefing on the scope and cost of the reinstatement, and an explanation of how this is being managed from a financial perspective. The sources of funding identified so far are as follows:

    a) Minor Events or Emergency Works $0. Existing funding of $150k allocated to Minor Events under QLDC's Long Term Plan (LTP) is already consumed on Minor Events.

    b) Applying for additional funding from New Zealand Transport Agency's (NZTA) National Land Transport Fund (NLTF), under Emergency Works work category 141. In the past, any funding has been at QLDC's standard Funding assistance rate (FAR) of 51%. An application has been submitted to NZTA and would be subject to assessment and approval. Funding of $0 to $980k (51% of the estimated $1.922m) depending on NZTA approval and total outturn cost.

c) In this case, a unique opportunity for additional financial contribution is also being sought from the landowner at 205 Chard Road as a key stakeholder and benefactor of any solution implemented on Chard Road.

d) Operational/Capital budgets will be assessed to determine whether there is any surplus where funding could be reallocated from. At this stage, no opportunities have been identified so far, but it will continue to be assessed as the end of financial year approaches.

e) Otherwise, the remainder of the cost is an unbudgeted expense. Council does not generally budget for emergencies as events and costs can vary greatly. This makes it difficult to allocate funding in advance which impacts rates.

Analysis and Advice | Tatāritaka me kā Tohutohu

5. The purpose of this paper is to raise awareness to the Infrastructure Committee on the scale and cost of the damage and provide a progress report on the repairs. It was not considered a viable option not to do the reinstatement work, so no option is considered and the paper is for noting only.

6. The site location, high level issue and estimated costs are summarised in Table 1 below, with further details in Attachment A.

No.	Road Name	High level scope	Location (RP, m)	Cost (Completed works)	Estimate (Outstanding works)	Total (Estimate)
1	Skippers Road	Slips and slumps	RP 6,500 – RP 16,243	$172,710.80	$15,600.00	$188,310.80
2	Branches Road	Slips and slumps	RP 500 – end	$39,940.18	$14,700.00	$54,640.18
3	Chard Road	Major drop out	RP 2,103	$7,868.81	$350,000.00	$357,868.81
4	Moonlight Track	Slips and slumps	RP 248- 396	$201.00	$18,579.00	$18,780.00
5	Wanaka-Mount Aspiring Road	Slips	RP 33,000-45757	$18,492.98	$0.00	$18,492.98
6	Kinloch Road	River washout and armouring	RP 1700-2600	$180,648.87	$247,190.76	$427,839.63
7	Von Road	River washout and armouring	RP RP 16,773	$4,025.06	$135,521.25	$139,546.31
8	Glenorchy-Queenstown Road	Slips, fallen trees	RP 523,12,269	$15,621.41	$0.00	$15,621.41
9	Motatapu Road	Slips, fallen trees	RP 2645 -4485	$20,555.42	$0.00	$20,555.42
10	Rees Valley Road	Slumps	RP 1,974 – 7,058	$17,691.68	$0.00	$17,691.68
11	Hensmen Road	Rock fall	RP 772-782	$7,387.23	$0.00	$7,387.23
12	Glenorchy-Routeburn Road	Slips	RP 2320	$6,080.95	$0.00	$6,080.95
13	Crown Range Road (zig zags)	Slip requiring benching	RP 886 - 23673	$187,942.97	$41,500.00	$299,942.97
14	Crown Range Road (other)	Slips likely requiring retaining	Various, 11 Sites	$0.00	$420,000.00	$420,000.00
			Total	$679,167.36	$1,243,091.01	$1,922,258.37

Table 1 summary of sites and estimated costs.

Consultation Process | Hātepe Matapaki

Significance and Engagement | Te Whakamahi I kā Whakaaro Hiraka

7. This matter is of medium significance, as determined by reference to the Council's Significance and Engagement Policy because it reports a likely unbudgeted expense and potential rating impact.

8. The persons who are affected by or interested in this matter are the residents/ratepayers and visitors to the Queenstown Lakes District.

9. The Council has not undertaken community consultation on this matter, except to the extent that Emergency Response works are included within the scope and remit of the Roading Maintenance Contract. Expediting the repair works to restore access and make roads safe has been the priority.

Māori Consultation | Iwi Rūnaka

10. The Council has not undertaken consultation with Iwi on this matter.

Risk and Mitigations | Kā Raru Tūpono me kā Whakamaurutaka

11. This matter relates to the Community & Wellbeing risk category. It is associated with RISK10017 Ineffective Council response to, or recovery from a civil defence emergency event within the QLDC Risk Register. This risk has been assessed as having a high residual risk rating.

12. The approval of the recommended option will allow Council to retain the risk at its current level. This will be achieved by noting that the planned repairs to the roading network will restore Level of Service.

Financial Implications | Kā Riteka ā-Pūtea

13. The maximum impact is estimated to be $1.922m but is expected to be significantly less than this figure per the financial impact mitigation discussed in the context section of this report. QLDC uses borrowing head room to take on debt when faced with emergencies. This means QLDC can access these funds quickly to cover the immediate costs of emergency response and recovery. This debt is repaid over time, often with interest or offset via overs and unders within the Transport Activity.

14. A NZTA Claim will be made to endeavour to reduce this overspend.

Council Effects and Views | Kā Whakaaweawe me kā Tirohaka a te Kaunihera

15. The following Council policies, strategies and bylaws were considered:
    - QLDC's Land Transport Asset Management Plan

16. The recommended option is consistent with the principles set out in the named plan which states that these events are difficult to predict and are often dealt with by emergency works funding (as opposed to proactively budgeting for them).

17. This matter is not included in the Long Term Plan/Annual Plan. Emergencies are unpredictable and therefore are not included in the LTP. It is difficult to set an appropriate rate due to the varying scope and scale of each event. If QLDC was to implement a rate for emergencies, it could

be seen as overrating residents when emergencies do not occur. An option could be looking at building up a provision over the next 5 years that is dedicated to emergency events.

Local Government Act 2002 Purpose Provisions | Te Whakatureture 2002 o te Kāwanataka ā-Kīaka

18. Section 10 of the *Local Government Act 2002* (the Act) states the purpose of local government is (a) to enable democratic local decision-making and action by, and on behalf of, communities; and (b) to promote the social, economic, environmental, and cultural well-being of communities in the present and for the future. Completing the reinstatement work allows the community to continue to access QLDC's roading network. As such, the recommendation in this report is appropriate and within the ambit of Section 10 of the Act.

19. The recommended option:
    - May impact future Long Term and Annual Plans. As noted in point 4 above, officers are actively exploring funding opportunities. However, there is a possibility that the full cost may not be covered, leaving a shortfall that would need to be assigned to debt and addressed through future Long Term and Annual Plans;
    - Is consistent with the Council's plans and policies; and
    - Would not significantly alter the intended level of service provision for any significant activity undertaken by or on behalf of the Council or transfer the ownership or control of a strategic asset to or from the Council.

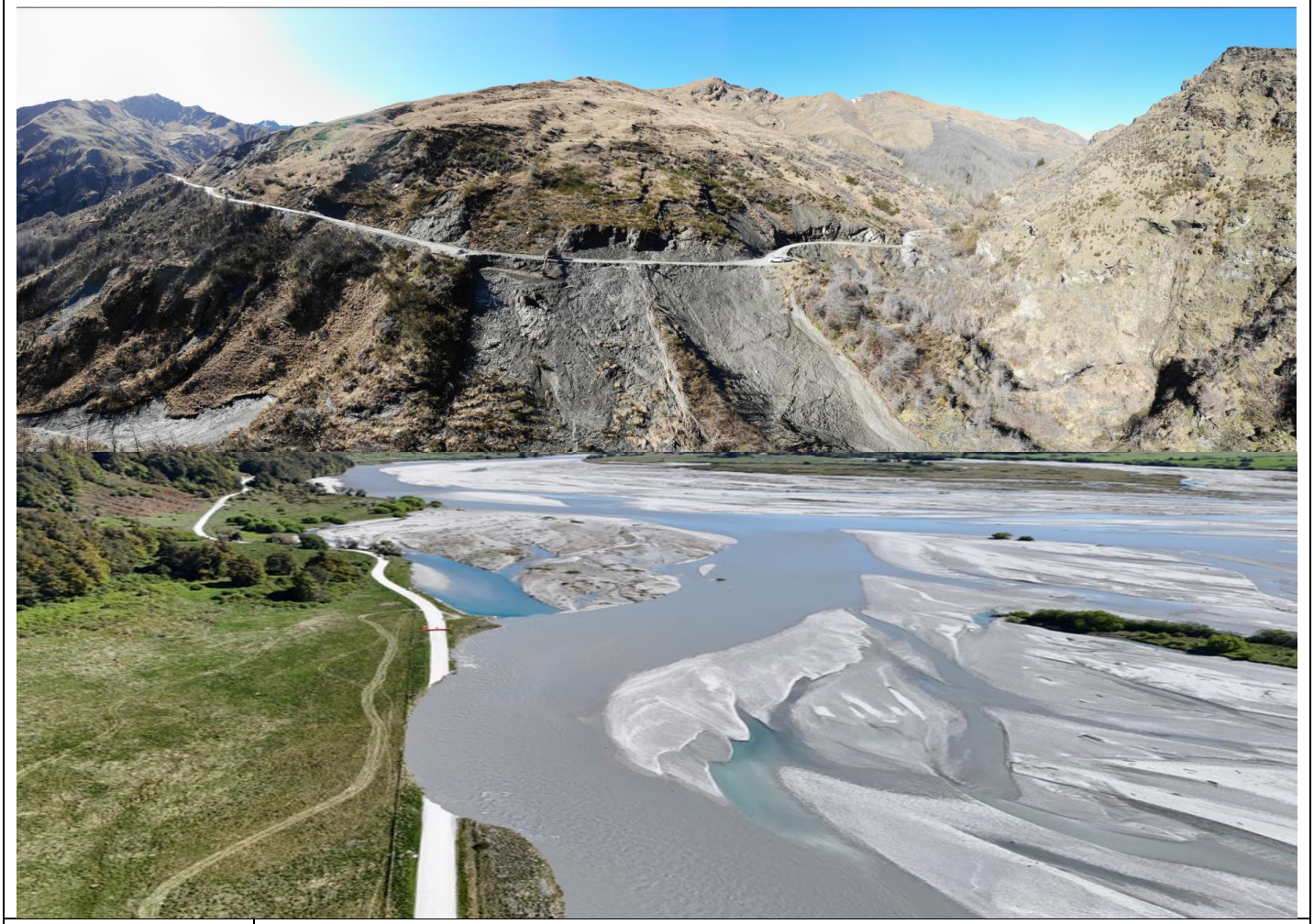
Attachments | Kā Tāpirihaka

A	Weather Event Network Damage Report – Sept / Oct 2024 v3

Weather Event Network Damage Report

Project:	**Queenstown Lakes District Council Maintenance Contract**
Report Status:	**Weather Event Report – V3**
Project No:	**CT16-007**
Client:	**Queenstown Lakes District Council**

Report Issue Date	Document Preparation & Control Contract Manager	Document Authorisation Engineer's Rep
4/12/2024	Luther Potgieter	Ben Greenwood



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Weather Event Network Damage Report

Introduction

During the month of September the QLDC geographical network area experience a record rain event, with a total **Rain (mm): 215.4mm.** There were significant periods of heavy rain fall scattered throughout the month that has put isolated areas on the network under significant duress. Periods of rain were concentrated in isolated areas resulting in road corridor defects such as widespread slips, blocked culverts, minor flooring, dropouts and scouring.

Since our 1st submission of the last report on the 26th September we have had an additional week of significant heavy rainfall back-to-back on the 2nd and 3rd October. This comes after an extremely wet month in September and already saturated network conditions. Ground levels have shown signs of over saturation and can also be observed in the pavements, drains and banks. With the heavy rain a further escalation of slips where logged and responded to across the Network. During October to Early November, we had further heavy record rains that placed the current volatile network under further stress.

Summary of Damaged Road Infrastructure

No.	Road Name	Location (Route Position)	Description
1	SKIPPERS ROAD	RP 6,500 – RP 16,243	Multiple Major Slips and Dropouts/ Washouts.
2	THE BRANCHES ROAD	RP 500 – END	Multiple Major Slips and Dropouts, Full extent unknown due to limited access to inspect to end of the Road.
3	CHARD ROAD	RP 2,103	Major/ Dropout- Road Closure/ Restrictions
4	MOONLIGHT TRACK	RP 248- 396	Minor slips and shoulder and swc washouts
5	WANAKA-MOUNT ASPIRING ROAD	RP 33,000-45757	Larger to Minor Slips, Slip Debris.
6	KINLOCH ROAD	RP 1700-2600	Large Road Washouts by River.
7	VON ROAD	RP RP 16,773	Dropouts/ Slips
8	GLENORCHY-QUEENSTOWN ROAD	RP 523,12,269	Slips /Dropouts
9	MOTATAPU ROAD	RP 2645 -4485	Slips and Trees
10	REES VALLEY ROAD	RP 1,974 – 7,058	Dropouts and Slips
11	HENSMEN ROAD	RP 772-782	Large Rock fall Blocking Road
12	REES VALLEY	Rp 1,974 & 7,045	Flood damage after heavy rain, scours and slips to SWC and shoulders.
13	GLENORCHY-ROUTEBURN ROAD	RP 2320	Large Slip Debris washout
15	CROWN RANGES ROAD	RP 886 - 23673	Large Dropouts and slips
16	MOUNT ASPIRING ROAD	Rp 33,000 & 42095-45757	Multiple large to medium slips blocking Road, Washouts.
17	MOTATAPU ROAD	RP4485	Sever scours from Sept Rains along large part of road.

Weather Event Network Damage Report

MONTHLY SUMMARY						
Queenstown			October 2024			
Stn ID: 93831	Daily Rainfall	Max Mean Speed	Max Gust	Mean Temp	Max Temp	Min Temp
1 Tue	0.0	SW 10 kt *(19 km/h)*	SW 18 kt *(33 km/h)*	9.8	15.0	4.5
2 Wed	26.6	S 20 kt *(37 km/h)*	S 35 kt *(65 km/h)*	6.5	9.6	3.4
3 Thu	17.4	NE 10 kt *(19 km/h)*	E 19 kt *(35 km/h)*	5.8	7.9	3.6
4 Fri	7.8	SE 10 kt *(19 km/h)*	S 17 kt *(31 km/h)*	8.5	10.3	6.7
5 Sat	0.2	W 9 kt *(17 km/h)*	W 13 kt *(24 km/h)*	9.3	15.6	2.9
6 Sun	0.0	W 9 kt *(17 km/h)*	W 15 kt *(28 km/h)*	9.4	15.8	2.9
7 Mon	0.0	W 9 kt *(17 km/h)*	W 14 kt *(26 km/h)*	11.7	16.7	6.7
8 Tue	11.6	NE 11 kt *(20 km/h)*	W 29 kt *(54 km/h)*	8.7	11.9	5.5
9 Wed	2.4	SW 19 kt *(35 km/h)*	S 30 kt *(56 km/h)*	7.3	10.7	3.9
10 Thu	0.0	SW 14 kt *(26 km/h)*	SW 26 kt *(48 km/h)*	6.8	13.5	0.1
11 Fri	0.0	SW 14 kt *(26 km/h)*	SW 26 kt *(48 km/h)*	9.2	15.7	2.6
12 Sat	0.8	S 21 kt *(39 km/h)*	S 32 kt *(59 km/h)*	8.9	15.6	2.2
13 Sun	2.4	S 14 kt *(26 km/h)*	S 26 kt *(48 km/h)*	5.8	9.7	1.8
14 Mon	0.0	S 17 kt *(31 km/h)*	S 23 kt *(43 km/h)*	7.3	15.0	-0.4
15 Tue	0.0	S 21 kt *(39 km/h)*	S 33 kt *(61 km/h)*	9.1	12.1	6.1
16 Wed	0.0	S 11 kt *(20 km/h)*	S 17 kt *(31 km/h)*	8.5	17.4	-0.4
17 Thu	0.0	SW 11 kt *(20 km/h)*	SW 15 kt *(28 km/h)*	8.1	15.6	0.6
18 Fri	0.0	S 12 kt *(22 km/h)*	S 20 kt *(37 km/h)*	12.5	18.0	6.9
19 Sat	0.0	W 9 kt *(17 km/h)*	SW 15 kt *(28 km/h)*	12.2	18.5	5.9
20 Sun	0.0	SW 11 kt *(20 km/h)*	SW 20 kt *(37 km/h)*	12.0	17.0	7.0
21 Mon	0.0	SW 9 kt *(17 km/h)*	SW 16 kt *(30 km/h)*	13.8	18.2	9.3
22 Tue	0.0	SW 10 kt *(19 km/h)*	SW 14 kt *(26 km/h)*	17.1	21.5	12.7
23 Wed	4.2	SW 15 kt *(28 km/h)*	SW 29 kt *(54 km/h)*	15.9	19.9	11.8
24 Thu	45.4	SW 12 kt *(22 km/h)*	W 21 kt *(39 km/h)*	12.7	14.8	10.6
25 Fri	0.0	S 17 kt *(31 km/h)*	SW 27 kt *(50 km/h)*	12.4	16.4	8.3
26 Sat	19.4	N 17 kt *(31 km/h)*	NE 30 kt *(56 km/h)*	5.8	8.6	3.0
27 Sun	0.0	NE 19 kt *(35 km/h)*	NE 30 kt *(56 km/h)*	9.1	13.1	5.0
28 Mon	0.8	S 18 kt *(33 km/h)*	S 28 kt *(52 km/h)*	9.2	11.9	6.5
29 Tue	0.0	S 17 kt *(31 km/h)*	S 24 kt *(44 km/h)*	8.9	15.5	2.3
30 Wed	0.0	SW 12 kt *(22 km/h)*	SW 24 kt *(44 km/h)*	9.7	16.7	2.7
31 Thu	0.4	SW 14 kt *(26 km/h)*	SW 24 kt *(44 km/h)*	13.6	18.0	9.2

Total October 2024 rainfall (mm)	139.4	Mean October 2024 Temperature (C)	9.8
Climate Average October rainfall (mm)	58.3	Highest October 2024 Maximum (C)	21.5
Rain Days October 2024 (≥ 0.1mm)	13	Lowest October 2024 Minimum (C)	-0.4
Wet Days October 2024 (≥ 1.0mm)	9	Climate Average - October Max	15.4
Very Wet Days October 2024 (≥ 5.0mm)	6	Climate Average - October Mean	9.7
Total rainfall YTD	772.2	Climate Average - October Min	4.0
Climate Average - Total rainfall YTD	518.1	Highest temperature YTD	27.0 (8 Jan)
Max October 2024 Gust	S 35kt (2 Oct)	Lowest Temperature YTD	-4.9 (14 Jul)
Max Gust YTD	S 50kt (8 May)		
Climate data provided by MetService based on the years 1991 - 2020			

Wettest October day on record	78.0 (13 Oct 1978)	Highest October Maximum on record	26.0 (28 Oct 1977)
Wettest October on record	184.0 (1988)	Lowest October Minimum on record	-4.2 (13 Oct 2018)
Driest October on record	4.8 (2017)		
Records start 1968 (totals: 9am - 9am)		*Records start 1972*	

Temperature observed above/below climatology					
-6	-5	-4	+4	+5	+6

rain day >=0.1mm	wet day >=1.0mm	very wet day >=5.0mm	very, very wet day >=25mm

Light winds <=8kt	Moderate 8-15kt	Fresh 16-21kt	Strong 22-33kt	Gale 34-48kt	Severe Gale >48kt

Issued: Fri 01 Nov 03:05 NZT
Note: Unless stated otherwise data is reported from midnight to midnight local time.

Weather Event Network Damage Report

Queenstown | 2024 | 11_November

MONTHLY SUMMARY						
Queenstown			November 2024			
Stn ID: 93831	Daily Rainfall	Max Mean Speed	Max Gust	Mean Temp	Max Temp	Min Temp
1 Fri	0.6	SW 12 kt *(22 km/h)*	W 21 kt *(39 km/h)*	12.2	16.4	7.9
2 Sat	5.8	S 26 kt *(48 km/h)*	SW 40 kt *(74 km/h)*	6.7	11.2	2.1
3 Sun	0.2	SW 13 kt *(24 km/h)*	SW 20 kt *(37 km/h)*	6.5	13.7	-0.7
4 Mon	2.4	W 12 kt *(22 km/h)*	W 22 kt *(41 km/h)*	10.0	14.8	5.2
5 Tue	0.6	S 17 kt *(31 km/h)*	SE 26 kt *(48 km/h)*	14.5	20.5	8.5
6 Wed	0.0	W 8 kt *(15 km/h)*	S 11 kt *(20 km/h)*	14.8	22.9	6.7
7 Thu	0.0	SW 10 kt *(19 km/h)*	SW 18 kt *(33 km/h)*	15.2	22.1	8.2
8 Fri	18.4	SW 9 kt *(17 km/h)*	W 19 kt *(35 km/h)*	13.8	16.2	11.3
9 Sat	4.8	SW 18 kt *(33 km/h)*	SW 27 kt *(50 km/h)*	16.2	21.1	11.3
10 Sun	0.0	SW 14 kt *(26 km/h)*	S 23 kt *(43 km/h)*	11.4	17.5	5.2
11 Mon	3.0	S 17 kt *(31 km/h)*	S 24 kt *(44 km/h)*	10.8	15.1	6.4
12 Tue	0.0	S 15 kt *(28 km/h)*	S 23 kt *(43 km/h)*	11.1	18.8	3.3
13 Wed	0.0	S 10 kt *(19 km/h)*	W 14 kt *(26 km/h)*	14.8	20.3	9.2
14 Thu	2.2	W 8 kt *(15 km/h)*	SW 14 kt *(26 km/h)*	9.9	13.8	6.0
15 Fri	6.2	S 27 kt *(50 km/h)*	S 37 kt *(69 km/h)*	10.6	15.1	6.1
16 Sat	0.2	S 17 kt *(31 km/h)*	S 31 kt *(57 km/h)*	8.5	12.6	4.3
17 Sun	0.0	S 13 kt *(24 km/h)*	S 17 kt *(31 km/h)*	9.8	18.4	1.2
18 Mon	0.0	SW 14 kt *(26 km/h)*	SW 25 kt *(46 km/h)*	12.6	19.9	5.3
19 Tue	0.4	W 14 kt *(26 km/h)*	W 24 kt *(44 km/h)*	13.9	19.0	8.8
20 Wed	0.8	SW 13 kt *(24 km/h)*	SW 21 kt *(39 km/h)*	12.5	17.0	7.9
21 Thu	5.6	S 24 kt *(44 km/h)*	S 33 kt *(61 km/h)*	8.1	11.8	4.4
22 Fri	0.0	SW 20 kt *(37 km/h)*	SW 28 kt *(52 km/h)*	8.4	16.8	0.0
23 Sat	0.0	S 22 kt *(41 km/h)*	S 32 kt *(59 km/h)*	10.8	15.7	5.9
24 Sun	0.0	S 18 kt *(33 km/h)*	SE 32 kt *(59 km/h)*	10.9	19.4	2.4
25 Mon	0.0	SW 13 kt *(24 km/h)*	SW 23 kt *(43 km/h)*	18.2	23.9	12.4
26 Tue	0.6	SW 20 kt *(37 km/h)*	SW 29 kt *(54 km/h)*	16.9	23.5	10.3
27 Wed	0.8	SW 16 kt *(30 km/h)*	SW 23 kt *(43 km/h)*	17.2	22.7	11.6
28 Thu	5.2	S 25 kt *(46 km/h)*	W 37 kt *(69 km/h)*	16.9	24.2	9.6
29 Fri	0.0	S 25 kt *(46 km/h)*	S 36 kt *(67 km/h)*	12.7	18.9	6.5
30 Sat	0.0	S 16 kt *(30 km/h)*	S 26 kt *(48 km/h)*	13.7	21.1	6.2

Total November 2024 rainfall (mm)	57.8	Mean November 2024 Temperature (C)	12.3
Climate Average November rainfall (mm)	54.0	Highest November 2024 Maximum (C)	24.2
Rain Days November 2024 (≥ 0.1mm)	17	Lowest November 2024 Minimum (C)	-0.7
Wet Days November 2024 (≥ 1.0mm)	9	Climate Average - November Max	17.8
Very Wet Days November 2024 (≥ 5.0mm)	5	Climate Average - November Mean	11.9
Total rainfall YTD	830.0	Climate Average - November Min	5.9
Climate Average - Total rainfall YTD	572.1	Highest temperature YTD	27.0 (8 Jan)
Max November 2024 Gust	SW 40kt (2 Nov)	Lowest Temperature YTD	-4.9 (14 Jul)
Max Gust YTD	S 50kt (8 May)		
Climate data provided by MetService based on the years 1991 - 2020			

Wettest November day on record	86.0 (16 Nov 1999)	Highest November Maximum on record	28.5 (28 Nov 2010)
Wettest November on record	244.0 (1999)	Lowest November Minimum on record	-2.1 (28 Nov 2003)
Driest November on record	4.2 (2007)		
Records start 1968 (totals: 9am - 9am)		*Records start 1972*	

Temperature observed above/below climatology					
-6	-5	-4	+4	+5	+6

rain day >=0.1mm	wet day >=1.0mm	very wet day >=5.0mm	very, very wet day >=25mm

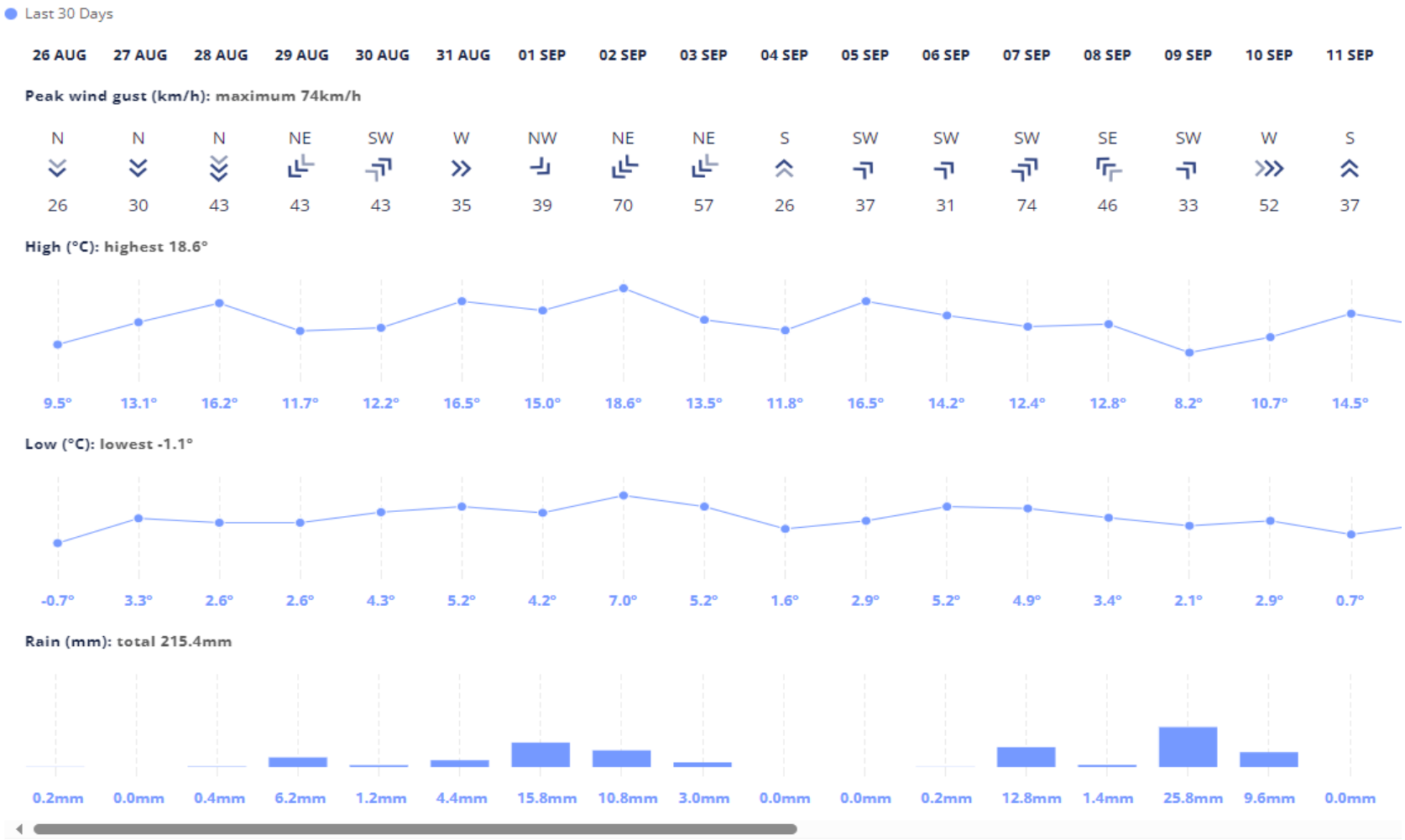
Light winds <=8kt	Moderate 8-15kt	Fresh 16-21kt	Strong 22-33kt	Gale 34-48kt	Severe Gale >48kt

Issued: Sun 01 Dec 03:05 NZT
Note: Unless stated otherwise data is reported from midnight to midnight local time.

Weather Event Network Damage Report

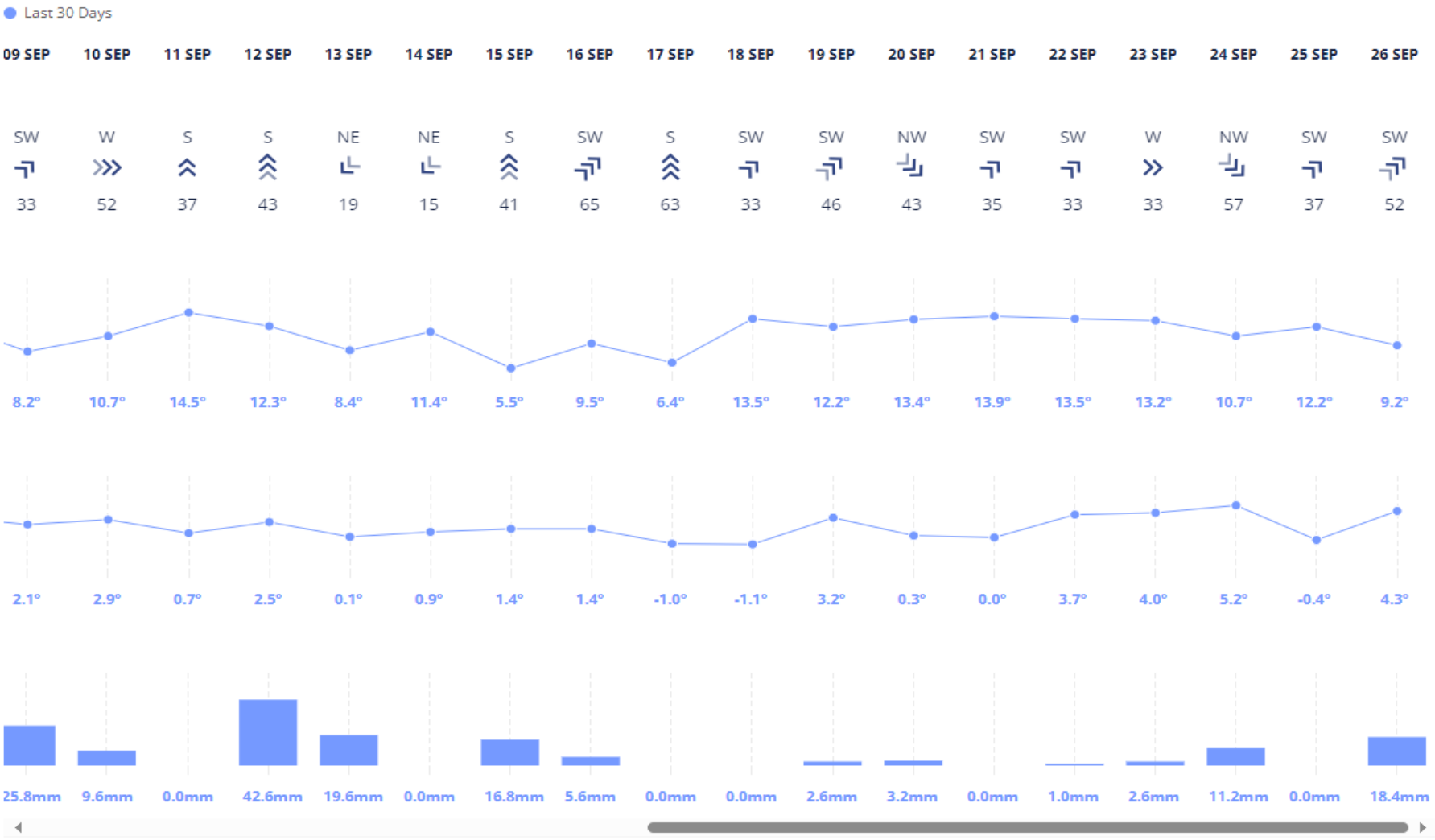
Weather Reports

Please see the below Last 30 Days weather graphs detailing:



Peak wind gust The direction and speed of the highest gust that was recorded on the calendar day.
Temperature The highest and lowest temperatures that were recorded on the calendar day.
Rainfall The total rainfall that fell during the calendar day.
Observations recorded at Queenstown Airport (AWS-93831)

Weather Event Network Damage Report



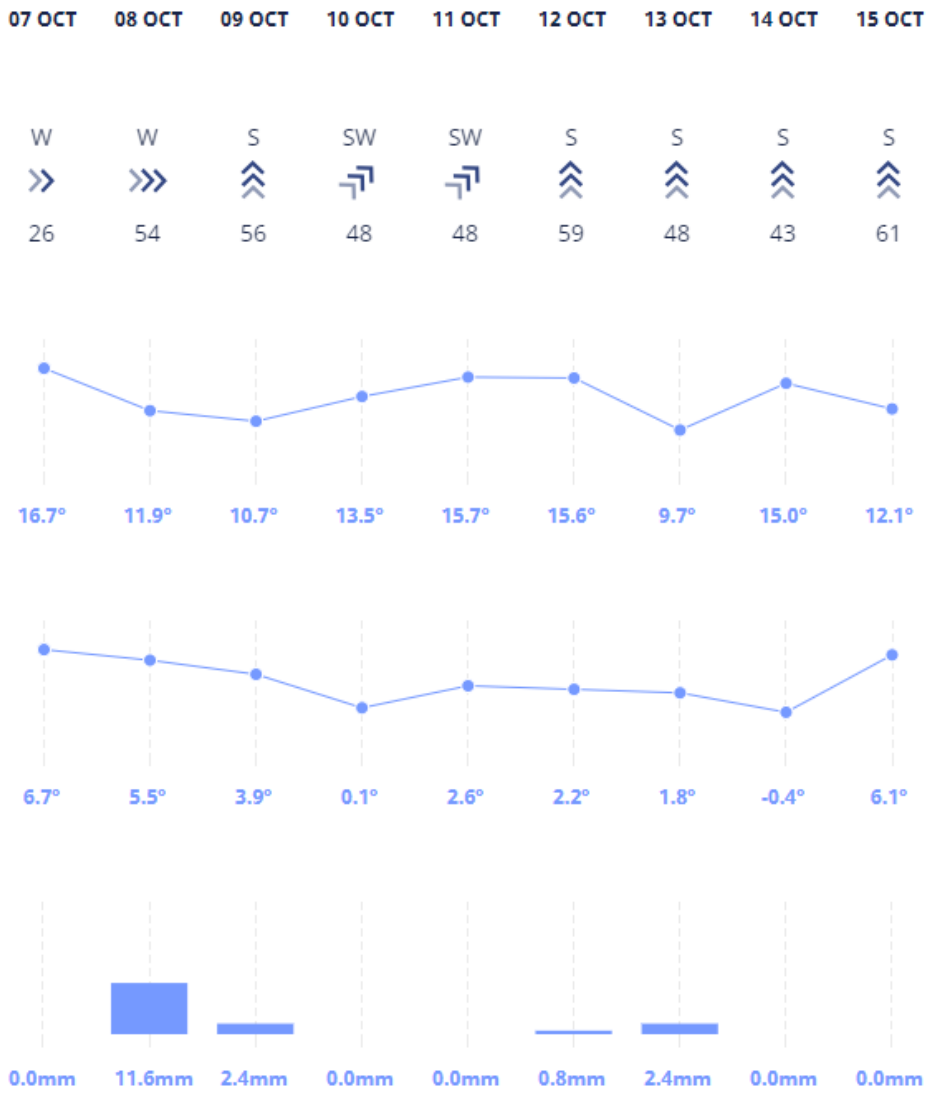
Peak wind gust The direction and speed of the highest gust that was recorded on the calendar day.
Temperature The highest and lowest temperatures that were recorded on the calendar day.
Rainfall The total rainfall that fell during the calendar day.
Observations recorded at Queenstown Airport (AWS-93831)

Weather Event Network Damage Report

Late 26th September to 16th October

Peak wind gust The direction and speed of the highest gust that was recorded on the calendar day.
Temperature The highest and lowest temperatures that were recorded on the calendar day.
Rainfall The total rainfall that fell during the calendar day.
Observations recorded at Queenstown Airport (AWS-93831)

Weather Event Network Damage Report



Please see the link for weather related data source: Queenstown Past Weather Observations - Met Service New Zealand

THE PRESS | TE MATATIKA

Milford Sound was not the only tourist hotspot to set a record for rainfall for the month – Queenstown recorded close to four times its average, Law said.

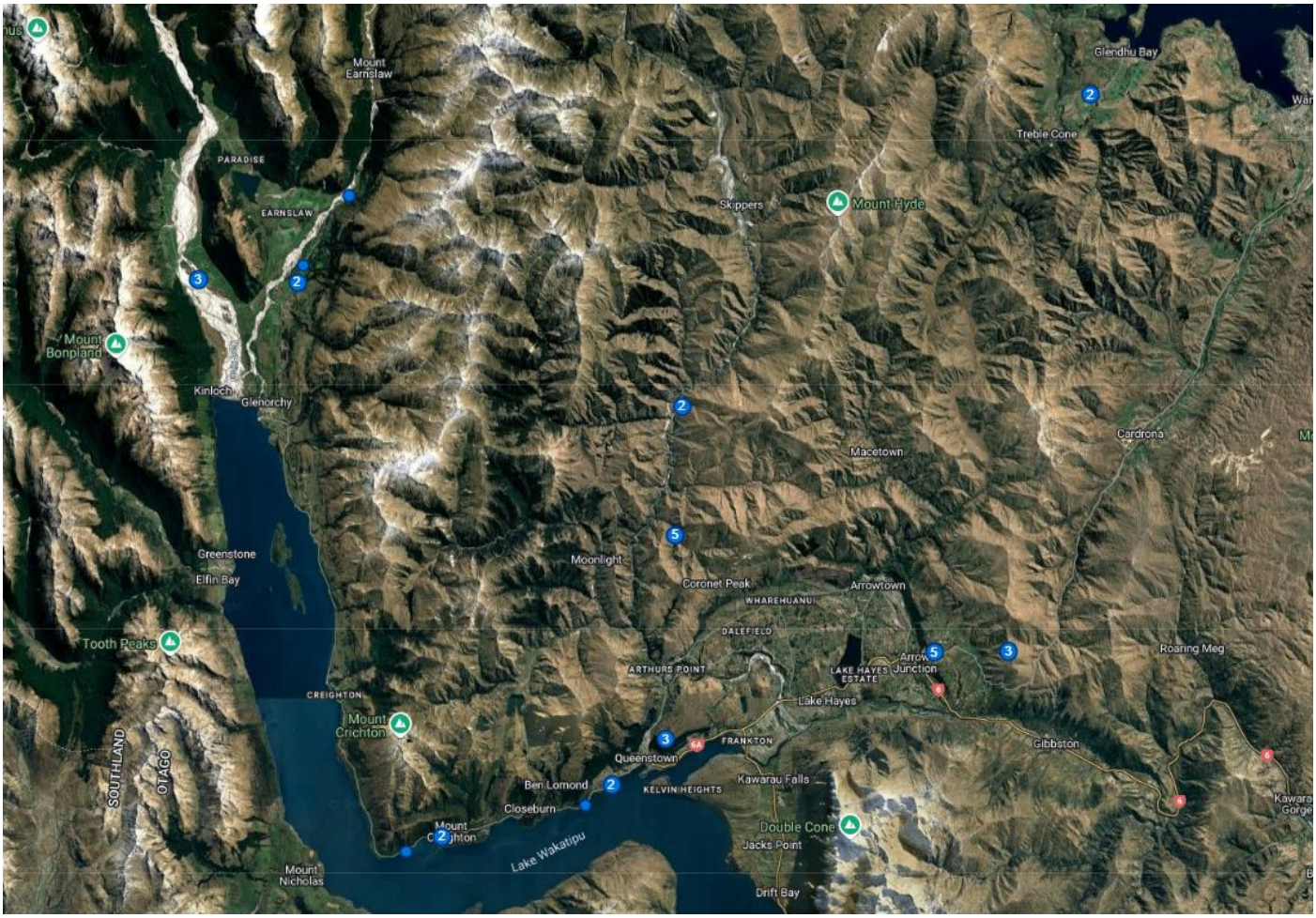
"It's been the wettest September in Queenstown since 1968 with 202mm for the month. The previous record is 171mm, and the average for the month is 54mm," he said.

Avalanches set off for preventative reasons in Southland

VIDEO CREDIT: WAKA KOTAHI

Please see the : September rain saturates Milford Sound and the deep south | The Press

Storm Event Defects Identified plotted over map area:



Network Impact Per Site Breakdown.

Name of Road	*SKIPPERS ROAD– RP 6,500 – RP 16,243*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$5,846.69	
Recovery (minor works) – Practitioner Solutions)	$15,600.00	$166,894.11	
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:	**$15,600.00**	**Total Cost Completed:**	**$172,740.80**
Total Estimate + Completed Cost	**$188,340.80**		
DESCRIPTION			
Skippers Road and Branches Road endured the significant duress and with a large number of defects across the length of the road section. Downer Teams have been able to identify all the defects and/or estimated due to access restrictions (Road Washouts). We have received some photos from local resident that are isolated on the other side of the road washouts but have not been able to inspect and estimate total impact on Skippers Road that then lead into Branches Road. Skippers and Branches severely impacted by weather event and resulted in slips, dropouts and large washouts along the full sections of Skippers and The Branches Road.			

Blue slip is driveable but is very steep. The plan is to wait for it to dry out as much as possible and lower the height by about a metre therefore reducing the severity of the angle of the far side of blue slip down to the skippers branches intersection. This work will take 4-5 days and whilst it is being carried out there will be limited access through blue slip. Michelle has sent a communication today to all affected parties communicating this.

Current Status of Road: (As of 4/12/2024)

Road has been fully opened. The surface after the branches intersection to the bridge could benefit from a grade. We will look to grade before the holidays. There is a weeping patch after wong gongs which needs some rock in it to future proof it. This will be done in the coming fortnight. Drainage work is still required along the length of the road where little slips and slumps have fallen into the water tables. I envisage this being another 1 week to 10 days on the wheeled excavator.

Both sections of road have been opened to road access, however the road sections are still in vulnerable conditions in the event of another weather event. Long – Term remediation repairs could consist of upgrading drainage structures, completing some retreat works on banks. Some areas would not be viable to attempt long-term repairs as hillsides are extremely high and steep elevation.

Photos (Damage extent):


44° 54' 31.398" S, 168° 40' 23.088" E

Weather Event Network Damage Report

Name of Road	*THE BRANCHES ROAD*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response			
Recovery (minor works) – Practitioner Solutions)	$14,700.00	$39,940.18	
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:	**$14,700.00**	**Total Cost Completed:**	**$39,940.18**
Total Estimate + Completed Cost	**$54,640.18**		

DESCRIPTION

Skippers Road and Branches Road endured the significant duress and with a large number of defects across the length of the road section. Downer Teams have been able to identify all the defects and/or estimated due to access restrictions (Road Washouts). We have received some photos from local resident that are isolated on the other side of the road washouts but have not been able to inspect and estimate total impact on Skippers Road that then lead into Branches Road. Skippers and Branches severely impacted by weather event and resulted in slips, dropouts and large washouts along the full sections of Skippers and The Branches Road.

Blue slip is driveable but is very steep. The plan is to wait for it to dry out as much as possible and lower the height by about a metre therefore reducing the severity of the angle of the far side of blue slip down to the skippers branches intersection. This work will take 4-5 days and whilst it is being carried out there will be limited access through blue slip. Michelle has sent a communication today to all affected parties communicating this.

Current Status of Road: (As of 4/12/2024)

Road has been fully opened. The surface after the branches intersection to the bridge could benefit from a grade. We will look to grade before the holidays. There is a weeping patch after wong gongs which needs some rock in it to future proof it. This will be done in the coming fortnight. Drainage work is still required along the length of the road where little slips and slumps have fallen into the water tables. I will estimate this being another 1 week to 10 days on the wheeled excavator between skippers and Branches Road to get pavement conditions on the road to acceptable drivable standards for public road users.

Both sections of road have been opened to road access, however the road sections are still in vulnerable conditions in the event of another weather event. Long – Term remediation repairs could consist of upgrading drainage structures, completing some retreat works on banks. Some areas would not be viable to attempt long-term repairs as hillsides are extremely high and steep elevation.

Photos (Damage extent):

Name of Road	*Chard Farm - Rp 1175*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response	-	$7,686.81	
Recovery (minor works) – Practitioner Solutions)			
Recovery (Major Works) – Designed Solution	$350,000.00 (Variable Options)		
Total Estimate to Complete:	**$350,000.00**	**Total Cost Completed:**	**$7,686.81**

Total Estimate + Completed Cost	$357,686.81

DESCRIPTION

Road has dropped out from further from and existing retaining repair. The road services an Orchard Farm at the end of the road, low vehicle volume road. The dropout/washout has extender for approx. 21m and across the existing repair. The dropout shoulder footing has dropped away and the opposite bank cliff has potential of slipping also. Road is extremely narrow through this section. Vehicle limit required to reduce the risk and close road during events.

Current Status of Road: (As of 4/12/2024)

Chard Farm has been opened under Road Restrictions.

- There are rockfall signs at both ends of the slip area. One of these is new since the incident.
- There are no stopping signs at both ends of the rockfall area. These are newly installed since the incident.
- The signs displaying the weight limit are a modified version of the RH4 which is the sign you get for the loading limits of bridges. This is a standard sized sign.

Road is very narrow at this dropout section and has risk of slipping away during heavy rain event. Current protocols put in place is to close road during heavy weather events.

Design Engineer has investigated the site, and the repair options are under review, the following options have been discussed:

1. Baley Bridge Install and Lease for 5 years (Cheapest Solution- $350,000.00 Install and Lease 5 years).
2. Slip Retreat and Dropout Repair ($500k-$600K Depends on Design).
3. Do Nothing-Monitor Road under Restriction- Placement of closure during events ($19,200.00 Estimate over 24 months).

Photos (Damage extent):

Weather Event Network Damage Report

Name of Road	*Moonlight Track – Rp 248-396*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$201.00	
Recovery (minor works) – Practitioner Solutions)	$18,579.00		
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:	**$18,579.00**	**Total Cost Completed:**	**$201.00**
Total Estimate + Completed Cost	**$18,780.00**		
DESCRIPTION			
The slip is adjacent to the tar edging of Moonlight Track. There is a risk that the edge of Moonlight Track may be undermined if there is ongoing rain. The slip is about 75metres past (on the right) of the driveway to properties 24/28 Moonlight track. A similar occurrence happened several years ago resulting in stone gabions being installed along Moonlight Track. The gabions are about 50 metres before the new slip. Shoulders have washed out during rain event. Required materials to be imported and backfilled, shaped and compacted.			
Current Status of Road: (As of 4/12/2024)			
Road is open to local traffic and signage installed to make safe. Shoulders required to reshaped and reformed, and pavement reinstated. Import Ap40 aggregates and place, shape and compact shoulders. Reinstate the seal in section where broken or washed out.			
Photos (Damage extent):			
			

Name of Road	*Wanaka Mount Aspiring Road RP 33,000-45,757*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$1,120.00	
Recovery (minor works) – Practitioner Solutions)		$17,372.98	
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:	**$**	**Total Cost Completed:**	**$18,403.65**
Total Estimate + Completed Cost	**$18,403.65**		
DESCRIPTION			

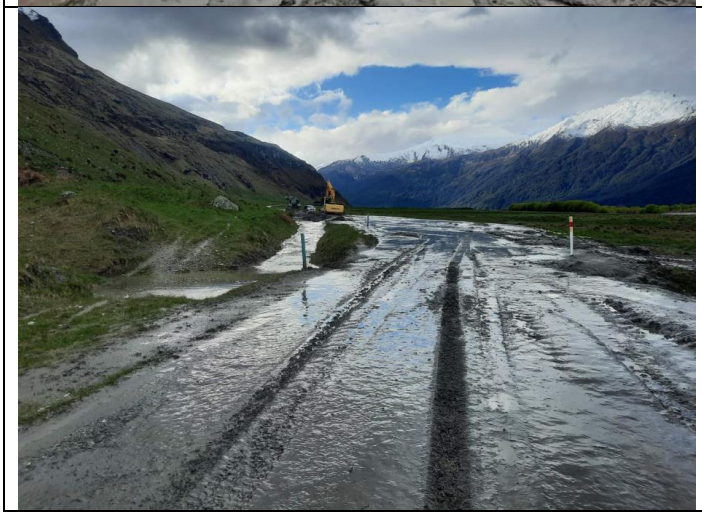
Hi Sam,
Just an update regarding Wanaka-Mount Aspiring Road:
Road Closed - 5pm due to slip/mudslide 1km north of Matukituki Station.
Traffic that was stuck is now able to exit thanks to the farmer diverting the mudslide into the water table.
CMH are heading in with a loader this evening to clear as much as they can just in case anyone is still up at the carpark yet to return to Wanaka. 6/10/2024

We will keep the road closed overnight at this stage and the Grader will sort the rest and we will re-open the road first thing.
Attached photos for more clarity on what's happening.
Mount Aspiring Road was inspected this afternoon. Unfortunately, the road will remain closed overnight
The road is closed beyond Matukituki Station and the Matukituki Lodge on Mount Aspring Road
An update will be provided at midday tomorrow Wednesday 9 Oct

Current Status of Road: (As of 4/12/2024)

Road has been opened and reinstated. Some Grading scheduled to complete.

Photos (Damage extent):



Name of Road	*Kinloch Road Rp 1727-2774*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$1,721.08	
Recovery (minor works) – Practitioner Solutions)			
Recovery (Major Works) – Designed Solution	**$247,190.76**	$178,927.79	
Total Estimate to Complete:	**$247,190.76**	**Total Cost Completed:**	**$180,648.87**
Total Estimate + Completed Cost	**$427,839.63**		

DESCRIPTION

Road severely washed out by the river during heavy rain. 11-09-2024
Temporary Track has been installed and some minor Groins have been installed to assist with river diversion.
Armouring of the scoured-out area of the Kinloch Road to prevent further scoring and secure the surrounding ground adjacent to the Temporary Track/Road alignment, along with the creating of Kicker Groins was completed on Saturday afternoon 22 November. The Temporary Track/ Road has had delineation installed along its alignment, as well as warning sign and directional signs at each end of Kinloch Road.

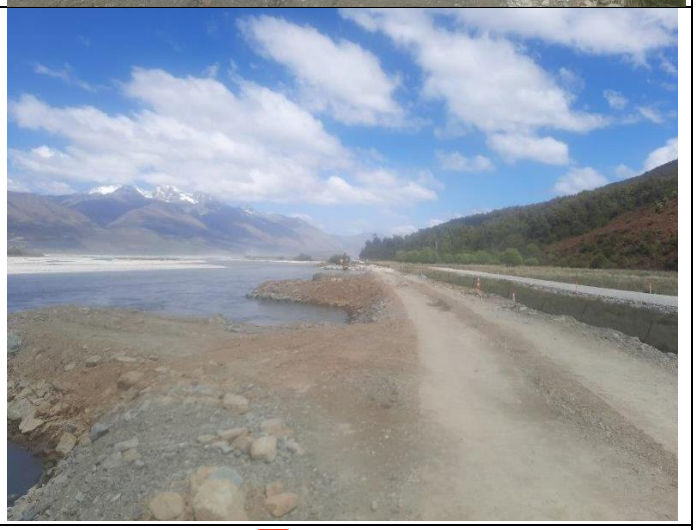
Long-Term Works is to reinstate the full road length 170m-180m, sourcing materials from riverbed overburden, compact in layers and Rock Armour the shoulder of the road with Large Boulders. Installation of Rock Boulder Groins to divert flow during heavy full river flows. While sourcing rock, divert river flow.

Current Status of Road: (As of 4/12/2024)

Temporary Road have been built through private property adjacent to the road. Access for Local residents have been reinstated until long-term planned works are approved and initiated.

Photos (Damage extent):




IMG_4936.MOV

Adobe Acrobat Document

Please see the attaced live video and PDF Report

Name of Road	***The Von Road - RP***		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$4,025.06	
Recovery (minor works) – Practitioner Solutions)			
Recovery (Major Works) – Designed Solution	$135,521.25		
Total Estimate to Complete:	$136,621.25	**Total Cost Completed:**	**$4,025.06**

Weather Event Network Damage Report

Total Estimate + Completed Cost	$139,546.31

DESCRIPTION

After the rains at the end of October the riverbank next to the Von Road has been chewed out much in the same way that Kinloch Road has been. This is in a different area to the one which we have previously repaired.
In the next very large rain event, the road could be compromised. At this stage I have not engaged Derek/Stantec to have a look. Please advise what course of action you would like us to take, inspection by Downer and or Stantec, via helicopters, driving etc. A noteworthy point is Te Anau earthworks who we use for repairs to this section of road are already in the valley undertaking work for South roads who have the maintenance contract for the other part of the Von Road. If we did want to take any action, then we would be well placed to do so this side of Christmas.
Derek and I at Rich's agreement are going to inspect the damage to Kinloch Road at the end of this week. Derek will follow up after we have had the site visit.

Long-Term Designed Repair: Establish 20/30t excavator on site. Establish moxi on site. Retrain river back into previous more desirable channel using digger. Use material from channel retraining to reprofile riverbank to previous form. Place bidim over new bank down to 1m below water level. 100mm beach material placed on top of bidim. Place 600t of rip rap rock on reprofiled bank for 80m. Rock to be carted from quarry in Mossburn.

Design engineer comments:

The traditional method is to armor the bank with a revetment of large rocks. Do you have a source of large rocks in the area? Otherwise, the other traditional remedy is gabions – but there is a risk of abrasion with gabions, it's probably not too severe here as the river does not have a bed load like the steep creeks around Glenorchy.

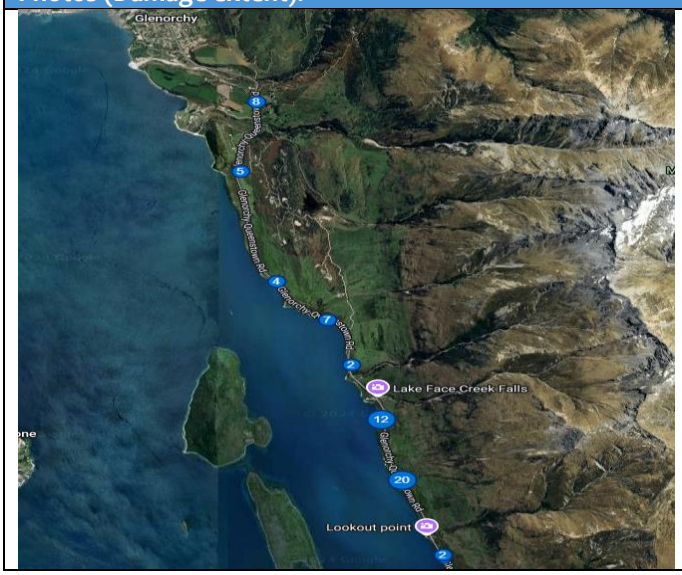
Last you could put a big digger in there and chase the creek over a bit, but this solution might not be durable as in the next flood it may go back to the same location.

Hard structures like walls or shotcrete are not very successful for training rivers as they tend to fail

Current Status of Road: (As of 4/12/2024)

Response / intermediate works completed to get road open: this is for the washout on the fords on the von road on three separate occasions. South roads had to go in and grade out the fords each time due to the road being impassible for vehicles.
Road has been made safe with some signage, the shoulder is eroded and road is in a vulnerable state in the event of significant weather impact. Proposal presented and will await approvals or instruction.

Photos (Damage extent):

Name of Road	*GLENORCHY-QUEENSTOWN ROAD RP 523-3281, 12408-14660*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$1,901.17	
Recovery (minor works) – Practitioner Solutions)		$13,720.24	
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:		**Total Cost Completed:**	**$15,621.41**
Total Estimate + Completed Cost	**$15,621.41**		
DESCRIPTION			
During the September Event and again in October there where multiple slips and trees that came down and blocked road access. The crews responded and cleared slips and trees to open access to road users. Caller reported about a tree has fallen on the Glenorchy-Queenstown Road blocking one lane. Tree is fallen almost one km from Bobs cove on Glenorchy-Queenstown Road. Caller advised that there is a section people called it narrow and it is close to narrow. Caller is happy to be contacted if required more information. Location: Glenorchy-Queenstown Road Fernhill Queenstown Otago 9371.			
Current Status of Road: (As of 4/12/2024)			
Road is fully open and no further weather event related issues.			
Photos (Damage extent):			
			

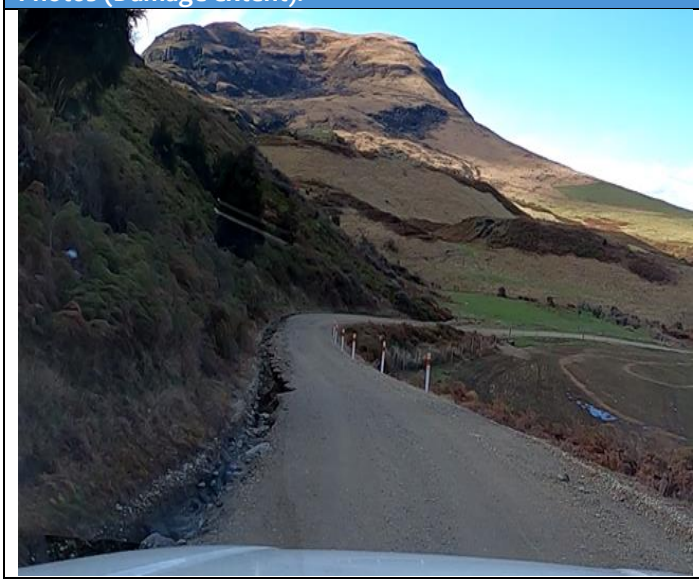
Name of Road	*MOTATAPU ROAD RP 2645-4485*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$700.86	
Recovery (minor works) – Practitioner Solutions)		$19,854.56	
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:		**Total Cost Completed:**	**$20,555.42**
Total Estimate + Completed Cost	**$20,555.42**		
DESCRIPTION			

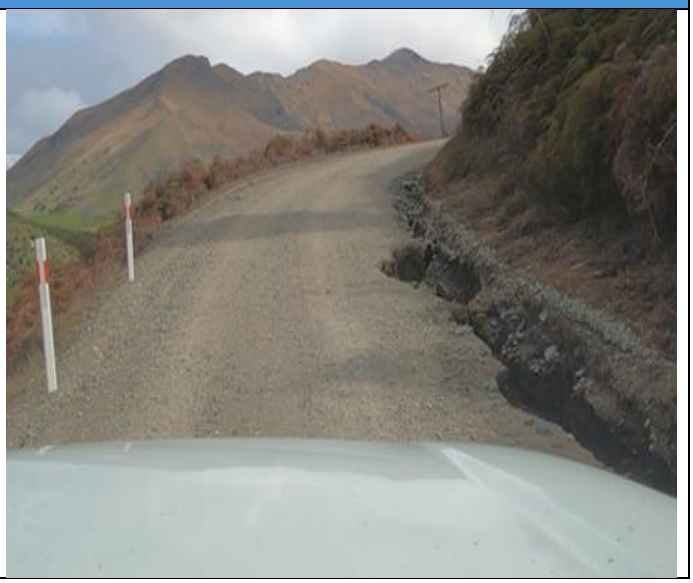
Severy scouring formed along road shoulder and very deep and dangerous. Team has responded and repaired road. Shoulder shaped and collapsed, materials imported and packed in layers and compacted. Drainage cleaned, formed and reinstated.

Current Status of Road: (As of 4/12/2024)

Road is fully open and no further weather event related issues.

Photos (Damage extent):





Name of Road	*Rees Valley Road – RP1974 - 7058*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$17,691.68	
Recovery (minor works) – Practitioner Solutions)			
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:		**Total Cost Completed:**	**$17,691.68**
Total Estimate + Completed Cost	**$17,691.68**		

DESCRIPTION

Large Roack and rockfall blocking road and teams responded to clear and remove.
Hi Team, Customer has called to say a huge rock has fallen onto Hensman Road. She had to drive around the rock. Thanks, BH.. Cleared using loader then broom and shovel.

Current Status of Road: (As of 4/12/2024)

Road is fully open and no further weather event related issues.

Photos (Damage extent):

Weather Event Network Damage Report

Name of Road	*Hensman Road RP 772-782*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$7,387.23	
Recovery (minor works) – Practitioner Solutions)			
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:		**Total Cost Completed:**	**$7,378.23**
Total Estimate + Completed Cost	**$7,378.23**		

DESCRIPTION

Large Roack and rockfall blocking road and teams responded to clear and remove.
Hi Team, Customer has called to say a huge rock has fallen onto Hensman Road. She had to drive around the rock. Thanks, BH.. Cleared using loader then broom and shovel.

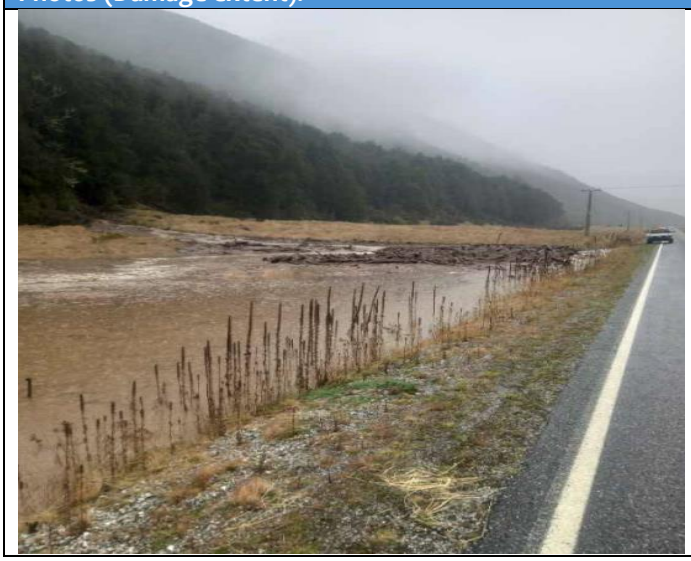
Current Status of Road: (As of 4/12/2024)

Road is fully open and no further weather event related issues.

Photos (Damage extent):

Weather Event Network Damage Report

Name of Road	*GLENORCHY-ROUTEBURN ROAD- RP2320*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$6,080.95	
Recovery (minor works) – Practitioner Solutions)			
Recovery (Major Works) – Designed Solution			
Total Estimate to Complete:		**Total Cost Completed:**	**$6,080.95**
Total Estimate + Completed Cost	**$6,080.95**		
DESCRIPTION			
Large Volume slip debris, mud, and timber. Blocking pipes and channels. Crew Responded and Cleared debris blocking infrastructure assets.			
Current Status of Road: (As of 4/12/2024)			
Road is fully open and no further weather event related issues.			
Photos (Damage extent):			



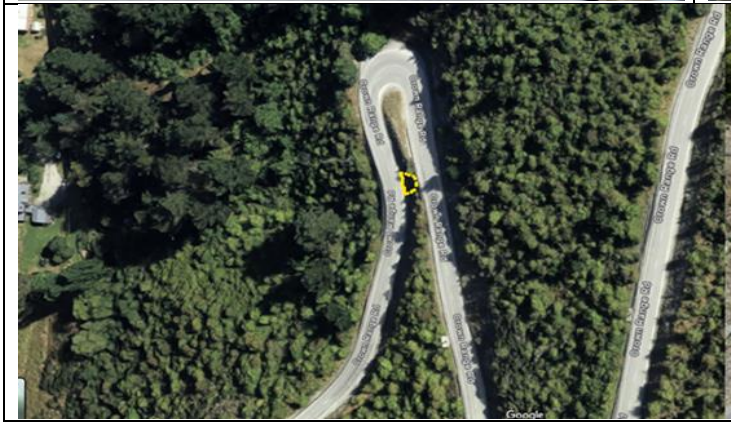
Name of Road	*Crown Ranges Zig Zags Rp 1264 to Summit*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response		$3,553.41	
Recovery (minor works) – Practitioner Solutions)	$41,500.00		
Recovery (Major Works) – Designed Solution	$70,500.00	$113,889.56	
Total Estimate to Complete:	**$112,000.00**	**Total Cost Completed:**	**$117,442.97**
Total Estimate + Completed Cost	**$229,442.97**		
DESCRIPTION			
Zig Zag Slip RP1.264.: Derek Chin Notes – Design Engineer. This email is in response to your request for comment regarding the severity of the upper slip on the Crown Terrace zig zags. There are a number of areas of slip following the rainfall in October 2024, and this response relates to the highest one at RP1.264. Please find attached a photo of the upper area of this slip. The slip is many tens of meters high; I estimate it extends to approximately 40m above the road.			

At the top of the slip are a series of vertical scarps and open cracks. The exposed scarp faces are up to approximately 1.5m high. Downslope of the scarps is an area of loose chaotic slip debris which is translationally sliding down the slope. Approximately 10-15m above the road there is a significant bulge as the translational slip debris is bulging outward , potentially because the toe is held up by the road but the weight of the debris sliding down is causing the bulge.
I have been passing the slip on a regular basis as I have been undertaking work at Cardrona. It is clear that the slip is still moving, and the bulge is shedding material which falls to the road below. I am aware that Downer is regularly clearing this area of the road due to the ongoing shedding of debris from the bulging area.
The slip is clearly still moving. To exacerbate the situation, the translational sliding has caused the material to become noticeably looser, and further open the scarp cracking at the top. The combination of loose chaotic material and the open scarp cracking at the top will allow further water ingress into the sliding material. Thus, with further rain I would expect the slip to become more active due to water entering the ground. Water in the ground will increase the mass of the slipping material and will reduce the effective resistance to sliding along the sliding plane. It is entirely possible that further rain will cause a complete, and potentially rapid, collapse of the loose material.
I appreciate that the slip it will be much easier to remove if it is all lying on the road surface, because you could pick it up from the surface with a loader. But it is a perilous situation to have traffic traversing beneath this feature, particularly following heavy rain as there is an increasing risk of rapid failure. A gauge of the safety of such features is to consider if you would park your car or camp beneath it, and the answer is No, there is no way I would camp or park immediately below that feature.
Thus, I think that the risk continues to grow as the material becomes looser, the cracks open wider and the bulge above the road grows. Further rainfall is only going to make the feature less stable. The best thing that can be done is get an excavator to the top of the slip and start to remove driving mass from the top. It should also be self-evident that it would be unsafe to have vehicles traversing beneath the operating digger at the top of the slip. There is a clear danger of dislodged blocks bounding down the slope and impacting on vehicles in the lane immediately below. The risk of rocks getting across the road, over the guard barrier and through the scrub to the zig zag below is considerably lower.

Current Status of Road: (As of 4/12/2024)

Major slip works in this section of the road has been completed including the major slip removal and retreat at Rp 1264. Other minor slips and retaining barriers cleaned and repaired close to the summit. Remedial slip and barrier work still to be completed under static site control approx. 5 days for the remainder of the works.
Additional Major Works Long-Term in section below.

Photos (Damage extent):






Name of Road	*Crown Ranges 11 Sites Various Section – Planned Major Works*		
Phase	**Cost Estimate (Still to complete)**	**Cost (Completed Works)**	
Response			
Recovery (minor works) – Practitioner Solutions)			
Recovery (Major Works) – Designed Solution	$420,000.00		
Total Estimate to Complete:	$420,000.00	**Total Cost Completed:**	
Total Estimate + Completed Cost	$420,000.00		

DESCRIPTION

Numerous Dropout cracking and settlement developed after the heavy wet periods during the period of September. Derek (Design Engineer) has been engaged to investigate the sites and have submitted a report. Please see the attached Report. Estimate an approx. value of minimum scope, with some sites selected Todo nothing and monitor or do minimum of crack sealing or pavement levelling. Estimate can be updated on full review of designs and decision of option selection.

Reference: Crown Range Road Multiple failures between gates and summit Queenstown side

The purpose of this memo is to record my inspection of multiple shoulder failures on the Crown Range Road following the unseasonally heavy rain during October. Eleven areas of instability have been identified on the length of the road between the 'viewing area' and the gates. This document describes each site and proposes a solution for discussion.

Figure 1. Crown Range Road Site Locations

The recommended actions for discussion and their assed degree of urgency are summarised on the table below.

Crown Range Road Summary of Repair Options and Actions

	Site	Urgency	Recommended Repair Methodology for Discussion
1.	Pavement cracking	No action currently	Minor cracking – asphalt patch at an appropriate tie and monitor
2.	Existing tied back post wall, slope failing from toe	Urgent	Add additional row of lower anchors and walers between exposed posts before wall is damaged
3.	80m wide area of remobilised ancient slip	Most urgent/ immediate remedial action recommended	Area currently moving. Construct tied post anchor wall. Two areas to repair, one where movement does not extend into road formation and a second repair design with longer posts and anchors where the movement extends into the upper lane
4.	Localised slipping does not affect pavement yet	No action	Monitor at this stage
5.	26m wide slip with near vertical scarp at road edge 7 unsupported guard rail posts	Urgent	Tied back driven steel post retaining wall suggested. Likely to require two rows of anchors.
6.	Existing rail iron wall	No action	Satisfactory existing cantilever driven rail wall
7.	Existing steel UC wall	No action	Satisfactory existing tied back UC wall
8.	30m Sagging gabion wall	No immediate action	No immediate action recommended. The Wall has sagged and rotated but does not appear to have been adversely affected by the recent rain

9. 18m wide translational failure	Repair after 2,3 &5	Currently the road formation is not affected, thus this site is of less urgency than sites 2,3 and 5. Driven tied back post wall recommended.
10. Existing tied post wall	No action	Satisfactory tied back UC wall
11. Circular slip failure 18m wide	Repair after 2,3 &5	The slip compromises a number of guard rail posts, but we believe is a similar priority as site 9. Driven tied back post wall recommended.

Site 1.

Site 1 is cracking in the middle of the downhill lane approximately 250m downhill of the viewing area. There is minor cracking in the seal on the outside lane which indicates a possible shoulder failure propagating into the lane. The guard rail posts are not visibly out of plumb or translated and thus, if settlement is occurring, it is minor. The edge line was not interrupted or cracked and thus the cracking may be indicative of a pavement failure rather than instability. This is shown in the photograph below.

Figure 2. Site 1.

Site 1	
cause	Possibly localised pavement failure rather than instability

Recommended action for discussion	Asphalt Patch

Site 2.

Site 2 is an existing steel pile and timber lagging wall tied back with self-drilling anchors with timber post walers. The wall was constructed 11 years ago. A significant portion of the hillside has mobilised immediately below the wall. The soil from the toe of the wall has moved out and down approximately 1m and this movement has left the bottom section of the piles exposed. The slip appears to be extensive and there are tension cracks propagating diagonally down slope on both sides of the wall.

Figure 3. Site 2 location from Google Earth

Figure 4. Site 2 with slope failing and sliding away from toe of retaining wall.

Figure 5. Pile driving at site 2 during construction 11 years ago, showing the length of the piles. The working shelf has completely disappeared.

Site 2 Summary.	
cause	Extensive slip propagating from toe of existing wall
Recommended action for discussion	• Excavate a level working platform at the top of the slipping material at the toe of the wall • Excavate between the soldier piles to expose the web to allow infill panels to be constructed • Drill a second set of angled self-drilling anchors in each panel between the soldier piles Either: • Infill between soldier piles with mesh reinforced shotcrete extending into the cavity between flanges. • Or place new 100 x 100 H4 treated timber lagging between the pile flanges and weld two SHS walers to carry the load from the anchors to the piles. Mesh reinforced shotcrete between piles may be a better option due to simplicity in installation.

Site 3.

Site 3 is an extensive slip which is approximately 70m long and the observed land movement extends a significant distance down slope. A series of cracks and settlement runs along the line of the guard rail for most of the slip length, and the slope has settled approximately by approximately 0.5m adjacent to the road. At the western end of the slip, cracks, and associated settlement of approximately 50mm, extend across the pavement into the uphill lane. There are extensive tension cracks within the slope below the road.

Two visits were made to the site on successive days and perceptible movement was apparent between the visits. Should heavy rainfall occur, water may enter the slip through the open cracks and increase the quantity of ground water and it is possible that the slipping rate may further increase.

At the eastern end of the slip is a slope, which appears to be a side scarp, this indicates that the feature may be an ancient landslide, and that periodic movement of the slope, or parts of the slope, has been occurring for a significant period. Google earth shows a head scarp above the road which indicates historic instability of the slope both below and above the road in this area. It is possible, if not likely, that various parts of this slope have mobilised at different times and that currently the lower section of the slope is moving, but no evidence of current movement of the upper section of this slip above the road has been detected. The slip and terrain are shown in the figures below:

Figure 6. Inferred extent of potential slope instability at site 3 from Google Earth. Historic head scarp above the road is clearly visible.

Figure 7. Cracking and settlement at the road shoulder at site 3.

Reference: Crown Range Multiple failures between gates and summit Queenstown side

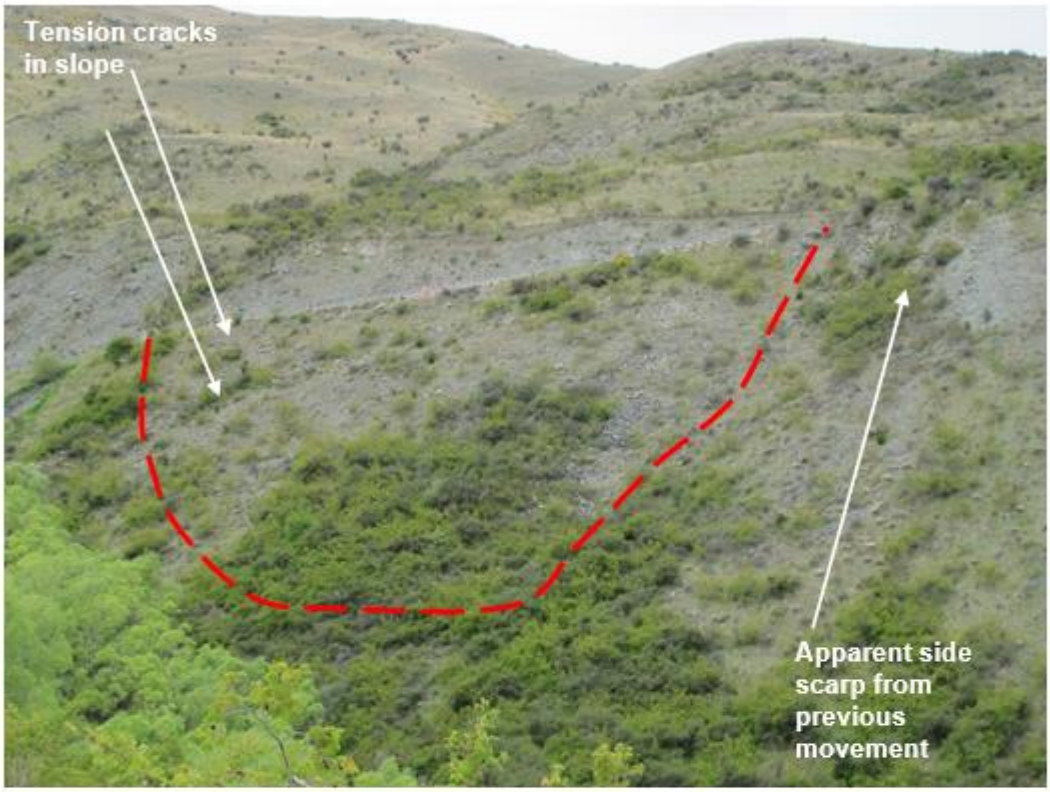


Figure 8. Inferred area of current land movement at site 3, slope tension cracking arrowed

Figure 9. Tension cracking downslope of the road at site 3

Figure 10. 50mm settlement in the pavement at site 3

It appears that the movement observed is limited to the area below the road and that the complete ancient landslide, which extends above the road, has not remobilized. Fortunately for much of the length of the slip, at the eastern side, the failure appears to be downslope of the road shoulder. The deeper-seated failure under the formation at the western end is more difficult to address.

A structural solution can be implemented at the eastern side of the slip to protect the formation from the risk of further removal of support and provide support to the guard rail posts. This may be achieved by constructing a driven steel pile wall tied back with soil anchors in a similar manner to site 2 and other similar repairs. The cracks in the pavement at the western end of the slip are more difficult to stabilise as a failure plane is located beneath the road and this plane may be at a significant depth.

The considerations in selecting a repair methodology include the following:

- Cost of the repair
- Disruption during the installation of the repair and the duration of the installation
- Durability of the repair
- Robustness of the repair

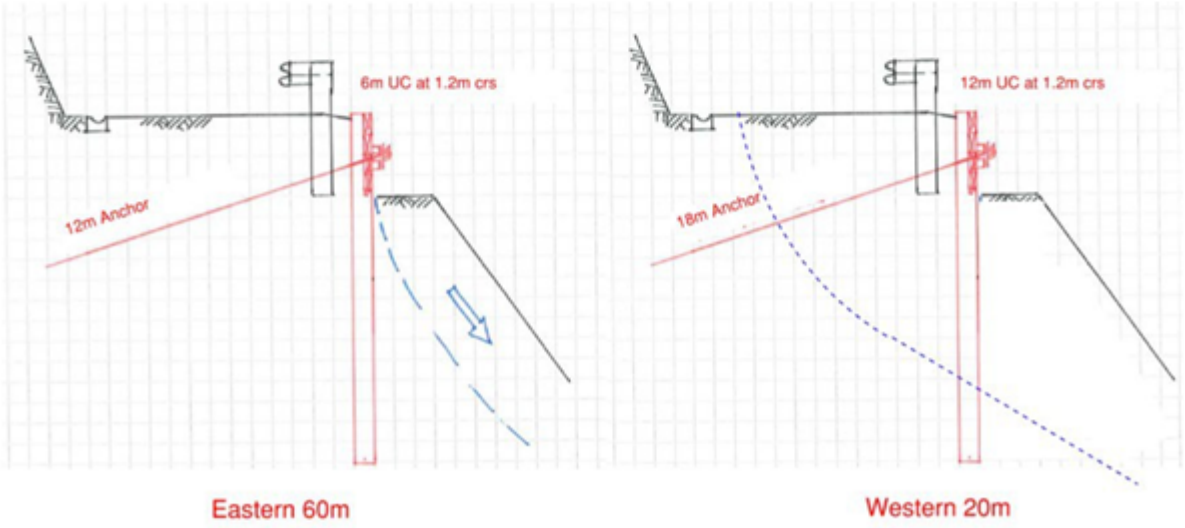
In general, there are three types of solution to this type of slip situation, and these are summarised in the table below:

Site 3 Solution Option Summary.		
Reduce ground water	Drill drainage holes	Difficult access to the site below the road. If water is drained from drilled holes it will need to be piped to the bottom of the slope to prevent it from soaking back into the ground. The site is extensive, and many holes would be required over the expanse of the slip.
	Construct counterfort drain trenches	Constructing Counterfort Drains is likely to be impractical due the access difficulty, depth of trench required, steepness and length of the slope.
	divert water away	No practical method of diverting water away has been identified
Realign the road	Move the road to avoid the slip	This may destabilise the slope above the road. A significant cut would be required. The road alignment would be adversely affected. This option is considered impractical and potentially unsafe.
Structural support solution	Construct a retaining structure to support the road formation	Likely to be the most practical option for the eastern side of site 3. This is less reliable for the western side due the likely depth of the failure surface.
Combination of the above	No worthwhile combination has been identified as realignment has been dismissed is unachievable and potential drainage options are complex to implement in a manner which will be effective	

The situation is summarised in the table below:

Site 3 Summary.

cause	Large historic landslide partially remobilized by recent unseasonal rainfall. The Eastern side of the failure propagates only to the road shoulder, on the Western side a failure plane extends to the uphill lane and 50mm of settlement of the pavement has occurred. The road formation is located on a larger potentially unstable area. Settlement is ongoing and the settlement is noticeably greater each day.
Potential courses of action for discussion:	
East side	• Excavate a working platform • Drive 6m long UC piles at approximately 1.2m crs • Drill 12m long ground anchors between piles at bench level • Place timber lagging between piles, above the level of the ground anchors • Weld SHS walers above and below the ground anchors and fix anchor to walers with steel anchor plate. • Backfill against timber and reinstate guard rail
West side	As per the east side but with longer piles and ground anchors to address potential depth of the failure plane. This has a greater risk of poor performance than the east side because the slip plane would intersect the piles and the structure would be required to support unstable ground



Risks:

- Further failures occur and remove support from the soldier piles
- Rock anchors are over stressed and pull out
- Driven soldier piles hit rock and cannot be driven to the desired depth
- Failure extends before the repair can be implemented
- Further failure planes extend into the road pavement and the design is too light weight to resist the increased load

Site 4.

Site 4 is a surface slip below the road level between site 3 and the adjacent creek. This site is immediately adjacent to site 3 and may be caused by the same features. Currently site 3 does not propagate as far as the road shoulder and there no sign of this causing immediate instability to the road was observed. Thus, at this stage no further action on site 4 is recommended as there are more significant adjacent issues to be addressed.

Figure 11. Site 4

Site 5.

Site 5 is a significant slip which extends from the road surface down slope to the riverbed below. The slip is approximately 26m wide. On the Wanaka side of the slip a large section of rock is exposed which may be bed rock. Above this rock there is a culvert discharging water. This water may be a contributing factor to the slip. Surface runoff from the road is likely to be a contributing factor.

The slip has left approximately six guard rail posts unsupported. The slip is shown below.

Figure 12. Site 5.

This site warrants a structural repair. The two likely solutions are either a tied back gabion structure or a tied back driven soldier pile design as proposed for site 3. A tied back gabion structure has a risk of foundation failure below and would require substantial road excavation and associated delays. A driven soldier pile solution as proposed for site 3 will be less disruptive to construct than a gabion solution. The proximity of rock on the Wanaka side is a risk as there may be rock present that prevents piles from being driven to the desired depth.

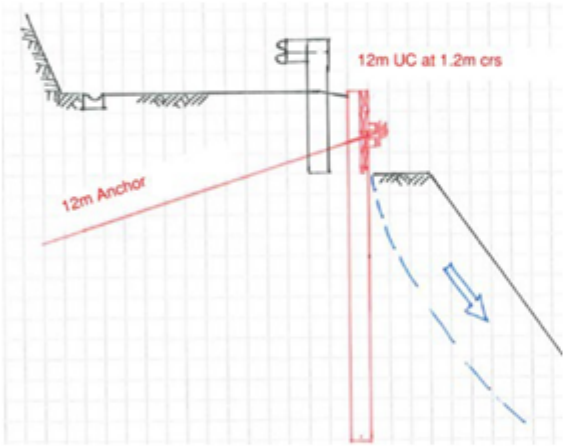
A more detailed measure of the site will be required to assess if one or two layers of ground anchors will be required to tie back the wall. An initial inspection indicates that, once a working platform is constructed, two layers of anchors may be necessary.

Site 5 Summary.

cause	A 26m wide landslide extends from the road to the creek below. This slip has propagated from the edge line of the pavement and left a number of guardrail posts hanging. The upper section of the slip has circular slip face while the lower section is translational.

Potential courses of action for discussion:

- Excavate a working platform
- Drive 12m long UC piles at approximately 1.2m crs
- Drill 12m long ground anchors between piles at bench level
- Place timber lagging between piles, above the level of the ground anchors
- Weld SHS walers above and below the ground anchors and fix anchor to walers with steel anchor plate.
- Backfill against timber and reinstate guard rail



Risks:

- Further failures occur and remove support from the soldier piles
- Rock anchors are over stressed and pull out
- Driven soldier piles hit rock and cannot be driven to the desired depth
- Failure extends before the repair can be implemented

Site 6.

Site 6 is an existing cantilevered driven rail iron retaining structure which appears to be functioning satisfactorily. No action is warranted at this site.

Figure 13. Site 6 driven rail iron wall

Site 7.

Site 7 is an existing tied back driven UC retaining structure which appears to be functioning satisfactorily. No action is warranted at this site.

Figure 14. Site 7.

Site 8.

Site 8 is an existing gabion wall. The gabions appear to be settling slowly, and the guard rail posts are no longer vertical. The road pavement has recently been patched over top of longitudinal cracking. Currently there is no indication for immediate concern about this site and it is of the lowest priority in this area.

Figure 15. Site 8

Site 9.

Site 9 is a spectacular translational slip that extends further than the eye can see down slope. The slip is 18m wide and does not currently affect the guard rail or the road formation.

Figure 16. Site 9

Because this site does not currently threaten the road formation it is of less urgency than other site in the area.

This is a similar layout to site 7 and a similar tied back driven UC post and timber infill is appropriate.

Site 10.

Site 10 is an existing driven tied back steel post retaining structure and is functioning adequately. No action is required at this site.

Figure 17. Site 10.

Site 11.

Site 11 is a 18m wide circular slip which has removed support from six guardrail posts. The ground movement is approximately 300mm settlement and translation. At the time of inspection, no cracks were visible in the adjacent pavement. This site is thus of medium level urgency for repair but is not as severe as sites 2,3 and 5. Because the guardrail support is compromised this is more urgent than site 9 for repair.

Gabions are not considered an appropriate repair option because of the added mass that they will add to the top of the slipping material. Thus, this site is also an appropriate location for driven tied back steel posts and timber infill.

Figure 18. site 11

At this stage I leave this memo with you for consideration and I suggest that we meet to discuss the details of the repairs, methodology, material procurement and timing for the works.

Regards,

Stantec New Zealand

Derek Chinn
Senior Principal Structures Engineer
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derek.chinn@stantec.com

Current Status of Road: (As of 4/12/2024)

Road is open to local traffic and signage installed to make safe where required, sites will be closely monitored on weekly basis.

Weather Event Network Damage Report

Total Summary of Estimate and Cost by Site:

No.	Road Name	Location (Route Position)	Estimate (Design Works Still to Complete LONG-TERM Solution)	Cost (Completed still to Claim)	Cost (Completed/Claimed)	Totals per site
1	SKIPPERS ROAD	RP 6,500 – RP 16,243	$ 15,600.00		$ 172,710.80	$ 188,310.80
2	THE BRANCHES ROAD	RP 500 – END	$ 14,700.00		$ 39,940.18	$ 54,640.18
3	CHARD ROAD	RP 2,103	$ 350,000.00		$ 7,868.81	$ 357,868.81
4	MOONLIGHT TRACK	RP 248- 396	$ 18,579.00		$ 201.00	$ 18,780.00
5	WANAKA-MOUNT ASPIRING ROAD	RP 33,000-45757	$ -		$ 18,492.98	$ 18,492.98
6	KINLOCH ROAD	RP 1700-2600	$ 247,190.76		$ 180,648.87	$ 427,839.63
7	VON ROAD	RP RP 16,773	$ 135,521.25		$ 4,025.06	$ 139,546.31
8	GLENORCHY-QUEENSTOWN ROAD	RP 523,12,269	$ -		$ 15,621.41	$ 15,621.41
9	MOTATAPU ROAD	RP 2645 -4485	$ -		$ 20,555.42	$ 20,555.42
10	REES VALLEY ROAD	RP 1,974 – 7,058	$ -		$ 17,691.68	$ 17,691.68
11	HENSMEN ROAD	RP 772-782	$ -		$ 7,387.23	$ 7,387.23
12	GLENORCHY-ROUTEBURN ROAD	RP 2320	$ -		$ 6,080.95	$ 6,080.95
13	CROWN RANGES ROAD Zig Zags	RP 886 - 23673	$ 41,500.00	$ 70,500.00	$ 117,442.97	$ 229,442.97
14	CROWN RANGES ROAD	11 Sites (planned major Works	$ 420,000.00			$ 420,000.00
		Totals:	$ 1,243,091.01	$ 70,500.00	$ 608,667.36	$ 1,922,258.37

Total Cost (Completed Works)	**$**	**608,667.36**
Total Cost (Completed Works not Claimed)	**$**	**70,500.00**
Total Estimate (Still to Complete):	**$**	**1,243,091.01**
Total:	**$**	**1,922,258.37**

Weather Event Network Damage Report

Ramm Dispatches and Cost Estimates

Dispatch ID	External Ref.	Local Area	Road	Fault Description	Start	End	Side	Date Added
263431		WAKATIPU	CHARD ROAD	Fixed Price Quote	1175		Centre	02/10/2024 14:17:45
263586	RD24/1904	WAKATIPU	CHARD ROAD	Emergency Incident (hr)	2103		Left	07/10/2024 09:09:51
265303		WAKATIPU	CHARD ROAD	Emergency Slip (m3)	1061	1071	Left	15/11/2024 10:45:02
264548	RD24/2069	WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	6878	6898	Centre	27/10/2024 13:02:05
264549	RD24/2070	WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	6878	6898	Centre	28/10/2024 17:01:46
264552		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	866	886	Right	29/10/2024 09:15:21
263490	RD24/1881	WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	2872	2882	Right	04/10/2024 10:19:21
263547	RD24/1892	WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	2872	2877	Right	04/10/2024 19:02:23
263549		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	2800	2899	Centre	04/10/2024 19:51:15
264560	TR24/0583	WAKATIPU	CROWN RANGE ROAD	Emergency Treefall (hr)	8040		Centre	29/10/2024 09:39:28
264645		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	1017	1027	Left	01/11/2024 09:25:32
264649		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	1709	1710	Left	01/11/2024 09:33:40
264660		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	7285	7335	Left	01/11/2024 10:09:03
264661		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	7477	7527	Left	01/11/2024 10:11:31
264662		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	7538	7578	Left	01/11/2024 10:13:36
264663		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	7868	7918	Left	01/11/2024 10:16:15
264665		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	8496	8511	Left	01/11/2024 10:20:54

Weather Event Network Damage Report

264668		WANAKA	CROWN RANGE ROAD	Emergency Slip (m3)	16088	16091	Left	01/11/2024 10:45:23
264680		WANAKA	CROWN RANGE ROAD	Emergency Slip (m3)	14759	14762	Left	01/11/2024 12:52:46
264688		WAKATIPU	CROWN RANGE ROAD	Emergency Slip (m3)	100	110	Right	01/11/2024 13:52:49
264720	RD24/2165	WANAKA	CROWN RANGE ROAD	Emergency Crash (hr)	23673		Centre	03/11/2024 17:01:49
262888	RD24/1782	WAKATIPU	CROWN RANGE ROAD	Emergency Crash (hr)	10000		Centre	23/09/2024 08:03:09
262512	RD24/1684	WAKATIPU	CROWN RANGE ROAD	Emergency Crash (hr)	5000		Centre	13/09/2024 02:02:23
246548	12	WANAKA	CROWN RANGE ROAD	Emergency Flood (hr)	21404		Right	22/09/2023 00:00:00
262574	RD24/1699	WAKATIPU	CROWN RANGE ROAD	Emergency Incident (hr)	5000		Centre	14/09/2024 01:02:23
262579	RD24/1702	WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Incident (hr)	12269		Centre	14/09/2024 15:01:22
262584		WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Dropout (hr)	523		Left	16/09/2024 07:23:12
262633	TR24/0502	WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Incident (hr)	14660		Centre	16/09/2024 23:59:43
259045	RD24/1062	WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Slip (m3)	1	3	Centre	01/07/2024 08:03:20
262508	RD24/1680	WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Incident (hr)	12408		Right	12/09/2024 15:50:40
263453	TR24/0532	WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Treefall (hr)	2000		Centre	03/10/2024 08:46:12
263587	RD24/1905	WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Slip (m3)	3281	3285	Centre	07/10/2024 09:21:40

Weather Event Network Damage Report

263701	TR24/0546	WAKATIPU	GLENORCHY-QUEENSTOWN ROAD	Emergency Treefall (hr)	2104		Left	08/10/2024 16:45:13
263199		WAKATIPU	GLENORCHY-ROUTEBURN ROAD	Emergency Flood (hr)	2320		Right	26/09/2024 12:13:25
261571	RD24/1544	WAKATIPU	HENSMAN ROAD	Emergency Slip (m3)	772	782	Left	26/08/2024 09:41:09
262333		WAKATIPU	KINLOCH ROAD	Emergency Flood (hr)	2695		Right	08/09/2024 21:21:46
262535	RD24/1697	WAKATIPU	KINLOCH ROAD	Emergency Treefall (hr)	1		Centre	13/09/2024 12:43:27
257057		WAKATIPU	KINLOCH ROAD	Emergency Dropout (hr)	1727		Left	08/05/2024 12:48:07
264974		WAKATIPU	KINLOCH ROAD	Emergency Flood (hr)	2774		Right	11/11/2024 07:58:45
264557		WAKATIPU	KINLOCH ROAD	Emergency Flood (hr)	2500		Left	29/10/2024 09:37:41
262721	RD24/1760	WAKATIPU	MOONLIGHT TRACK	Emergency Incident (hr)	248		Right	18/09/2024 14:42:09
263454	RD24/1867	WANAKA	MOTATAPU ROAD	Emergency Treefall (hr)	2645		Right	03/10/2024 08:46:45
263834		WANAKA	MOTATAPU ROAD	Emergency Flood (hr)	4485		Right	11/10/2024 14:08:57
263400	RD24/1854	WAKATIPU	REES VALLEY ROAD	Emergency Incident (hr)	1974		Centre	01/10/2024 11:26:58
262896		WAKATIPU	REES VALLEY ROAD	Emergency Dropout (hr)	7058		Left	23/09/2024 10:30:37
261972	RD24/1584	WAKATIPU	SKIPPERS ROAD	Emergency Slip (m3)	6500	6530	Centre	03/09/2024 11:17:49
262077		WAKATIPU	SKIPPERS ROAD	Emergency Slip (m3)	15319	15819	Centre	04/09/2024 11:48:39
262699		WAKATIPU	SKIPPERS ROAD	Emergency Incident (hr)	4500		Full Width	18/09/2024 11:45:29
262700		WAKATIPU	SKIPPERS ROAD	Emergency Incident (hr)	4648		Full Width	18/09/2024 11:46:50
262701		WAKATIPU	SKIPPERS ROAD	Emergency Incident (hr)	4648		Full Width	18/09/2024 11:49:16

Weather Event Network Damage Report

262702		WAKATIPU	SKIPPERS ROAD	Emergency Incident (hr)	6428		Full Width	18/09/2024 11:50:37
262704		WAKATIPU	SKIPPERS ROAD	Emergency Incident (hr)	15026		Full Width	18/09/2024 11:54:04
263986		WAKATIPU	SKIPPERS ROAD	Culvert Inlet/Outlet Repair	2101		Centre	16/10/2024 08:32:40
263992		WAKATIPU	SKIPPERS ROAD	Emergency Dropout (hr)	14990		Full Width	16/10/2024 10:50:56
263993		WAKATIPU	THE BRANCHES ROAD	Emergency Dropout (hr)	49		Full Width	16/10/2024 10:54:44
247143		WAKATIPU	VON ROAD	Emergency Dropout (hr)	13200		Left	28/09/2023 17:52:15
263190		WAKATIPU	VON ROAD	Emergency Dropout (hr)	16773		Full Width	25/09/2024 16:19:44
263432		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Fixed Price Quote	42951		Centre	02/10/2024 14:20:55
262421		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Flood (hr)	42955		Right	10/09/2024 15:24:45
262422		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Slip (m3)	42951	42981	Full Width	10/09/2024 10:40:33
246653		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Slip (m3)	42095	42115	Right	26/09/2023 11:42:25
261073		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Slip (m3)	45757	45758	Left	13/08/2024 13:10:26
261074		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Slip (m3)	43060	43067	Right	13/08/2024 13:21:41
261075		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Slip (m3)	45157	45159	Left	13/08/2024 15:31:14
263835		WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Flood (hr)	33330		Centre	11/10/2024 14:13:13
263578	RD24/1898	WANAKA	WANAKA-MOUNT ASPIRING ROAD	Emergency Slip (m3)	33000	33040	Centre	06/10/2024 17:31:06