

The Auckland Volcanic Field



Photo credit: <https://businessviewoceania.com/new-zealand-tourism-and-hospitality/>

Aotearoa New Zealand is home to a number of volcanoes encompassing **volcanic fields**, **cone volcanoes** and **calderas**.¹ These include the Auckland Volcanic Field, Mt Taranaki, Ruapehu, Ngāuruhoe and Whakaari/White Island.² The Auckland Volcanic Field is a collection of **53 individual volcanic centres spread across Auckland**.³ This field is described as monogenetic, meaning that each volcanic centre erupts only once. Consequently, it is **unknown** where the next Auckland Volcanic Field eruption will occur, however, as the field is still active it is a question of when not if.

This means that there are a number of uncertainties around a future eruption including: where it will happen, when it will occur, the **size** of the eruption, and the **number of people impacted** (both through the initial evacuation and from long-term impacts). It is also relatively unusual to have a **major city** built upon an active volcanic field, and the large population exposed to this hazard creates an extra layer of complexity.

As the Auckland Volcanic Field is still active, it is critical to ensure that the **legal tools to plan and prepare for a future eruption** are available. This includes ensuring that the legal framework is prepared to plan for, respond to and recover from an eruption. One of the challenges posed by an eruption will be **evacuation**. This includes ensuring that the existing legal framework including:

- **legislation;**
- **policies;**
- **plans;** and
- **other (quasi) legal instruments**

have addressed the necessary aspects of disaster risk management, including having plans in place to **prepare for, respond to and recover from disasters**. This encompasses having **powers** available to implement the plans, including providing for the **necessary resources**.

Evacuating the Auckland Volcanic Field

Due to the **destructive nature** of certain volcanic hazards including pyroclastic flows and lava flows,⁴ **often the only mitigation strategy is evacuation**. An Auckland Volcanic Field eruption is likely to trigger an evacuation. Research undertaken by Wild and others explored evacuation clearance times for an Auckland Volcanic Field eruption.⁵ Their research suggests that:⁶

The total evacuation clearance time ranges between 37 and 40 h for the 5 km evacuation zone with no vent uncertainty buffer applied, when considering free-flowing road carrying capacity. This increases to a maximum of 49 h when vehicle carrying capacity is reduced to a third. The worst-case clearance time found was when a vent uncertainty of 10 km is applied and the vehicle carrying capacity is reduced to a third, resulting in a clearance time of ~55 h.

An idea of the 5 km evacuation zone is shown in Figure 2. This map shows that a significant area may require evacuation from an eruption including the central business district (CBD). Wild and others also highlight the need to consider the people and communities who cannot self-evacuate. These can include hospitals, rest-homes and prisons.⁷

Volcanic Hazards

Volcanic eruptions can create a **number of hazards** depending on the characteristics of the volcano. These hazards can impact different parts of society including **people**, **agriculture**, the **built environment** and **transport**.⁸ The impact of these hazards will be different depending on whether the volcano is located in a **rural or urban area**. Legal tools will be required to manage, respond to and recover from these hazards.

As highlighted in the image below, there are a range of volcanic hazards that can occur during an eruption sequence.

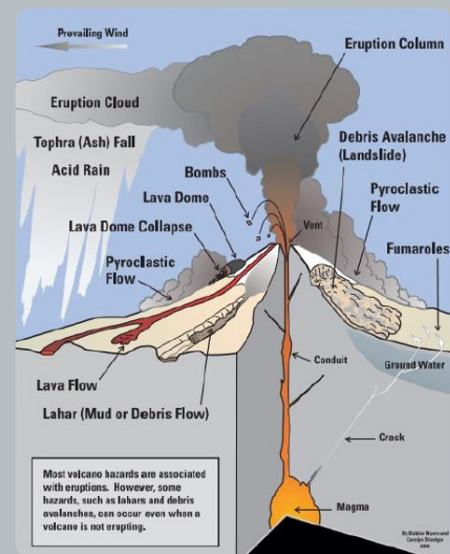


Figure 1: Geologic hazards at volcanoes.⁹

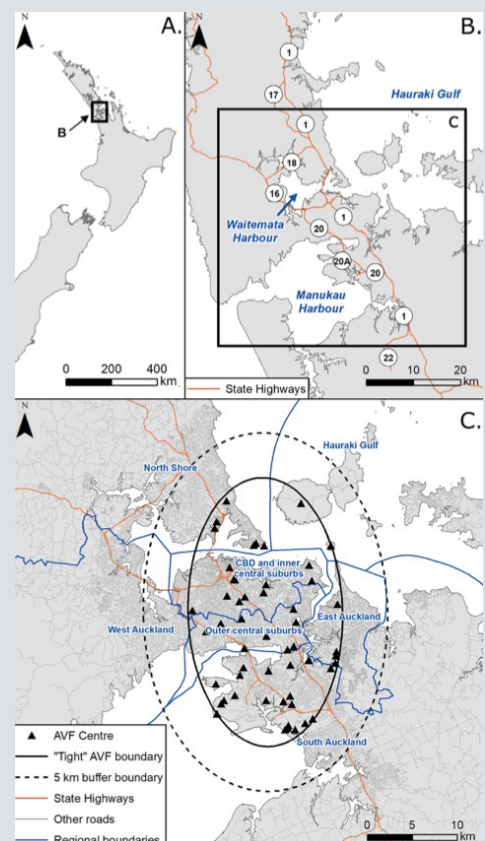


Figure 2: Map from Wild and others.¹⁰ (A) Location of Auckland in New Zealand's North Island, (B) Geography of Auckland's isthmus, state highways and harbours, and (C) Auckland Volcanic Field vent locations with "tight" and 5 km buffer boundary to illustrate the current understanding of the AVF extent. The 5 km buffer is a conservative estimate of the maximum extent of the AVF.

Ready or Not? Legal Preparedness for an Auckland Volcanic Field Eruption

Dr Holly Faulkner

Legal tools for undertaking an Auckland Volcanic Field eruption evacuation

Evacuations are complex logistical operations which will require legal tools to implement. For example, there needs to be a **legal requirement** to create a **plan to evacuate** (including for **large-scale evacuations**), what issues need to be **incorporated into this plan** (and how these will be required), who is **reviewing** and **monitoring** these plans, how often they need to be **updated** and a requirement to incorporate (or at least consider) appropriate **evacuation modelling** and other **scientific data**.

The legal framework needs to be clear about **how** these plans should be developed, for example: **who** in the community needs to be **consulted**, **how** this consultation will occur, and **when** will this take place.

The **logistics** of the evacuation will also need to be set out in the plans, alongside the legal tools (e.g. **powers**) and the people (e.g. **institutions/agencies**) to implement these logistics. For example, **who** can make the **decision to initiate the evacuation** (and how to manage those who are **unable to self-evacuate** e.g. rest-homes and prisons), **how** the evacuation will be taken (e.g. which **form of transport** will be recommended), who will undertake it (**self-evacuation, police, emergency services**), how the **messages** around evacuation will be **communicated**, and how to manage those that **refuse** to evacuate.

The plans will also need to consider how the **different agencies** involved in an evacuation will **work together** and their key decision-making processes (e.g. will they utilise a Coordinated Incident Management System (CIMS)). The Auckland Civil Defence Emergency Management Group, the National Emergency Management Agency, response agencies (including the fire services and police) and transport representatives will all be involved in an evacuation.

These are just some of the issues that need to be managed by the legal framework for the initial eruption phases, these are not including the complexities of the next phase i.e. **recovery** and what to do with the people that have been evacuated. Even more issues will need to be legally prepared for to manage this next step!

Overseas case study: 1973 Heimaey Eruption

The island of Heimaey in Iceland experienced a volcanic eruption in 1973 which triggered a **short-notice, large-scale evacuation** where approximately 5,300 residents were evacuated within 6 hours.¹¹

Only required personnel and volunteers remained on the island. Although this number may seem relatively small, the **impact** of rehousing and providing services for this group of people was the equivalent of:

... finding emergency housing with overnight notice for 5.3 million Americans.¹²

An evacuation of this scale could only be undertaken at such speed because of the **pre-planning** undertaken by the **Icelandic State Civil Defense Organization**.



Photo credit: <http://english.cctv.com/20100122/101418.shtml>

This example shows that **large-scale evacuations** can be undertaken at **short notice**, but they require **pre-planning**. This includes ensuring that the legal framework provides the power to implement evacuation plans.

Health & Safety



Photo credit: Transdev

As discussed above, undertaking an Auckland Volcanic Field evacuation raises questions:

- (1) **Who** will be undertaking the evacuation (police? emergency services? fire service? military?)
- (2) **How** will this evacuation be undertaken? (bus? car? boat? train?)

Because people will be required to help assist with the evacuation, legal issues that will need to be considered pre-event will relate to the **health & safety** and **contractual requirements** of those needed to participate in the evacuation. It is likely that larger numbers of **non-emergency personnel** will be needed (e.g. **bus drivers**, if buses are going to be used to evacuate people). Therefore, the legal tools needed to undertake these arrangements will need to be considered for example, **how** will these **logistics** be managed? what provisions would there be for **refusal** (e.g. if the bus drivers decide they do not want to be part of the evacuation or choose not to return to the evacuation zone), would they be covered by **insurance** for these activities? could **other staff** be used?

These are examples of questions that are raised in relation to the legal framework for an Auckland Volcanic Field eruption. **Legal tools** (powers and institutions) need to address these **recognised problems**.

Prompts for legal preparedness

Legal frameworks need to be considered **pre-event** to ensure that they are able to manage (plan for, respond to and recover from) disasters.

Here are some **example questions** that can be used to check if the framework is legally prepared:

- Is there a legal requirement to have an **evacuation plan** for the large-scale evacuation of Auckland?
- Are the **legal tools** (**powers** and **institutions**) available to implement these plans?
- Are there legal requirements to **review, update** and **monitor** these plans?
- **How** does this evacuation plan **work with other plans** for the Auckland Volcanic Field?
- Is there a legal requirement for these plans to address the **logistics** associated with a large-scale evacuation?
- Is there a legal requirement to incorporate relevant **modelling** and **scientific evidence** to ensure that the plans are up-to-date?

Ensuring that these questions (and similar) are considered as part of the **preparedness phase** and addressed within the legal framework will help to ensure that **Aotearoa New Zealand** is **legally prepared** to manage the impacts of a future Auckland Volcanic Field eruption including a large-scale evacuation at short-notice.

References

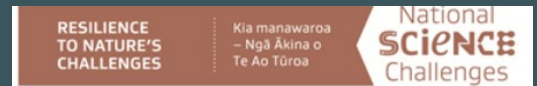
- ¹ GNS Science Te Pū Ao, 'Volcano Types' <<https://www.gns.cri.nz/our-science/natural-hazards-and-risks/volcanoes/volcano-types/>>.
- ² Bruce W Hayward Volcanoes of Auckland (Auckland University Press, 2019).
- ³ Hayward, above n 2.
- ⁴ Pyroclastic density currents (PDC) are "gravity-controlled rapidly expanding clouds of volcanic material"; Alana May Weir, 'The Impact of Complex Multi Hazard Volcanic Eruptions on Interdependent, Distributed Infrastructure Networks' (PhD Thesis, University of Canterbury, 2021).
- ⁵ Alec J Wild and others 'Modelling Spatial Population Exposure and Evacuation Clearance Time for the Auckland Volcanic Field, New Zealand' (2021) 416 Journal of Volcanology and Geothermal Research 107282, 7.
- ⁶ Wild and others, above n 5, at 19.
- ⁷ Wild and others, above n 5.
- ⁸ United Nations International Strategy for Disaster Reduction Global Assessment Report on Disaster Risk Reduction 2015 (2015).
- ⁹ Bobbie Myers and Carolyn Driedger, 'Geologic Hazards at Volcanoes' USGS: science for a changing world (2008) <https://pubs.usgs.gov/gip/64/>.
- ¹⁰ Wild and others, above n 5.
- ¹¹ Richard S Williams Jr and James G Moore, Man against Volcano: The Eruption on Heimaey, Vestmannaeyjar, Iceland (US Geological Survey, 1983).
- ¹² Williams Jr and Moore, above n 11, at 12.

Acknowledgments

Dr Faulkner Publications:

- Holly Alexandra Faulkner "Ready or not? Legal preparedness for an Auckland Volcanic Field eruption" (PhD thesis, University of Canterbury, 2024) .
- Holly Faulkner "From Black Swans to Legal Black Elephants: Analysis of Aotearoa New Zealand's Disaster Preparedness Frameworks" (2026) Yearbook of International Law 246.

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