BAY OF PLENTY EMERGENCY MANAGEMENT GROUP

CD CIVIL DEFENCE

Distant-Source Volcanic Ash Response Plan

2012

Distant-Source Volcanic Ash Response Plan 2012

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Part 1: Bay of Plenty Volcanic Ash Fall Event

The Bay of Plenty region is vulnerable to two different types of volcanic risks "distant" and "local". The *Distant-Source Volcanic Ash Response Plan* ("the Plan") is written for "distant" risks which are generally non-life-threatening, but could still impact sectors (and lifeline services) within the region.

Excluded from the Plan are "local" ash fall events which can be life-threatening (including lahar and debris flow). In the event of a "local" volcanic event, the following plan should be followed: The Bay of Plenty Civil Defence Emergency Management Group Volcanic Contingency Plan Part 1 – Ōkataina Volcanic Centre and Part 2 Mount Edgecumbe Volcano, April 2007 (see References, page 37).

1.1 Response

Response to volcanic ash fall varies from Civil Defence Emergency Management (CDEM) usual response procedures for an "Emergency Regional Event".

The Bay of Plenty CDEM Group agreed the Bay of Plenty Group Emergency Coordination Centre (GECC) will act as the lead agency in a volcanic ash fall event.

The GECC will immediately move immediately into a 'monitoring mode' upon receiving a significant Volcanic Alert Bulletin change. In this mode, the GECC will liaise and communicate with other agencies and assess the potential impacts on the region. The GECC will inform the agencies of any developments so they are ready to respond if (or when) ash fall reaches the region (this includes activating Local Emergency Operating Centres).

When volcanic ash is evident in reaching the region, then the GECC will move into an "operational mode". During the "monitoring mode" and the "operational mode" a 'declaration' is unlikely unless the situation changes dramatically. In a regional ash fall event, all Local Emergency Operating Centre's (LEOC) directly affected will fully activate. Those not directly affected are likely to remain in a "monitoring" role, until capacity in the affected area is exceeded, or when directed by the Group Controller.

1.2 Overview of the response to ash fall hazard

Responding to an ash fall event commences when an actual or potential need for response is identified by the CDEM Manager or Controller. Figure 1 provides a guideline for the response and the subsequent actions. Agencies' roles in responding to a *potential*, *imminent* or *occurred* ash fall situation are provided in Tables 1, 2 and 3. A *potential* impact is defined as "ash fall is present, but outside the Bay of Plenty region". An *imminent* hazard occurs when "ash fall is present (outside the region) but is about to impact parts of the Bay of Plenty region". An *occurred* hazard is when the "ash has begun to impact parts of the Bay of Plenty region.

Volcanic ash consists of tiny jagged particles of rock and natural glass blasted into the air by a volcano. Ash can threaten the health of people and livestock, pose a hazard to aviation, damage electronics and machinery, and interrupt power generation and telecommunications (USGS).
Wind can carry ash thousands of miles, affecting far greater areas and many more people than other volcano hazards. Even after a series of ash-producing eruptions has ended, wind and human activity can stir up fallen ash for months or years, presenting a long-term health and economic hazard (USGS).

Mt.Tongariro, 2012

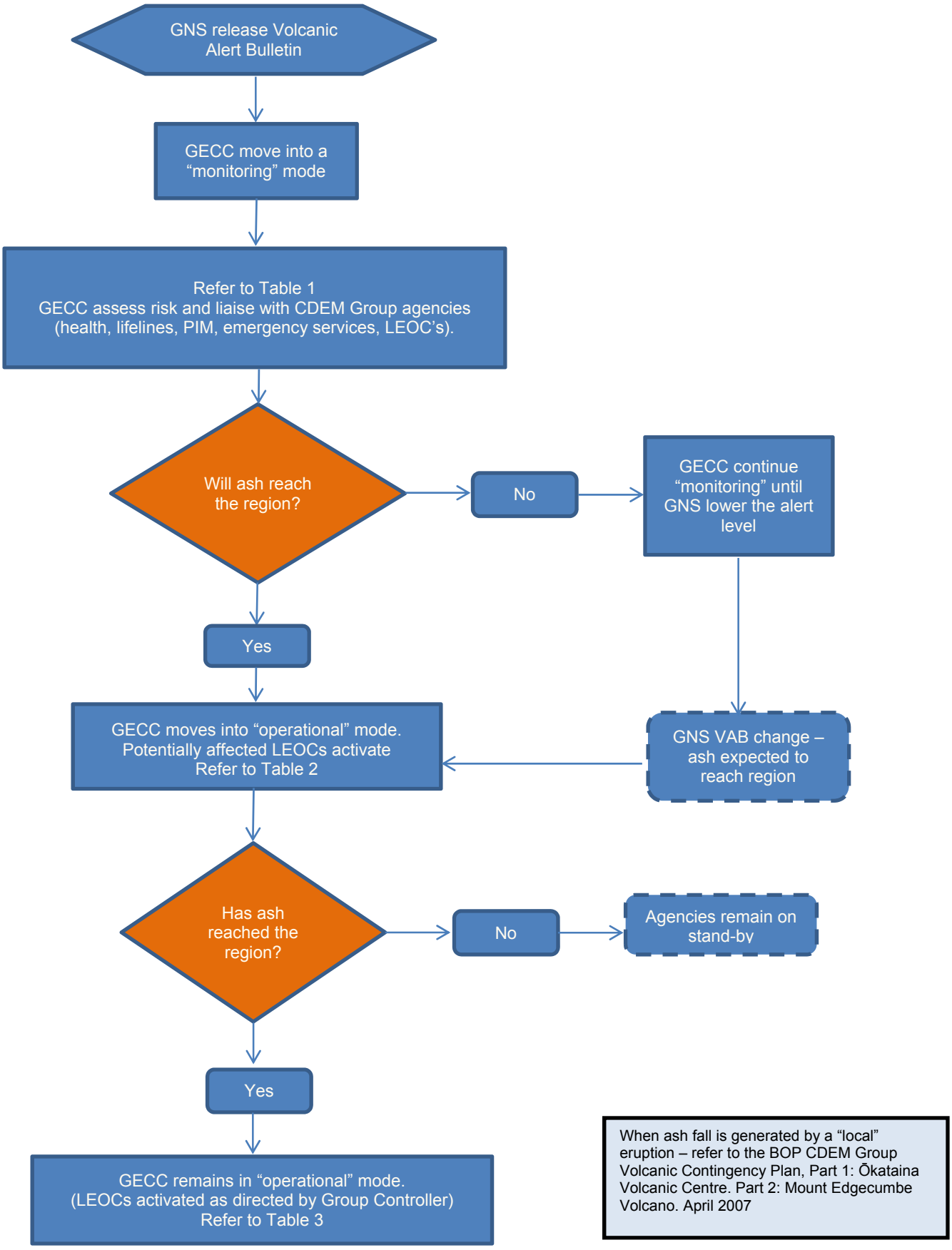

Figure 1 CDEM Group response to "DISTANT" volcanic ash fall

Table 1 GNS Volcanic Alert Bulletin received – ash is present outside the region

AGENCIES	POTENTIAL IMPACT (Ash is present outside the region)
CDEM Group	• Lead agency for volcanic ash event • Activate GECC in a "monitoring" mode • Increase staff and resources as required • Maintain situational awareness • Assess potential impact on own organisation and advise CDEM Controller • Manage local liaison with key agencies to inform them of the size, nature and severity of situation • Undertake planning and preparation for activating emergency management structures and deploying resources • Liaise with PIM and/or health agencies in preparation of media releases (ensure consistent messaging) • Maintain business as usual – plan to extend resources and staff to affected and adjacent areas/regions if (and when) required
Local EOC	• Not activated at this stage
Emergency Services	• Maintain business as usual - plan to extend resources and staff to affected and adjacent areas/regions if (and when) required
Health Agencies	• Prepare volcanic ash health advice to provide to the Public Information Manager • Prepare media release(s) for own website i.e. consistent messaging to the public to reduce anxiety • Maintain business as usual – plan to extend resources and staff to affected and adjacent areas/regions if (and when) required
Public Information Manager (PIM)	• Prepare and plan for providing accurate information to the media, other agencies and public • Monitor media and public interest and report the events to the Controller • Consider additional message delivery mechanisms, if needed
Warning Agencies	• Provision of prompt and accurate information related to the hazard (refer to Section 5.5 of BOP CDEMG Emergency Management Plan)

Table 2 Agencies' response – ash fall imminent

AGENCIES	IMPACT IMMINENT (Ash is expected to fall in parts of the region)
All key agencies	Follow roles described in Table 1 plus the following: • Assess potential impact on own organisation and advise CDEM Controller • Prepare to activate emergency management structures and deploy resources
Warning Agencies	Follow roles described in Table 1
CDEM Group	Follow roles described in Table 1 plus the following: • Activate GECC in an "operational" mode • Meet with liaisons from key agencies to establish size, nature and severity of situation
Local EOC	• Activate *potentially affected* LEOCs (or when directed by the Group Controller) • Gather and provide information to CDEM Controller on size and scale of event, threat to life, and other factors impacting health and safety of the community (BOP-CDEM Group Emergency Management Plan)
Emergency Services	Follow roles described in Table 1 plus the following: • Provide information to the CDEM Controller on risk/threat assessment to the public and to emergency services
Health Agencies	Follow roles described in Table 1 plus the following: • Increase staff and resources as required • Provide volcanic ash health advice to the Public Information Manager
PIM	Follow roles described in Table 1 plus the following: • Provide regular and accurate information to the media and public • Continue to monitor media and public interest and report the events to the Controller • Media liaison: Organise media conferences, arrange for media access to affected areas • Liaise with TAs, emergency services and other agencies PIM • Liaise with other agencies to establish a facility to handle public inquiries

Table 3 Agencies' response to minor (<100 mm) ash fall impact in the region

AGENCIES	IMPACT OCCURRED (Volcanic ash is present in the Bay of Plenty region)
All key agencies	Follow roles described in Tables 1 and 2 plus the following: • Assess impact on own infrastructure, resources and organisation and advise CDEM Controller • Activate emergency management structures and deploy resources • In "distant" ash fall events it is unlikely that ash >100 mm will impact the region, however, all key agencies should plan and prepare for any significant change(s) and associated potential affect
Warning Agencies	Follow roles described in Table 1
CDEM Group	Follow roles described in Tables 1 and 2 plus the following: • Advise key agencies where resources and staff are needed most. • Liaise with neighbouring Groups and NCMC about ability to receive and support resources, and staff • Coordinate information management
Local EOC	Follow roles described in Table 2 plus the following: • Continue to update and provide information to Group Controller on preferred transport routes, public transport resources and other factors affecting impacted areas • Plan and prepare for collection, disposal and clean-up of volcanic ash
Emergency Services	Follow roles described in Tables 1 and 2 plus the following: • Increase staff and resources as required • First responders to provide safety and control until other agencies can coordinate resources to take over responsibility (Police) • Continue to provide information to the CDEM Controller on risk/threat assessment to the public and to emergency services • Consider response and support if evacuations are required
Health Agencies	Follow roles described in Tables 1 and 2 plus the following: • Continue to provide health related messages to PIM and public • Provide health services for patients needing medical care from volcanic ash • Consider response and support if evacuations are required
PIM	• Follow roles described in Tables 1 and 2
Neighbouring Groups	• Support with public messaging in own regions • Respond to requests for support for BOP CDEM Group
Road Controlling Authorities	• Deploy traffic management resources

Part 2: Introduction

This guiding document provides information on the potential impact of volcanic ash fall in the Bay of Plenty region for the Bay of Plenty Civil Defence Emergency Management Group (CDEM Group). Ash fall can come unexpectedly and from outside (and within) the region. This document provides direction to agencies and sectors for their planning, preparation, and response to volcanic ash fall.

The *Distant-Source Volcanic Ash Response Plan* will integrate with the Bay of Plenty Civil Defence Emergency Management Group's Volcanic Contingency Plan.

2.1 Scope

The *Distant-Source Volcanic Ash Response Plan* provides the framework for key agencies to coordinate a regional response to "distant" volcanic ash events. These include local authorities, local and group emergency operating centres, neighbouring region CDEM groups, emergency services, lifeline utilities and welfare agencies. The detailed operational plans lie with the ECC/EOCs and the agencies supporting the operations (see Appendix 1, page 29) for a glossary of terms and acronyms used throughout this Plan.

2.2 Plan framework

The *Distant-Source Volcanic Ash Response Plan* is guided by the *Guide to the National CDEM Plan 2006* and the *Bay of Plenty CDEM Group Plan - 2012-2017* (see Figure 2 and References, page 28). The Plan is consistent with neighbouring region's volcanic ash plans and other CDEM Group plans and procedures (i.e. welfare, recovery, public information plans). The delivery is carried out through the operational plans of local EOCs and supporting agencies.

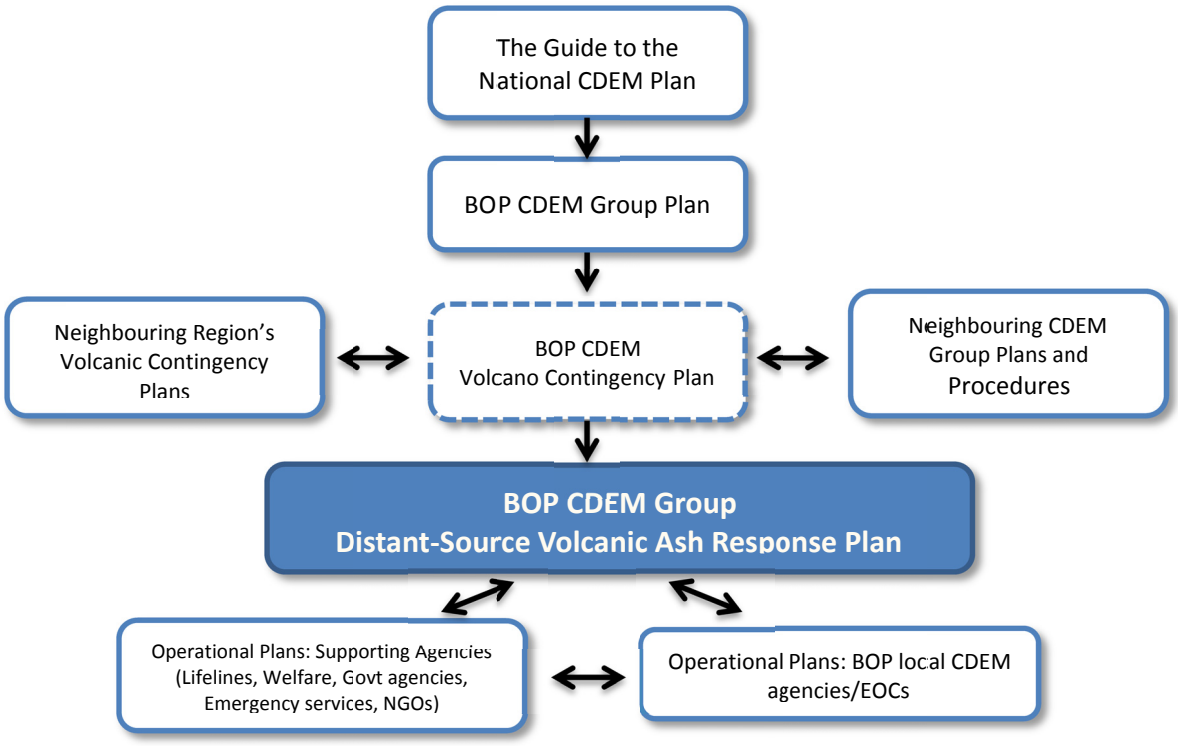

Figure 2 Plan framework

Part 3: Bay of Plenty Region "Distant" Volcanic Ash Fall

This Plan focuses specifically on the impact of "distant" volcanic ash fall in the Bay of Plenty CDEM Group area (Figure 3).

Volcanic ash can be hazardous to human/animal health; commuters (hinders ability to see and judge distances); machinery (including vehicles); electrical networks, water supply, wastewater and other lifeline utilities.

If volcanic ash falls in the Bay of Plenty then most residents, to some degree, will be impacted. Some sectors could be affected directly such as the Bay of Plenty's primary industries (agriculture, forestry and horticulture) while other sectors could be affected indirectly (tourism and retail). Refer to *Potential impact on the region's sectors*, page 12 for further information.

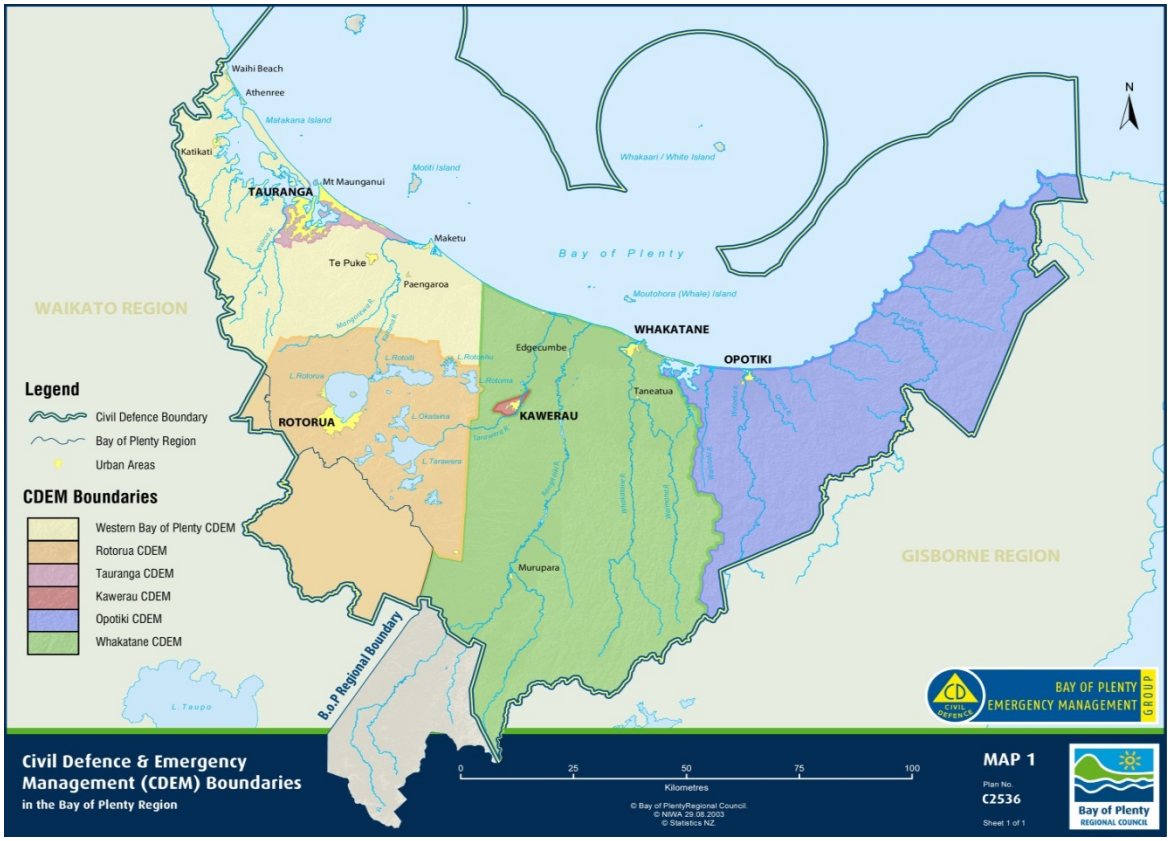

Figure 3 Bay of Plenty CDEM Group boundaries

3.1 Volcanic eruptions

New Zealand has a high density of active volcanoes and a high frequency of eruptions. Volcanoes produce a wide variety of hazards life-threatening to animals and people as well as destroy property. Eruption durations can last from months to years. Volcanic unrest usually occurs before a significant volcanic eruption, providing some form of warning.

The likelihood of volcanic ash deposits of any given thickness at any site is based on the type of eruption and wind distribution. Frequently active and reawakening volcanoes are located within (and outside) the Bay of Plenty region and pose an ash fall risk to Bay of Plenty communities.

Ash fall from the following volcanoes are most likely to impact the Bay of Plenty region:

- Tongariro-Ngauruhoe.
- Ruapehu.
- Mt. Taranaki/Egmont.
- White Island.

More information on volcanoes can be found on the GNS Science website (see References page 37).

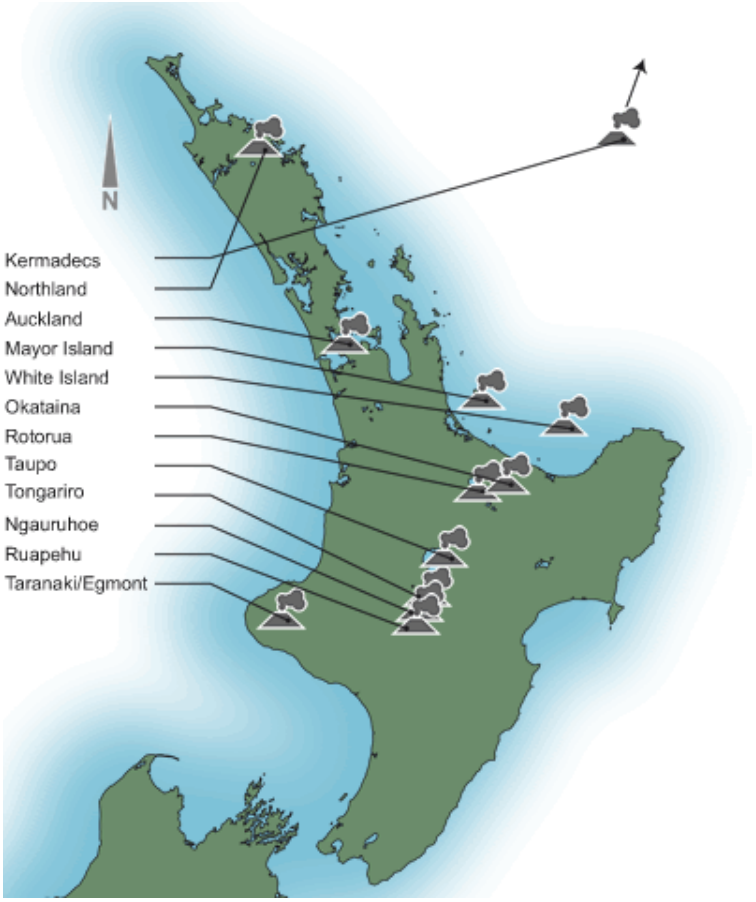

Figure 4 *Map showing the location New Zealand's volcanic centres (Sourced from GeoNet Website)*

Part 4: Risk Assessment

4.1 Volcanic ash scenarios

GNS scientists have calculated probabilistic ash fall hazard models by applying a volcanic eruption size-frequency relationship for each volcano, along with the current wind patterns to produce the predicted distribution and thickness of volcanic ash. Until site specific hazard studies and maps are developed, this information assists understanding the geographical areas in the Bay of Plenty at highest risk to volcanic ash fall (Figure 5 Hurst and Smith, 2010). This technique was applied to the following volcanoes:

- Ruapehu
- Mt. Taranaki/Egmont
- Taupō
- Ōkataina
- Ngauruhoe
- Tongariro
- Auckland Volcanic Field
- Mayor Island

The area extending from Rotorua to Whakatāne and Rotorua and Matatā were calculated as the Bay of Plenty region's highest risk to ash fall accumulation.

White Island, Raoul Island, and volcanoes of the Kermadec island group were excluded because they do not pose a significant hazard to the mainland (supported by historical eruption events and wind records, Hurst and Smith, 2010).

From this study, the most likely amount of accumulated ash fall in the Bay of Plenty region is less than 1 mm for a 500 year return period.

The area extending from Rotorua to Whakatāne and Rotorua and Matatā were calculated as the Bay of Plenty region's highest risk to ash fall accumulation. This risk decreases towards the north-west (Hamilton, Tauranga and Waihi areas).

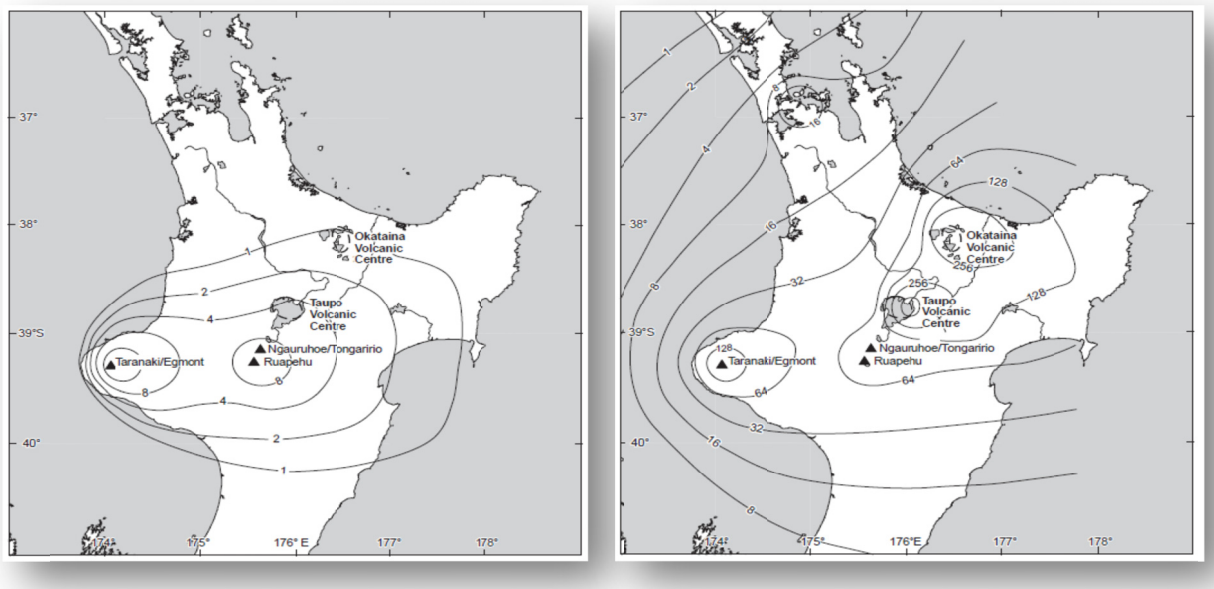

Figure 5 Volcanic ash hazard map for 500 year return period (left) and 10,000 year return period (right) (Hurst and Smith, 2010)

Part 5: Potential effects of ash

5.1 Potential impact of varying quantities of ash fall across the Bay of Plenty region

The actual effects on utilities and sectors will depend on the following:

- Ash quantity
- Weather conditions at the time of ash deposition
- Mitigation measures during the ash fall

Potential impact for a "distant" ash fall event on sectors and individuals has been assessed in terms of ash fall thickness or deposition: (1) less than 1 mm, (2) 1-5 mm, and (3) 5-10 mm (Table 4). The thickness of ash generally correlates to the degree of impact (i.e. higher ash level = higher impact). Ash fall thickness greater than 100 mm would be atypical of a "distant" ash fall event and is not considered in the Plan.

Roles and responsibilities of agencies, during an ash fall hazard, are set out in on page 18.

Table 4 Potential impact of varying quantities of volcanic ash (measured in millimetres)

Less than 1 mm ash thickness	Sectors and individuals likely to be affected
Health Impact Will act as an irritant to lungs and eyes	People with existing respiratory illness and wearers of contact lenses
Airports will close due to the potential damage to aircraft. Full clean-up of runways will be necessary prior to return to operation	Rotorua, Whakatāne and Tauranga airports
Buildings, Vehicles and Equipment Possible minor damage to vehicles, houses and equipment caused by fine abrasive ash	Owners of: vehicles, houses and equipment (susceptible to fine ash)
Water Supplies Possible contamination of water supplies, particularly roof-fed tank supplies	Bay of Plenty region's territorial authorities; and communities who rely on roof-fed tank water supply
Roads - Dust (or mud) affects roads: • Reduced visibility (during ash fall and due to remobilised dust following deposition) • Traction problems (especially if wet) • Loss of access for emergency services and transport disruption if roads closed • Blockage of surface water collection	New Zealand Transport Agency Bay of Plenty territorial authorities (TAs) New Zealand Fire Service Police St John's Ambulance

Ash Thickness: 1-5 mm Effects that occur with < 1 mm of ash will be amplified, plus:	Bay of Plenty agencies and sectors likely to be affected
Agricultural sector Crops are likely to be impacted. Livestock may be affected and may suffer from lack of feed, wear on teeth, and possible contamination of water supplies. Livestock are at risk of fluorine poisoning (particularly sheep and deer)	Agricultural sector
Horticultural sector Ash showers can cause physical and chemical impact. Dust can affect bees, reducing crop pollination	Horticultural sector
Electricity Distribution Systems Electricity may be cut; ash shorting may occur at substations if the ash is wet and therefore conductive. Low voltage systems more vulnerable than high	Contact Energy; Bay of Plenty Energy; Trust Power; Horizon Energy Distribution. Disruption to electricity networks will impact all sectors
Buildings/Structures and Roofs Minor damage to houses will occur if fine ash enters buildings, soiling interiors, blocking air-conditioning filters etc	All buildings (especially those with air-conditioning units)
Roads Roads may need to be cleaned to reduce the dust nuisance (remobilisation of ash) and prevent storm-water systems becoming blocked	NZTA Bay of Plenty territorial authorities
Water Supply Infrastructure Water supplies may be cut or limited due to failure of electricity to pumps. This can include water supply from TAs and other 'community' water suppliers in the district. Water supplies may be effected with: • Turbidity • Leaching of soluble components • Contamination of water supplies (by chemical leachates) • Damage to filters at intake structures and/or treatment plants • Change in pH and microbiology of supply High water demand for clean-up operations can lead to temporary water storages	Bay of Plenty region's territorial authorities. Community water supplies at schools, marae, DOC etc. are registered with the Ministry of Health Water restrictions are likely to impact all sectors
Electrical Equipment, Vehicles and Machinery Damage to electrical equipment, machinery, vehicles (wear on moving parts and paintwork) may occur Damage to engines is likely. Daily (to 4-hourly) changing of oil and filters is recommended during operation in ash fall to protect against engine failure	Public safety vehicles (fire engines, ambulances) may be impacted, along with most other sectors

Sewerage Systems Sewage systems may be blocked by ash, or disrupted by loss of electrical supplies. • Pipe blockages • Damage to exposed systems • Damage to exposed electrical/mechanical system • Pump damage • Interference with treatment processes • Disruption of biological media processes • Transportation of ash to settling ponds requiring removal • Possible damming or breaching of waterways	Sewerage and storm water networks of: • Western Bay of Plenty District Council • Rotorua District Council • Ōpōtiki District Council • Whakatāne District Council • Kawerau District Council • Tauranga City Council
Telecommunications Disruption to telephone and radio communications is likely as ash particles may penetrate contact breakers and induce short-circuiting. This may cause disruption to landlines and mobile phone networks, and internet access. High demand on the network (due to an ash fall event) can cause 'overloading of telephone systems'	Telecom NZ Vodafone NZ TelstraClear All sectors could experience service disruption (landlines, mobile phones and internet)
Health Impact Respiratory illness will increase	Health agencies. Residents with chronic respiratory illness
Ash Thickness: 5-100 mm **Effects that occur with < 5 mm of ash will be amplified, plus:**	**Bay of Plenty agencies and sectors likely to be affected**
Horticultural, Forestry and Agricultural sectors Ash will affect vegetation, causing burial of pasture and low plants. Foliage may be stripped off some trees but most trees will survive Most pasture will be killed with ash thickness of over 50 mm Farm machinery is likely to be severely impacted Vehicle radiators and milk and fruit cooling vats may block with ash, leading to reduced cooling efficiency	Horticultural, forestry and agricultural sectors
Municipal Areas Major ash removal operations in urban areas	Bay of Plenty territorial authorities
Buildings/Structures and Roofs Most buildings will support the ash load but weaker roof structures may collapse at 100 mm ash thickness, particularly if wet (wet ash is heavier) Ash may block buildings surface water draining (from roofs) and cause corrosion	All sectors

Roads and Transportation Road transport may be halted due to the build-up of ash on roads. Cars still working may soon stop due to clogging of air-filters	All sectors Emergency services will continue to be impacted i.e. Police, New Zealand Fire Service and St John's Ambulance
Railways Rail transport may be forced to stop due to signal failure brought on by short circuiting if ash becomes wet Reduced visibility (during ash fall) and wear on moving parts	KiwiRail

5.2 Potential impact on the region's sectors

During a "distant" volcanic eruption the Bay of Plenty region would receive a combination of both coarse and fine ash particles. Ash fall thickness and grain size usually decrease with distance from the volcano vent. The coarse ash will have the greatest impact on lifeline utilities and primary industries. The very fine ash can impact people's health, especially when inhaled into the lungs.

5.2.1 Effects on forestry

Impacts on forests are significant when ash fall exceeds 100 mm. Ash deposits thicker than 100 mm could destroy young forests i.e. up to two year trees. Ash fall less than 100 mm is not likely to kill mature trees.

Forestry infrastructure also can be damaged, complicating the response to the direct effects on the forest. For example, if waterways and water sources are contaminated by ash, then the pumping systems used to control forest fires may not be effective.

5.2.2 Effects on agriculture

Ash fall accumulation effect on pastures and livestock will vary significantly depending on the following: the ash type; consistency and depth of ash deposited; chemical nature of ash and poisonous aerosols attached to the ash; amount of rainfall immediately following any ash fall; wind direction; metabolic and nutritional demands of the livestock at the time; age of livestock; and pasture length.

A thin layer of ash (1mm) can contain potentially toxic amounts of fluorine triggering fluorine poisoning.

Impacts of ash can include:

- Contamination to water supply and pastures leading to reduced availability to feed (leading to stock not drinking/eating).
- Increased maintenance costs, and rust to vehicles and machinery.

As a result of less than 5mm ash fall on the Rangitāiki Plain (Taupō) during the 1995 Ruapehu eruption, approximately 2,000 ewes and lambs were killed by eating ash-affected pastures. Autopsies of dead animals suggested fluorine poisoning or pregnancy toxaemia was the main cause of death. USGS (Photo from Watson and Donoghue, Stuff.co.nz, Mt Tongariro eruption 2012).

- Adverse effects to livestock health (including eye and skin irritations; respiratory distress; abrasion to teeth and hooves; blockages to the gastrointestinal tract due to quantities of ash consumed, fluorine poisoning).
- Reduced crop yields and quality and/or contamination of animal fleeces.

(Referenced from Taupō District Council – Volcanic Ash Advice: Rural)

Guidance for farm owners on disaster and recovery planning is also available on the Ministry for Primary Industries website (see References, page 37).

5.2.3 Effects on horticulture

Ash showers on horticulture can result in considerable physical and chemical impacts (Table 5). During critical crop performance time, light ash deposition can reduce crop performance significantly. Also the ash can aggravate pest management such as increasing predator pests and reducing the bee's ability to pollinate. Certain horticultural species are more vulnerable to ash at different stages of their life cycle.

Table 5 Periods when crops are most at risk (from research in the temperate regions of New Zealand): (Neild and others, 1998)

Species	Risk
Kiwifruit	Is at risk at, and 6-8 weeks after, blossom (flowering occurs in spring). There would also be a problem at harvest time. As kiwi fruit cannot be washed prior to packing, the hairy nature of the fruit would make ash removal very difficult.
Grapes	Have three main periods when damage could occur: • Flowering, when acidic ash could burn plant tissues, reduce pollination and reduce bunch fill. • Fruit development, where ash deposits would block sunlight and reduce quality. • Harvest, where ash deposits would be a contaminant with the extra acidity of the ash possibly having a significant impact on wine quality. Ash would have to be removed prior to harvesting by washing and allowing bunches to dry.
Citrus fruit	Light dousing of ash adheres to the skin of citrus, which can render fruit unfit for juice production because it may not be economically feasible to separately clean each fruit before processing.
Pipfruit	Has three danger periods: • During blossom where severely acidic ash (pH less than 3) could burn plant tissue and result in poor pollination. • 6 to 8 weeks after blossoming, when the skin of fruit is particularly sensitive. • Later stages of development when fruit is prone to cosmetic blemishing.
Stonefruit	Is also susceptible at the same times as pipfruit, except that the early fruit development period is 4-6 weeks after blossoming, when sensitive fruit skins could be damaged, and show russet or deformation in severe cases.
Pea	From emergence until end of flowering.
Squash	During the initial stages of growth and flowering.
Tomatoes	During seed emergence and flowering stages.
Sweetcorn	During the early stages of growth.

5.2.4 Effects on tourism and the retail sectors

Ash can impact the air traffic industry causing flights to be shutdown indirectly impacting passengers. Passengers may need to source alternative modes of transport and/or change their itinerary/travel destinations (voluntary or involuntary). Inbound/outbound and domestic travellers, who are unable to embark on their trips during airspace shutdown, impact the economy through loss of revenues. The tourism and hospitality supported sectors are most affected.

On 14 April, 2010, Iceland's Eyjafjallajokull volcano spewed an ash plume which spread broadly across European airspace. Concerns over engine safety caused an interruption in global air traffic. The closure of large portions of European air space over the week 15-21 April disrupted global travel, trade and business.

An economic impact from ash fall events on airlines and airports can result from travellers deferring travel or organizing alternative means of transportation.

Importers / exporters dependent upon imported products and/or exports with limited lifespans also can incur financial hardship.

5.2.5 Effect on communities

"Distant" ash fall events are more likely to be disruptive than catastrophically damaging to communities. Clear, consistent messaging is important and will help reduce people's anxiety during an ash fall event.

Loss of Lifelines - some essential services (water services, electricity, transport, airports etc.) may not operate to full capacity during an ash fall event. Water supplies could be restricted. Refer to the *Bay of Plenty Lifelines Group Vulnerability Study, April 2011*.

Health - ash can cause respiratory and eye symptoms. Community members with existing respiratory illness are more at risk. No chronic effects of ash on eyes have been recorded from previous ash fall events. During an ash event, Public Health Services will communicate to the public on all public health related matters.

5.3 Collection, disposal and clean-up of volcanic ash

Depending on the duration and levels of ash fall, collection and clean-up may be required on buildings and structures; roads; sewerage and storm water systems; water supplies; airports; electricity distribution systems; and residential properties.

Agencies, when planning to mitigate the impact of ash on their infrastructure and services, should also consider clean-up and disposal of ash i.e. identify and secure potential location of ash dump sites.

After the Ruapehu 1995 ash fall Rotorua District Council reported that "after initial ash fall we began the mammoth task of sweeping and removing ash from the central city footpaths etc." (Rotorua District Council written. comm.). The cost of the clean-up operation was estimated at $53,511 and included cleaning the CBD, kerbs and channels in all urban areas and cesspits in every area.

Examples from other countries (and NZ ash fall events) suggest that ash clean-up and disposal can be costly (collection, transport and disposal).

5.3.1 Resource management issues

The majority of activities associated with response to a major ash fall would likely be considered emergency works under the Resource Management Act and would not require resource consent. However, in accordance with the provisions of that part of the Act, it may be necessary to submit an application within 20-working days of undertaking the activity. There are also provisions in the Act to extend the 20-day timeframe depending on the circumstances.

Ash disposal requires the consideration of the environmental effects as outlined in the permitted activity for earthworks in the *Bay of Plenty Regional Water and Land Plan*. The disposal activity needn't necessarily meet these requirements but they could form the basis on which to make decisions about disposal sites, making the consenting process more straight forward. Refer to the Bay of Plenty Regional Water and Land Plan, Clause 9.2.1 - Rule 1 Permitted Activities for Earthworks and Quarries (see References, page 37).

Activities to consider when identifying an ash dump site:

- Don't fill expensive valuable land sites – find an alternative; i.e. old quarries have been used in the past.
- Ash is considered toxic to the environment. Guidance provided by LEOCs (or district/city councils) on handling the removal should be followed. The environmental effect would need to be taken into account (refer to Bay of Plenty Regional Water and Land Plan, permitted activity for earthworks).
- Sensitivity to landowners.
- Consult with affected parties i.e. iwi.
- Accessibility.
- Wind effect at site i.e. wind can spread the collected ash (ash must be stabilised on site).
- Surface cover of binding vegetation would be an advantage.

Part 6: Alert Warnings

6.1 The International Civil Aviation Organisation (ICAO) Aviation Colour Code for Volcanic Activity

Table 6 below is the International Civil Aviation Organisation (ICAO) Aviation Volcano Level Colour Code. This code is used by the Civil Aviation Authority in New Zealand to alert the aviation industry to changes in the status of volcanoes within the coverage of Wellington Volcanic Advisory Centre (VAAC).

Table 6 International Civil Aviation Organisation Aviation Volcano Level – Colour Code

ICAO Colour code		Status of activity of volcano
Green		Volcano is in normal, non-eruptive state. Or, after a change from a higher alert level: Volcanic activity considered to have ceased, and volcano reverted to its normal, non-eruptive state.
Yellow		Volcano is experiencing signs of elevated unrest above known background levels. Or, after a change from higher alert level: Volcanic activity has decreased significantly but continues to be closely monitored for possible renewed increase.
Orange		Volcano is exhibiting heightened unrest with increased likelihood of eruption. Or, volcanic eruption is underway with no or minor ash emission [specify ash-plume height if possible].
Red		Eruption is forecasted to be imminent with significant emission of ash into the atmosphere likely. Or, eruption is underway with significant emission of ash into the atmosphere [specify ash-plume height if possible].

6.2 Volcanic Alert Levels in New Zealand

Volcanic alert levels and indicative phenomena for the various alert levels for 'active' and 're-awakening' volcanoes have been described by the *Guide to the National Civil Defence Emergency Management Plan*, Ministry of Civil Defence and Emergency Management, 2006, (Table 7).

All calderas in New Zealand, except for Raoul Island in the Kermadecs, are considered 'reawakening volcanoes'.

Table 7 *Volcanic alert levels: indicative phenomena for the various alert levels of both active and re-awakening volcanoes*

Frequently active cone volcanoes White Island, Tongariro-Ngauruhoe, Ruapehu, Kermadecs		**VOLCANIC ALERT LEVEL**	**Reawakening volcanoes** Northland, Auckland, Mayor Island, Rotorua, Okataina, Taupo, Egmont/Taranaki	
Volcano status	**Indicative phenomena**		**Indicative phenomena**	**Volcano status**
Usual dormant, or quiescent state	Typical background surface activity, seismicity, deformation and heat flow at low levels.	0	Typical background surface activity; deformation, seismicity, and heat flow at low levels.	Usual dormant, or quiescent state.
Signs of volcano unrest	Departure from typical background surface activity.	1	Apparent seismic, geodetic, thermal or other unrest indicators.	Initial signs of possible volcano unrest. No eruption threat.
Minor eruptive activity	Onset of eruptive activity, accompanied by changes to monitored indicators.	2	Increase in number or intensity of unrest indicators (seismicity, deformation, heat flow and so on).	Confirmation of volcano unrest. Eruption threat.
Significant local eruption in progress	Increased vigour of ongoing activity and monitored indicators. Significant effects on volcano, possible effects beyond.	3	Minor steam eruptions. High increasing trends of unrest indicators, significant effects on volcano, possible beyond.	Minor eruptions commenced. Real possibility of hazardous eruptions.
Hazardous local eruption in progress	Significant change to ongoing activity and monitoring indicators. Effects beyond volcano.	4	Eruption of new magma. Sustained high levels of unrest indicators, significant effects beyond volcano.	Hazardous local eruption in progress. Large-scale eruption now possible.
Large hazardous eruption in progress	Destruction with major damage beyond volcano. Significant risk over wider areas.	5	Destruction with major damage beyond active volcano. Significant risk over wider areas.	Large hazardous volcanic eruption in progress.

Part 7: Roles and responsibilities

The lead agency in a volcanic ash fall event will be the Bay of Plenty Civil Defence Emergency Management Group. In all volcanic events the Group Emergency Coordination Centre will be activated ("monitoring" mode) when they receive a Level 2 (or higher) GNS Volcanic Alert Bulletin.

The Civil Defence Emergency Management Act 2002 directs a responsibility on Government departments, lifeline utilities and other groups to function to the fullest extent, even though at a reduced level, during and after an ash fall hazard.

Individual groups recognised in the Plan are responsible for maintaining their own response plans to mitigate against, prepare for, and respond to emergency events. The Plan excludes agencies generic responsibilities in a civil defence emergency. Instead, it focuses on their responsibilities in ash fall events.

For a more detailed list of agency responsibilities refer to the Bay of Plenty Civil Defence Emergency Management Group Plan, 2012-2017 (Roles and Functions).

7.1 Lead response for ash fall

7.1.1 CDEM Group, Controller

The CDEM Act 2002 sets out the framework for CDEM in New Zealand and provides a range of statutory roles, including that of the Controller.

The Bay of Plenty Group Controller is responsible for the decision to activate the GECC in a volcanic ash event in order to:

- Provide leadership in establishing situational awareness.
- Establish Group wide priorities, define objectives, and provide coordination and leadership during an ash fall event.
- Determine resource requirements or likely resource requirements.
- Act as a point of contact between the National Controller, MCDEM Regional Emergency Management Advisor (REMA), and CDEM agencies.

7.1.2 CDEM Group Emergency Coordinating Centre (GECC)

The BOP CDEM Group is responsible for maintaining Group warning systems. Most dissemination of local community warnings comes from the local TAs however Readynet® could be used, and would be managed at a Group level. The Group Warning Standard Operating Procedures (SOP) supports the Group Plan by outlining the warning systems and the responsibilities and procedures for using them. The Bay of Plenty CDEM Group Public Information Management (PIM) Plan provides guidance on informing both community and media during an ash fall event.

The Bay of Plenty CDEM Group is required to respond within 30 minutes of receiving a national warning from MCDEM of pending ash fall.

Key responsibilities in a regional ash fall event are:

- Provide situational awareness and a Group wide common operating picture.

- Provide forward planning, resources and facilities to support the Group Controller (i.e. communications, information, database access, expert advice, briefing and liaison).
- Undertake appropriate analysis and planning to confirm response triggers, impacts and consequences.
- Communicate directions and coordination instructions from the Group Controller to Local Controllers as required.
- Receive, assess and disseminate information for emergency response agencies.
- Where possible, provide logistical, planning and intelligence and operations support when requested by a Local EOC.
- Ensure major emergency response agencies are involved in the Group response, and major agencies have liaison officers present at, or in communication with, the GECC.
- Ensure communications are in place with key regional response agencies.
- Receive, assess and disseminate information about potentially affected lifeline utility services and likely community/national consequences.
- Coordinate the distribution of information about the event and the Group response.
- Provide a control base for national resources assigned to the Bay of Plenty region.
- Undertake regional recovery preparation and implementation.
- Ensure communications are in place with the National Crisis Management Centre (NCMC).
- Provide support to or from other CDEM Groups.
- The GECC also has a monitoring role when a Local EOC is activated.

7.1.3 Emergency Operating Centres (EOCs)

EOCs provide support to response operations within TAs and provide coordination between Incident Control Points (ICP) and the Group Emergency Coordination Centre (GECC).

The role of EOCs in an ash fall event is to:

- Provide situational awareness to the GECC (and Group Controller), and contribute towards a Group wide common operating picture.
- Provide forward planning, resources and facilities to support the Local Controller (communications, information, database access, expert advice, briefing and liaison) in determining situational awareness, and any appropriate planning.
- Provide a coordination and liaison point for all emergency services, voluntary organisations, TA personnel and Government departments involved in emergency management during significant multi-agency ash fall events.
- Collect, collate, analyse and disseminate intelligence, and information about the impact of ash fall from all parts of the district.
- Provide local public information management.

(i) Establish and manage welfare centres (with the support of volunteer agencies) if evacuations are required and activate Welfare Centres to service the needs of affected communities.

(ii) Request assistance from the GECC as required.

(iii) Manage spontaneous volunteers (ash clean-up) and have a Spontaneous Volunteer Plan.

Each TA is responsible for maintaining EOC provisions within its jurisdiction according to local arrangements. EOCs may be activated at the request of responding agencies, the Local Controller or the Group Controller.

7.1.4 Territorial Authorities (TAs)

Each territorial authority is required to plan and provide emergency management for its district in an ash fall event. TA's coordinate response at local level as set out in the BOP CDEM Group Plan 2012.

Key responsibilities (pending, during and post) an ash fall event:

- Provision of capability, expertise, assets and equipment to support the Local Controller and EOC in it coordination of response efforts.
- Provide technical expertise that would effectively monitor ash fall on behalf of the EOC.
- Provide technical expertise that would effectively manage ash collection and disposal (including identifying options and develop strategies on how and where to dispose of ash) on behalf of the EOC.
- Provide technical expertise that would effectively assess the effect of ash on local infrastructure (roads/transportation, telecommunications, storm water, sewerage, electricity supply) on behalf of the EOC.
- Ensure that business continuity arrangements are in place that allows for continued monitoring of potable water supplies. This includes planning for:
  - Increased water demand for clean-up operations
  - Conserving water for human consumption
  - Reviewing stocks of essential items such as spare filters and treatment chemicals
  - Ensuring access to back-up power generation
- Have public health risks management plans for each water supply
- Ensure that business continuity arrangements are in place that allows for traffic management i.e. alternative route planning in consultation with NZTA, the Group Lifelines Utility Coordinator (LUC) and NZ Police.

7.1.5 Bay of Plenty Regional Council

The role of the Regional Council in an ash fall event will include:

- Provision of capability, expertise, assets and equipment to support the Group Controller and GECC in its coordination of response efforts.
- Ensuring robust business continuity arrangements that allow for the continued provision of normal business services such as:
  - Monitor pollution particles that are smaller than 10 micrometres.

- Monitor any ash affect to coastal, river and lake recreation sites throughout the region for water quality.
- Provide assistance to TAs in their monitoring of their potable water supplies if required.

7.2 National volcanic monitoring and alert agencies

7.2.1 GNS Science

GNS Science is the lead agency for National volcanic monitoring and alerting relevant agencies.

GNS Science, through the GeoNet[1] Project, is the national source of volcanic monitoring and alerts. New Zealand's volcanoes are monitored continuously by GNS to detect changes in activity. Volcanic monitoring includes visual observation, detecting earthquakes and tremor with seismographs, analysing gas and water chemistry, and gauging ground deformation (sourced from GeoNet website, Volcano Monitoring Methods).

Alerts for all volcanoes are initially disseminated nationally and then scaled down to potentially affected CDEM Groups as necessary. GNS Science (GeoNet) is responsible for:

- Notifying MCDEM of any change in volcanic alert level status through Volcanic Alert Bulletins (VABs).
- Releasing national media statements.
- Providing ash fall prediction maps.
- Notifying the Airways Corporation and New Zealand Met Service so aviation protocols can be initiated.

7.2.2 MetService

MetService is a support agency for a National volcanic response. They provide volcanic ash dispersal and wind advice for aviation. They also operate the Wellington Volcanic Ash Advisory Centre (VAAC).

7.2.3 Ministry of Civil Defence Emergency Management

MCDEM is the agency responsible for issuing national warnings to CDEM Groups and other key emergency response agencies for events of national significance. For volcanic eruptions, MCDEM will monitor volcanic ash events and may activate the NCMC to support and coordinate on behalf of affected CDEM Groups and National Government agencies.

Key responsibilities:

- Receive volcano alert bulletins and volcanic ash advisories from GNS (and other sources).
- Disseminate bulletins and advisories as appropriate to recipients of the National Warning System.
- Provide support and coordination of response efforts at a national level if required.

[1] GeoNet is a collaboration between the Earthquake Commission and GNS Science. It is the official source of geological hazard information for New Zealand.

7.3 Emergency services

7.3.1 New Zealand Police

Statutory responsibility for the enforcement of law and order remains with the NZ Police at all times. Requirements for specific Police functions prior to, and during, an emergency are detailed within Police Operations Plans, the Civil Defence Emergency Management Act 2002, National CDEM Plan and Guide and the Group CDEM Plan.

Police are a support agency during an ash fall event. Some of the major roles that Police are expected to undertake during an ash fall event include:

- Often first responders to cordon and control areas until other agencies (territorial authorities) can coordinate resources to take over the responsibility.
- Working with Road Controlling Authorities (RCAs) in support of traffic management and safety.
- Assisting with dissemination of warning messages as required or directed by the lead agency.
- Coordinating movement over land to assist the movement of evacuees and other essential services.
- Providing initial security of evacuated areas, including the establishment of cordons.

7.3.2 New Zealand Fire Services

Statutory responsibilities for preparatory and response measures for the Fire Service during an emergency are detailed within Fire Service legislation and operational plans, the Civil Defence Emergency Management Act 2002, National CDEM Plan and Guide and the Group CDEM Plan. In brief they relate to fire, first response to hazchem incidents and rescue of trapped people.

Key responsibilities during an ash fall event:

- Coordinate fire and rescue response i.e. if ash has caused building/structure collapse.
- Support the Police when ash fall is significant and requires evacuations and/or movement control.
- Assisting with dissemination of warning messages as required or directed by the lead agency.

7.4 Health agencies

7.4.1 Ministry of Health

Key responsibilities during an ash fall event:

- Supply Regional Emergency Management Adviser (REMA) function
- Assist in co-ordination where more than one Region involved through National Health Co-ordination Centre (NHCC).

7.4.2 Bay of Plenty District Health Board and Lakes District Health Board

Key responsibilities during an ash fall event:

- Support volcanic ash health advice being promulgated by Toi Te Ora Public Health Service and CDEM Public Information Manager (PIM).
- Provide health services for patients that need acute medical care in response to volcanic ash i.e. increased respiratory illness, eye irritation and crush injuries post building collapse.
- Take all practicable steps to protect utilities and infrastructure at key sites, to ensure key service areas remain open and available to the public.
- In conjunction with CDEM and other emergency services, co-ordinate evacuations where necessary of vulnerable populations e.g. hospitals, rest-homes and disabled persons.

7.4.3 Toi Te Ora - Public Health Service (Bay of Plenty and Lakes Health Districts)

During an ash fall event, designated Officers (Medical Officer of Health and Health Protection Officers) within Public Health Service are responsible for:

- Identifying and assessing the extent of public health risks through:
  - an analysis of the hazards and threats posed by the situation.
  - delineation of the area and population affected.
  - an estimation of the resources (scale and composition) needed for an initial response.
- Monitor all risks that may impinge on the health of the public.
- Ensure appropriate management of the public health aspects.
- Communicate with the Incident Controller about the assessment of the emergency situation.
- Communicate with the public on all matters relating to public health.
- In liaison with Public Information Manager communicate with the community on all matters relating to public health.
- Provide advice and support to local authorities, environmental health officers and engineering staff as required.
- Provide advice to the public on measures to reduce impacts on them.

7.4.4 St John Ambulance

Key responsibilities during an ash fall event:

- To ensure the continued provision of pre-hospital medical and emergency care services to the regional population.
- Ensure all vehicles and infrastructure remains operational in order to continue to provide high level of service.
- Support CDEM and other emergency services as required.
- Should the district St John resources become over tasked, other assets from other districts may be diverted or the Mass Causality Transport Plan (MCTP) be activated.

7.5 Lifelines

During an ash fall event several lifelines will be impacted. Essential industries have a statutory responsibility for the maintenance and delivery of essential services such as power, gas, airport, roading, telecommunications, water, drainage and sewerage. As such they must prepare and maintain their own contingency plans to mitigate against, prepare for, respond to, and recover from the effects of any volcanic emergency within the Bay of Plenty region. This process will involve some planning being done just prior to and also during any ash fall.

Key responsibilities in an ash fall event include:

- Restore services as quickly as possible, with consideration of CDEM priorities for service restoration such as emergency operating centres, critical sites of other lifelines and critical community sites.

More information is available in the Bay of Plenty Lifelines Group Vulnerability Study, Version 1 – April 2011 (see References, page 37).

7.6 Welfare Advisory Group agencies

7.6.1 New Zealand Red Cross (NZRC)

New Zealand Red Cross works with the Ministry of Civil Defence and Emergency Management, other government agencies and Emergency Management Groups to ensure the skills and abilities of their staff and volunteers are put to use in helping those in need during an ash fall event. Within the Bay of Plenty region Red Cross Service Centres are located in Whakatane, Rotorua and Tauranga.

Their response is more likely to be required in extreme ash fall events when welfare centres are established. Responsibilities during an ash fall event could include:

- Supporting Bay of Plenty territorial authorities with welfare centre staff and management.
- Assisting with the provision of non-food items and recovery planning.

7.6.2 Salvation Army

In an ash fall event the Salvation Army staff and volunteers will work alongside Civil Defence and local councils to provide practical care to community members and the emergency workers. Their response is more likely to be required in extreme ash fall events when welfare centres are established.

7.7 Government agencies

Statutory responsibilities and functions of Government Agencies, both prior and during an emergency, are detailed within the Civil Defence Emergency Management Act 2002, National CDEM Plan and Guide and the Group CDEM Plan. This generally involves the continuation of service to the public, but may also involve some increase in core activity.

7.7.1 Ministry of Primary Industries (MPI)

As a government agency, MPI has statutory responsibilities and functions, both prior and during an emergency. As the effects of a volcanic event will also impact on rural communities MPI has a key role in advising on such matters as effects of volcanic ash on livestock, horticulture, agriculture and pastoral based industries. During a

major volcanic event MPI will play an essential role in response and recovery matters within the Bay of Plenty region and also by activating and managing the Rural Trust.

7.7.2 Ministry of Agriculture and Forestry (MAF)

MAF's initial role following an adverse event is to monitor and assess the impact on the rural sector, provide input into CDEM Groups and their arrangements, and make recommendations to the Minister and Government about the need for any central government rural-related response.

Depending on the scale of the event, the Government may provide recovery assistance at the on-farm level that is additional to any initial response and wider community recovery measures.

There are currently three broad categories of on-farm recovery assistance:

- General recovery measures – available for significantly affected producers, even where the scale of the event is fairly small.
- Emergency recovery measures – available when there is a medium to large-scale event beyond the capacity of a community to cope.
- Special recovery measures – additional measures following a large-scale event.

7.7.3 Rural Support Trust

Rural Support Trusts assist rural communities in times of adversity and vulnerability. The operations and focus of the Rural Support Trusts differ throughout New Zealand depending on their resources, structure and reason for establishment.

The core services generally include:

- Providing advice on financial planning;
- Disseminating information on welfare assistance; and
- Providing welfare and social support.

Rural Support Trusts can play a major role in the local response and recovery phases after an adverse event. The trusts also perform a role in building community preparedness for the future.

7.7.4 Child Youth and Family

If volcanic ash fall was sufficient to cause evacuations, Child Youth and Family would:

- Support the evacuation of children in care of the state.
- Identify families that have foster children in their care and support authorities with evacuation process.

7.7.5 Te Puni Kōkiri

Marae are the cultural and political centres for whānau, hapū and iwi. During an ash fall event Te Puni Kokiri would work with local iwi to provide support to the Māori communities in the region.

Key responsibilities in an ash fall event:

- Assist to communicate key messages on mitigating ash fall to Māori communities.
- Provide updates on the status of Māori communities i.e. resources, support.

If evacuations are necessary due to ash fall they will:

- Link with iwi providers who can provide support at maraes located across the region.
- Assess welfare requirements and provide staff for welfare centres where possible.
- Identify resource requirements for affected communities.

7.7.6 Housing New Zealand Corporation

If volcanic ash fall was sufficient to cause evacuations, Housing NZ would:

- Support with emergency short term accommodation where available, and coordinate temporary and long-term accommodation for people displaced from their normal dwellings.

7.8 Other agencies

7.8.1 Iwi Authorities

Iwi authorities provide assistance to CDEM to facilitate engagement with their marae communities.

Iwi by Māori Constituency 2011 - *Link to Map of Marae in the Bay of Plenty region: http://www.boprc.govt.nz/council/kaupapa-maori/marae-in-the-bay-of-plenty-region/*

7.8.2 Civil Aviation Authority of New Zealand (CAA)

The Civil Aviation Authority of New Zealand are responsible for responding to emergencies and providing information on the availability of operational resources and expertise that may be able to be used during an emergency including the location and capabilities of aerodromes, aircraft and aircraft operators (refer to Table 6).

7.8.3 Society for the Prevention of Cruelty to Animals (SPCA)

The SPCA is a non-government agency that will provide assistance to protect animals during an ash fall event.

7.8.4 Volunteers

There are likely to be two types of volunteers in an ash fall event. Those from a specific organisation such as the CDEM Red Cross and the Salvation Army (organised volunteers) and those members of the general public who offer their services i.e. to assist with ash clean-up (spontaneous volunteers). Spontaneous volunteers are managed at the Local EOC level and local Emergency Management Offices should have a Spontaneous Volunteer Plan.

7.8.5 New Zealand Transport Agency (NZTA)

State highway management falls under the jurisdiction of the NZTA. The management for all other roads lies with territorial authorities. NZTA key responsibilities in an ash fall event will be to:

- Assess state highways usability subject to ash fall.
- Identify and warn users of hazards i.e. reduced visibility, traction problems (especially if wet), vehicle damage (wear on moving parts and paint work), blockage of surface water collection.
- Remove ash from state highways if necessary.
- Liaise with TAs and the NZ Police over state highway traffic management (includes identifying alternative routes during ash fall event).
- Prioritise access for emergency services.
- Advise Controller on the traffic management plan.

7.8.6 New Zealand Defence Force

Requests for support from the NZDF beyond local levels of commitment should be made through the National Controller in accordance with the agreement between MCDEM and the NZDF. Note: the Sixth Hauraki Battalion Group has headquarters in Hamilton and Tauranga.

Part 8: Public information

In an event that adversely impacts the Bay of Plenty CDEM Group, the Group Public Information Manager (PIM) and their team will work collaboratively with other agencies to provide consistent, clear messaging to the public (both electronic and print). This includes liaison with experts from key agencies i.e. health agencies to ensure the public are receiving factual and appropriate messages which will in turn reduce anxiety.

There needs to be consistency with all media releases, agency websites etc. A media release will, as a guide, be triggered by notification of an eruption to explain what is happening and what preparations people should be making.

News releases may be co-ordinated nationally by the Director of Civil Defence and Emergency Management (MCDEM). However releases on local conditions and actions people should take will be co-ordinated by the Local Controller. Further guidance on methods and standard messaging templates are contained in Group and Local PIM plans.

See References (page 37) for the following documents: *Working from the Same Page, Consistent Messages for CDEM (*MCDEM). Version 1.0 April 2010; and *Bay of Plenty CDEM Public Information Management Plan – 2010.*

Figure 6 illustrates the primary lines through which key messages are disseminated to key stakeholders and the public. It does not show all communication lines i.e. the Group PIM will also be liaising with other agencies such as: NZTA to ensure consistent traffic management messages and the public health agencies. Note: The NCMC can be requested to support the GECC for any matter that arises during an emergency event.

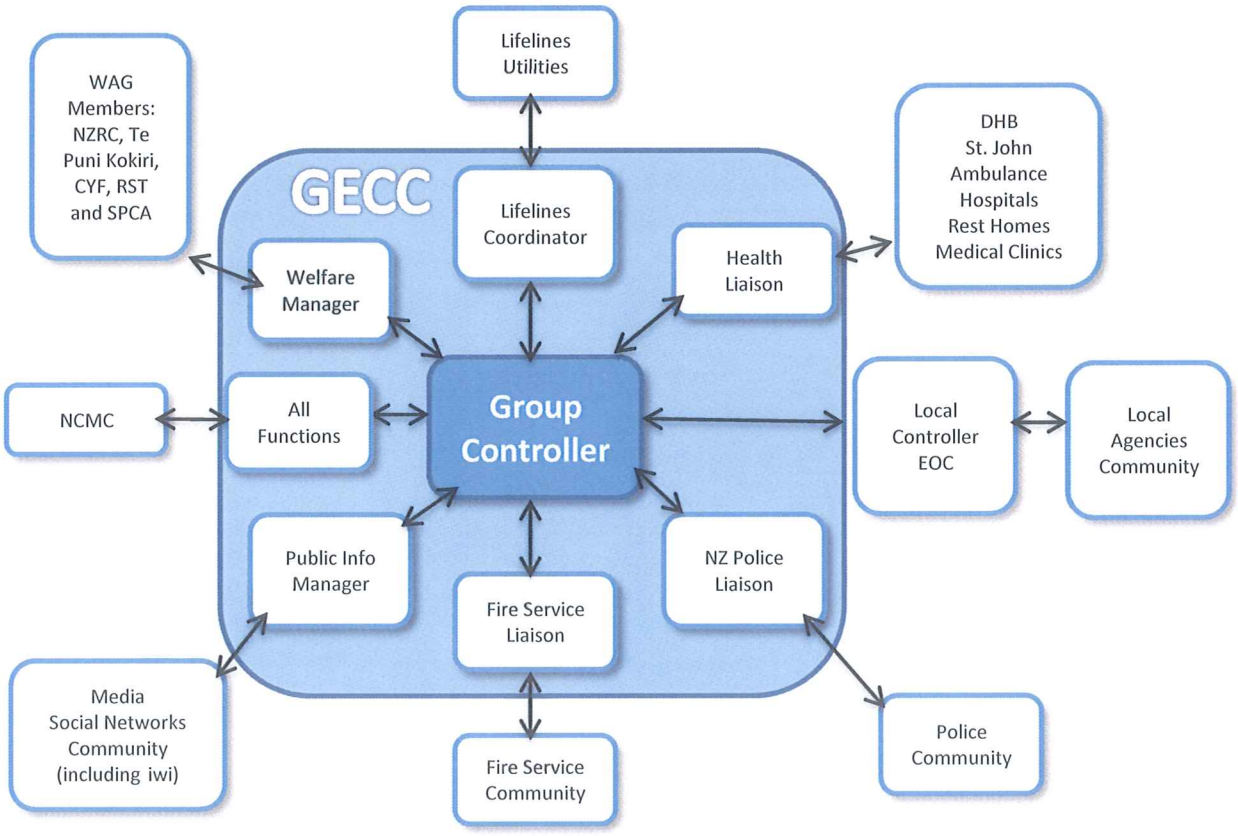

Figure 6 Communication lines for dissemination of messaging

Part 9: Monitoring and evaluation

Ongoing monitoring and evaluation will provide assurance to the Bay of Plenty CDEM Group and communities that this plan remains relevant, effective and continues to meet its objectives.

The BOP CDEM Group Plan 2012-2017 (Part 7) sets out how the Group will implement its monitoring and evaluation.

An eruption column at Ngauruhoe in 1974, rising to about 500 metres above the volcano. Eruptions from Okataina have produced columns which rose 5 – 10 times higher than this event, depositing 1000 – 10,000 times more ash. (Photo from GeoNet and description adapted from I.A. Nairn of GNS).

9.1 Developments during an ash fall event

9.1.1 Planning

- Clean-up plan will need to be developed at the time for public areas.

9.2 Future work

9.2.1 Planning

- Land use planning – develop criteria for assessing suitability of ash disposal sites.
- Recovery planning.
- Community engagement plan.

9.2.2 Public Information

- Determining trigger level to instigate general public health messaging before ash fall and develop public health information for dissemination.

Part 10: References

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International Civil Aviation Authority – ICAO Aviation Volcano Level – Colour Code http://www.icao.int/safety/meteorology/ivatf/Meeting%20MetaData/IP.24%20with%20attachment.pdf

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U.S. Geological Survey website: http://volcanoes.usgs.gov/ash/agric/index.php

GeoNet website: http://info.geonet.org.nz/display/volc/Monitoring+Methods

Appendix 1 – Glossary of terms and acronyms

AP	Action Plan
BOP	Bay of Plenty
BOPRC	Bay of Plenty Regional Council
CDEM	Civil Defence Emergency Management
CDEMG	Civil Defence Emergency Management Group
CEG	Coordinating Executive Group
CYF	Child, Youth and Family
DHB	District Health Board, includes hospital, health and ambulance service
ECC	Emergency Coordination Centre
EMO	Emergency Management Office
EOA	Emergency Operating Area
EOC	Emergency Operations Centre
GERL	Government Emergency Response Line
GECC	Group Emergency Coordination Centre
IAP	Incident Action Plan
LUC	Lifelines Utility Coordinator
MCDEM	Ministry of Civil Defence and Emergency Management
NCMC	National Crisis Management Centre
NECC	National Emergency Coordination Centre
NGO	Non-Government Organisation
NZFS	New Zealand Fire Service
NZRT	New Zealand Response Team
NZRC	New Zealand Red Cross
PIM	Public Information Manager
RCA	Road Controlling Authority (NZTA and TLAs)
REMA	Regional Emergency Management Adviser
RST	Rural Support Trust
SOP	Standard Operating Procedure
Sitrep	Situation Report
SPCA	Royal New Zealand Society for the Prevention of Cruelty to Animals
TA	Territorial Authority (includes city, district and unitary authorities)
VAAC	Wellington Volcanic Ash Advisory Centre
WAG	Welfare Advisory Group