Transport Accident Investigation Commission

Final report
Tuhinga whakamutanga

Rail inquiry RO-2021-106
Derailment of Train 220
South of Hunterville
13 December 2021

May 2023

The Transport Accident Investigation Commission
Te Kōmihana Tirotiro Aituā Waka

No repeat accidents – ever!

"The principal purpose of the Commission shall be to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future, rather than to ascribe blame to any person."

Transport Accident Investigation Commission Act 1990, s4 Purpose

The Transport Accident Investigation Commission is an independent Crown entity and standing commission of inquiry. We investigate selected maritime, aviation and rail accidents and incidents that occur in New Zealand or involve New Zealand-registered aircraft or vessels.

Our investigations are for the purpose of avoiding similar accidents in the future. We determine and analyse contributing factors, explain circumstances and causes, identify safety issues and make recommendations to improve safety. Our findings cannot be used to pursue criminal, civil or regulatory action.

At the end of every inquiry, we share all relevant knowledge in a final report. We use our information and insight to influence others in the transport sector to improve safety, nationally and internationally.

Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Stephen Davies Howard
Commissioner	Paula Rose, QSO
Commissioner	Richard Marchant (until 31 October 2022)
Commissioner	Bernadette Arapere (from 1 December 2022)
Commissioner	David Clarke (from 1 December 2022)

Key Commission personnel

Chief Executive	Martin Sawyers
Chief Investigator of Accidents	Naveen Kozhuppakalam
Investigator-in-Charge for this inquiry	David Manuel
Commission General Counsel	Cathryn Bridge

Notes about Commission reports
Kōrero tāpiri ki ngā pūrongo o te Kōmihana

Citations and referencing

The citations section of this report lists public documents. Documents unavailable to the public (that is, not discoverable under the Official Information Act 1982) are referenced in footnotes. Information derived from interviews during the Commission's inquiry into the occurrence is used without attribution.

Photographs, diagrams, pictures

The Commission owns the photographs, diagrams and pictures in this report unless otherwise specified.

Verbal probability expressions

For clarity, the Commission uses standardised terminology where possible.

One example of this standardisation is the terminology used to describe the degree of probability (or likelihood) that an event happened or a condition existed in support of a hypothesis. The Commission has adopted this terminology from the Intergovernmental Panel on Climate Change and Australian Transport Safety Bureau models. The Commission chose these models because of their simplicity, usability and international use. The Commission considers these models reflect its functions. These functions include making findings and issuing recommendations based on a wide range of evidence, whether or not that evidence would be admissible in a court of law.

Terminology	Likelihood	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

Figure 1: Train 220, locomotive DL9210

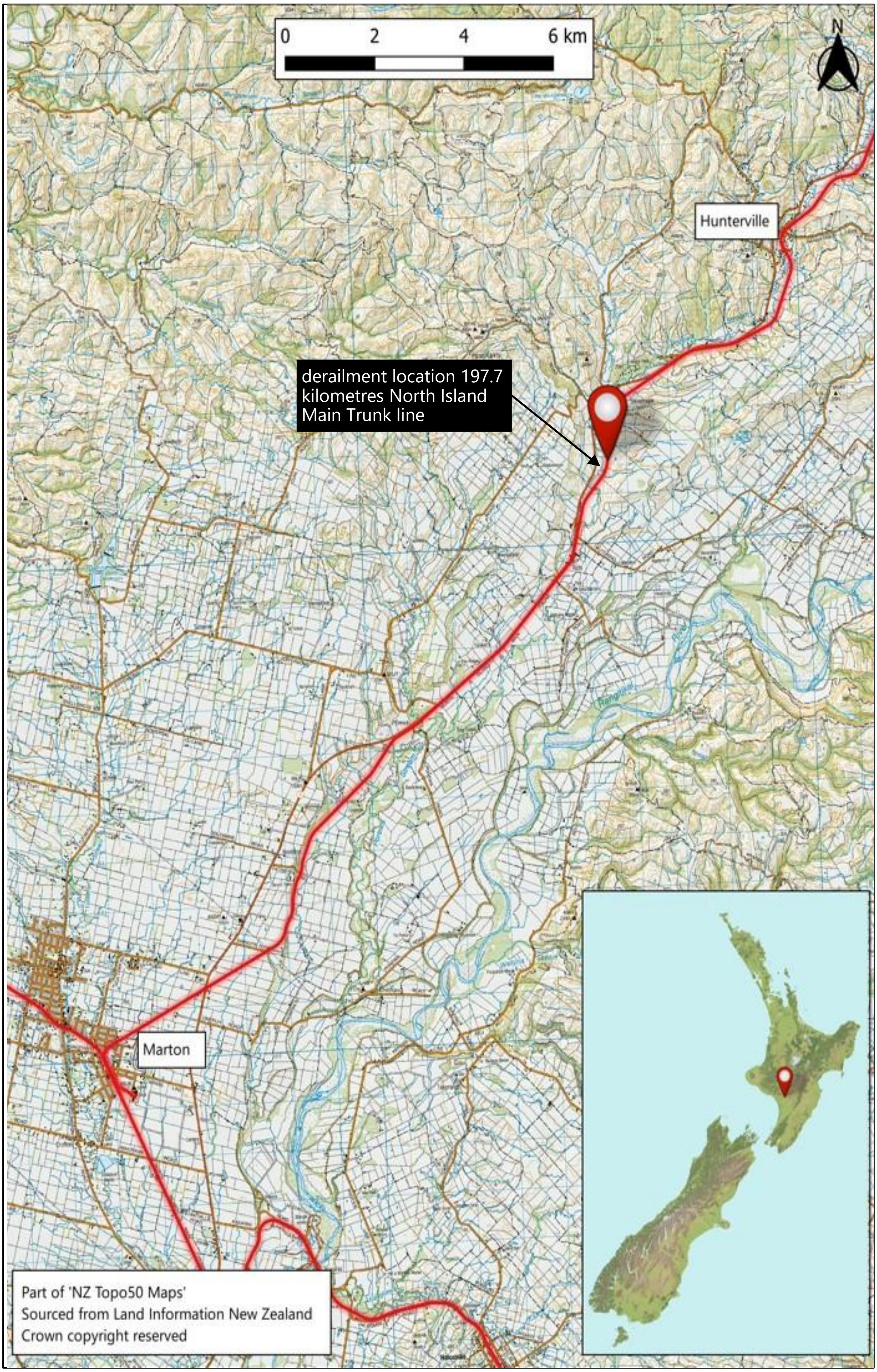


Figure 2: Location of accident
(Credit: Toitū Te Whenua Land Information New Zealand)

Contents
Rārangi take

Figures

1 Executive summary
Tuhinga whakarāpopoto

What happened

1.1 At about 2300 on Monday 13 December 2021, a KiwiRail freight train was travelling north between Marton and Hunterville on the North Island Main Trunk line.

1.2 As the train rounded a left-hand curve, the train driver saw that the field to their right was flooded with water and that the floodwater was crossing the railway track in front of the train.

1.3 The train driver immediately reduced power to the train as it approached the water and then, suspecting that the train had derailed, applied the train's brakes.

1.4 Once the train had stopped, the train driver remained in the locomotive cab to await assistance, as they had seen that the overhead electrical wire was damaged.

1.5 When assistance arrived, it was discovered that 17 of the train's 37 wagons and the locomotive had derailed.

Why it happened

1.6 In the days preceding the accident, unseasonal significant rainfall had occurred throughout the country. The Porewa catchment area, which was the closest to the accident site, recorded significant rainfall of 38.5 millimetres in a two-hour period before the accident.

1.7 This rainfall had led to flooding in the area the train was traversing.

1.8 The area in which the flooding occurred was not within monitoring or capture distance of the nearest weather stations.

1.9 Floodwater inundated an area of farmland that had no recent history of flood events.

1.10 The floodwater removed the ballast formation that was supporting the railway track. The unsupported track moved as the train passed over it, causing the train to derail.

What we can learn

1.11 The transport industry needs to prepare for and be able to adapt and respond to the increase in frequency of unseasonal and severe weather events.

Who may benefit

1.12 All rail access providers and rail operations personnel may benefit from the findings in this report.

1.13 Anyone involved in planning for the impacts of weather events on transport networks may also benefit from the findings.

2 Factual information
Pārongo pono

Narrative

2.1 On 12 December 2021 the North Island of New Zealand was experiencing an unseasonal significant rainfall event.

2.2 Rainfall continued in varying amounts throughout the five-day period of 12 to 16 December.

2.3 Significant rainfall collected in Porewa Stream, about 5 kilometres south of Hunterville in an area of farmland near the North Island Main Trunk (NIMT) line[1]. This caused the stream to rise and eventually overflow into the farmland.

2.4 At 2050[2] on Monday 13 December a train driver (the driver) commenced their shift at Palmerston North rail depot.

2.5 The driver carried out various duties in preparation for the arrival of Train 220 en route from Wellington.

2.6 At 2147, after the arrival of Train 220 at Palmerston North, the driver assumed responsibility for Train 220 from the incoming train crew.

2.7 At 2151 Train 220 departed Palmerston North platform and travelled north on the NIMT.

2.8 A roll-by inspection[3] of Train 220 had been conducted while the train was crossing[4] another train at Greatford, approximately 20 kilometres south of the derailment site. No irregularities had been found in Train 220 during this inspection.

2.9 At about 2259 Train 220 was travelling at 63 kilometres per hour when the driver noticed flooding in a paddock to the right of the track. As the track straightened out the driver noticed floodwater flowing across the track in front of the train (see Figures 3 and 4).

[1] The main railway line for freight and passengers between Wellington and Auckland.
[2] Times used in this report are expressed in the 24-hour format based on New Zealand Daylight Time.
[3] A visual and aural inspection of a moving train to detect faults such as insecure loads and damaged wheels.
[4] Rail terminology for trains meeting each other at a purpose-designed crossing loop. The crossing loop allows trains to pass each other on a single-line track.

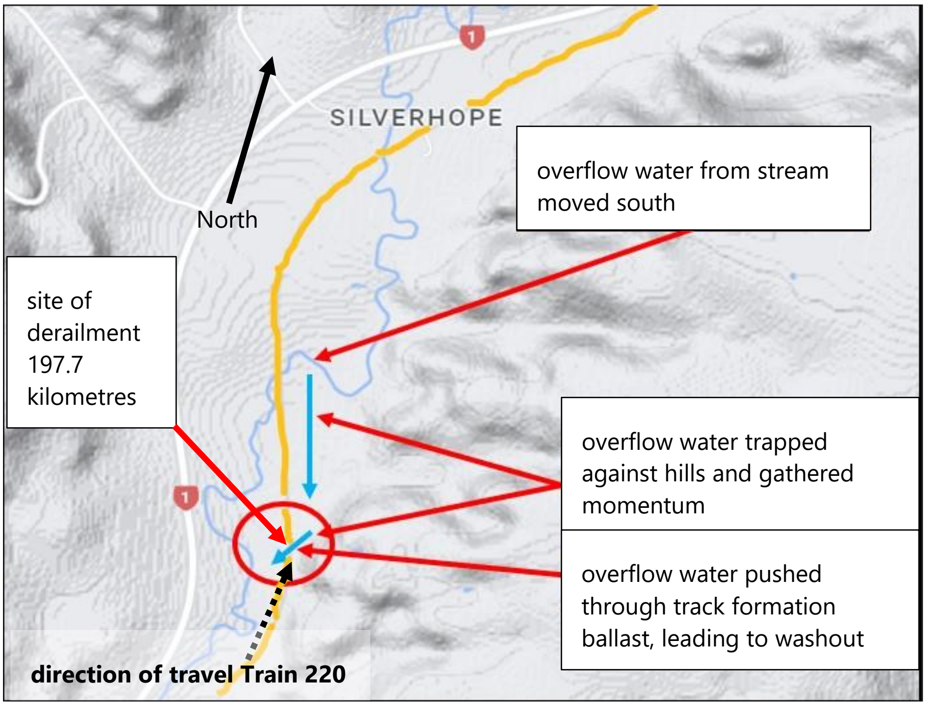


Figure 3: Waterflow leading to washout

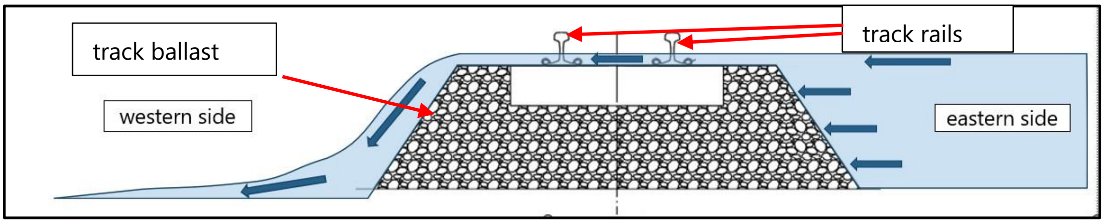


Figure 4: Direction of floodwater over track

2.10 On sighting the floodwater, the driver reduced power to the locomotive by moving the throttle from notch[5] seven to notch four in a five-second period.

2.11 As the train entered the flooded track area the driver heard a loud noise, and at 2300:06 applied the train's emergency brake.

2.12 At 2300:26 the train stopped at the 197.7-kilometre mark on the NIMT[6], approximately 5 kilometres south of Hunterville.

2.13 The activation of the emergency brake set off an alarm at train control,[7] which initiated radio communication between train control and the driver.

2.14 Once the train had stopped, the driver saw that the overhead electrical traction wire[8] had been disturbed, meaning that there was a potential risk of electric shock should they exit the locomotive. The driver advised train control that they would remain in the locomotive cab to await recovery.

[5] Power control for locomotives in New Zealand is typically separated into eight notches, where notch one is minimum power and notch eight is maximum power. The train driver selects power notches by operating a handle in the locomotive cab.

[6] The NIMT is measured by each kilometre starting at Wellington Railway Station (0 kilometres). This increases in a northerly direction to Britomart Transport Centre in Auckland (682 kilometres).

[7] The national train control centre is situated in Wellington Railway Station. It is responsible for track authorisations and the safe movement of rail traffic.

[8] 25-kilovolt electrical wires used for providing power (traction) to electric trains. The wires are held aloft from the track by traction masts.

2.15 From inside the cab the driver was able to observe that at least one wagon had derailed, but was not able to see the full extent of the derailment.

2.16 Assistance arrived about one hour after the derailment. On confirmation that traction power had been isolated, the driver exited the cab and the train was examined.

2.17 A site examination by Transport Accident Investigation Commission (Commission) investigators determined that floodwater had caused washouts[9] in three separate locations, resulting in the train derailing.

Personnel information

2.18 The driver had six years' train-driving experience and had been employed by KiwiRail in rail operations roles for 10 years. They were fully certified for the role. The driver underwent drug and alcohol testing after the incident. The tests indicated negative (clear) results.

Train/Vehicle information

2.19 The train was 588 metres long and weighed 1001 tonnes. It was powered by a DL class locomotive hauling 37 wagons.

2.20 The maximum line speed for the area in which the train was travelling was 80 kilometres per hour. At the time of the incident the train was travelling at 63 kilometres per hour.

Meteorological information

2.21 The Rangitīkei region had been experiencing significant rainfall on the preceding day. At the time of the incident there was no severe weather warning in place for the area. It was dark and visibility was poor.

2.22 Rainfall had collected in Porewa Stream and overflowed onto farmland on the eastern side of the railway. The floodwater had been channelled south into a small valley between hills on the eastern side of the rail formation.[10] The floodwater from the Porewa Stream had gained momentum and the volume of water was further increased by floodwater travelling downhill from a pond situated at the top of the nearby hills (see Figure 5).

2.23 Track-maintenance staff had earlier been called to investigate a report that vegetation was obstructing the track approximately 5 kilometres north of the derailment site. Another train had travelled through the area less than two hours before Train 220. Neither of the track occupants had observed flooding or severe weather requiring a report to train control prior to the accident.

[9] A situation where the formation under a rail track has been removed by water, resulting in the remaining track being unsupported and unsafe for rail traffic.

[10] The structured base on which a track is built, usually consisting of impacted earth and ballast. The formation is designed to support the track and prevent it moving.

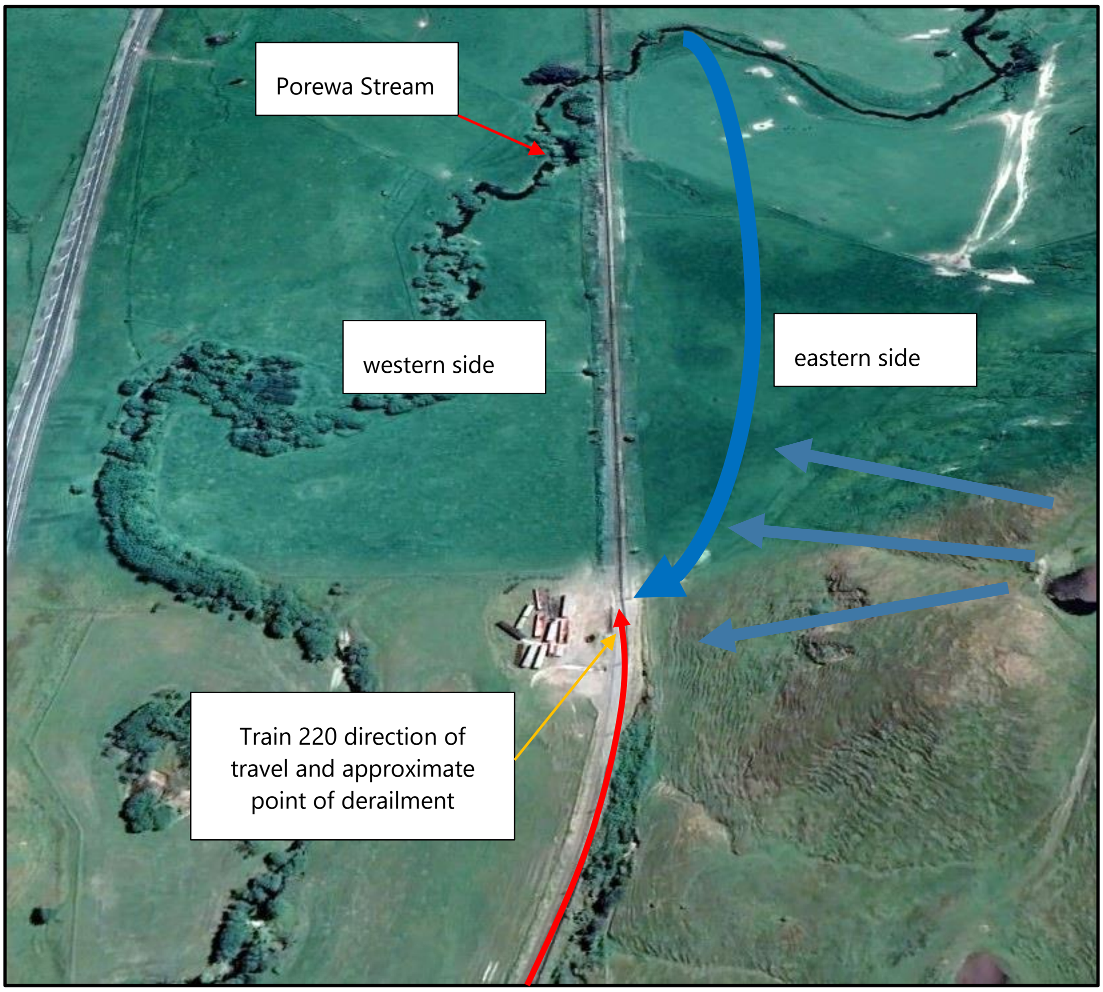


Figure 5: Direction of floodwater
(Credit: Google Earth, modified by Transport Accident Investigation Commission)

Recorded data

2.24 The locomotive was fitted with a data recorder known as Tranzlog. The Tranzlog download was obtained by the Commission and the verified data has been used in this report.

Site and wreckage information

2.25 The train consisted of 38 vehicles (one locomotive and 37 wagons). The locomotive and first wagon passed over the site of the washout; however, the second wagon derailed, causing a further 15 wagons to derail, of which some overturned (see Figures 6 and 7).

2.26 The rear axles of the locomotive and first wagon also derailed, but the vehicles remained upright on the track.

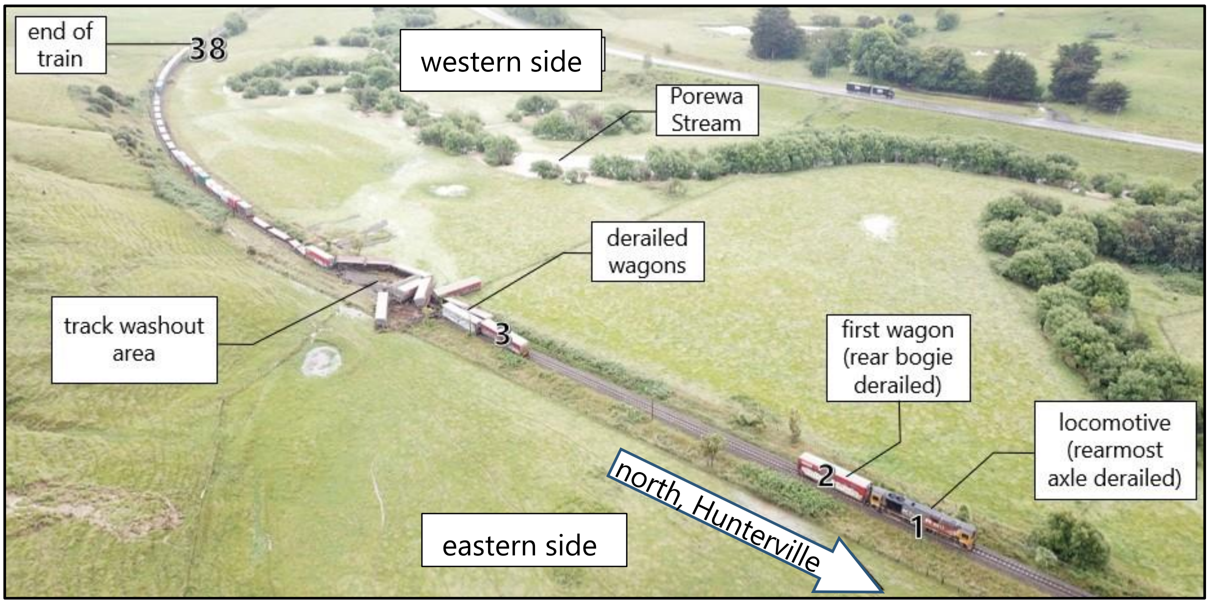


Figure 6: Derailment scene showing entire train
(Credit: KiwiRail, modified by Transport Accident Investigation Commission)

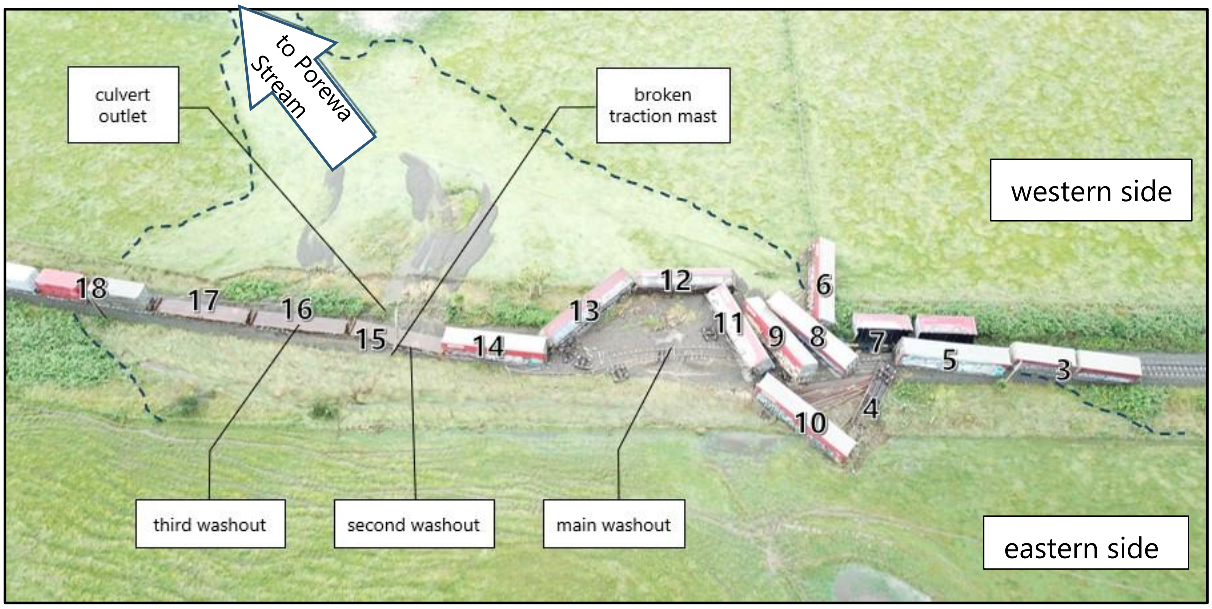


Figure 7: Washout detail
(Credit: KiwiRail, modified by Transport Accident Investigation Commission)

Organisational information

2.27 KiwiRail Holdings Limited, trading as KiwiRail, was the operator of the train and railway.

3 Analysis
Tātaritanga

Introduction

3.1 The weather event that led to the derailment had been ongoing for at least 24 hours prior to the accident.

3.2 KiwiRail had procedures in place to analyse and react to severe weather reports issued by its meteorological weather data supplier. On this occasion the risk to the safety and integrity of the railway was caused not by localised rainfall but by a build-up of floodwater in an unmonitored area that had not flooded for several decades, and no severe weather warning was issued.

3.3 The following section analyses the circumstances surrounding the event to identify those factors that increased the likelihood of the event occurring or increased the severity of its outcome. It also examines any safety issues that have the potential to adversely affect future operations.

3.4 The Commission found that it was **virtually certain** that the derailment followed the events described below.

Occurrences that led to the derailment of freight Train 220

3.5 The floodwater gathered at a natural depression and inundated the track ballast.[11] The ballast was forced from underneath the track by the weight and pressure of the floodwater from the eastern (hill) side to the western (stream) side (see Figure 8).

[11] Crushed stone or rocks placed under rail to support and hold the track in place as trains roll over it.

Figure 8: Ballast washed to western side of railway track
(Credit: KiwiRail)

3.6 Culverts[12] designed to disperse water underneath and away from the track formation at the main washout were not effective due to the volume of floodwater flowing into the area.

3.7 The removal of the ballast from underneath the track seriously weakened the structural integrity of the formation and resulted in the rail track being unable to support the weight of the rail vehicles (see Figure 9).

3.8 As the train passed over the length of track that was now unsupported, the track moved and spread sideways under the weight. This caused the wheels of the rail vehicles to lose contact with the rail and they were forced off the railhead.[13]

3.9 The locomotive and first wagon both derailed at their rear axles, but remained upright and moving forward until they were brought to a stop when the driver initiated the emergency braking.

3.10 The second wagon derailed and left the track to the right-hand (eastern) side. As it left the track the wagon came to an immediate stop, which in turned had a concertina effect on the wagons behind.

3.11 The momentum of the following wagons meant that a series of 'nose-to-tail' collisions occurred. The wagons were forced off the track to both sides and several wagons overturned as a result (see Figures 6 and 7).

[12] Structures that channel water past obstacles to alleviate flooding.
[13] The uppermost part of a track that provides a surface for train wheels to roll over.

Figure 9: Washout showing unsupported rail
(Credit: KiwiRail)

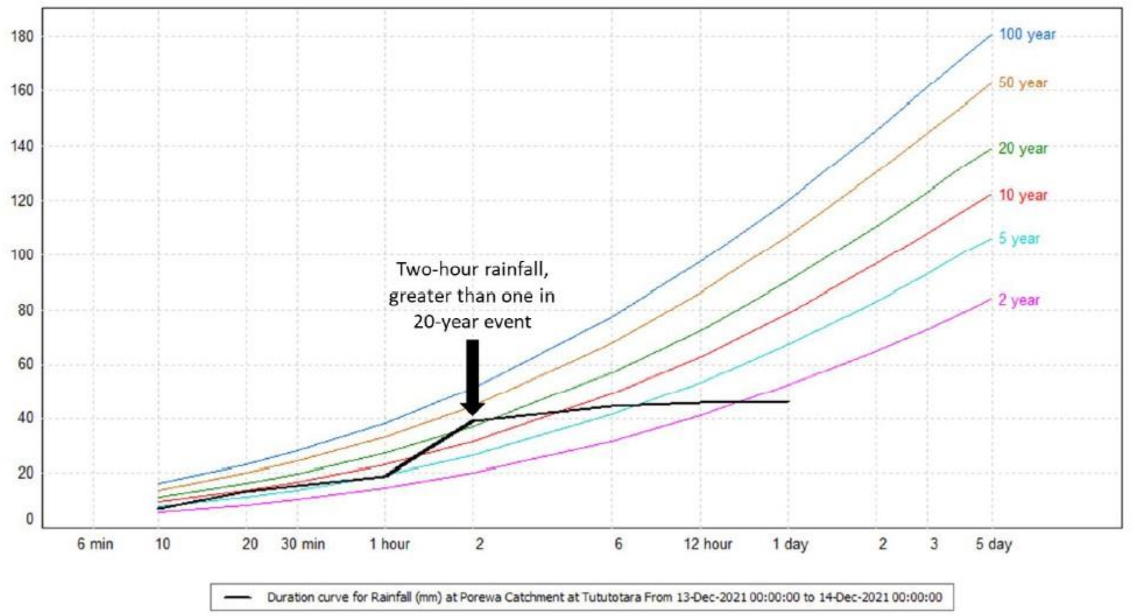
Meteorological information

Safety issue: There were no severe-weather-warning or flood-monitoring measures in place for the area in which the derailment occurred.

3.12 The weather conditions at the time of the accident were abnormal for the time of year[14] (see Appendix 1). A total of 46 millimetres of rain was reported in the Porewa catchment area, 10 kilometres south of the derailment, between midnight on 13 December and midnight on 14 December. In a two-hour period between 1800 and 1959 that same day, 38.5 millimetres of rainfall were recorded, equating to an approximately one-in-24.5-year event (see Figure 10).

3.13 In comparison, there had been a total of 45.5 millimetres of rainfall during the 12 days preceding the accident, including zero rainfall in the three days immediately prior.

[14] Data in paragraph 3.12 was provided to the Commission by Horizons Regional Council. See Appendix 1 for full report.



From the above table and plot, it can be seen that the most significant rainfall event that occurred on 13 December 2021 was a two-hour heavy rainfall event (this occurred during 18:00 to 19:59). During this two-hour event, 38.5 mm was recorded, giving an average rainfall rate of 19.3 mm/hr. The results suggest this two-hour rainfall event is an approximately one in 24.5-year event.

Figure 10: Porewa catchment area rainfall data for 13 December 2021
(Credit: Horizons Regional Council, modified by the Transport Accident Investigation Commission)

3.14 KiwiRail supplied the Commission with its Severe Weather Management protocols, which outlined the procedures and actions to be taken to mitigate the risks of severe weather events.

3.15 KiwiRail's 'Severe Weather' risk actions rely on information provided by its meteorological data supplier. The information is gathered by the supplier from its monitoring sites established at strategic locations around the country. However, it is not considered practicable to have monitored sites in every possible location in the country. The site of the accident was not monitored.

3.16 The meteorological data supplier operates a system where rainfall totalling above 25 millimetres in a 24-hour period from the start of a rain event triggers a yellow alert, and more severe conditions are elevated to either amber alert or red alert.

3.17 KiwiRail assesses the information supplied and takes precautions for particular geographical locations based on the forecast conditions. Depending on the severity of the conditions, the precautions range from simply alerting rail staff to adverse weather conditions in the area to conducting track inspections, implementing speed restrictions and, for more extreme conditions such as ex-tropical cyclones, stopping all activity on the railway. Drivers of rail vehicles are alerted to adverse weather warnings but are not required to take any further actions unless directed by train control.

3.18 In this situation, and as the extent of the rainfall had not reached the 24-hour period required to trigger an alert at the time of the accident, there was no severe weather warning in place.

3.19 Another northbound train had travelled through the area 100 minutes before Train 220 derailed, and the driver of that train had not observed, and therefore had not reported, any weather conditions of concern.

3.20 It is **very likely** that during the 100-minute period between the trains passing through the area the deluge of floodwater occurred quickly.

3.21 Even if a severe weather warning had been in place, it is **unlikely** that, beyond alerting staff, any precautionary action would have been taken by KiwiRail, due to the fact that there was little precedent for flooding in the location.

Further safety actions

3.22 Since the accident KiwiRail has taken further safety actions by carrying out hydrology assessments and flood modelling of the area. It also intends to replace the existing culverts at the location with larger pipes and install a flood-monitoring gauge. The work is expected to be completed by mid-April 2023.

3.23 While the Commission welcomes these actions, there is still a wider implication that parts of New Zealand's rail network may be vulnerable to unforeseen severe weather events resulting from climate change.

3.24 According to a 2020 United Nations Office for Disaster Risk Reduction report, the planet has experienced 'a staggering rise in climate-related disasters'[15] in the past 20 years. Worldwide, between 1980 and 1999 there were 1389 reported disastrous floods. Between 2000 and 2019 the reported number increased to 3254.

3.25 New Zealand has recognised the significance of this increase and is taking steps to build resilience into the country's infrastructure. These steps include a climate adaption plan to enable climate-resilient transport networks, and investment in improving the reliability of rail infrastructure through the Ministry of Transport-funded Rail Network Investment Programme (RNIP).

3.26 One of the core goals of the RNIP is for KiwiRail to 'anticipate and adapt to emerging threats, withstand and absorb impacts of unplanned disruptive events and respond and recover quickly'.

3.27 The Commission recognises that this work is ongoing and is intended to address the safety issue, and therefore has not made a recommendation.

[15] A disaster for this purpose is defined as one or more of the following: 10 or more people reported killed; 100 or more people reported affected; a declaration of a state of emergency; and a call for international assistance.

4 Findings
Ngā kitenge

4.1 The region in which the derailment occurred had been experiencing an unseasonally significant amount of rainfall for the time of year.

4.2 Localised conditions had not reached a threshold value whereby a severe weather alert would have been triggered.

4.3 There was no recent history of flooding in the area where the derailment occurred.

4.4 The train was inspected a short time prior to the derailment and there were no defects identified that might have led to the train derailing.

4.5 The train was travelling at below the maximum line speed for the area at the time of the derailment.

4.6 The driver took appropriate action by not exiting the locomotive cab immediately after the derailment, due to the risk of electrical shock.

4.7 It is **virtually certain** that the derailment was caused by floodwater inundating and washing out ballast from underneath the track. This led to the track being unable to support the weight of the train.

4.8 It is **likely** that this flooding occurred rapidly during a 100-minute period between trains.

4.9 Even if a severe weather warning had been in place, it is **unlikely** that, beyond alerting staff, any precautionary action would have been taken by KiwiRail, due to the fact that there was little precedent for flooding in the location.

4.10 There is a programme of funding in place to improve the resilience and reliability of New Zealand's rail network.

5 Safety issues and remedial action
Ngā take haumanu me ngā mahi whakatika

General

5.1 Safety issues are an output from the Commission's analysis. They typically describe a system problem that has the potential to adversely affect future operations on a wide scale.

5.2 Safety issues may be addressed by safety actions taken by a participant, otherwise the Commission may issue a recommendation to address the issue.

5.3 One new safety issue was identified.

Safety issue: There were no severe-weather-warning or flood-monitoring measures in place for the area in which the derailment occurred.

5.4 Had a severe weather warning been in place, it is **unlikely** that any precautionary action beyond alerting staff would have been implemented due to the lack of precedent of flooding in the area. As such, a severe weather warning in this area would **likely** not have prevented this accident.

5.5 An improved monitoring of the area, however, would **likely** have allowed KiwiRail to identify the unexpected hazard.

5.6 Since the accident, KiwiRail has taken the following safety actions to address this issue:

- conducted hydrology assessments and flood modelling
- planned the replacement of the existing culverts at the location with larger pipes (scheduled to be completed by mid-April 2023)
- planned the installation of a flood-monitoring gauge (scheduled to be completed by mid-April 2023).

5.7 In the Commission's view these safety actions, combined with the expected goals of the RNIP, have addressed the safety issue. Therefore the Commission has not made a recommendation.

6 Recommendations
Ngā tūtohutanga

General

6.1 The Commission issues recommendations to address safety issues found in its investigations. Recommendations may be addressed to organisations or people and can relate to safety issues found within an organisation or within the wider transport system that have the potential to contribute to future transport accidents and incidents.

6.2 In the interests of transport safety, it is important that recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

New recommendations

6.3 No recommendations were issued.

7 Key lesson
Ngā akoranga matua

7.1 The transport industry needs to prepare for and be able to adapt and respond to the increase in frequency of unseasonal and severe weather events.

8 Data summary
Whakarāpopoto raraunga

Vehicle particulars

Train type and number:	Train 220
Classification:	freight
Operator:	KiwiRail

Date and time	13 December 2021, 2300
Location	197.9 kilometres NIMT
Operating crew	one train driver
Injuries	nil
Damage	17 wagons derailed, 11 extensively damaged, track extensively damaged

9 Conduct of the inquiry
He tikanga rapunga

9.1 On 13 December 2021, Waka Kotahi NZ Transport Agency notified the Commission of the occurrence. The Commission subsequently opened an inquiry under section 13(1) of the Transport Accident Investigation Commission Act 1990 and appointed an investigator in charge.

9.2 Commission investigators attended the site on 14 December 2021 and conducted a site investigation.

9.3 The Commission obtained records and information from sources that included:

- interviews with two train drivers
- Tranzlog data from the locomotive
- train control voice recordings
- train control graphs
- meteorological data for the area
- rail formation specifications
- culvert specifications
- KiwiRail's severe weather procedures.

9.4 On 7 December 2022 the Commission approved a draft report for circulation to three parties for their comment.

9.5 The Commission received three responses, including one submission, and any changes as a result of these have been included in the final report.

9.6 On 23 March 2023 the Commission approved the final report for publication.

Abbreviations
Whakapotonga

NIMT	North Island Main Trunk line
RNIP	Rail Network Investment Programme

Glossary
Kuputaka

ballast	crushed stone or rocks placed under rail to support and hold track in place as trains roll over it
culvert	a structure that channels water past an obstacle to alleviate flooding
formation	the structured base on which a track is built, usually consisting of impacted earth and ballast. The formation is designed to support the track and prevent it moving
North Island Main Trunk line	the main railway line for freight and passengers between Wellington and Auckland
roll-by inspection	a visual and aural inspection of a moving train to detect faults such as insecure loads and damaged wheels
train control	the national train control centre, situated in Wellington Railway Station. It is responsible for track authorisations and the safe movement of rail traffic
washout	a situation where the formation under a rail track has been removed by water, resulting in the remaining track being unsupported and unsafe for rail traffic

Appendix 1 Rainfall report

RAINFALL INVESTIGATION

Porewa Catchment at Tututotara: 13 December 2021

FEBRUARY 10, 2023

Hannah Marley
HORIZONS REGIONAL COUNCIL

Environmental Data: Regional Services and Information
✉Catchment.DataRequests@horizons.govt.nz

horizons
REGIONAL COUNCIL

horizons
REGIONAL COUNCIL

Disclaimer

SUPPLY OF HYDROLOGICAL DATA

GENERAL TERMS AND CONDITIONS

The enclosed information is supplied, within the framework of our quality system, from the best data currently available.

However, as we endeavour to continuously improve our products, we reserve the right to amend the data on which this information is based, where necessary and without notice, at any time.

As a result, the information supplied to you now may not be the same as that subsequently produced for you or any other client.

While Manawatū-Whanganui Regional Council has exercised all reasonable skill and care in controlling the contents of the information, you should independently check the information provided if the accuracy of that information is important to you.

Under no circumstances will the Manawatū-Whanganui Regional Council or its employees or agents be liable in contract, tort or otherwise to compensate you for any loss, injury or damage (including loss of profits or consequential loss) arising directly or indirectly from the supply by the Council or its agents of inadequate, inaccurate or incorrect information.

Manawatū-Whanganui Regional Council is the owner of the copyright subsisting in the enclosed material unless otherwise specified. Copies of the enclosed material, or any part thereof, by any means whatsoever shall be made only for use by you as the client for your own internal purposes and shall not be conveyed to any third party or merged into another machine readable database without the express permission of the Council.

Any use of the material supplied, for example, by inclusion in a report or a media release, should be accompanied by an acknowledgment of the source of the data.

Your acceptance of the enclosed material and/or services signifies your acceptance of these terms and conditions.

Supplementary Conditions of Data Provision

HRC Staff Member:	Hannah Marley
Source:	Provisional Automation
Date:	FEBRUARY 10, 2023
RequestID:	PID93255

This Data series contains un-audited data, as with all data it needs to be treated with caution.

Rainfall data

The following rainfall statistics and analyses are based on our SCADA rainfall record, which refers to the raw rainfall intensity data recorded by a tipping bucket rain gauge.

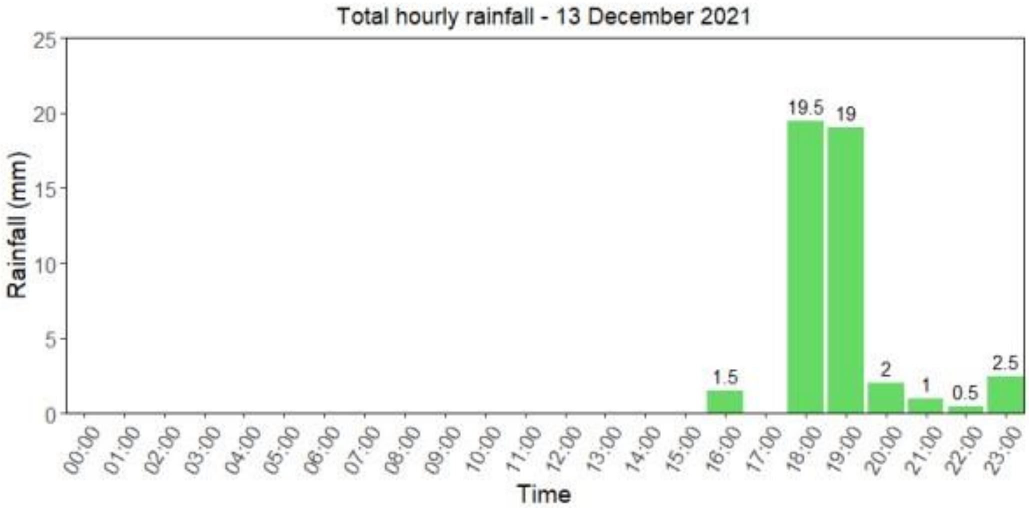
Total rainfall on 13 December 2021

The below table and plot display the total hourly and total daily rainfall recorded at Porewa Catchment at Tututotara on 13 December 2021. The total daily rainfall was 46 mm for 13 December and was recorded during eight hours (16:00 to 23:59).

While a smaller amount of rainfall was recorded during the two-hour period of 22:00 to 23:59 (3 mm), a large amount of rainfall was recorded during the two-hour period of 18:00 to 19:59 (38.5 mm). This large amount of rain would likely have contributed to pooling or flooding in the hours after this event, as there can be some lag between peak rainfall and when pooling or flooding is observed.

Hour	Rainfall (mm)	Hour	Rainfall (mm)
00:00	0	12:00	0
01:00	0	13:00	0
02:00	0	14:00	0
03:00	0	15:00	0
04:00	0	16:00	1.5
05:00	0	17:00	0
06:00	0	18:00	19.5
07:00	0	19:00	19
08:00	0	20:00	2
09:00	0	21:00	1
10:00	0	22:00	0.5
11:00	0	23:00	2.5

Total daily rainfall: 46 mm

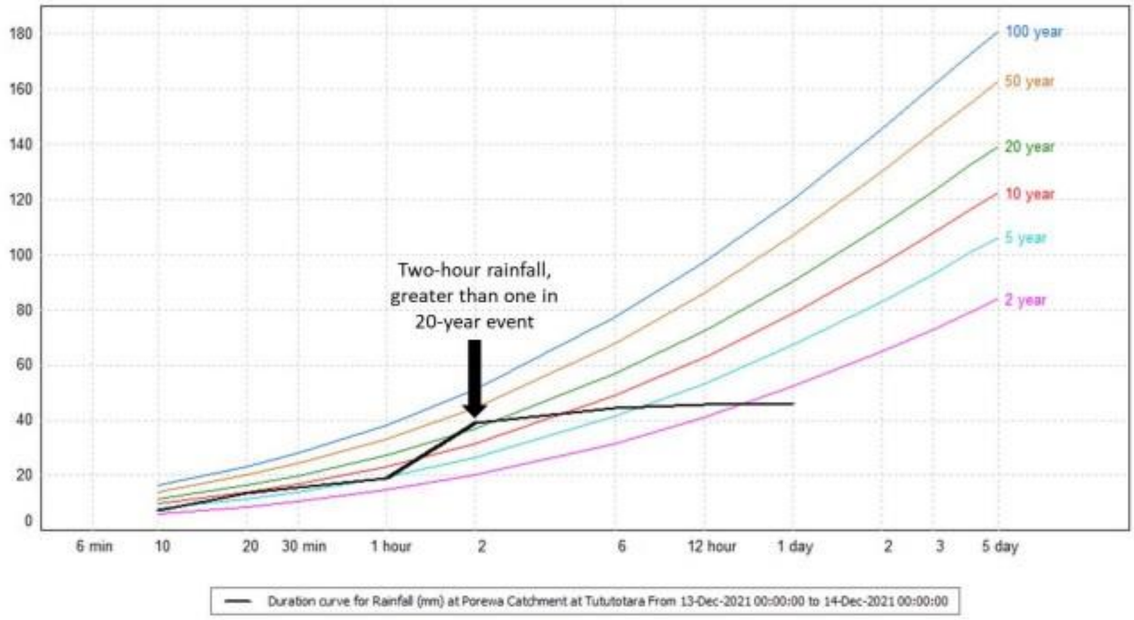


horizons REGIONAL COUNCIL

Event significance (recurrence)

The following table displays the estimated ARIs (recurrence intervals) for the maximum rainfall recorded over different durations on 13 December 2021. These estimates were derived using the HIRDS V4 Intensity-Duration-Frequency spreadsheet for the Porewa Catchment at Tututotara site sourced from https://hirds.niwa.co.nz/. Screenshots of the spreadsheet with the derivations for each duration are shown at the end of this document and the spreadsheet is attached with this request for reference. The plot below the table displays a visual representation of the information in the table and shows the rainfall intensity-duration curve plotted in black (rainfall in mm on the y-axis and duration on the x-axis) in relation to the recurrence intervals (in years) plotted as coloured lines.

Rainfall duration	Max rainfall recorded (mm)	Rainfall rate (mm/hr)	ARI (years)
10 min	7.2	43.2	3.6
20 min	13.6	40.8	9.6
30 min	15.4	30.8	7.1
1 hour	19.5	19.5	5
2 hour	38.5	19.3	24.5
6 hour	44.5	7.4	6.8
12 hour	46	3.8	2.9
1 day	46	1.9	1.4



From the above table and plot, it can be seen that the most significant rainfall event that occurred on 13 December 2021 was a two-hour heavy rainfall event (this occurred during 18:00 to 19:59). During this two-hour event, 38.5 mm was recorded, giving an average rainfall rate of 19.3 mm/hr. The results suggest this two-hour rainfall event is an approximately one in 24.5-year event.

The following screenshots are from the HIRDS V4 Intensity-Duration-Frequency spreadsheet for the Porewa Catchment at Tututotara site, retrieved from https://hirds.niwa.co.nz/. They show the estimation of the ARI (recurrence interval in years) for the maximum rainfall recorded over different durations on 13 December 2021. In the spreadsheet the duration is entered in the green cell, and the ARI (orange cell) is experimented with until a rainfall rate (blue cell) that is closest to the recorded rainfall rate for a given duration is achieved. The lighter coloured cells in the 'Rainfall intensities (mm/hr) :: Historical Data' tables show the corresponding intensity-duration-frequency values based on historical data for this site.

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode	Paramete	c	d	e	f	g	h	i
	Values:	-0.00948618	0.475326	-0.02226	0	0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)		
		0.17	3.6	-1.79176	1.122631	43.1		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode Paramete		c	d	e	f	g	h	i
	Values:	-0.00948618	0.475326	-0.02226	0	0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)		
		0.33	9.6	-1.09861	2.207267	40.8		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode	Paramete	c	d	e	f	g	h	i
	Values:	-0.00948618	0.475326	-0.02226	0	0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)		
		0.5	7.1	-0.69315	1.885152	30.8		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode	Paramete	c	d	e	f	g	h	i
	Values:	-0.00948618	0.475326	-0.02226	0	0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)		
		1	5	0	1.49994	19.5		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode	Paramete	c	d	e	f	g		h	i
	Values:	-0.00948618	0.475326	-0.02226	0		0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)			
		2	24.5	0.693147	3.177909		19.3		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode	Paramete	c	d	e	f	g	h	i
	Values:	-0.00948618	0.475326	-0.02226	0	0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)		
		6	6.8	1.791759	1.838444	7.4		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

horizons REGIONAL COUNCIL

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode	Paramete	c	d	e	f	g	h	i
	Values:	-0.00948618	0.475326	-0.02226	0	0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)		
		12	2.9	2.484907	0.860722	3.8		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

HIRDS V4 Intensity-Duration-Frequency Results
Sitename: Porewa Catchment at Tututotara
Coordinate system: WGS84
Longitude: 175.4807
Latitude: -40.0287

DDF Mode	Paramete	c	d	e	f	g	h	i
	Values:	-0.00948618	0.475326	-0.02226	0	0.26955615	-0.00849	2.582963
	Example:	Duration (hrs)	ARI (yrs)	x	y	Rainfall Rate (mm/hr)		
		24	1.4	3.178054	-0.22535	1.9		

Rainfall intensities (mm/hr) :: Historical Data

ARI	AEP	10m	20m	30m	1h	2h	6h	12h	24h	48h	72h	96h	120h
1.58	0.633	31.5	22.9	18.8	13.2	9.1	4.81	3.13	1.99	1.24	0.934	0.759	0.644
2	0.5	35	25.4	20.8	14.6	10	5.27	3.42	2.18	1.35	1.01	0.824	0.699
5	0.2	47.6	34.2	28	19.5	13.2	6.9	4.44	2.8	1.73	1.29	1.05	0.885
10	0.1	57.6	41.2	33.6	23.3	15.8	8.14	5.22	3.28	2.01	1.5	1.21	1.02
20	0.05	68.6	48.9	39.7	27.3	18.4	9.46	6.03	3.77	2.3	1.71	1.38	1.16
30	0.033	75.5	53.7	43.5	29.9	20.1	10.3	6.53	4.07	2.48	1.84	1.48	1.25
40	0.025	80.7	57.2	46.4	31.8	21.3	10.9	6.9	4.29	2.61	1.93	1.55	1.31
50	0.02	84.8	60.1	48.6	33.3	22.3	11.3	7.19	4.46	2.71	2.01	1.61	1.36
60	0.017	88.3	62.5	50.5	34.6	23.1	11.7	7.43	4.6	2.79	2.07	1.66	1.4
80	0.013	94	66.4	53.6	36.6	24.5	12.4	7.81	4.83	2.93	2.16	1.74	1.46
100	0.01	98.5	69.5	56.1	38.2	25.5	12.9	8.11	5.01	3.03	2.24	1.8	1.51
250	0.004	118	83	66.8	45.2	30	15	9.4	5.77	3.47	2.55	2.04	1.71

Kōwhaiwhai - Māori scroll designs

TAIC commissioned its four kōwhaiwhai, Māori scroll designs, from artist Sandy Rodgers (Ngāti Raukawa, Tūwharetoa, MacDougal). Sandy began from thinking of the Commission as a vehicle or vessel for seeking knowledge to understand transport accident tragedies and how to avoid them. A 'waka whai mārama' (i te ara haumaru) is 'a vessel/vehicle in pursuit of understanding'. Waka is a metaphor for the Commission. Mārama (from 'te ao mārama' – the world of light) is for the separation of Rangitāne (Sky Father) and Papatūānuku (Earth Mother) by their son Tāne Māhuta (god of man, forests and everything dwelling within), which brought light and thus awareness to the world. 'Te ara' is 'the path' and 'haumaru' is 'safe' or 'risk free'.

Corporate: Te Ara Haumaru - the safe and risk free path

The eye motif looks to the future, watching the path for obstructions. The encased double koru is the mother and child, symbolising protection, safety and guidance. The triple koru represents the three kete of knowledge that Tāne Māhuta collected from the highest of the heavens to pass their wisdom to humanity. The continual wave is the perpetual line of influence. The succession of humps represents the individual inquiries.

Sandy acknowledges Tāne Māhuta in the creation of this Kōwhaiwhai.

Aviation: Ngā hau e whā - the four winds

To Sandy, 'Ngā hau e whā' (the four winds), commonly used in Te Reo Māori to refer to people coming together from across Aotearoa, was also redolent of the aviation environment. The design represents the sky, cloud, and wind. There is a manu (bird) form representing the aircraft that move through Aotearoa's 'long white cloud'. The letter 'A' is present, standing for a 'Aviation'.

Sandy acknowledges Ranginui (Sky father) and Tāwhirimātea (God of wind) in the creation of this Kōwhaiwhai.

Maritime: Ara wai - waterways

The sections of waves flowing across the design represent the many different 'ara wai' (waterways) that ships sail across. The 'V' shape is a ship's prow and its wake. The letter 'M' is present, standing for 'Maritime.

Sandy acknowledges Tangaroa (God of the sea) in the creation of this Kōwhaiwhai.

Rail: rerewhenua - flowing across the land

The design represents the fluid movement of trains across Aotearoa. 'Rere' is to flow or fly. 'Whenua' is the land. The koru forms represent the earth, land and flora that trains pass over and through. The letter 'R' is present, standing for 'Rail'.

Sandy acknowledges Papatūānuku (Earth Mother) and Tāne Mahuta (God of man and forests and everything that dwells within) in the creation of this Kōwhaiwhai

Transport Accident Investigation Commission

Recent Rail Occurrence reports published by the Transport Accident Investigation Commission (most recent at top of list)

RO-2021-103	Te Huia passenger service, train parting, North Island main trunk line, Paerata, 19 July 2021
RO-2021-102	Freight Train 391, collision with light truck, Saunders Road, Marton, 13 May 2021
RO-2021-101	Serious injury during shunting operations on board the Aratere, Interislander ferry terminal, Wellington, 9 April 2021
RO-2020-101	Level crossing collision, Mulcocks Road, Flaxton, 10 February 2020
RO-2020-104	Safe working irregularity, East Coast Main Trunk Line, Hamilton – Eureka, 21 September 2020
RO-2020-103	Collision between bus and locomotive, Clevely Line level crossing, Bunnythorpe, 16 September 2020
RO-2019-108	Level crossing collision, Piako Road, Morrinsville, 7 December 2019
RO-2020-102	Express freight Train 932, strikes hi-rail vehicle, Limeworks Road, 24 April 2020
RO-2019-105	Express freight Train 268, derailment, Wellington, 2 July 2019
RO-2019-107	Passenger service SPAD and near collision, Wellington, 6 November 2019
RO-2019-106	Passenger train 804, Irregular disembarkation of passengers, Rolleston, Canterbury, 3 September 2019
RO-2019-104	Unsafe entry into worksite, Taimate, 5 June 2019
RO-2019-103	Derailment of Train 626, Palmerston North, 4 April 2019
RO-2019-101	Safe-working occurrence, Westfield yard, Ōtāhuhu, Auckland, 24 March 2019
RO-2019-102	Clinton derailment, 29 March 2019

Price $16.00

ISSN 1178-4164 (Print)
ISSN 1179-9102 (Online)