WAIKATO REGION EMERGENCY MANAGEMENT GROUP

Waikato Civil Defence Emergency Management Group

Hazard Risk Assessment

Report

December 2024

Forward

Civil Defence Emergency Management (CDEM) Groups are required to develop a CDEM Group Plan under section 48 of the Civil Defence Emergency Management Act 2002. The Waikato CDEM Group is reviewing and developing a new CDEM Group Plan and as part of the process it conducted a regional risk assessment to help inform the plan development.

The National Emergency Management Agency (NEMA) has provided a new guidance document to inform the development of group plans. This guideline has been used to inform the process of the Waikato CDEM Group hazard risk assessment. The review process identified regional hazards and supported the consequences of those hazards.

The regional risk assessment process was conducted in three phases:

- Review of regional hazards, maximum credible event scenarios and likelihoods
- Review of hazard consequences (Regional Workshops, hazard surveys and validation)
- Analysis of hazard risks using the NEMA Risk Assessment tool

This report outlines the results of the risk assessment workshops and risk assessment surveys conducted between May 2022 and May 2023, and the subsequent validation process with subject matter experts undertaken in July 2024 to confirm the results for use in the development of the Group Plan. The results within the report have been validated, noting that some results are likely to change due to events and new research during the life of the next Waikato CDEM Group Plan.

It should also be noted that these results represent the risk of hazards to the entire region, not to a specific area. Therefore, some risks that would potentially have more severe impacts in a specific area may actually represent a lower overall risk due to the limited exposure to other parts of the region.

Acknowledgements

The contribution and support of the wider Waikato CDEM Team has been invaluable. Additionally, the input of the emergency services and organisational representatives from around the region in support of the development of the hazard scenarios and consequence descriptors to be used within the process has also been invaluable and greatly appreciated. The continued contribution of all CDEM Group Partners at the workshops and validation process is acknowledged during a period where other considerable demands were placed upon them.

Cover picture: View of Lake Taupō, courtesy of GNS Science Limited under the Creative Commons licence v3.0 - https://www.geonet.org.nz/about/volcano/taupo

Contents

List of figures

List of tables

Introduction

Background

The Waikato Civil Defence Emergency Management (CDEM) Group is required under section 48 of the Civil Defence Emergency Management Act 2002 (the Act) to prepare a CDEM Group Plan. This document is required to be reviewed every five years under section 56 part 1 of the Act to ensure it remains consistent with the National Disaster Resilience Strategy and CDEM Plan.

As part of a group plan review and development process, CDEM Groups are advised by the National Emergency Management Agency (NEMA) to conduct a risk assessment of the hazards identified within their region, to enable CDEM Groups to identify where their priorities are to be focussed across the 4R's of emergency management; Reduction, Readiness, Response and Recovery.

The risk assessment process used in this hazard review is provided in NEMA's Director's Guideline 23/20 – Risk Assessment: Guidance for CDEM Group Planning (Draft). The process of risk assessment advised within this guideline differs from that used in previous CDEM Group risk assessments and is based on the international risk management standard AS/NZS ISO 31000. This process provides a more thorough assessment of the consequences of hazards; allowing a more detailed review of consequences found to be common across a range of hazards, and enabling consequence-based planning and targeted risk mitigation.

The risk assessment process that was undertaken is outlined in Figure 1.

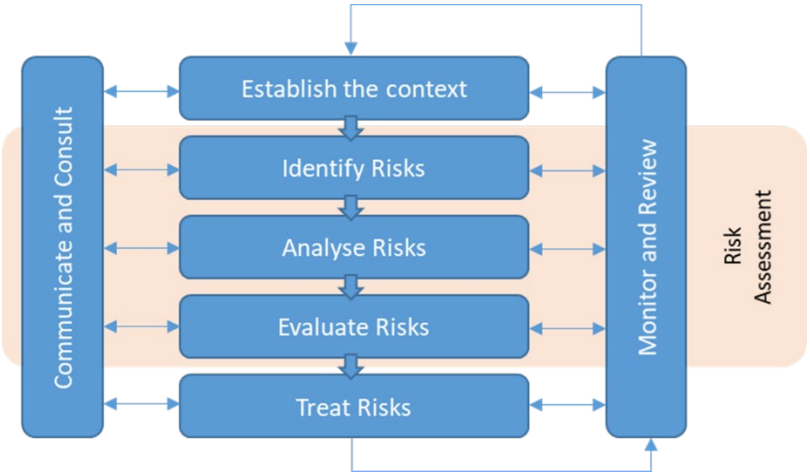


Figure 1: The risk assessment process

The Waikato CDEM Group risk assessment project was conducted in three stages:

- A review of existing identified hazards, maximum credible scenarios, likelihood of occurrence and consequence ratings
- Hazard impact assessment (analysis)
- Assessment data collation, validation and reporting (evaluation).

This report outlines the results of the risk assessment and validation processes conducted between May 2022 and July 2024 and identifies where further work is required in understanding the consequences of known hazards within the Waikato Region. Additionally, this report highlights significant consequences found across the assessed hazards within the CDEM Group and links these findings to future work addressing the findings across the 4R's.

Recommendations

From the Risk Assessment results the following recommendations for the Waikato CDEM Group are:

- Conduct assessments throughout the life of the next CDEM Group Plan to ensure the risk assessment is as current as possible; hazards that appear as a very high or high risk, or with a major consequence to the region should be prioritised. It is suggested the next risk assessments start with the following hazards, as soon as practicable:
    - Aquatic pest / disease
    - Coastal flooding – storm surge / erosion
    - Cyberattack
    - Human pandemic
    - Land instability - landslides
    - Plant pest / disease
    - Tornadoes
    - Major maritime pollution
- Work in partnership with local iwi to understand the specific impact of hazards on hapū and marae within the region.
- Work with relevant agencies, government departments and research organisations to facilitate research and understanding of major hazards within the region and re-assess the maximum credible event scenarios used and the results of the risk assessment as this information becomes available.
- Maintain and update the NEMA risk assessment tool based on the outcomes of any research or real events to ensure the assessment is truly reflective of the likely impacts of event to the region.
- Assess the current mitigation measures that are in place for high-risk hazards and the suitability of response plans to deal with the potential identified impacts across the four environments.
- Where possible, identify reduction activities that can be undertaken to reduce the impacts of consequences that appear at a high or very high risk level across multiple hazards.
- Work with the community to increase knowledge and preparedness for the high risk and high consequence hazards within the region.
- Utilise the results from this risk assessment to inform the development of the next CDEM Group Plan.

Review of regional hazards, scenarios and likelihoods

Hazard identification and review

The Waikato CDEM Group Plan 2018-2023 contains a list of regional hazards that were assessed prior to the development of the plan. Over the life of the Group Plan understandings of many major hazards within New Zealand has further developed, specifically around the risk from earthquake and tsunami. In order to ensure that those previously identified hazards truly reflected the risks posed to the region, a full review was undertaken to determine if any further hazards had changed as a result of new research. A group of representatives from across the CDEM Group reviewed and came to a consensus on what hazards were to be included within the risk assessment.

The agreed hazard list for the risk assessment, is shown in Table 1.

Hazard amendments from previous assessments

Some hazards that were listed in the previous Group Plan have been amended due to the following reasons:

- The hazard is a localised risk and not deemed to present a significant risk to the region.
- The hazard is similar to another and can be combined to create a single hazard title that captures the consequences of both.
- The hazard is a consequence of other hazards and cannot be assessed independently.
- The hazard is an exacerbating factor influencing the severity of other hazards (e.g. climate change) and should be assessed as part of the process across a range of hazards.

Hazard scenarios and likelihoods

To enable the assessment of the consequences of hazards within the region, a maximum credible event scenario was developed for each hazard as recommended within the Directors Guideline 23/20 Risk Assessment: Guidance for CDEM Group Planning (Draft). Maximum credible event scenarios are utilised in the process to represent the worst-case scenario requiring considerable coordination and management across the 4R's. It is worth noting that these scenarios also encompass the requirements for responses to events on a smaller scale.

In general, scenarios have been developed for each of the hazards using available research or previous similar events. Where possible, these have been reviewed by experts within the field to ensure they represent a realistic maximum credible event.

The likelihood for each hazard scenario occurring has been calculated using Figure 2. This utilises, where available, either an Annual Exceedance Probability (AEP) percentage, or an Annual Return Interval (ARI) to determine the likelihood of the hazard occurring.

Likelihood Classification	Likelihood Description	AEP (%)	ARI (Annual Return Interval) (rounded)
Rare	Almost certainly not to occur but cannot be ruled out	<0.1	>1000
Unlikely	Considered not likely to occur	0.1 - <1	>100 - 1000
Possible	Could occur, but is not expected to	1 - <10	>10 - 100
Likely	A good chance that it may occur	10 - <63	>1 – 9.5
Almost Certain	Expected to occur if all conditions met	≥63	≤1

Figure 2: Likelihood of occurrence table

The maximum credible event scenarios developed, and the likelihood of occurrence for each of the hazards, are shown in the Hazard summaries in the Appendices. The AEP or ARI was used to establish the likelihood of occurrence, where applicable. Where neither of these were available from existing research, a likelihood has been assigned based on previous events within New Zealand and the Waikato region.

It is important to note that the likelihood is for the maximum credible event occurring rather than for smaller events that occur more frequently and are likely to have a larger occurrence interval.

Waikato hazards for assessment

Table 1 advises the hazards for assessment, the likelihood of occurrence and the method of risk assessment subsequently undertaken.

Hazard	Likelihood	Method
Natural Hazards		
Severe weather – short duration	Likely	Survey
Coastal flooding – storm surge / erosion	Possible	Survey
Drought	Possible	Workshop
Extreme temperatures	Possible	Survey
Extreme weather event – cyclone	Possible	Workshop
Fire – wildfire	Possible	Survey
Land instability – landslides	Possible	Survey
Land instability – subsidence / long term deformation	Possible	Survey
River flooding	Possible	Workshop
Snowfall	Possible	Survey
Tornadoes	Possible	Survey
Volcanic activity – local eruption	Possible	Survey
Volcanic activity – caldera unrest	Possible	Workshop
Earthquake	Unlikely	Workshop
Earthquake and tsunami – local source	Unlikely	Workshop
Geothermal activity	Unlikely	Survey
Tsunami – regional / distant source	Unlikely	Survey
Volcanic activity – distant (ashfall)	Unlikely	Survey
Volcanic activity – caldera eruption	Rare	Survey

Hazard	Likelihood	Method
Biological Hazards		
Animal pest / disease	Possible	Workshop
Aquatic pest / disease	Possible	Survey
Human pandemic	Possible	Survey
Plant pest / disease	Possible	Survey
Technological / Human Hazards		
Civil unrest	Possible	Survey
Cyberattack	Possible	Survey
Fire - structure	Possible	Survey
Fuel supply failure	Possible	Workshop
Hazardous substance event	Possible	Survey
Major maritime pollution	Possible	No assessment
Water supply failure / contamination	Possible	Survey
Mass fatality transport accident	Unlikely	Survey
Terrorism	Unlikely	Survey
Dam break / failure	Rare	Survey

Table 1: Waikato hazards list

Consequence descriptions

To fully understand the likely impact of a hazard a number of consequence descriptions are used to help determine the impact severity. The consequence descriptions are based across four environments to ensure that all possible consequences from a hazard occurring are considered in the process.

The four environments

The four environments utilised in the risk assessment process are: Social, Built, Economic and Natural. The diagram below shows the elements that are considered within each environment when determining the consequence of a hazard.

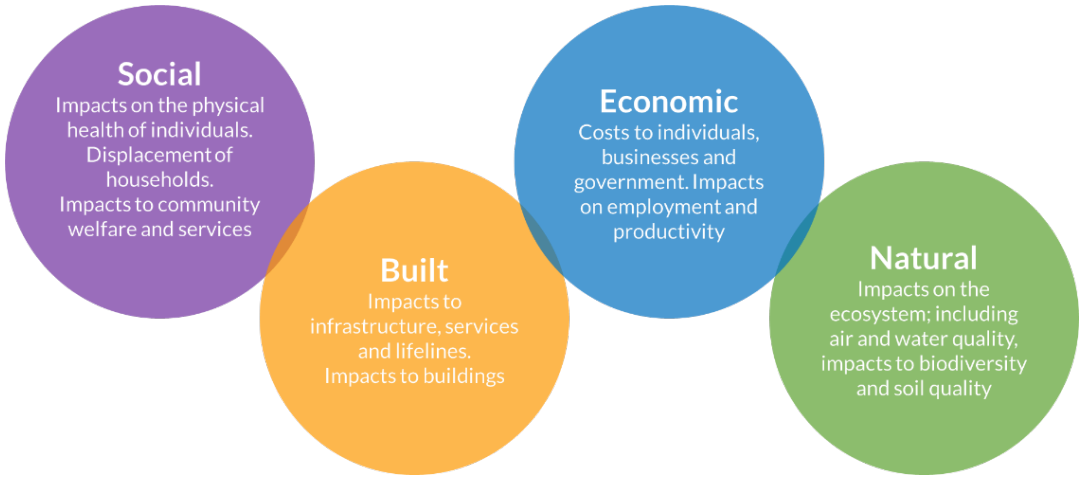


Figure 3:The four environments

Ratings, elements and descriptors

The risk assessment uses a severity rating of "Insignificant; Minor; Moderate; Major; Extreme" to determine the likely level of consequence for elements within each of the four environments.

To enable an in-depth analysis of the consequences of a hazard across the four environments, each environment is broken down further into individual elements. Descriptors of the impact at each level of severity are then developed to enable an overall level of severity to be assigned. A table of elements and base descriptors is provided as part of the NEMA risk assessment tool, however, these can be adapted and refined to ensure that they reflect the circumstances within each CDEM Group region.

An initial workshop was held with key Waikato emergency management staff and representatives of response agencies to review the table of consequences used and ensuring that the elements and descriptors met the needs of the Waikato CDEM Group. Additional elements specific to Waikato were added into the process to ensure a full assessment of impacts to the four environments of the region.

While the consequences to Māori have been considered in the risk assessment process, specific impacts to Māori have not been identified within the NEMA tool provided for consequence elements. It is the intention of the Waikato CDEM Group Office to develop these in partnership with the relevant representatives through the life of the next Group Plan.

Table 2 shows the elements that were included within the assessment. The full table with impact descriptors can be found in the appendices.

Social Environment
• Deaths • Injuries and illness • Psychological impacts • Households in need of accommodation • Displaced households • Welfare services - emergency finance and other essential services support • Education services - access to preschool, school and tertiary services • Community services - local government and not for profit community support services • Social wellbeing and connectedness - participation and inclusiveness • Access to essential consumer products • Cultural wellbeing - ability to participate in cultural life, recreation, rituals and activities • Companion animals - pets, companion animals, non-production animals
Built Environment
• Damage to residential buildings • Damage to commercial and industrial buildings • Damage to government and non-commercial (community facilities) buildings • Damage or loss of access to emergency facilities, impacting function (incl health) • Impacts to potable water services (inc. water tanks and private bores) • Impact to stormwater networks • Impacts to wastewater services inc. wastewater facilities • Impacts to regional flood schemes - stop banks, retention dams, pumping systems • Impacts to reticulated gas • Impacts to land transportation (road, rail) • Impacts to ports and airports • Impacts to telecommunications • Impacts to fuel distribution/availability • Impacts to electricity supply
Economic Environment
• Direct losses to individuals • Direct losses to businesses, commercial entities and Industries • Direct losses to rural sector (agriculture, horticulture and other associated businesses and activities) • Direct losses to local and central government • Losses and disruption to the region's key economic sectors/industries/employers • Direct impacts on employment/job sector • Impact to local and regional economic drivers
Natural Environment
• Air quality and associated ecosystem services • Soil quality and associated ecosystem services • Freshwater quality (ground and surface water) and associated ecosystem services • Marine environment and ecosystem services • National parks, forests and bush reserves • Impacts to iconic flora and fauna species • Impacts to significant environments or iconic landforms • Impacts to geothermal environments

Table 2: Elements used to assess consequences of hazards across the four environments

Risk results and analysis

The analysis of the hazards and their consequences across the four environments was undertaken through risk assessment workshops and risk assessment surveys.

Regional risk assessment workshops

Three risk assessment workshops were held where the impacts of the following eight hazards to the region were assessed:

- Animal pest / disease
- Earthquake and tsunami – local source
- Extreme weather event – cyclone
- River flooding
- Drought
- Local earthquake
- Fuel supply failure
- Volcanic activity – caldera unrest

The workshops were attended by representatives from the following organisations:

- Waikato CDEM Group emergency management staff
- Emergency Services and Health representatives
- Waikato councils' staff representatives; CEG members, emergency management, resilience, iwi liaison, RMA planners, risk and infrastructure
- Lifeline utilities representatives
- Welfare organisation representatives including Māori providers
- MPI – Ministry for Primary Industries
- GNS – Institute of Geological and Nuclear Sciences Limited| Te Pū Ao

All elements within the four environments were discussed to determine the consequences of each hazard to the region. Consequence on Māori and iwi were considered throughout the workshops with the understanding and agreement that there is opportunity to advance development through further engagement.

Hazard risk assessment surveys

The hazard surveys were conducted using an online risk assessment tool to assess the initial data regarding the eight hazards listed above. This was a change to the process used in previous risk assessments. For the complete consequence elements list, see the appendices.

The initial hazard survey carried out in June 2022 received responses from eight organisations, and the second survey carried out in May 2023 received responses from four organisations. The respondents to these surveys provided an indication of where hazards might sit within the risk matrix. The results set a guide for future risk assessment focus and provided an alignment with the Directors Guideline, and the regional hazard risk and consequence level, to inform the Group Plan development.

Risk assessment results validation

A process was undertaken in July 2024 to validate the results of the risk assessment and to ensure that any missed information for both workshopped assessed and surveyed hazards was included. This was conducted to ensure that where possible, subject matter expert input had been provided across all hazards.

The validation process used a targeted approach with relevant organisations being sent appropriate portions of the risk assessment to check, include any missed information, and to provide evidence to support or amend the assessed consequence levels of relevant hazards. Existing networks, as listed below, including the

Waikato Lifeline Utilities Group and Welfare Coordination Group, were used to conduct the validation process across the four environments:

- Fire and Emergency New Zealand
- Hamilton City Council
- Hato Hone St. John Ambulance
- Hauraki District Council
- Ministry for Primary Industries
- Ministry of Education
- New Zealand Police
- Ōtorohanga District Council
- South Waikato District Council
- SPCA
- Te Whatu Ora – Health New Zealand
- Hamilton Airport
- Thames-Coromandel District Council
- The Salvation Army
- Transpower NZ
- Waikato Regional Council

Assessment confidence

To fully determine risk and to assist with further understanding of where research of a hazard may be required, a level of confidence in the assessment of each element is determined. Figure 4, below, outlines how the level of confidence was determined during the process. For the majority of the workshops the confidence level was set at moderate unless there was appropriate representation from a subject matter expert or well-established impacts from previous events. Data collected as part of the hazard surveys was originally given a low level of confidence to denote a requirement of further analysis to enable more confidence in the assessment result which resulted in the Group undertaking a validation process with experts within the field in July 2024.

	Lowest	Low	Moderate	High	Highest
Supporting Evidence	• No historical events • No scientific model	• Anecdotal information of historical events • Scientific model which could be applied with significant modification	• Historical event of similar magnitude in a comparable community of interest • Relevant scientific model available	• Recent historical event of similar magnitude in a directly comparable community of interest • Good scientific model available	• Recent historical event of similar magnitude to that being assessed in the community of interest • Highest quality scientific model
Expertise	No expertise is available	Expertise is available	Relevant expertise is used to make decision	Relevant expertise is highly influential in the decision	Relevant and demonstrated expertise available and highly influential in making the decision
Participant Agreement	Fundamental disagreement of assessment	Disagreement of major aspects of assessment	Disagreement of minor aspects of assessment	Agreement of assessment	Strong agreement of assessment

Figure 4:Assessment of confidence table

Risk assessment results

The current risk assessment results are detailed in the following section. It should be noted that these assessment results, while having undergone validation, will likely change in the future due to events and new research. The Waikato CDEM Group will conduct more analysis of individual hazards, and their consequences, in ongoing assessments during the life of the next Group Plan.

It should also be noted that these results represent the risk of hazards to the entire Waikato region, not to a specific area. Therefore, some risks that would potentially have more severe impacts in a given area may actually represent a lower overall risk due to the limited exposure to other parts of the region. For this reason, it is suggested that the regional risk assessment is used only as a guide and that significant local risks, that were not intended to be identified or included in this process, are assessed locally and appropriately prepared for.

Analysis of elements that occur across multiple hazards is based upon data from the workshops, hazard surveys and validation process. Acknowledging that the process does not offer absolute certainty, the data can be used to guide the development of the Waikato CDEM Group Plan.

2024 Waikato risk assessment results matrix

Consequence

Likelihood	Insignificant	Minor	Moderate	Major	Extreme
Almost Certain					
Likely	• Severe weather – short duration				
Possible		• Civil unrest • Extreme temperatures • Fire – structure • Fuel supply failure • Hazardous substance event • Land instability – subsidence / long term deformation • Snowfall • Water supply failure / contamination • Volcanic activity – caldera unrest • Volcanic activity – local eruption	• Animal pest / disease • Aquatic pest / disease • Coastal flooding – storm surge / erosion • Cyberattack • Drought • Fire - wildfire • Land instability – landslides • Plant pest / disease • River flooding • Tornadoes • Major maritime pollution (provisional)	• Extreme weather event - cyclone • Human pandemic	
Unlikely		• Geothermal activity • Mass fatality transport accident • Volcanic activity – distant (ashfall)	• Terrorism • Tsunami – regional / distant source	• Earthquake • Earthquake and tsunami – local source	
Rare			• Dam break / failure	• Volcanic activity – caldera eruption	

Critical
Very High
High
Medium
Low

Table 3:2024 Waikato risk assessment results matrix

Hazard risk levels

Following the assessment process each hazard was given a risk level based on the likelihood of occurrence and the overall level of consequence which determines the position within the risk matrix. The risk level ranges from low to critical; the purpose being that the risk level enables groups to prioritise work to address the higher risk hazards. Along with the risk levels, additional factors should be considered, such as the occurrence of specific consequences across multiple hazards, or the impacts of a hazard upon a specific environment, to inform which hazards to address and actions to take across the 4R's.

Addressing higher level risks includes determining the level of risk acceptance within the group and wider community, understanding and reviewing risk mitigation measures that are in place, identifying further risk reduction that can occur, preparing response arrangements and conducting further hazards research to better understand the risk and consequence of a hazard.

Due to the ranges set out in Figure 2 and using the maximum credible event scenarios, few hazards can be rated a likelihood level above possible and it's unlikely that any of the assessments would result in many hazards placed higher than "very high risk" within the matrix. Note that this does not diminish the consequences of the hazard, and the risk matrix is to be used alongside other available tools for hazard risk assessment.

Critical risks

Currently the risk assessment shows no critical level risks within the Waikato region.

Very high level risks

- Extreme weather event – cyclone
- Human pandemic

High level risks

- Animal pest / disease
- Aquatic pest / disease
- Coastal flooding – storm surge / erosion
- Cyberattack
- Drought
- Earthquake
- Earthquake and tsunami – local source
- Fire - wildfire
- Land instability – landslides
- Major maritime pollution (**provisional*)
- Plant pest / disease
- River flooding
- Tornadoes

Medium level risks

- Civil unrest
- Dam break / failure
- Extreme temperatures
- Fire – structure
- Fuel supply failure
- Hazardous substance event
- Land instability – subsidence / long term deformation
- Severe weather – short duration
- Snowfall
- Terrorism
- Tsunami – regional / distant source
- Volcanic activity – caldera eruption
- Volcanic activity – caldera unrest
- Volcanic activity – local eruption
- Water supply failure / contamination

Low level risks

- Geothermal activity
- Mass fatality transport accident
- Volcanic activity – distant (ashfall)

Note: *Major maritime pollution incident was not assessed. It retains its previous assessment rating of high risk as a provisional rating, until a full risk assessment for this hazard is undertaken.

Risk assessment by hazard category

	Risk assessment	Hazard
		Natural Hazards
	Very High	Extreme weather event – cyclone
	High	Coastal flooding – storm surge / erosion
	High	Drought
	High	Fire – wildfire
	High	Earthquake
	High	Earthquake and Tsunami – local source
	High	Land instability – landslides
	High	River flooding
	High	Tornadoes
	Medium	Extreme temperatures
	Medium	Land instability – subsidence / long term deformation
	Medium	Severe weather – short duration
	Medium	Snowfall
	Medium	Tsunami – regional/distant source
	Medium	Volcanic activity – local eruption
	Medium	Volcanic activity – caldera unrest
	Medium	Volcanic activity – caldera eruption
	Low	Volcanic activity – distant (ashfall)
	Low	Geothermal activity
		Biological Hazards
	Very High	Human pandemic
	High	Animal pest / disease
	High	Aquatic pest / disease
	High	Plant pest / disease
		Technological / Human Hazards
	High	Cyberattack
	High	Major maritime pollution incident
	Medium	Dam break / failure
	Medium	Water supply failure / contamination
	Medium	Fire - structure fire
	Medium	Hazardous substance event
	Medium	Fuel supply failure
	Medium	Civil unrest
	Medium	Terrorism
	Low	Mass fatality transport accident

Discussion

The process undertaken for this risk assessment follows the NEMA Director's Guideline 23/20 - Risk Assessment: Guidance for CDEM Group Planning (Draft). The process outlined within this DGL differs from the process previously used by CDEM groups and this may account for some hazards not having the same degree of identified risk as previous assessments.

The process utilises maximum credible event scenarios. Some hazards may have been given a higher risk rating than in previous assessments due to assessing a greater scenario consequence, or this may result in some anomalies if the likelihood of the maximum credible event is lower than an "expected" more frequent event, potentially lowering the final risk level. Utilising the maximum credible event means it is doubtful that many hazards will have a likelihood higher than "possible" in the assessment process, meaning that it is unlikely to have hazards that appear as critical risks in the final results.

The assessments should be scheduled to be reviewed following events, the release of new research, or as a result of any planning workshops and discussions. Where possible the results should be validated by specific groups, such as the Waikato Lifeline Utilities Group or the Welfare Coordination Group.

It is best practice to further assess results of any risk assessment to understand the levels of acceptance by the CDEM Group partners and community, the potential for reduction of the risk, existing mitigation measures and the suitability of response planning that is in place. Additionally, significant local risks should be identified from the process and workshopped to understand the consequences at a local level.

Comparison to the current Group Plan risk assessment results

The current Waikato CDEM Group Plan (2018-2023) contains a regional risk assessment of hazards based upon the likelihood of occurrence and potential consequence, and also the risk after reduction activities have been undertaken for the hazard. Noting that the process previously undertaken was considerably different to the process used in this risk assessment; When comparing the risk levels of hazards in the 2018-2023 Group Plan to the hazards in this current assessment, that appear as a very high, or high level risk, it is noted that there is still some correlation between the two.

Higher risk hazards Waikato CDEM Group Plan 2018-2023	Current risks of assessed hazards with very high or high level of risk
Drought	Extreme weather event – cyclone
Pandemic (animal)	Human pandemic
Pandemic (human)	Animal pest / disease
Tsunami	Aquatic pest / disease
Volcanic (ashfall only)	Coastal flooding - storm surge / erosion
Volcanic (caldera unrest)	Cyberattack
Earthquake	Drought
Infrastructure failure (Lifeline/technological)	Earthquake
Land instability – long-term deformation	Earthquake and tsunami – local source
Marine oil spill	Fire - wildfire
River flooding	Land instability - landslides
Severe storm	Plant pest / disease
Volcanic (caldera eruption)	River flooding
Volcanic eruption	Tornadoes

Table 4: Comparison risk assessment results; 2018-2023 to current

Hazard consequence and risk levels

Understanding the hazards that will potentially have the highest consequence in a specific environment, should they occur, can support the identification of activities across the 4R's that need to be actioned. This may not necessarily reflect the hazards that represent the highest overall risk to the region, or the hazards that represent the highest risk to that individual environment, but represents those that will require the most coordination and management should they occur.

The risk and consequence level of each hazard to the Waikato region across all environments are shown in Table 3. When referring to the results the method of assessment undertaken for that hazard should be noted.

The risk level and consequence level of specific hazards to each environment are shown on the following pages. The risk level is determined by the likelihood of the hazard occurring and the level of collective consequences across all elements assessed. The consequence level is determined by the number of elements within the environment that are rated high.

Individual environment graphs

Social Environment – Risk level

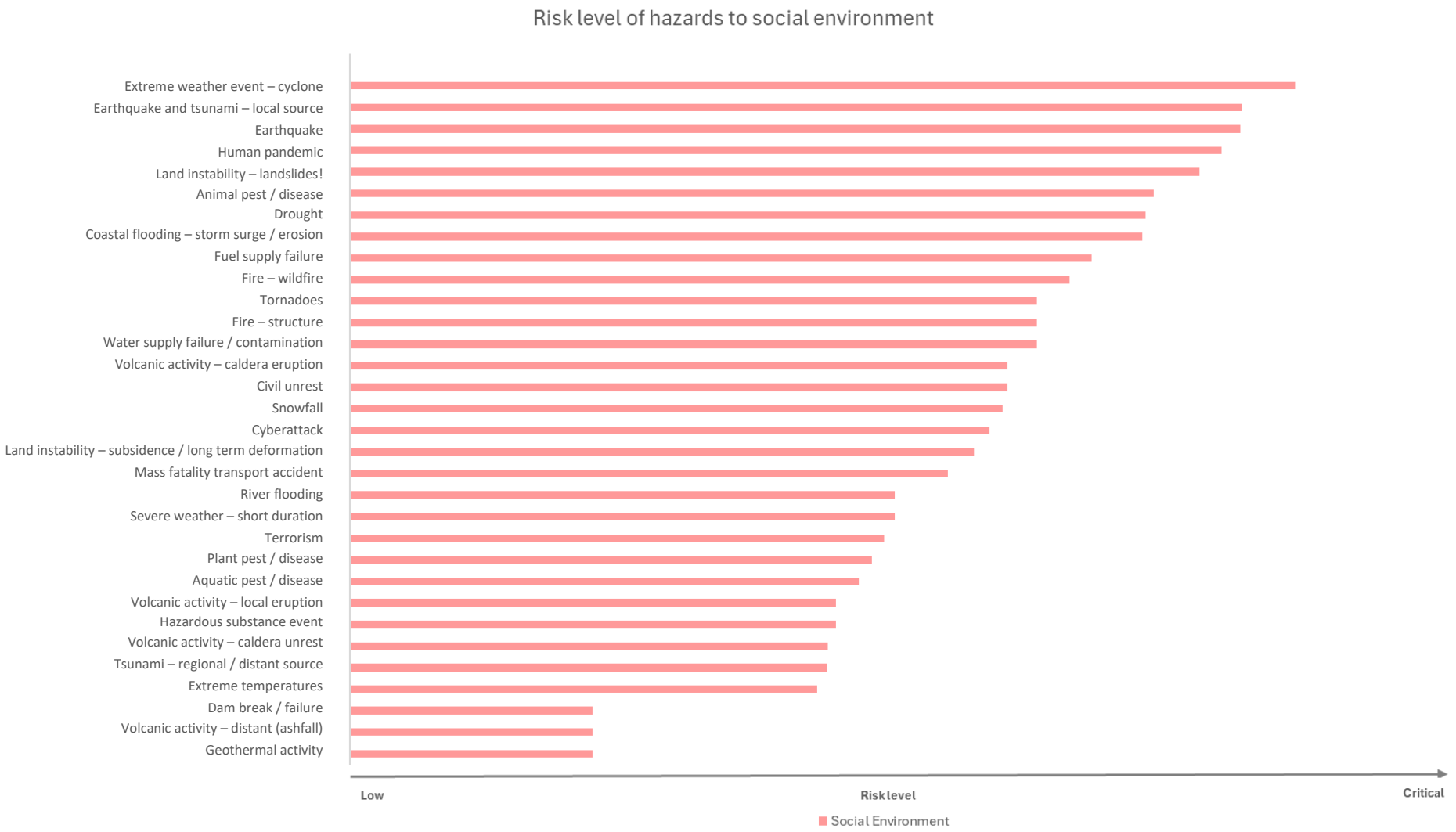


Table 5: Chart showing risk level of hazards to the social environment

Social Environment – Consequence level

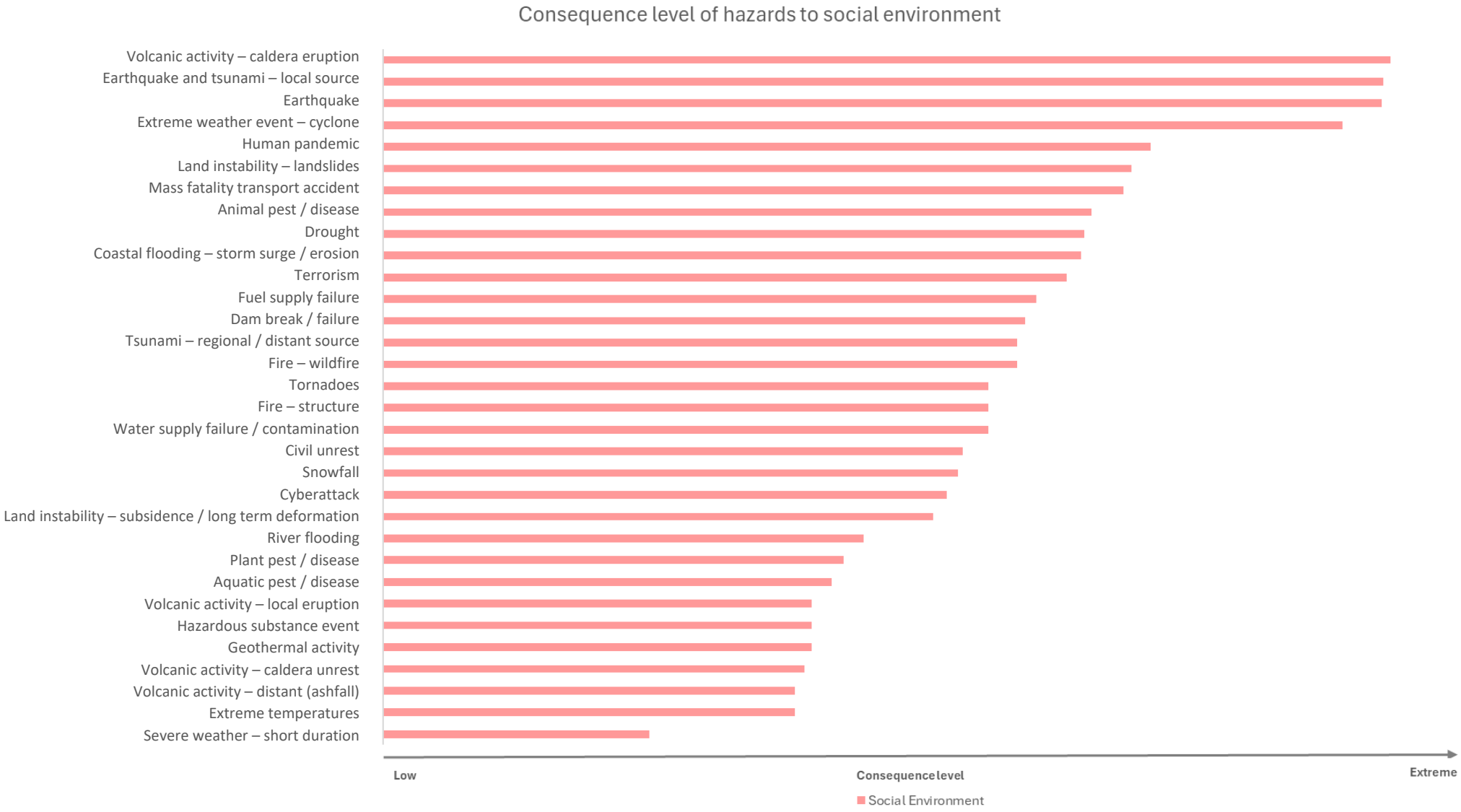


Table 6: Hazards that present the highest consequence to the social environment

Social environment – High level risk occurrence across multiple hazards

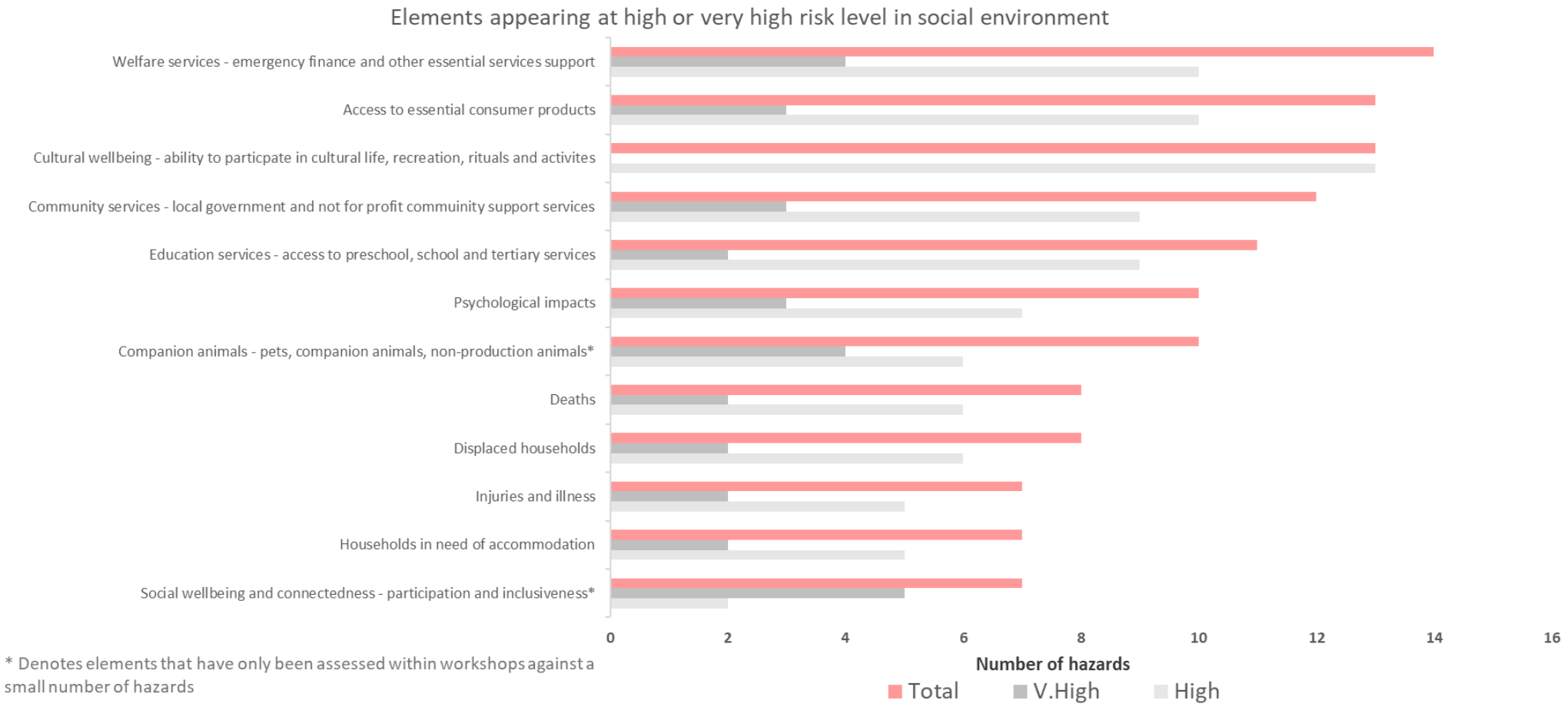


Table 7: Consequence elements in the social environment with the highest occurrence across all hazards

Built environment – Risk levels

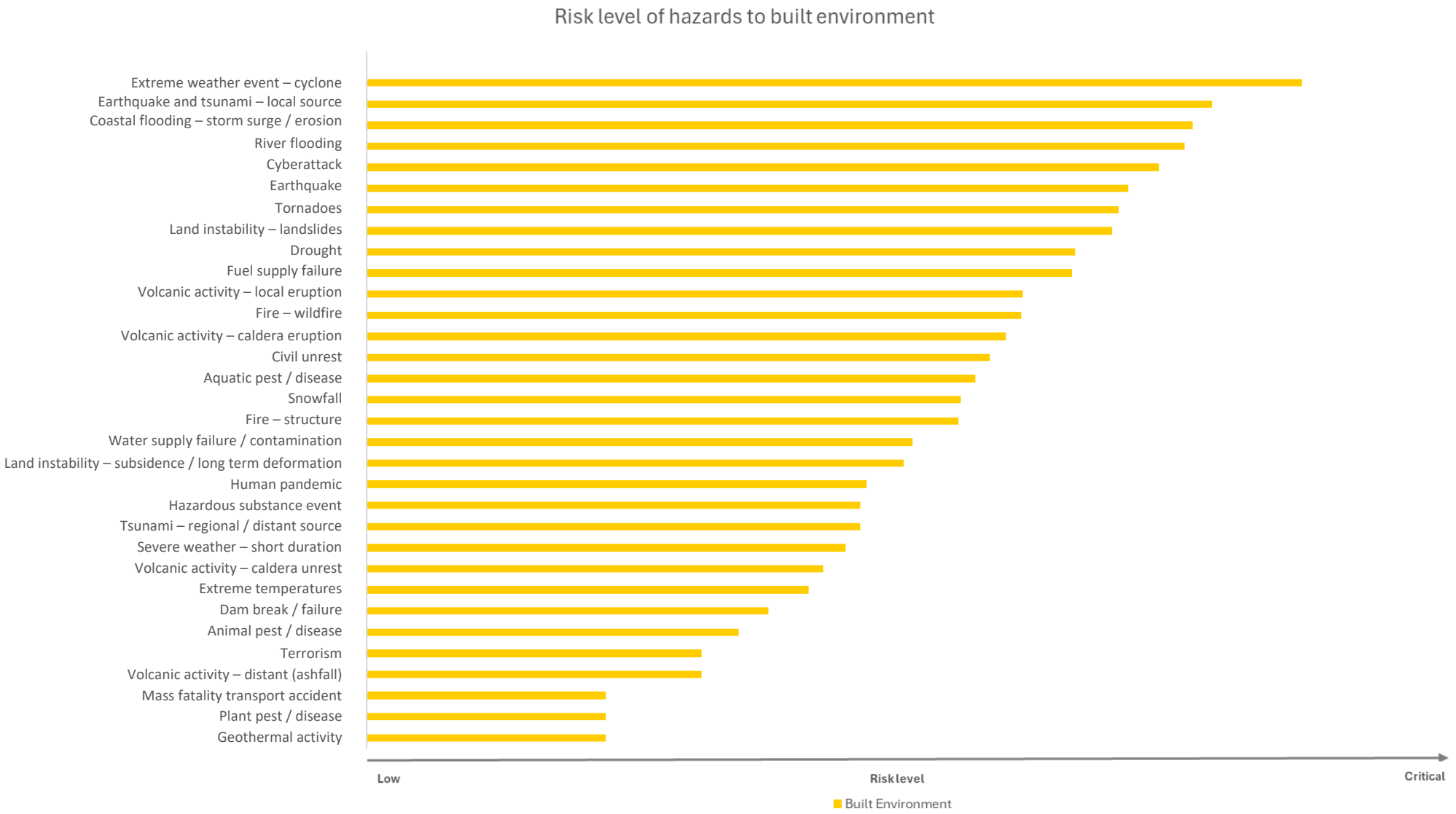


Table 8: Chart showing risk level of hazards to the built environment

Built environment – consequence levels

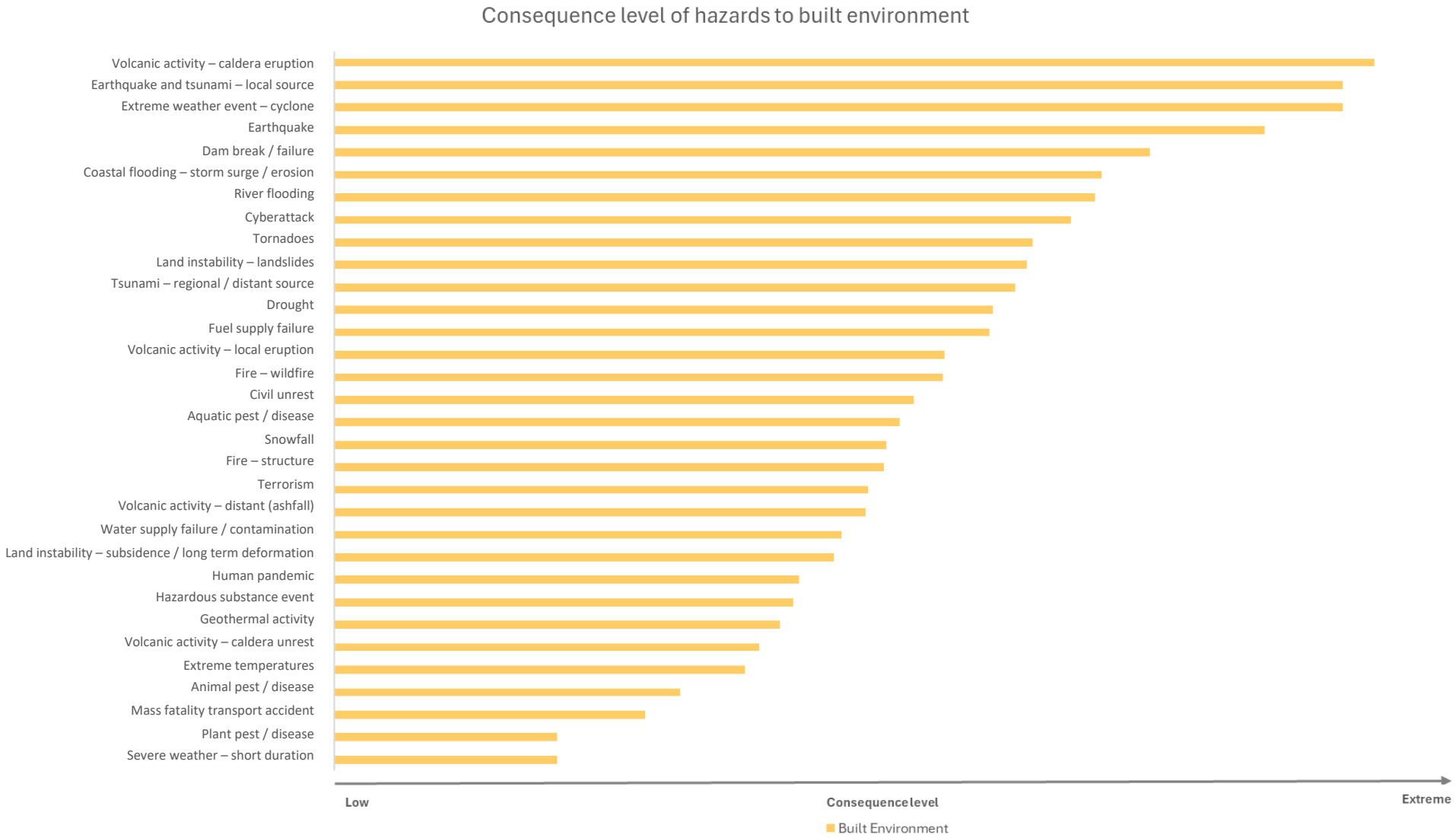


Table 9: Hazards that present the highest consequence to the built environment

Built environment – High level risk occurrence across multiple hazards

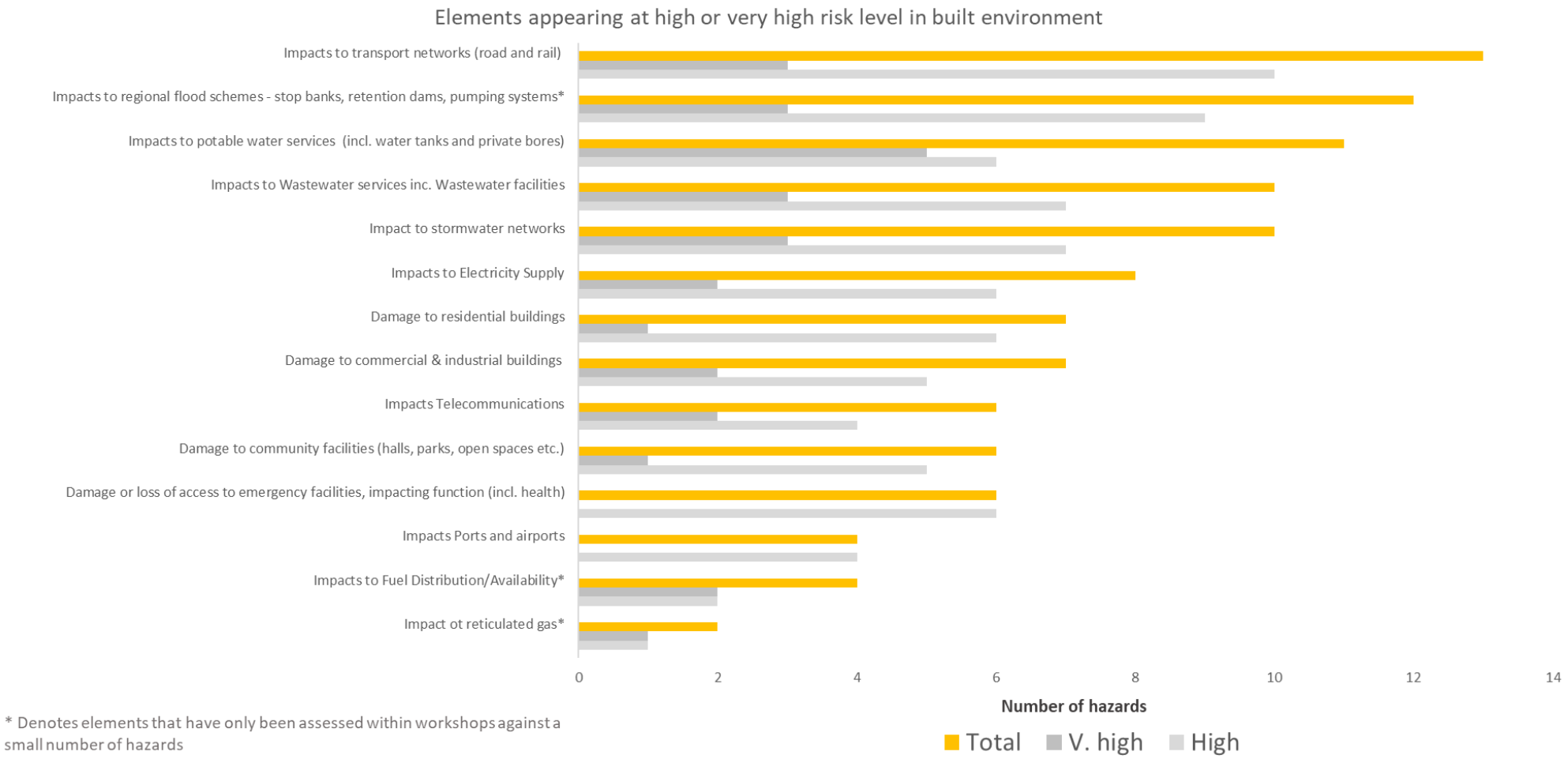


Table 10: Consequence elements in the built environment with the highest occurrence across all hazards

Economic Environment – Risk levels

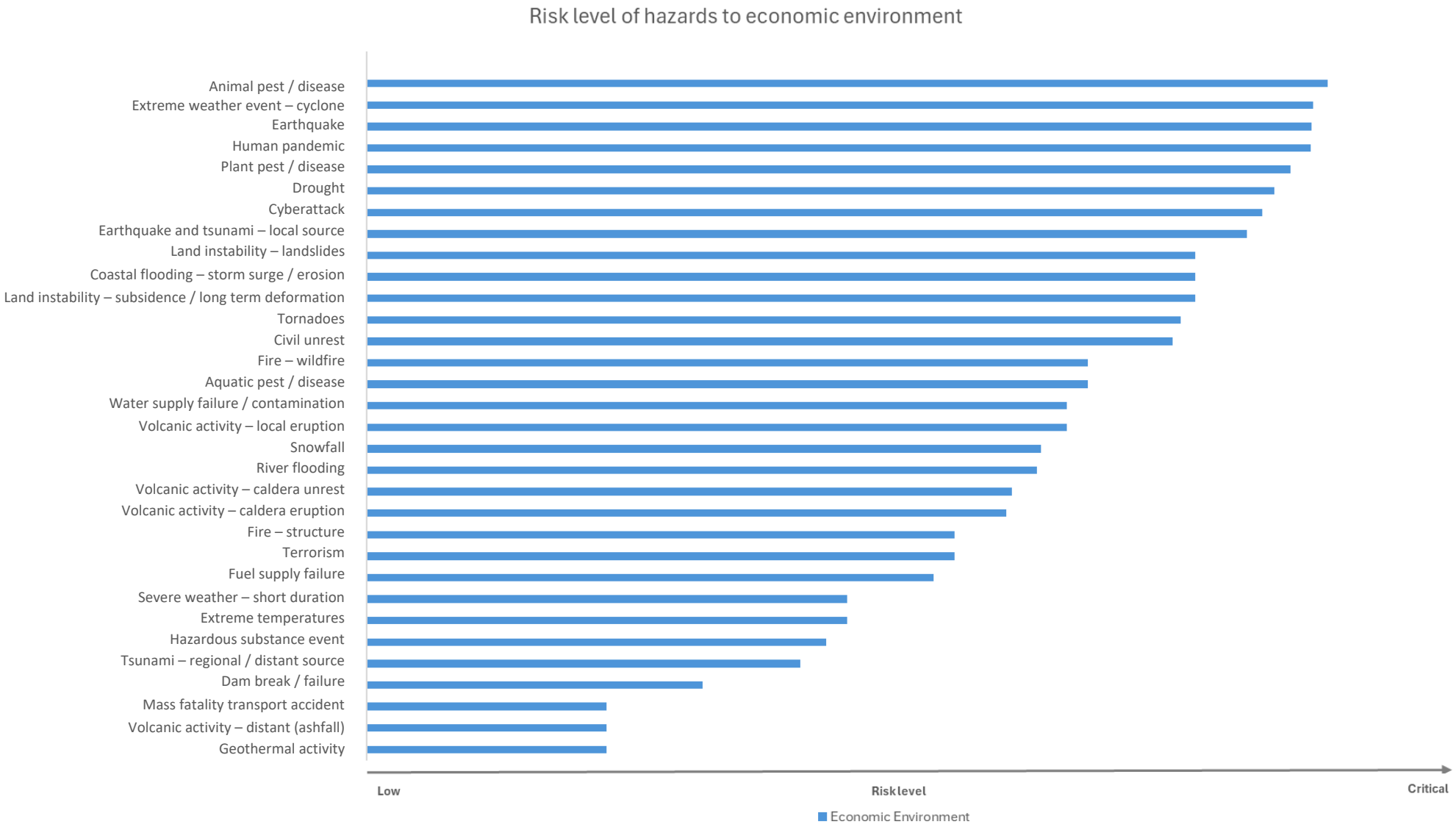


Table 11: Chart showing risk level of hazards to the built environment

Economic environment – Consequence levels

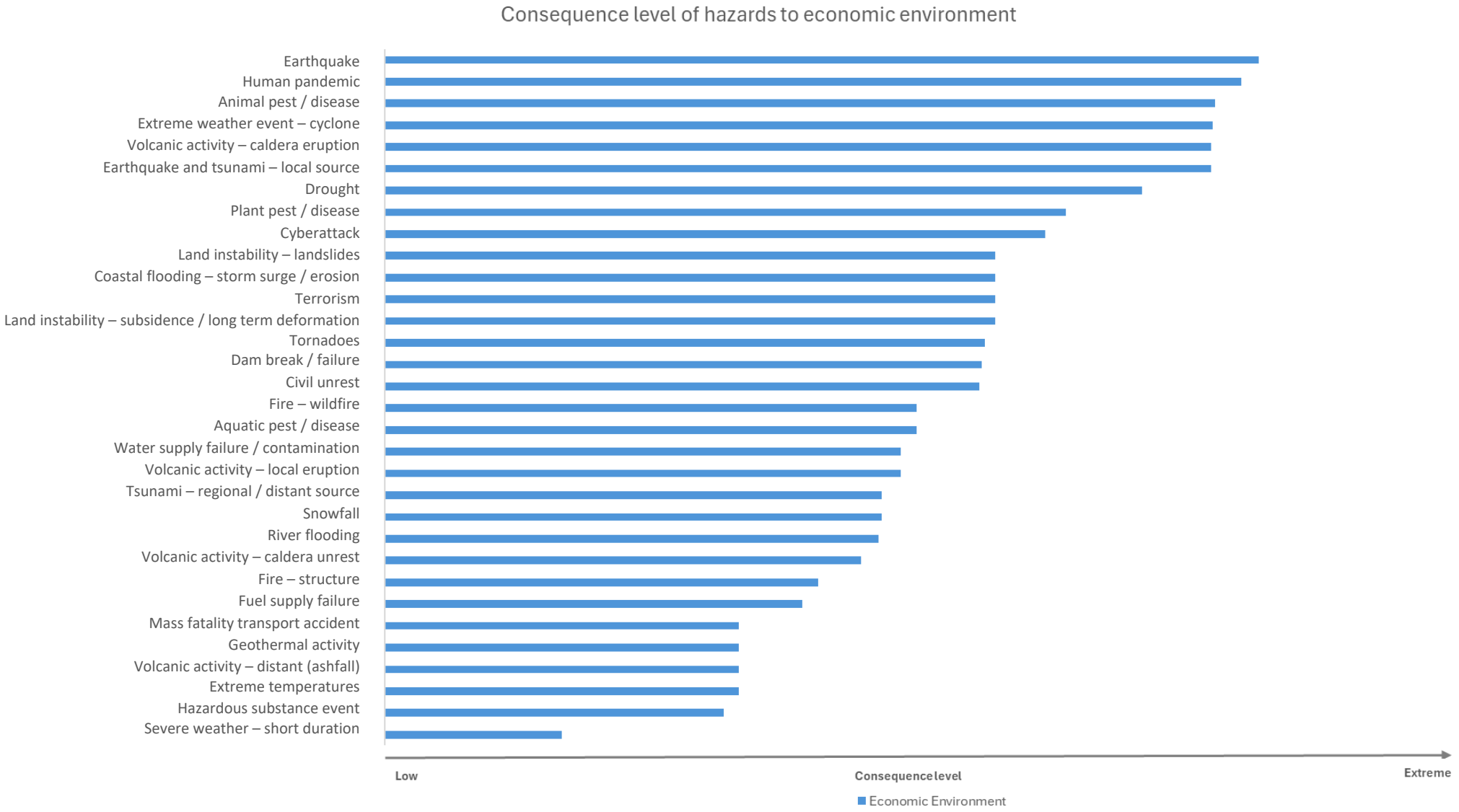


Table 12: Hazards that present the highest consequence to the economic environment

Economic environment – High level risk occurrence across multiple hazards

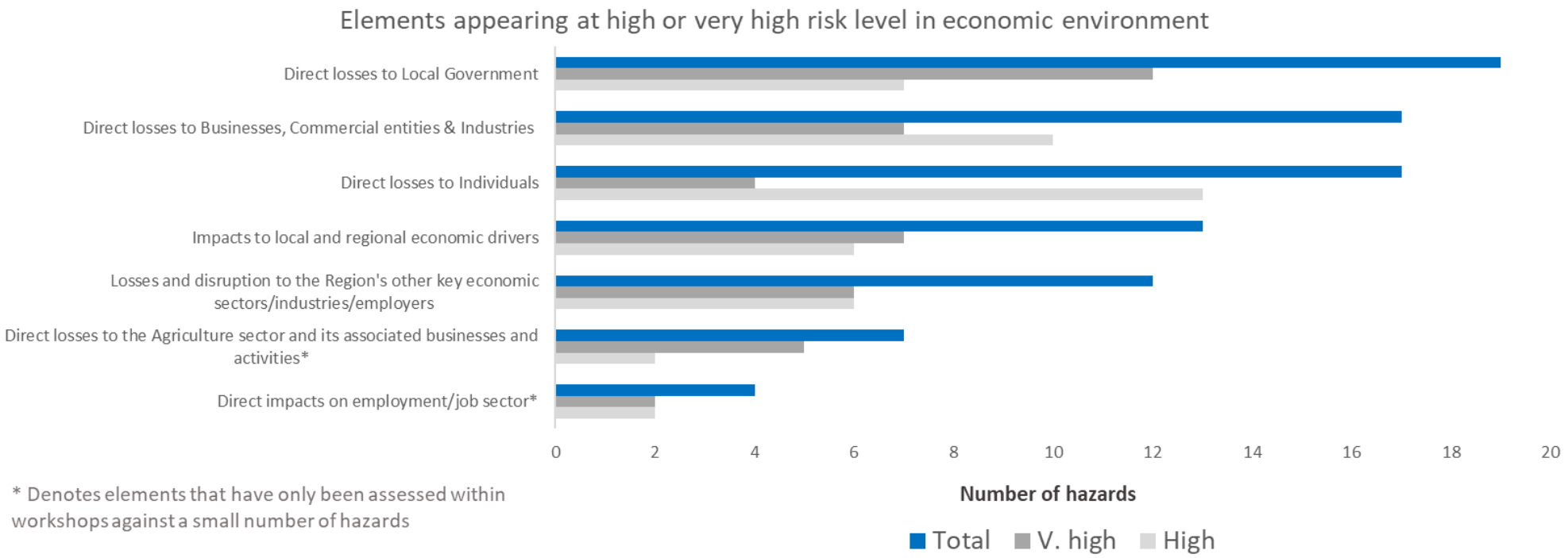


Table 13:Consequence elements in the economic environment with the highest occurrence across all hazards

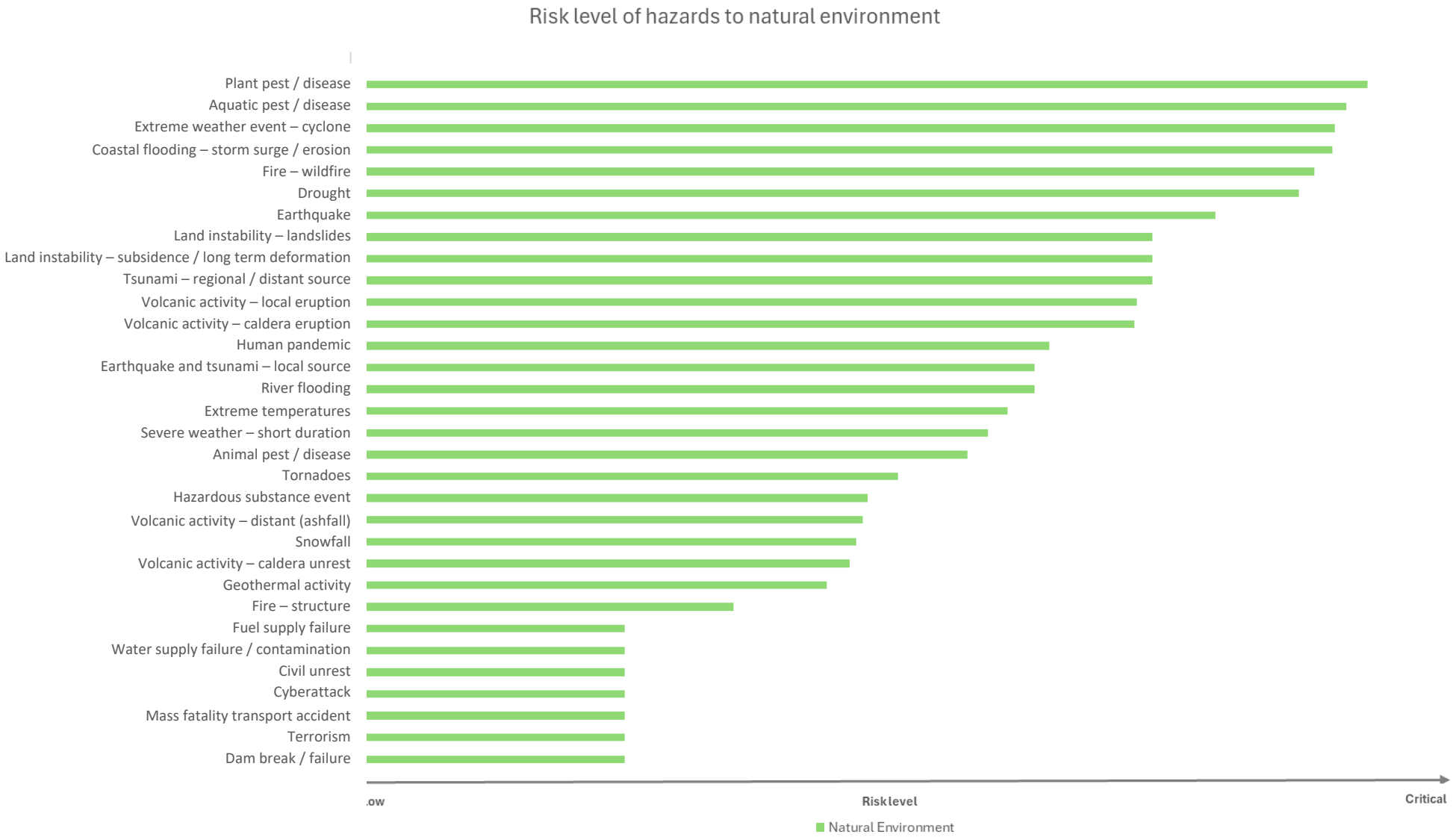


Table 14: Chart showing risk level of hazards to the natural environment

Natural environment – Consequence levels

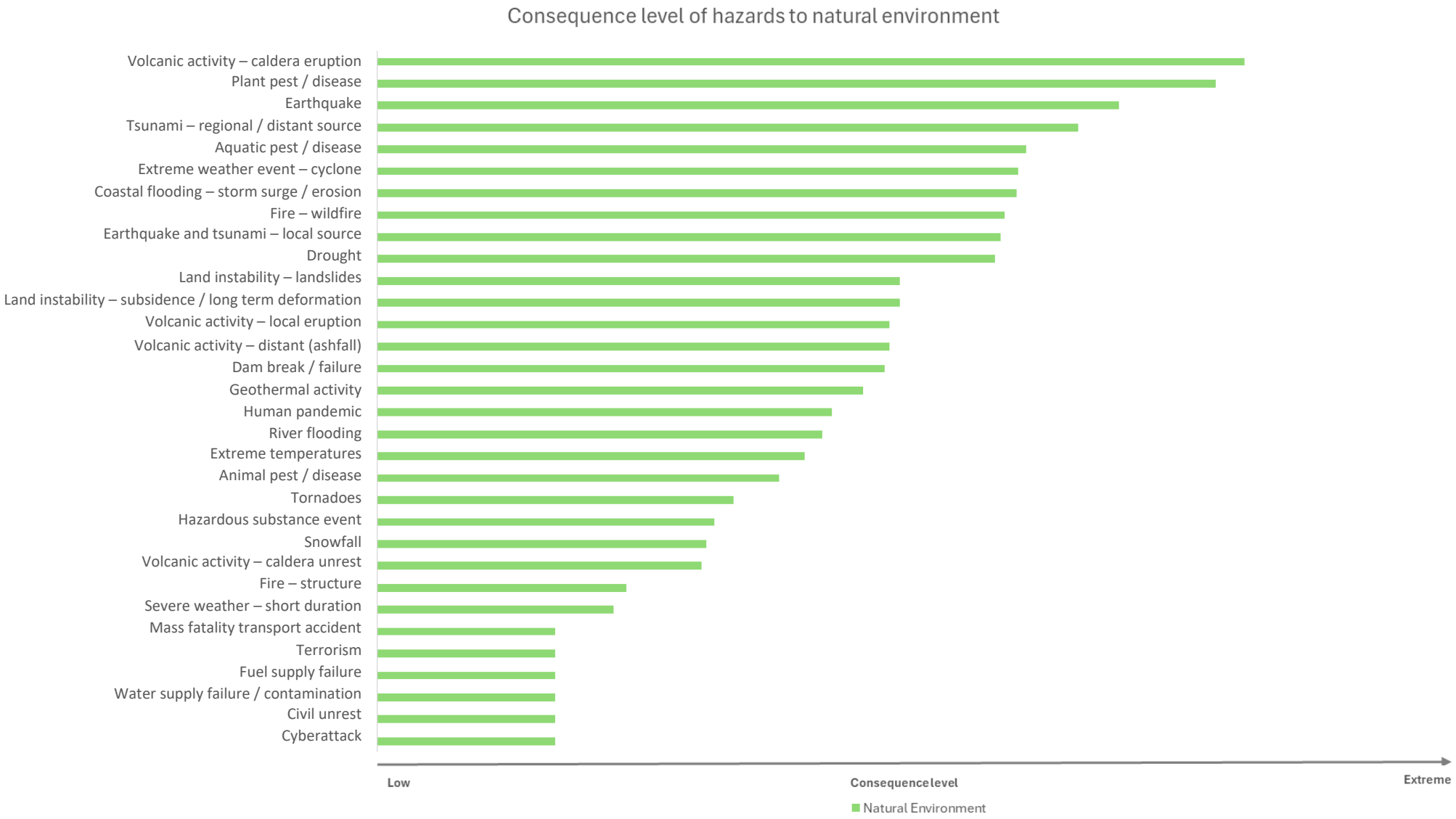
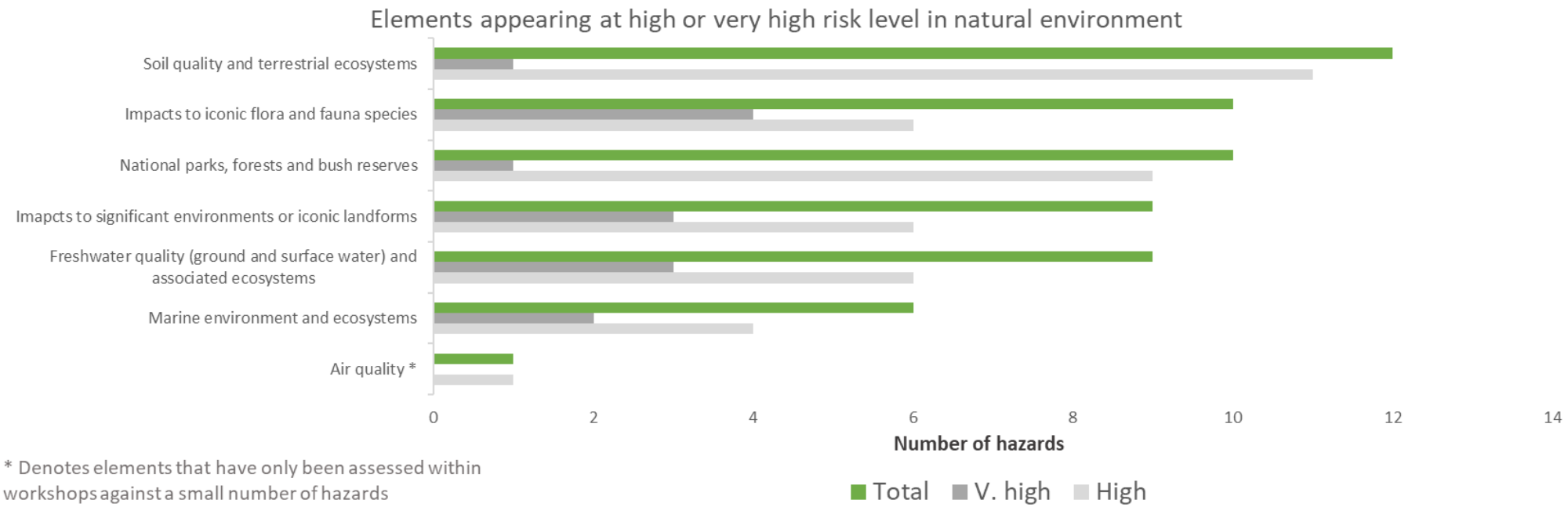


Table 15: Hazards that present the highest consequence to the natural environment

Natural environment – High level risk occurrence across multiple hazards



* Denotes elements that have only been assessed within workshops against a small number of hazards

Table 16: Consequence elements in the natural environment with the highest occurrence across all hazards

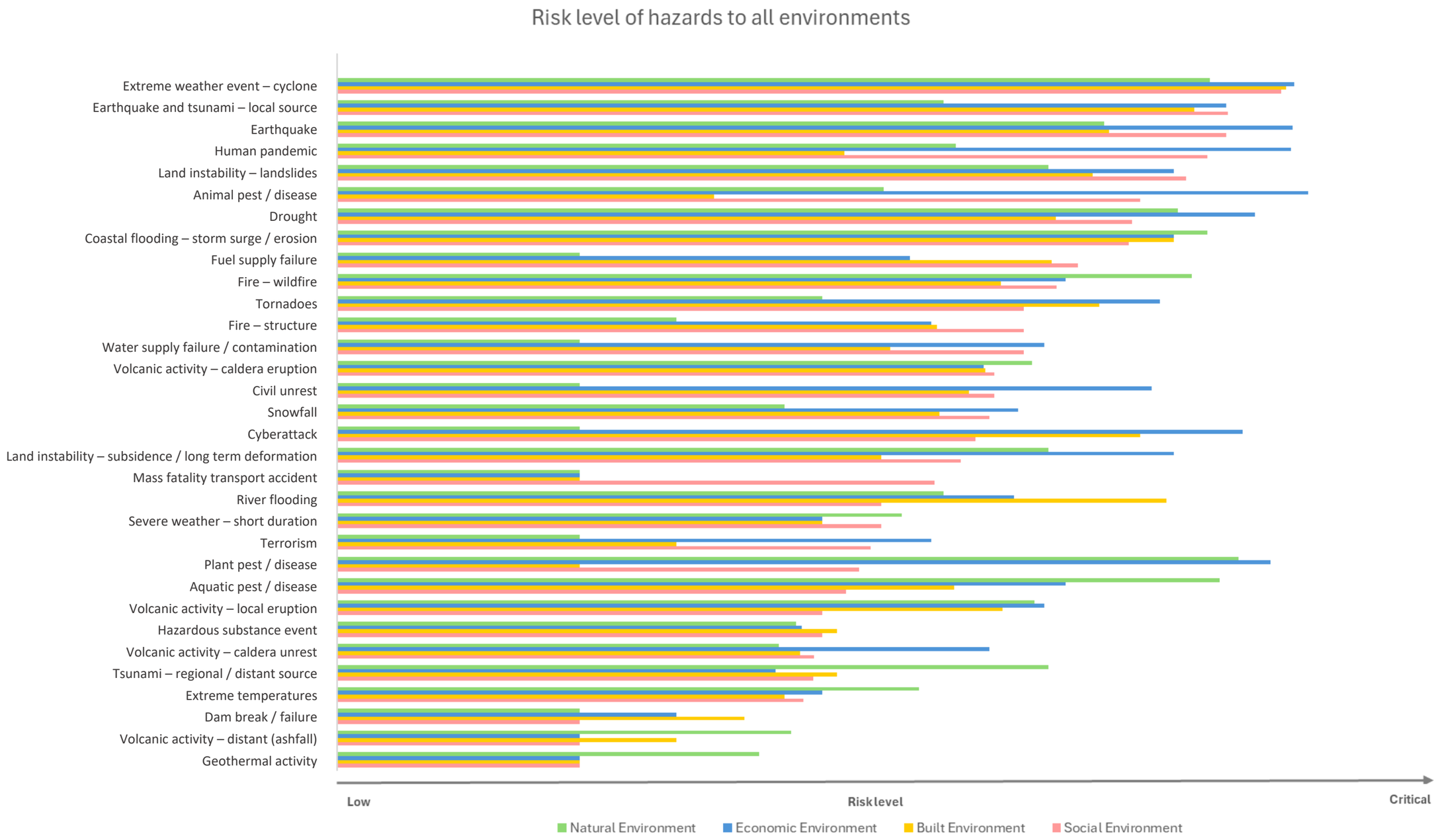


Table 17: Chart showing hazard risk level across all environments

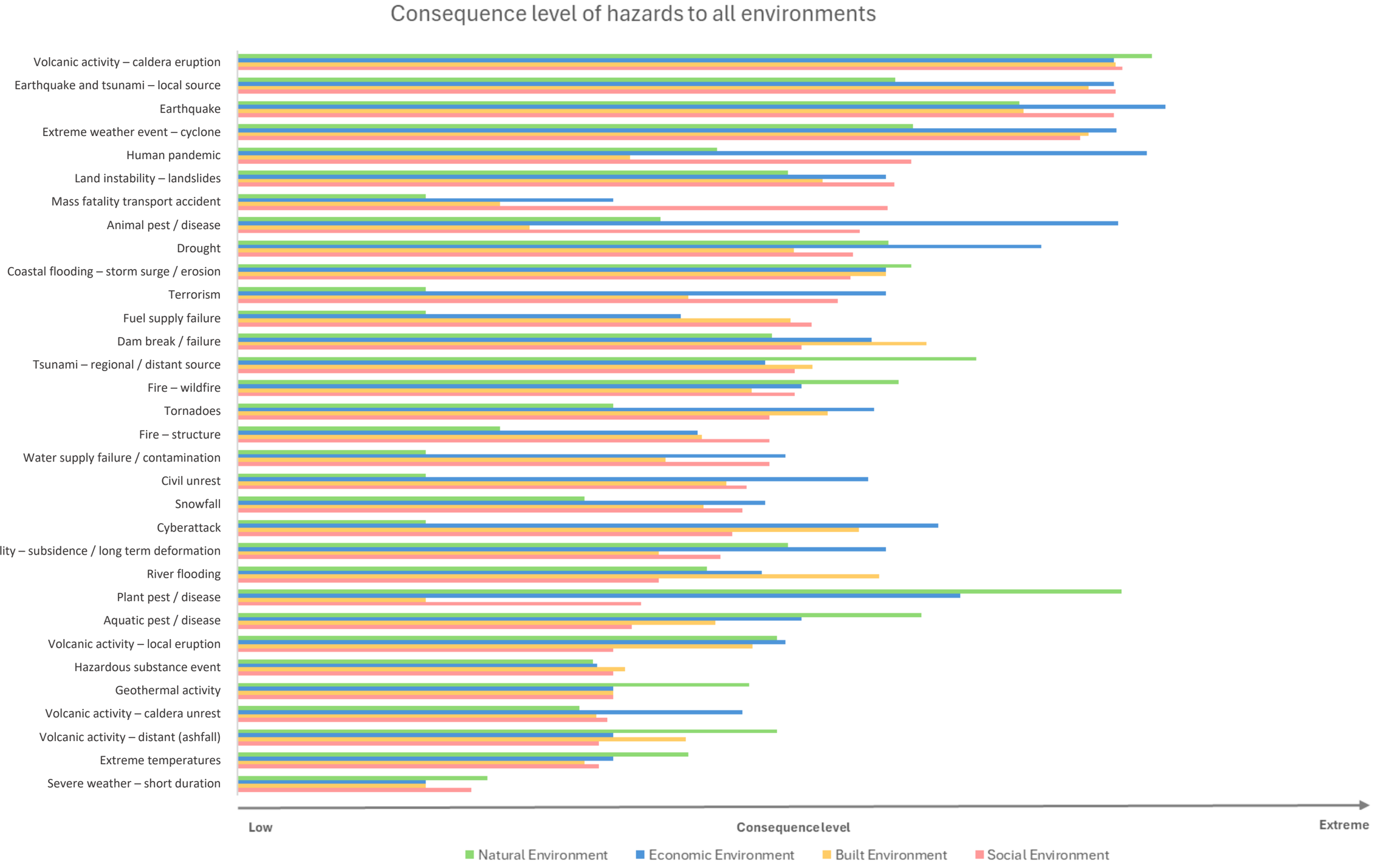


Table 18: Chart showing consequence level of hazards across all environments

Appendices

Hazard scenarios

The table below shows the revised list of hazards assessed as part of the Waikato CDEM Group Risk Assessment process.

Hazard	Scenario (Maximum credible event)	Likelihood
Coastal Flooding – Storm surge / erosion	A severe storm system passing to the north of New Zealand has resulted in large swells on both coasts of the region. The large waves and storm surge occur during a King Tide and result in erosion and coastal flooding in several places along the western Waikato coast and Coromandel. In the western Waikato erosion is particularly bad along Point Rd, Mōkau and Sunset Beach, Port Waikato. In Coromandel, coastal flooding and erosion has impacted Te Puru and Tararu on the western coast. Low-lying farmland around the southern Firth of Thames has experienced flooding and saltwater intrusion. On the eastern coast, large swells have impacted a number of areas including Cooks Beach, Buffalo Beach and Whangapoua Beach, resulting in significant erosion along the beach front and some flooding of low-lying land. *Reference event: Cyclone Fehi and Gita, 2018*	**Possible**
Drought	Following a previous drought, a particularly dry autumn and winter see's low levels of aquafer recharge and a particularly warm and dry summer results in widespread severe drought conditions occurring across the region. Soil moisture levels are at their lowest ever and river flows in parts of the region are exceeding their lowest ever recorded levels. A drought is acknowledged for the Waikato region and a Regional Drought Committee is established. Full water restrictions are put in place for all activities for extended periods and some towns experience water supply issues as a result of low river and aquafer levels.	**Possible**
Earthquake	A Mg.7.4 earthquake occurs on the Te Poi, Waitoa and Awaiti segments of the Kerepehi Fault, with the fault rupturing from south of Matamata near Te Poi to north of Ngatea. Shaking intensities of MM10 are experienced Te Aroha, MM8 in Matamata and MM7 in Thames, Hamilton and Whangamatā. The fault rupture results in land deformation along the fault, with subsidence along the western side and uplift on the eastern side of the fault. Near Matamata uplift of up to 1m and subsidence of up to 1m is observed along the fault. Near Waitoa uplift of 0.5–1m and subsidence of 0.5-1m is observed. Further north near the Kopuatai Bog uplift and subsidence of 0.5m is observed. North of Ngatea, subsidence of up to 0.5m is observed. The subsidence and uplift results in a change to the course of the Waitoa River where the fault crosses to the North of Waitoa and to the south of the Kopuatai Bog. This results in the ponding of water in lower lying areas. The course of the Waihou River north of Te Poi is also affected. Other streams and small tributaries that are near to the fault are also impacted by the ground deformation. Liquefaction occurs in a number of the towns in the Hauraki Plains, including Matamata and Te Aroha. It is most severe in areas near to the main rivers, the Kopuatai Bog and north of Ngatea near the Firth of Thames. (*Reviewed by Pilar Villamour GNS)*	**Unlikely**
Earthquake and Tsunami – Local Source	A Mg.8.9 earthquake occurs on the Hikurangi Subduction Zone to the east of New Zealand. It is the middle of the day on a Saturday in summer. Large parts of the region experience shaking for several minutes with intensities of MM7 (Severe) for more than 20 seconds across much of the region and intensities of MM8-9 in the south. Liquefaction is experienced in vulnerable soils where severe shaking occurs. Less than an hour after the quake the first tsunami arrive on the eastern coasts of the region. Offshore wave heights of 4-5m+ are observed in the Coromandel. In Whitianga inundation flow depths of 3m are experienced at Buffalo Beach and 5m at Ohuka Beach. Other parts of the eastern Coromandel coast experience between 3-5m inundation flow depths. Both Whitianga and Whangamatā harbours experience strong tidal currents of 10 knots+ (20kmph+). Tsunami activity continues for up to 24 hours following the quake with further inundation resulting from subsequent waves. Many other parts of New Zealand's North Island east coast have also been impacted by strong shaking and significant waves, including Hawke's Bay, Gisborne and the Bay of Plenty. *Based on Hikurangi Subduction Zone scenario and 2014 Coromandel tsunami risk study*	**Unlikely**
Extreme Temperatures	The region experiences a 2-week spell of continued high temperatures due to a high sitting over the country. Several days see the region hit record temperatures above 35 degrees and sustained temperatures in the early 30's. Overnight temperatures remain warm in the low twenties.	**Possible**
Extreme weather event – cyclone	A significant cyclone forms in the southern Pacific in Mid-February and moves slowly south-east towards New Zealand. At its peak it reaches Category 5 status, causing devastation in the Pacific Islands of Vanuatu. Although the system gradually loses power and is re-classified as an ex-tropical cyclone, as it moves across the Pacific and into the Tasman the storm still has sustained winds in excess of 140km/h, with gusts in excess of 160km/h. The system is predicted to make landfall north of Auckland late in the afternoon on a Saturday and track South-South-East down the North Island. However, it is preceded by large swells on the West Coast, with storm surge resulting in erosion along Point Rd, Mōkau, Sunset Beach and Port Waikato from late Friday night and early on the Saturday morning. Low-lying areas are inundated, and this continues to occur throughout the storm.	**Possible**

Hazard	Scenario (Maximum credible event)	Likelihood
	By late Saturday afternoon the storm makes landfall and begins to impact the north of the region. Wind speeds begin to increase across the north of the region with gusts in excess of 140km/h experienced in Port Waikato and Coromandel by the evening. Heavy rainfall starts to occur across the north of the region and within hours many trees have fallen, and power is cut to large parts of the region. Several key roads are closed due to tree fall as the weather intensifies. Central and southern areas begin to feel the brunt of the storm in the early hours of Sunday morning, with strong winds and rain impacting the roading, communications and electricity networks. In Coromandel, coastal flooding and erosion has impacted Te Puru and Tararu on the western coast. Low-lying farmland around the southern Firth of Thames has experienced flooding and saltwater intrusion as the storm surge builds. The storm system slows its progression across the region throughout the Sunday, resulting in intense rainfall over a 24hr period across the main river catchments. At most sites over 400mm of rain is recorded, with some receiving this in less than 16hrs. The hills surrounding Port Waikato receive more than 500mm of rain, and parts of Coromandel record their highest ever 24hr rainfall totals. Ponding occurs in low-lying areas and the river systems throughout the region begin to flood surrounding land. Flooding occurs along the Waikato River and Waipa Rivers north of Hamilton in Ngāruawāhia and Huntly. The Waitoa and Waihou Rivers flood across the Hauraki Plains and numerous smaller streams and rivers in the area break their banks. A stop bank breach in Paeroa leads to inundation to part of the town. In the Coromandel, many streams within steep catchments experience debris flows as the result of a high intensity period of rainfall, including streams near Thames, which exacerbates flooding of surrounding areas. Widespread slipping occurs in the high country of the region. The worst of these have occurred in the areas to the south of Port Waikato, and around the Coromandel. While these are some of the worst affected areas, the entire region has seen damaging slips. Many small communities are impacted, particularly in the east and west of the region. Several large slips have occurred on the state highways causing closures. By Sunday evening, the storm begins to move over the east coast of New Zealand and into the Pacific. Strong winds continue to occur into the early hours of the Monday Morning for most parts of the region, with Taupo and Tokoroa both experiencing high winds speeds in excess of 120km/h well into the Monday afternoon. *Scenario based on the impacts of Cyclone Gabrielle*	
Fire – Wildfire	Continued dry, hot weather through the summer months has created a high level of fire risk across the region. A major fire is burning in a forestry block to the west of Tokoroa covering 1600ha and is spreading rapidly, fanned by strong winds from the northwest. A second fire outbreak has occurred in the Hakarimata Scenic Reserve near to Ngāruawāhia and is also spreading rapidly as a result of the high temperatures and strong winds. In the east of the region several smaller fires have developed. A fire on rural land near Ngatea has developed into a peat fire covering an area of 20ha. Several smaller fires have been lit deliberately in bush north of Whangamatā and are being fanned by the strong winds.	**Possible**
Geothermal activity	A hydrothermal eruption occurs in the Rangatira Park area of Taupo, with material ejected for several hundred metres around the area impacting homes. The eruption continues for a number of days. *Reference events: 2005 Reporoa Geothermal eruption, Rotorua 2016*	**Unlikely**
Land instability – Landslides	After a sustained period of rain widespread slipping has occurred in the high country of the region. The worst of these have occurred in the areas to the south of Port Waikato, and around the Coromandel. While these are some of the worst affected areas, the entire region has seen damaging slips. Many small communities are impacted, particularly in the West of the region. Several large slips have occurred on the state highways causing closures. Several slips have created debris dams in tributaries of the Waikato River and small streams across the region.	**Possible**
Land instability – Subsidence / long term deformation	A swarm of earthquakes occurring in Lake Taupō over several months leads to subsidence along the shore of the lake in a short period. Along the northern shore the subsidence impacts lower-lying parts of Taupō, particularly around the Two, Three and Four Mile Bay areas, where up to o.5m is observed. In the eastern and southern parts of the lake the subsidence is more severe, resulting in increased flood risk and erosion of lower-lying areas surrounding Tūrangi, Tauranga Taupō Bay, Motutere and Waitahanui. *Reference event – 1922 earthquake swarm and subsidence / 1983 Earthquake swarm and subsidence*	**Possible**
River Flooding	A Rainfall event associated with a significant low occurs in mid-winter, bringing significant rainfall to the entire region over a period of three days. Many areas have already experienced a sustained period of wet weather from a prior low-pressure system and ground water levels and river flows are already high. River systems throughout the region begin to flood surrounding land and flooding occurs along the Waikato River and Waipa Rivers north of Hamilton in Ngāruawāhia and Huntly. The Waitoa and Waihou Rivers flood across the Hauraki Plains and numerous smaller streams and rivers in the area break their banks. A stop bank breach in Paeroa leads to inundation to part of the town. In the Coromandel, many streams within steep catchments experience debris flows as the result of a high intensity period of rainfall, including streams near Thames, which exacerbates flooding of surrounding areas. *Based on Regional 1% AEP flood maps, 1998 Waikato Flood event and Report: The potential for debris flows from Karaka Stream at Thames, Coromandel - Feb 2006*	**Possible**

Hazard	Scenario (Maximum credible event)	Likelihood
Severe Weather – short duration	A short duration severe weather event occurs bringing strong winds, thunderstorms and periods of heavy rainfall to the region. Wind speeds exceed 120km/h in exposed areas of the region and rainfall levels result in surface flooding across many of the region's highways and within several towns, including Te Awamutu, Paeroa and parts of Hamilton. *Reference events – Hamilton storms, 2018 & 2020, Te Awamutu 2021*	**Likely**
Snow fall	Heavy snowfall occurs across the Central Plateau, closing State Highways 1, 47 and 49 south of Tūrangi and State Highway 5 Taupo to Napier. The snowfall is up to 15cm deep, with deeper drifts in higher areas. Many smaller rural settlements and farmland access routes are cut-off. Cold conditions are set to remain with snow to remain settled on the ground for several days. *Reference event - August 2016 Snowfall event*	**Possible**
Tornadoes	During a spell of thunderstorms around the middle of the day a strong tornado forms to the west of Frankton. It touches down in the industrial area of Frankton and continues eastwards towards the Hamilton CBD, before crossing into Hamilton East and then moving into rural areas to the east of the city. It is on the ground for 10 minutes and has wind speeds of over 200km/h. The tornado cuts a path 200m wide and several kilometres long. *Reference event – 1948 Waikato tornado Cambridge event*	**Possible**
Tsunami – Regional / Distant source	A magnitude 9.4 earthquake occurs on the western coast of South America creating a tsunami that travels across the Pacific to New Zealand. The first waves arrive on the east coast of the region mid-morning on a weekend in summer at high tide. Wave heights of up to 5m are recorded in Whitianga and other parts of the eastern Coromandel coast. Inundation of the coast occurs. Lesser wave heights are experienced I the Firth of Thames, however, waves of up to 2.5m are experienced, with inundation of some low-lying coastal areas. *Based on 2013 GNS Tsunami report and 2014 Coromandel tsunami risk study*	**Unlikely**
Volcanic Activity – Distant (Ashfall)	An eruption has occurred at Mt. Taranaki resulting in the ejection of approximately 0.5km3 ash plume thousands of metres into the sky. The prevailing south-westerly wind has resulted in ash fall being dispersed across a large part of the region. The southwest of the region is the worst impacted area, with ashfall depths of several millimetres near to the Taranaki boundary on State Highways 3 and 4. Taupo, Te Kuiti and Tokoroa all experience ash fall depths up to 1mm. Hamilton and Cambridge experience a light dusting of ash. *Reviewed by Brad Scott, GNS*	**Unlikely**
Volcanic Activity – Local eruption	Heightened activity around the Te Maari vent has been recorded at Mt. Tongariro and volcanic tremor has increased in magnitude and frequency over the past fortnight. The volcanic alert level was raised to level 2 ten days ago and activities in the park restricted, including the Tongariro Crossing. At 2pm on a weekday the mountain erupts resulting in a 0.1km3 ash plume rising 10-15km high and projectiles being ejected up to 4km from the vent. Ashfall in the areas surrounding the vent reach up to 50mm and 20mm in other areas of the park, including Whakapapa village. The south westerly wind results in 10mm of ash is recorded in Tūrangi and 5mm of ash in Taupo. State highways around the mountain (SH 47, 46, 1) are all closed and have ashfall to between 10-20mm in depth. *Reviewed by Brad Scott, GNS*	**Possible**
Volcanic Activity – Caldera unrest	An initial earthquake of magnitude M_W5.4 occurs to the southeast of Tūrangi causing some damage to SH1, localised landslides and liquefaction near the source. The initial quake is followed by several more over the following months and the volcanic alert level is raised to level 1. Swarms of earthquakes beneath the lake become a regular occurrence over the next few years and uplift of several centimetres along the north and eastern shores of the lake is observed after each swarm of quakes. Earthquake frequencies increase over time and magnitudes reach up to M_W4.5. Often swarms consist of tens of quakes per day. *ECLIPSE Scenario A – Taupo caldera unrest sequence*	**Possible**
Volcanic Activity – Caldera eruption	Following a period of unrest over several years, an eruption takes place beneath the lake resulting in a large ash plume up to 10km high. As the eruption continues the ash plume reaches over 30km high depositing thick layers of wet ash on the surrounding area. Taupo is impacted by thick ash up to 50cm and pyroclastic material. Mud and debris flows impact rivers and streams across the region, with the Waikato River significantly impacted. The eruption ends with a large pyroclastic flow that spreads in all directions from the lake and covers the area within 80km of the lake in pyroclastic material. The majority of the materials are ejected to the east due to predominant winds, with Taupo and surrounds covered in a further 50-100cm of material. Mud flows and ground shaking continues for months following the eruption. *ECLIPSE Scenario B – Taupo eruption*	**Rare**
Aquatic Pest / disease	A significant outbreak of an aquatic pest occurs in the region, resulting in widespread damage to aquaculture activities, including mussel and oyster farms in the Firth of Thames.	**Possible**
Animal pest / disease	A number of cases of a highly infectious animal disease are detected at a farm in the region. The infected stock were recently purchased at a cattle sale. The origins of the outbreak are unknown, but it is suspected to be present in other farms within the region and biosecurity restrictions are put in place. After several months, many of the region's farms have cases of the disease present and mass culling of stock is undertaken. *(Example threats – Foot and Mouth, Mad Cow Disease, Avian Bird Flu)*	**Possible**

Hazard	Scenario (Maximum credible event)	Likelihood
Human pandemic	New Zealand has re-opened the borders following the COVID-19 outbreak, and quarantine is no longer required to enter the country from most parts of the world. People are moving freely again between New Zealand and Europe, the United States and the majority of Asian countries. Only travel to some parts of South America and Africa still faces restrictions on entry back into New Zealand. It's mid-winter and reports of a new strain of Influenza are beginning to surface in Europe with many people reporting severe symptoms impacting their nose, throat and lungs and a number of deaths already associated to the virus in a number of countries. A recent returnee to New Zealand from Europe begins to exhibit symptoms and is diagnosed to have the new strain of influenza. Several more people across the country begin to exhibit the symptoms and all are linked to a flight between Sydney and New Zealand. Following contact tracing it is found that a family on the flight who had travelled to New Zealand to attend a wedding in Waikato were in close proximity to the returnee are now confirmed as having the virus, with an elderly family member falling critically ill and being hospitalised. The wedding had several hundred guests, and some now have symptoms associated to the illness. Further community cases arise with several more people admitted to hospital. It is clear that community transmission is occurring, and an outbreak is occurring within the region, however, contact tracing is complicated due to the short incubation period of the virus. Projections show many hundreds are likely to have now contracted the virus since it first entered the region, and it is expected this number will grow quickly over the coming days.	**Possible**
Plant pest / disease	An outbreak of a new plant pest is identified in part of the region. After several months the outbreak has become widespread, resulting in damage to crops, fruit, and vegetables. Many other plants are impacted because of the outbreak. *(Example threats – Marmorated Stink Bug, PSA vine disease)*	**Possible**
Civil unrest	Mass protests throughout New Zealand opposing a government decision descend into civil unrest in main centres including Hamilton. Violence and vandalism occurs across the city and in other towns in the region.	**Possible**
Cyber attack	A sustained cyberattack targeting electrical supply and generation infrastructure leads to widespread power supply issues nationally and across the region with blackouts of 24 hours and up to 48 hours in parts. Finance systems such as banking and EFTPOS are unavailable, fuel supply is limited to sites with generators and some tele communication sites are impacted due to power loss.	**Possible**
Dam break / failure	The Karapiro Dam suffers a catastrophic collapse of the structure following sliding of a gravity abutment as a result of earthquake shaking. This results in a large influx of water into the Waikato River, leading to flooding of several metres through parts of Cambridge, Hamilton, Huntly and Ngāruawāhia. *Source: Waikato River Adare Flood Hazard Report / Karapiro Dam: Report on dam break analysis*	**Rare**
Fire -Structure fire	A major fire breaks out at a transport hub in Hamilton and spreads to nearby buildings. The fire creates a plume of black smoke that drifts across the Te Rapa and Forest Lake areas of the city. It is believed that there are hazardous materials within the building. The fire requires multiple fire crews to respond and the closure of part of State Highway 1.	**Possible**
Fuel supply failure	Geo-political disruption in a significant oil-producing region results in an international shortage. Over the following months, Fewer fuel deliveries arrive in New Zealand – there is less fuel to go around, and significant price increases are seen at the pump because of the shortage.	**Possible**
Hazardous substance event	A truck transporting chlorine from the Kinleith Mill swerves to avoid a collision on SH1 in Tokoroa. The truck rolls off the road and the impact results in a breach of the tank. Chlorine begins to leak into the surroundings. The plume begins to move north-west into the CBD and residential areas of the town.	**Possible**
Mass fatality transport accident	The morning Saturday train from Hamilton to Auckland collides at speed with a minibus at a crossing in Horotiu, south of Ngāruawāhia. The train derails and veers off the tracks, resulting in carriages rolling. The train was near capacity with 180 passengers and the minibus had 7 occupants.	**Unlikely**
Major maritime pollution incident	The 260m King of the Seas container vessel loses power while rounding the Coromandel Peninsula in heavy seas. The vessel drifts quickly towards the Western Coromandel coast, eventually grounding near to Great Mercury Island. A large number of containers and oil are lost which impacts the coastline from Port Jackson to Whangamatā. *Reference event – MV Rena grounding*	**Possible**
Terrorism	Terrorist incident occurs within the Hamilton city centre during a crowded event.	**Unlikely**
Water supply failure / contamination	The water supply to Hamilton has become contaminated and several hundred people have sought medical assistance as a result of illness, with many others reporting illness but not requiring assistance. The supply is shutdown to enable a full purge of the system with water unavailable from the mains system for over a week. *(Example event – Havelock North drinking water contamination)*	**Possible**

Consequence rating descriptors - Full Assessment elements

	Base Descriptors				
	No impact or negligible impact on people and/or social wellbeing	**Minor impact on people and/or social wellbeing**	**Moderate impact on people and/or social wellbeing**	**Major impact on people and/or social wellbeing**	**Extreme impact on people and/or social wellbeing.**
Rating	**Insignificant**	**Minor**	**Moderate**	**Major**	**Extreme**
Social Environment - considerations: scale, duration and recoverability					
Deaths	No deaths	Number of deaths can be managed within local BAU capacity and capability and / or number of deaths is likely to have minimal societal impact	Number of deaths exceeds BAU capacity and capability. Requires District support to increase capacity and capability and / or number of deaths is likely to have short term societal impact	Number of deaths exceeds District capacity and capability. Requires Regional support to increase capacity and capability and / or number of deaths is likely to have medium term societal impact	Number of deaths exceeds Regional capacity and capability. Requires National support to increase capacity and capability and / or number of deaths is likely to have long term or permanent societal impact
Injuries and illness	No significant change in injuries or illness	Noticeable short term rise in numbers of people affected	Many affected, short term recovery for all	Many affected. Long recovery for some, short term recovery for most	Many affected. Permanent impacts on some people, long recovery for many
Psychological impacts	No significant change in demand for services	Noticeable short term rise in numbers of people affected	Many affected, short term recovery for all	Many affected. Long recovery for some, short term recovery for most	Many affected. Permanent impacts on some people, long recovery for many
Households in need of accommodation	No alternative accommodation required	Some, localised/short term alternative accommodation required	Widespread short term or localised long-term alternative accommodation required	Widespread, long-term alternative accommodation required	Widespread need for permanent alternative accommodation
Displaced households	Negligible displacement	Displacement of households can be managed within the impacted area.	Displacement of households requires support from other areas within the district.	Displacement of households requires support from other areas within the region.	Permanent displacement of households requiring support from other regions.
Welfare services - emergency finance and other essential services support	No increase in demand	Noticeable short-term rise in demand	Widespread short-term rise in demand	Widespread medium term rise in demand	Widespread, permanent increase in demand
Education services - access to preschool, school and tertiary services	No impact on services	Isolated and short term disruption	Multiple short term service disruption	Widespread short to medium term service disruption	Widespread, long term service disruption

Community services - local government and not for profit community support services	No impact on services	Isolated and short term disruption	Multiple short-term service disruptions	Widespread short-medium term service disruption	Widespread, long term service disruption
Social wellbeing and connectedness - participation and inclusiveness	No Impact	Some communities affected for a short time	Many communities affected for a short time	Widespread impact on communities, medium term, some connections lost	Communities permanently lost, many communities disconnected/lose participation long-term
Access to essential consumer products	No impact on supply	Isolated and short term disruption	Multiple short term disruptions	Widespread short to medium term disruptions	Widespread, long term disruption, loss of some supply chains
Cultural wellbeing - ability to participate in cultural life, recreation, rituals and activities	No Impact	Some people unable to participate in cultural life and / or express their cultural identity - short term	Many people unable to participate in cultural life and/or express their cultural identity - short term	Many people unable to participate in cultural life and / or express their cultural identity - medium term	Many experience permanent loss of taonga, cultural identity, or ability to participate
Companion animals - pets, companion animals, non-production animals	No impact	<10 companion animals lost, killed or abandoned and unable to be reunited with owners	10-50 companion animals lost, killed or abandoned and unable to be reunited with owners	50-100 companion animals lost, killed or abandoned and unable to be reunited with owners	>100 companion animals lost, killed or abandoned and unable to be reunited with owners

	No impact or negligible impact on structures and the services/functions they provide	**Minor impact on structures and the services/functions they provide**	**Moderate impact on structures and the services/functions they provide**	**Major impact on structures and the services/functions they provide**	**Extreme impact on structures and the services/functions they provide**
	Insignificant	**Minor**	**Moderate**	**Major**	**Extreme**
Built Environment considerations: scale, duration, ability to relocate function/service and recoverability					
Damage to residential buildings	No Impacts	Isolated damage of residential buildings in a township or area	Widespread damage of residential buildings in a township or area	Widespread critical damaged of residential buildings in a township or area	Widespread critical damage of residential buildings across the Region
Damage to commercial and industrial buildings	No Impacts	Isolated damage of commercial and industrial buildings in a township or area	Widespread damage of commercial and industrial in a township or area	Widespread critical damaged of commercial and industrial in a township or area	Widespread critical damage of commercial and industrial buildings across the Region
Damage to government and non-commercial (community facilities) buildings	No Impacts	Isolated damage of government and non-commercial (community facilities) buildings in a township or area	Widespread damage of government and non-commercial (community facilities) buildings in a township or area	Widespread critical damaged of government and non-commercial (community facilities) buildings in a township or area	Widespread critical damage of government and non-commercial (community facilities) buildings across the Region
Damage or loss of access to emergency facilities, impacting function (incl health)	No impacts	Emergency facilities have suffered non-critical damage and are still operational	Several emergency facilities have suffered damage and are useable with some limitations	Several emergency facilities have suffered critical damage and are unusable	Critical emergency facilities in region have suffered extensive damage and are permanently unusable

Impacts to potable water services (inc. Water tanks and private bores)	Negligible impacts	Isolated and short term disruption	Multiple short term service disruptions	Widespread short to medium term service disruptions	Widespread, long term service disruption
Impact to stormwater networks	No Impacts	Isolated and short term disruption	Multiple short term service disruptions	Widespread short to medium term service disruptions	Widespread, long term service disruption
Impacts to Wastewater services inc. Wastewater facilities	No Impacts	Isolated and short term disruption	Multiple short term service disruptions	Widespread short to medium term service disruptions	Widespread, long term service disruption
Impacts to regional flood schemes - stop banks, retention dams, pumping systems	No impacts	Isolated non-critical damage to part of the flood scheme	Short term critical damage to part of the flood scheme	Long term critical damage to part of the flood scheme	Long term critical damage to multiple parts of the flood scheme
Impacts to Reticulated Gas	Negligible impacts	Isolated and short term disruption	Multiple short term service disruptions	Widespread short to medium term service disruptions	Widespread, long term service disruption
Impacts to Land Transportation (road, rail)	Negligible impacts	Short term minor closures	Short term minor closures and/or critical link closure	Medium term closures, including critical links	Long term critical closures
Impacts to Ports and Airports	Negligible impacts	Temporary disruption/closures	Short term disruption and/or temporary major hub closure	Major hub - Medium term disruption/closure	Major hub - Long term disruption
Impacts to Telecommunications	Negligible impacts	Isolated and short term disruption	Multiple short term service disruptions	Widespread short to medium term service disruptions	Widespread, long term service disruption
Impacts to Fuel Distribution/Availability	Negligible impacts	Isolated and short term disruption	Multiple short term service disruptions	Widespread short to medium term service disruptions	Widespread, long term service disruption/closure
Impacts to Electricity Supply	Negligible impacts	Isolated and short term disruption	Multiple short term service disruptions	Widespread short to medium term service disruptions	Widespread, long term service disruption

	No impact or some local impact to the economy and financial systems	**Minor impact on the regional economy and financial systems**	**Moderate impact on the regional economy and financial systems**	**Major impact on the regional economy and financial systems**	**Extreme impact on the regional economy and financial systems**
	Insignificant	**Minor**	**Moderate**	**Major**	**Extreme**
Economic Environment considerations: scale, duration and recoverability					
Direct losses to Individuals	No impact	A small number of people affected with minimal financial losses	Many individuals with financial losses	Many people affected, with large financial losses	Whole of community impacts with large financial losses
Direct losses to Businesses, Commercial entities and Industries	No impact	Short term disruption and/or minimal impact to profitability	Medium-term loss of value/ output and/or localised business failure	Long-term loss of value/ output and/or localised business failures	Permanent loss of value/ output and/or widespread business failure
Direct losses to Rural sector (Agriculture, horticulture and other associated businesses and activities)	No impact	Short term disruption and/or minimal impact to profitability	Medium-term loss of value/ output and/or localised business failure	Long-term loss of value/ output and/or localised business failures	Permanent loss of value/ output and/or widespread business failure

Direct losses to Local and Central Government	No impact	Short-term increases in costs	Medium term increase in costs, minimal loss of assets	Long term increases in costs, some loss of assets	Long term costs increase, and significant loss of asset value
Losses and disruption to the Region's Key Economic Sectors/Industries/Employers	No Impact	Short term loss of output for a key sector	Medium term loss of output for a key sector	Long term loss/closure of a key sector	Permanent closure of key economic sector(s)
Direct impacts on employment/job sector	No Impact	Short-term disruption to employment	Medium-term reduction in employment	Medium to long term reduction in employment	Widespread, permanent job losses
Impact to local and regional economic drivers	No impact to local / regional economic drivers	Short term impact to local economic drivers not affecting Gross Regional Product	Long term impact to local economic drivers affecting Gross Regional Product	Long term impact to regional economic drivers affecting Gross Regional Product	Long term impact to Regional economic drivers affecting Gross National Product

	No impact on the natural environment and the ecosystem services provided	**Minor impact on the natural environment and the ecosystem services provided**	**Moderate impact on the natural environment and the ecosystem services provided**	**Major impact on the natural environment and the ecosystem services provided**	**Extreme impact on the natural environment and the ecosystem services provided**
	Insignificant	**Minor**	**Moderate**	**Major**	**Extreme**
Natural Environment considerations: scale, duration, recoverability, iconic nature					
Air quality and associated ecosystem services	No impact	Temporary, localised impact	Sustained localised impact, or widespread short-term impact	Widespread, harmful degradation of air quality	Permanent, harmful degradation of air quality
Soil quality and associated ecosystem services	No impact	Temporary, localised impact	Sustained localised impact, or widespread short-term impact	Widespread, degradation of soil quality and loss of ecosystem services	Permanent, degradation of soil quality and loss of ecosystem services
Freshwater quality (ground and surface water) and associated ecosystem services	No impact	Temporary, localised impact	Sustained localised impact, or widespread short-term impact	Widespread degradation of water quality	Permanent degradation of water quality, harmful to aquatic life
Marine environment and ecosystem services	No impact	Temporary, localised impact	Sustained localised impact, or widespread short-term impact	Widespread loss or degradation of the marine environment	Permanent loss or degradation of the marine environment, harmful to marine life
National parks, forests and bush reserves	No impact	Temporary, localised impact	Widespread impacts to forest and bush, medium-term recovery	Widespread impacts on forest and bush - long-term recovery	Permanent widespread loss of forest and bush
Impacts to iconic flora and fauna species	No impact	Temporary, localised impact	Sustained localised impact, or widespread short-term impact	Loss species within region, recoverable	Permanent, widespread loss of species
Impacts to significant environments or iconic landforms	No impact	Temporary, localised impact	Minor damage to iconic landforms and/or medium-term loss of significant environments	Damage to iconic landforms and/or long-term loss of significant environments	Destruction of iconic landforms and/or permanent loss of significant environments
Impacts to geothermal environments	No impact	Temporary, localised impact	Sustained localised impact, or widespread short-term impact	Widespread loss or degradation of geothermal environment	Permanent loss or degradation of a geothermal environment

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