

**Assessment of Auckland Civil
Defence and Emergency
Management Group warning system
options**

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ABSTRACT

This report recommends priority options for public notification of warnings for the short (1 year), medium (1 to 5 years) and long (5 to 10+ years) term for the Auckland CDEM Group, based on a review of 26 options under the broad headings of 'natural warnings', 'via institutional staff to those in their care', 'via community/organisation networks to the public', 'via third-party hardware and/or staff' and 'via dedicated hardware'.

Early warning public notification is discussed in the context of an effective warning system, as part of the underlying goal of improving community resilience. Effective warning systems include, as well as early warning and public notification: response planning; discussion and communication; education, training, maps and signs; exercises; underpinning hazard research; and effectiveness evaluation. In parallel to this report there is also a long-term community resilience project underway for the Auckland region.

Technology currently allows, in theory, for the vast majority of people to receive a detailed warning message within seconds of the notification system being activated. The major limiting factors are cost, technology-implementation lead-time, ongoing maintenance costs, ongoing effort through testing and exercising of the system, and most importantly the development of a resilient community with the capability and motivation to make the correct decisions based on the warning message received. The partial, and/or un-maintained/un-exercised implementation of a new hardware-based system may have a negative impact on overall community resilience, especially due to reduction in other mitigation measures because of reliance on the warning system to 'save us'.

In the short term (1 year), development of existing available warning systems should allow for the notification of a substantial proportion of both rural diffuse-populations and urban areas for most if not all hazards (hazards with seconds to minutes of lead time may not have full, or in the shortest-time frame cases any, public notification via these systems). These are broadly (a) notification through existing organisations and groups that maintain their own communication networks (e.g. Surf Lifesaving, Rural Fire, etc.), (b) notification via existing third party hardware and staff (e.g. Radio and TV stations; Police and Fire mobile PA loud-hailers, and/or door-to-door notification). The biggest cost is the effort of start-up detailed planning of the method, notification priorities, message content etc., and effort in ongoing and regular exercising, evaluation and improvement of these arrangements. The awareness and motivation required to respond to natural warnings can also begin to be fostered in the short term.

In the medium term (1 to 5 years) detailed feasibility analysis of new technologies should be carried out to determine if the cost-benefit is acceptable. Effective response to such systems would require a more resilient community with greater awareness of hazards, warning systems, potential warning messages and appropriate response to them; without this, panic and other inappropriate decisions based on receipt of a warning message may result in a worse response than would occur without implementation of any new technologies. Bimodal population density means group notification may not be the most efficient, or even possible, for rural diffuse-population areas, whereas individual notification may not be as fast or

practical for high-density urban areas. The best available new technologies to directly reach the large majority of the rural diffuse population relatively quickly are cell-broadcast (or similar mobile communications technology) and/or tone-alert radio; these two and/or fixed PA loud-speakers should be analysed in detail for urban areas. All are cost-limiting, but the cell broadcasting appears to have the potential to be the cheaper and more cost-effective in the medium term.

We recommend a national working group between CDEM Group representatives, MCDEM, communication providers and warning supply agencies to brainstorm this option and other new mobile communications technologies possibly on the horizon.

The time-lag between initiation of notification and receipt by all available end-users is the critical success factor for a major new all-hazard technology-based system. It needs to accommodate as best as possible short time-frame hazards such as earthquake (seconds, possibly never feasible), dam failure, tornado, local or regional source tsunami (minutes; seconds for notification is better). This time-lag criticality also means that the time taken to initiate an early warning prior to notification, and for people to respond, should also be a focus of effort by the CDEM Group. It is unclear whether mobile communications technologies such as cell broadcast can, with full automation of the system, notify all end-users in seconds, but minutes is certainly feasible. Technological advances in the next few years may well improve this. Development of a major dedicated hardware system such as tone-alert radio or fixed PA loudspeakers may take years, and then in short order be superseded by cheaper and faster mobile communications as the optimum system.

In the longer term (5 to 10+ years) the target should be the development of wider community resilience. Improved resilience reduces the impacts of natural hazards through several community-driven means including, but not limited to, the ability and motivation to receive, understand and make decisions based on early warning messages. Such changes to the awareness and motivation of the community take place over decades rather than years.

KEYWORDS

Auckland, effective early warning system, public notification, all hazards, civil defence, emergency management, community resilience, new technology

1.0 INTRODUCTION

The Auckland Civil Defence and Emergency Management Group (CDEMG) is investigating the provision of a system to disseminate warnings to the public of the Auckland region. This report discusses and makes recommendations for such a system. This requirement is set out in the Ministry of Civil Defence and Emergency Management (MCDEM) National Plan and the draft National Plan. In addition, the Auckland CDEM Group Plan sets out as a target that the CDEMG will, 'determine how the national warning system can be initiated on a regional basis by December 2005'.

The Auckland CDEMG have explored the option of using the fixed line telecommunications network to disseminate automatic warnings and have identified a number of limitations. The CDEMG committee resolved that priority be given to further investigate the use of telecommunications and electronic technology for the provision of early warning and other assistance for CD Emergencies. This project seeks to meet the objectives resolved in that meeting and explore wider options for warning dissemination.

Warning systems will be utilised for a range of different scenarios including those with relatively short warning times (e.g. tsunami, volcanic eruption, flooding) and those with longer warning periods (e.g. cyclone, drought, epidemic). The amount of warning time and immediacy of response will determine which warning systems are appropriate. It may be necessary to utilise different mechanisms for disseminating warnings with different timeframes. For some hazards, warning systems will not be useful, such as earthquake.

1.1 Project objectives

The objectives of this project are to develop a number of recommended options for the dissemination of CDEM warnings to potentially affected businesses and communities in the Auckland Region, so that an informed selection can be made of system(s) for implementation.

Recommended options should meet the following requirements:

- be based on examples of best practice from elsewhere in New Zealand and overseas
- be easy to understand/interpret
- be suitable to the Auckland hazard context
- could be applied consistently throughout New Zealand
- could be targeted to specific geographic audiences
- are cost effective
- can be implemented quickly and easily
- address social behaviour models.

1.2 Project tasks

In order to meet the project objectives, several tasks have been undertaken. This project:

- Assesses New Zealand and overseas examples of best practice effective warning systems, with a focus on public notification arrangements (Section 4, Appendix 3).
- Reviews systems in use in countries that are considered to have a “like New Zealand” hazard profile and social values (Appendix 2);
- Assesses which public notification systems meet the requirements listed under ‘Project objectives’ above (Sections 3 and 4), with comment on how these best fit within an effective warning system (Section 2);
- Recommends a number of options for delivery of public warnings (‘public notification’) in Auckland (Section 5);

In addition, the authors will participate in the presentation of the results of this project to CEG and the CDEMG at a future date.

1.3 Research and external input

A list of system and hazard-specific references (including internet references) can be found in the ‘Reference’ section at the back of this report. In addition, a list of people, agencies, and suppliers who were contacted during the course of this project can also be found as part of the reference section.

1.4 Context

This section lays out the national and regional CDEM context within which the current review sits.

1.4.1 Legislation, plans and existing early warning systems

Many warnings are generated or supplied by the MCDEM via the national warning system. Under the National CDEM Plan¹, MCDEM is responsible for issuing warnings of national significance to CDEM Groups, local authorities, police, certain government departments, lifeline utilities, and certain broadcasters. CDEM Groups are responsible for disseminating national warnings to local communities and maintaining local warning systems. The National Plan does not include local actions and procedures required to disseminate or respond to warnings – that is the responsibility of each CDEM Group. Appendix 1 outlines sections 60-62 of the National Plan, which describes the objective and scope of general warnings, and the national warning system.

The Auckland Region CDEM Group Plan acknowledges that currently no warning system exists that can be initiated for regional events. The objective is therefore to develop an integrated system for the region that can provide warnings to the public of impending events

¹ The National Civil Defence Management Plan comes into effect on 1 July 2006.

and other emergency conditions. The recommendations of this report will contribute to the development of this system. Following consultation with the media (a key partner in warning systems), an integrated regional warning system will be introduced that is consistent with the national system.

The CDEM Group Plan includes a table 'Event Types and Status' (Section 3 - Operational Arrangements, Table 3.2) which outlines event levels, status/procedures, and the role of the EOC and Controller. However, although it describes the five levels of events (Level 1 being a small local incident where no declaration is required, to Level 5 being an imminent or State of National Emergency), it does not provide guidance on how or when public notification should occur within these levels. Any new notification system should be included in this table.

While there is no physical warning system currently in place, a framework for a public warning system does already exist. The purpose of the proposed public warning system is for warnings to be issued to the public concerning physical safety from a hazard or emerging threat, prior to and during a civil defence emergency. The general public can be currently alerted via radio and television to an impending emergency. Any new warning system that is used for this purpose will be introduced in public education activities to ensure that the level of community understanding on how to access emergency information is established. Warnings will be issued in accordance with SOP G202: Regional Warning System. Specific warning systems will also be developed for hazards through Contingency Plans.

Where no Contingency Plan exists, the following warning levels are established to assist readiness:

Advisory – The status quo. No response required, information received from monitoring and surveillance agencies (e.g. Institute of Geological and Nuclear Sciences (GNS Science));

Alert – A preparatory phase recognising that limited information may be available for an emerging threat. Liaison with emergency services is initiated. Notification from the CDEM Office to:

- Group Controller and Local Controllers
- CDEM Group
- Local Authorities
- MCDEM
- Emergency Services

Standby – Threat imminent and key personnel put on standby. Liaison with emergency services is increased and the Public Information and Media Management Plan is activated. Standby warnings will be issued to those agencies detailed in SOP G202 (yet to be completed)

Full Activation – Event occurred or inevitable.

Any warning system must be incorporated into the warning levels, to aid decision making as to when public notification is required.

The CDEM Group Plan states that a decision to declare a state of civil defence emergency will be publicised in accordance with the Public Information and Media Management Plan. According to this plan, information will be circulated via media releases. These will be available at the Media Management Centre, on the Auckland CDEM website, and faxed or emailed to media organisations and local EOC's. They will also be disseminated to the emergency services, government agencies, lifelines and other entities involved. This existing system is part of the region's warning notification system.

Waitakere City Council has a Warnings and Activation Procedures SOP (SOP 108), which states that local warnings to the public may be issued by the Mayor or the Emergency Services, using Radio NZ or TV if applicable. Police and Fire vehicles have loudspeaker facilities that can be used for localised warnings. This SOP could be further developed to provide information on when these measures should be used.

The Auckland CDEM Group Plan acknowledges that the region consists of many diverse cultures, which has implications for communicating and engaging with these communities. Any warning system will need to take into account this diversity when considering options for notifying the public of an event. This needs to be incorporated into the CDEM Group Public Education Strategy, which includes engaging the public in developing an understanding and knowledge of what to do before, during and after an emergency.

District Plans manage land use within the Auckland region. The Plans do not include a requirement for warning systems to be initiated/installed with any new or existing development. However, warning systems could be considered a mitigation measure in situations where there is a hazard which could affect a development, such as a coastal or flood plain development that could be adversely affected by tsunamis, storm surge or flooding. Any warning system would need to be regularly tested, serviced, and an education campaign launched for those residents and visitors within the proposed warning area.

Auckland Region does not have any formal public notification arrangements (Tables 1 and 2).

Plan / Standard Operating Procedure	Status
Rodney District	nil
North Shore City	nil
Waitakere City	
SOP 108 – Warnings and activation procedures	Complete
SOP 120 – Tsunami warning system	Draft
Auckland City	nil
Manukau City	nil
Papakura District	nil
Franklin District	nil

Table 1 Relevant regional supporting documents (based on Auckland CDEMG website, 2005)

Plan / Standard Operating Procedure	Status
GROUP FUNCTIONAL PLANS AND STRATEGIES	
GFP P2 Group Evacuation Plan	To write
GFP P3 Group Logistic Plan	To write
GFP P4 Public Information and Media Management Plan	In revision
GFP P5 Group Welfare Plan	Complete
GFP P6 Public Education Strategy	Complete
GROUP CONTINGENCY PLANS	
GCP C1 Volcanic Contingency Plan	Complete
GCP C2 Tsunami Contingency Plan	To write
GROUP STANDARD OPERATING PROCEDURES	
<i>GEOC Related</i>	
SOP G101 GEOC Activation Procedure	Complete
SOP G102 GEOC Structure, Staffing and Operations Procedure	Complete
SOP G103 Transition from Response to Recovery	Complete
SOP G104 Impact and Needs Assessment	Not complete
SOP G106 Volunteer Management	Not complete
<i>General</i>	
SOP G201 Operational Planning Group Role, Emerging Threat Planning and Event Training Process	Complete
SOP G202 Regional Warning System	To write, based on this review
SOP G203 Urban Search and Rescue	Complete
SOP G204 Transition from Harbourmaster to CDEM Group for Emergencies in the CMA	Not Complete

2.0 EFFECTIVE HAZARD WARNING NOTIFICATION AS PART OF IMPROVED COMMUNITY RESILIENCE

In this section we examine the role of warning notification systems within the wider context of effective warning systems and the overarching goal of improving community resilience. For the implementation of any notification system strategy to improve overall resilience its role within wider strategies must be carefully considered and compatible with a wider strategy to confront hazard effects. For example, if the warning process can identify the likely scale, consequences and duration of impact, it may allow more time to evaluate available resources and organise them in ways that enhance adaptive capacity. Warnings can be part of an overall strategy to improve community resilience if they are issued to populations capable of acting appropriately on warning information.

2.1 Effective warning systems

Warning notification systems are the components of early warning systems that deliver warning message(s) to users who need to make decisions based upon them (public, organisations, etc.). These are also sometimes referred to as ‘alert systems’ but ‘alert’ is also often used as a name for warning messages, so this usage is avoided here. Note that ‘public notification’ is also used in non-warning-related contexts, such as the public notification of planning documents.

We refer to ‘early warning systems’ as the hardware, electronics, communications, and planning necessary to generate and notify a hazard warning. An ‘effective warning system’ is the wider set of actions necessary to make sure that message is delivered and acted upon in an informed way (Figure 1).

Currently there is no single ‘best practice’ internationally that has been seen to effectively remove most people from harm’s way consistently for all hazards. However by drawing together a) evidence from observations of public response to past events internationally, b) empirical studies, and c) common sense best practice, recommendations for developing appropriate and effective response to hazard warnings have been grouped into the components shown in Figure 1 (Consistent with UN/ISDR Platform for the Promotion of Early Warning, and discussed and justified in detail by Johnston et al., 2005; Leonard et al., 2005; Leonard et al., 2004).

RESEARCH: (Sciences of monitoring systems, sources, propagation, inundation, risk assessment; and of awareness, and effective response)	1. EARLY WARNING SYSTEM: Hardware, electronics, communications and planning necessary to effectively detect a hazard, generate warning messages and transmit them to at-risk regions (including any use of public notification hardware).	EFFECTIVENESS EVALUATION
	2. PLANNING: Decision-making tools: thresholds, evacuation routes and maps, inter-organisational relationships and communication channels.	
	3. COOPERATION, DISCUSSION AND COMMUNICATION: Pre-planned and exercised communication between central government agencies, local emergency management agency staff, scientists and community representatives. Renewal of contacts must be regular and permanently sustained, to overcome common high staff turnover.	
	4. EDUCATION: Public education, staff training, maps, and signs.	
	5. EXERCISES: Scenario development and simulations — table-top and full, with observation and feedback.	

Figure 1 A model of components of an effective hazards warning system

To illustrate what is involved in an effective warning system, Table 3 shows the recently reviewed (Webb (compiler), 2005) state of effective warning system arrangements for tsunami within the Auckland region.

Table 2 Auckland CDEM Group reported arrangements for effective response to tsunami warnings, data reported for the current tsunami preparedness review (Webb (compiler), 2005). Codes w = written, o = oral, p = perception of involvement in notification, but not written arrangement; T = tsunami-specific (doesn't differentiate source distances), g = generic across hazards, * = participated in the 2003 Coastal Survey (includes tsunami public awareness).

	CDEM Group Plan	Auckland
Early Warning System: Regional Components	Who in Group receives warning	wg
	Where warning comes from	Wg
	Proportion of time can receive warning	Wg
	How warning is received	Wg
	What is done with warning, decisions made	Wt
	Who is contacted once warning received	Wt
	Tsunami warning hardware	-
	Tsunami warning hardware testing	-
	Arrangements for getting info to public	-
Planning	Sub-group-level plans	-
	Sub-group-level plans were last reviewed	-
	Tsunami warning decision preplanning	Wt
	Inundation or evacuation mapping	Wt
	Evacuation decider/ manager	Og
	Role of police	P
	Role of Fire Service	-
	Role of other key organisations	wg
	Arrangements for giving "all-clear"	-
	Tsunami warning SOP's	wt
Communications	Communications with other regions	wg
	Media/ communications plans	wg
	Arrangements with radio station(s)	-
Education etc.	Tsunami warning public education	wg
	Tsunami training	wg
	Awareness/ monitoring research	*
	Tsunami-related signs exist	-
Tsunami warning simulations		wg

2.1.1 Developing understanding and the capacity to respond

Understanding and response capacity are outcomes of the combined effect of all components of an effective warning system (Figure 1) and wider community resilience.

Identifying who the warning is intended for is a significant issue (see also Sections 3.3). Several recipient groups can be identified, all of which have different needs, expectations and capabilities. When developing warning systems, it is thus appropriate to consider whose needs have to be served. For example, is the warning intended for emergency management agencies, citizens, community groups (e.g., religious), societal institutions (e.g., welfare agencies, charities), and business. Given this diversity, the emphasis should shift from the delivery of warning messages per se to ensuring that each group knows what they mean and that they have a capacity to act upon them. Without developing this end-user capacity to

interpret and respond, a myriad of warning content, media of delivery, and technology of delivery may have to be developed to meet the needs of each group which may not be cost effective. The development of a range of end-users' capacity to understand and respond to a simpler warning message has additional merit in that it could also be adapted to fit the demands of a range of hazard characteristics, and future 'new' hazards.

2.1.2 Effective warning messages

Effective warning messages are an outcome of both the early warning system, and the response planning, components of an effective warning system (Figure 1).

The warning message(s) that need to be conveyed by notification system(s) influence which system(s) are most appropriate. Warning messages must not be confused with information disseminated outside of a warning for the purposes of improving resilience such as the capacity to decide to respond appropriately to warnings. The purpose and content is different.

Research into the effectiveness of warnings system messages has been undertaken for several decades (Mileti and Sorensen, 1990; Sorensen, 2000). Through this sustained social science research effort much is known about what makes warnings effective. Public response to tsunami warnings is most dependent upon the information provided by authorities during the event (Mileti and Sorensen, 1990). The Partnership for Public Warnings (PPW, 2002) concludes that an effective warning system messages should:

- (1) be focused on people at risk;
- (2) be ubiquitous;
- (3) be capable of reaching people irrespective of what they are doing;
- (4) be easy to access and use;
- (5) not create added risk;
- (6) be reliable;
- (7) provide appropriate lead time so people can have a chance to protect themselves; and
- (8) generate authenticated messages.

Research has also highlighted the critical importance of the message itself (Mileti and Sorensen, 1990) Mileti & O'Brien 1992). For warning messages to be effective they need to be clear and understandable; accurate; frequent; credible; specific to the situation of the recipient (and user) and give specific advice on what the effect will be and what to do to reduce the risk from the impending hazard event (Aguirre, 2004; Mileti and Sorensen, 1990; Sorensen, 2000). Even with a well designed and implemented system, when delivering sound warning messages a number of factors may conspire to reduce its ultimate effectiveness (Aguirre, 2004).

Human response to warnings has been found to relate to factors such as: age, ethnicity, gender, social status, previous experience of hazards and/or past warnings, proximity to the hazard, physical cues in the environment and responses of others receiving the same warning (Sorensen, 2000). The recipients of warnings may be from a number of user groups and have a range of needs, roles and responsibilities and thus respond in different ways (Aguirre, 2004).

Groups with responsibilities to initiate measures to protect the public may include the emergency services, emergency management agencies, mass media, and industry users (e.g. tourism operators). The issue of whether or not to issue a tsunami warning is always a difficult decision. To develop capacity to respond effectively and make appropriate decisions by those with warning roles and responsibilities it is essential consideration is given to training, exercises and drills.

The at-risk public, who are often targeted recipients of warnings delivered by the fore mentioned groups, are not themselves a homogenous group. Differing subpopulations with our society (e.g. young, older, the poor, new immigrants, tourists, those in institutions etc) have differing levels of vulnerability and have been shown to respond in different ways to warnings (Aguirre, 2004; Drabek, 1994; Drabek, 1996; Paton and Johnston, 2001).

Although research has consistently shown information provided during an event is the key to an effective response, pre-event education is also important. There has been limited research into the role pre-event public education has in improving warning response (Sorensen, 2000) but the evidence supports that well designed public education initiatives will increase response. The warnings and emergency public information during an event Mileti (2004) suggests that public education should at least address:

- Who will issue the warning message(s)
- What the warning message(s) could say
- How the warning message(s) will be issued
- What communication media will be used and how to access them.

It is also important to include in each message:

- What should be done in response to that warning message.

2.1.3 Importance of the 'all-clear' message

It is essential to plan to give the all-clear message, and on what basis this all-clear should be initiated (see Hawai'i examples, Appendix 2).

2.1.4 Part of a wider goal: improved community resilience

The 'effective warning system' model given in Figure 1 provides a set of practical components that may, if designed to integrate with measures beyond a warning system, improve resilience, i.e. the capacity of community members for self-reliance. Two issues are relevant in this context: the reception of warning messages, and the relationship between warnings and capacity to respond.

It is generally assumed by emergency management agencies responsible for developing warnings that they are intended to inform people of potentially threatening events, and that these warnings will be treated at face value, accepted and acted upon. This assumption is not, however, always justified. For example, recent research on tsunami warnings (Johnston, Paton, Crawford, Ronan, Bürgelt and Houghton, 2005) found that people may choose not to respond to warnings for several reasons. For example, some believe the warnings are inadequate because they fail to discriminate between local and distant tsunamis and do not provide sufficient time to perform relevant actions such as evacuating. Some don't respond because evacuating conflicts with concerns about being trapped in their car (e.g., roads blocked by the volume of fleeing traffic) or because they place higher value on locating family members than on acting in the manner intended on receipt of the warning. Some residents think that because government authorities put economic and political concerns ahead of their safety (e.g., authorities believe warning information and signs adversely affect tourism/business development), that warning systems are inadequate, reducing their willingness to act. Some people are reluctant to respond because they do not wish to appear foolish if they evacuate and it proved to be a false alarm or they assume others will come to their rescue no matter what happens.

Given that some warnings may occur within close timing of the actual event, getting people to act on receiving the warning is a key aspect of an effective warning process. While the examples of barriers to warning response given above are specific to a given population, they highlight the need to consider the needs and expectations of the intended recipients of warnings. A failure to do so reduces the effectiveness of the warning and increases the demands on emergency management agencies who have to deal with emergent problems resulting from people acting in ways that are inconsistent with expectations.

Resilience requires that warnings are developed through community engagement. Beyond motivating response to a warning, the second issue that links resilience research with warnings development concerns the core goal of resilience to ensure an intrinsic capacity for community action, ensuring they are prepared for what happens after they respond to the warning.

2.1.5 Hazard resilience research within the Auckland region

Improved community resilience is the underlying goal of hazard mitigation options in the Auckland Region, and is the focus of a parallel inter-related research project currently underway. The goals of this research project, which is FRST-funded through GNS Science in conjunction with Auckland CDEM Group and MCDEM, are the development of resilience predictors, and the establishment of their validity and reliability, that will be tested in subsequent research. Building on this research 'Measuring and Monitoring Resilience' (for which the data collection is Auckland CDEM Group funded), aims to ensure that strategic objectives of the Group, as outlined in the CDEMG Plan, are being progressed towards the achievement of CDEMG Plan targets in an efficient manner.

This work has direct relevance for dealing with issues raised in Section 3. The resilience project is not only developing the means to assess capacity for effective response to warnings, it is doing so within a community engagement framework that will allow community needs and expectations to be articulated, and their relevance for warning effectiveness to be evaluated and accommodated. This project will, firstly, identify the resources that communities, their members, businesses and societal institutions must possess (e.g., emergency plans, business continuity plans) that are required to safeguard their safety and ensure the continuity of core societal functions. Secondly, it will identify the competencies (e.g., self-efficacy, community competence, trained staff) required to respond to warnings by mobilizing, organizing and using their resources to confront the problems encountered and use them to adapt to hazard consequences. A resilient community will be better placed to organize and mobilize its response quickly.

The resilience research project will consider the planning and development strategies required to ensure the sustained availability of these resources and the competencies required to use them over time and against a background of hazard quiescence and changing community membership and functions. This work is developing a multi-level model that can be used to assess warnings issues at these different levels. That is, it will provide a framework to develop individual, community and societal level capacity. These elements are depicted in Figure 2.

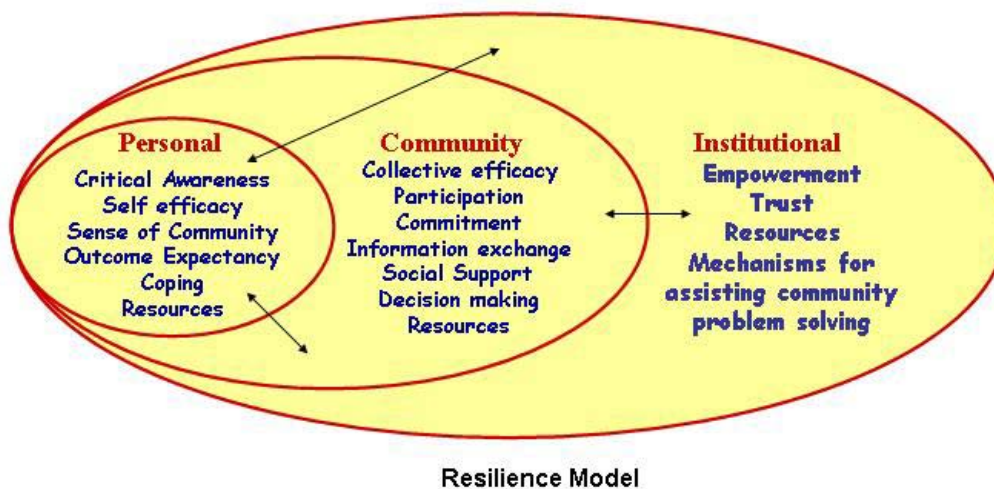


Figure 2 Community resilience model based on Paton and Johnston (2001).

2.1.6 Limitations of early warning systems

An early warning system only activates a decision-making process. The quality of the decision-making is the true measure of the effectiveness of a warning system therefore building the capacity to make effective decisions is the key challenge. There are many historic examples where at-risk populations in full or in part have failed to respond to official warnings, even when a well resourced (and what was considered well planned) warning system was operating (e.g. Biever and Hecht, 2005; Gregg et al., (submitted); Handmer, 2002; Pfister, 2002; Voight, 1990). Many of these failures have resulted from a lack of understanding of the need for a holistic approach linking various elements into an integrated system (Handmer, 2002; Leonard, Johnston and Paton, 2005).

Realistic effectiveness

No early warning system will be 100% effective at mitigating risk, because people make risk-acceptance decisions based on the interaction between their needs/expectations and the warning messages, and some of those decisions will lead to no, or only partial, reduction of the risk. As outlined above, this can lead to warnings being ignored. In some situations there is difficulty notifying diffuse populations. For example, in rural remote coastal or wilderness areas you may never reach all farmers, let alone trampers and surf-casters etc. Systems must be appropriate to population density, and be available to the majority of people as a priority.

Planning for system failure

No warning system is foolproof and all systems have a potential for failure. For example on the 14th June 2005 a Tsunami Warning was issued for Washington, Oregon, and California, following a magnitude 7.4 earthquake off shore in northern California. The response to the warning was variable and a number of hardware and procedural problems were experienced

(Biever and Hecht, 2005). Public response was also inconsistent across the communities that received warnings. To reduce the chances of failure a holistic approach to warnings must be adopted.

Potential to reduce community resilience

The existence of a public notification system, or even just a report outlining system options and recommendations, may in fact reduce a community's resilience due to individuals' transfer of responsibility for managing the risk to the authorities promoting the warning system (Ballantyne et al., 2000); this is especially true if it is not specifically designed as part of a wider programme to improve resilience (Paton and Johnston, 2001).

Business and politic resistance to warning systems

Many proposals for establishing warning systems and disseminating public information about hazards (e.g. erecting signs) are met with opposition from members of the community, fearing negative impacts on business development and tourism. Recent examples in New Zealand have seen several councils reject the installation of tsunami warning signs (e.g. Gisborne, Wellington and Kaikoura). However, a number of studies have shown that initial fears of negative consequences prove to be unfounded with no long-term business impacts occurring as a result of improved warning systems and public information (Yeo 2003; Johnston et al. 2002; Johnston et al. 2005).

Realistic ongoing costs and commitment

Many warnings systems are developed without a realistic understanding of ongoing costs. These may exceed the initial cost of a hardware-based warning system. Ongoing and regular testing, maintenance, simulation exercises and effectiveness evaluation must be budgeted for and these must be an ongoing commitment to maintain such activities. There is a need for all components to be present, exercised and evaluated (regular and ongoing) to achieve and be able to state a level of effectiveness.

2.2 Auckland region emergency experience, exercising

There has been little experience of a district- or region-wide emergency in the Auckland region in the last few decades. The last declared emergency within the region was the Waitakere city flooding in the early 1980s. The 1994/95 water shortages and 1998 power crisis have come the closest to a declaration since this time (Stockley, 2000).

Prior to these episodes, probably the last major event that was a declared emergency event was the Parnell Fumes Crisis in 1973 that resulted in the establishment of ESCC's due to the lack of co-ordination in dealing with that incident (CIPCDE), 1973).

There is an annual CDEM Group exercise, in addition to annual exercises conducted by TLA Civil Defence /EMO's.

The CDEM Group Exercise generally includes senior level staff from Group organisations, whereas the local TLA exercises encourage the involvement of operational managers (Sergeants and Senior Sergeants) from the Police and allied organisations. The police, for example, seldom have regular exercising for the wider operational staff; these staff instead rely on 5-weekly training days.

Table top exercises are a rarity although small specific-role groups within the police regularly exercise (e.g. the AOS, STG, and SAR). The Auckland CDEM exercising will be enhanced by the adoption of the National Exercise Programme.

3.0 WARNING NOTIFICATION NEEDS IN AUCKLAND REGION

This section lays out the variety of social, geographic and hazard situations within the Auckland region and how these need to be accommodated in the selection of an optimum set of warning notification arrangements.

There are a wide range of public notification systems available (Section 4, Appendix 3), internationally most commonly including sirens and media announcements. Within New Zealand there is a wide variety of current and planned approaches. It is frequently asked “What is the best system?”. International research shows that the most appropriate system will vary between communities and should be tailored around the specific nature of the location, society, and hazard (Mileti and Sorensen, 1990; OEM&ODGAMI, 2001; Sorensen, 2000).

The early warning system, of which public notification is a key component, can vary widely depending upon (modified from Tierney, 2000):

- Technology employed to detect hazard events
- Reliability of event detection technology and understanding
- Length of time needed to achieve accuracy in forecasts
- Reliance on human mediation
- Types of warning systems and devices used
- Channels employed to issue warnings
- Familiarity, routinisation and institutionalisation of early warning procedures
- Settings in which systems are used
- System goals and objectives

The audience will vary in terms of demographic characteristics and function (e.g., welfare agencies, commercial businesses). The activities they are conducting when a notification is given will also be variable and may vary for the same person at different times. For example the notification needed for tourists in a motel will be different to that of a permanent resident

on the street, or even in that same motel. For the public notification system to be assured as reliable in the event there must be redundancy, permanently ongoing testing and maintenance, battery back up (Darienzo et al., 2005; Gruntfest and Huber, 1989; OEM&ODGAMI, 2001).

Warning processes do not operate within a social vacuum. People are not passive recipients of information, even when it is intended to inform them about significant issues in their environment (Paton and Johnston, 2001). People make judgements about the information presented to them and actively interpret it within frames of reference. The public's frames of reference can differ systematically from their scientific and civic counterparts, who are responsible for developing and delivering risk messages. People interpret information in a context defined by their social context (e.g., social norms, cultural beliefs), their expectations, their past experience, and their beliefs and misconceptions about hazards and how to respond to them. Because people actively evaluate the relevance of warnings information for them, this can result in their being disinclined to attend to information or to interpret it in ways that differ from that intended by civic agencies. Hence, to pursue the wider goal of encouraging effective understanding of and response to warnings, it is important to understand how people interpret their relationship with hazards, how they interpret hazard and warning information, and to identify which factors influence the interpretive process (Paton and Johnston, 2001). The starting point is to consider the sources of warning information.

3.1 Sources of warning messages and information

While emergency management agencies are the primary source of warnings information (Fig. 3), they are not necessarily the most important from the perspective of understanding warnings issues (Paton and Johnston, 2001). They are but one source of information. Information is also available, to civic agencies and citizens alike, from the media. In many cases, the media are the more active source, particularly when it comes to reporting warnings, as well as the response and recovery efforts that follow them. They constitute a significant influence on people's perceptions of hazard characteristics and their consequences and can exercise a strong influence on people's beliefs and attitudes to warnings.

The importance of the media can also be attributed to the fact that it often delivers information that is filtered, processed and interpreted to varying extents and with varying degrees of accuracy. Furthermore, the information the media make available often extends well beyond the hazards issues per se to include their interpretation of the credibility of the sources of mitigation plans and the quality of their efforts (Paton and Johnston, 2001). Media analyses are usually post hoc. Given the fundamental uncertainty associated with the periods in which warning processes are activated, this is a fertile area for misinterpretation. Not all those who receive media coverage will be able to weave their way through the maze

of issues required to construct an objective view of the warning issues and their implications. Thus, how the media treat hazard complexity and uncertainty can influence levels of trust in information sources (e.g., emergency management, civic and scientific agencies). If this trust is broken, the future integrity of warning systems may be compromised.

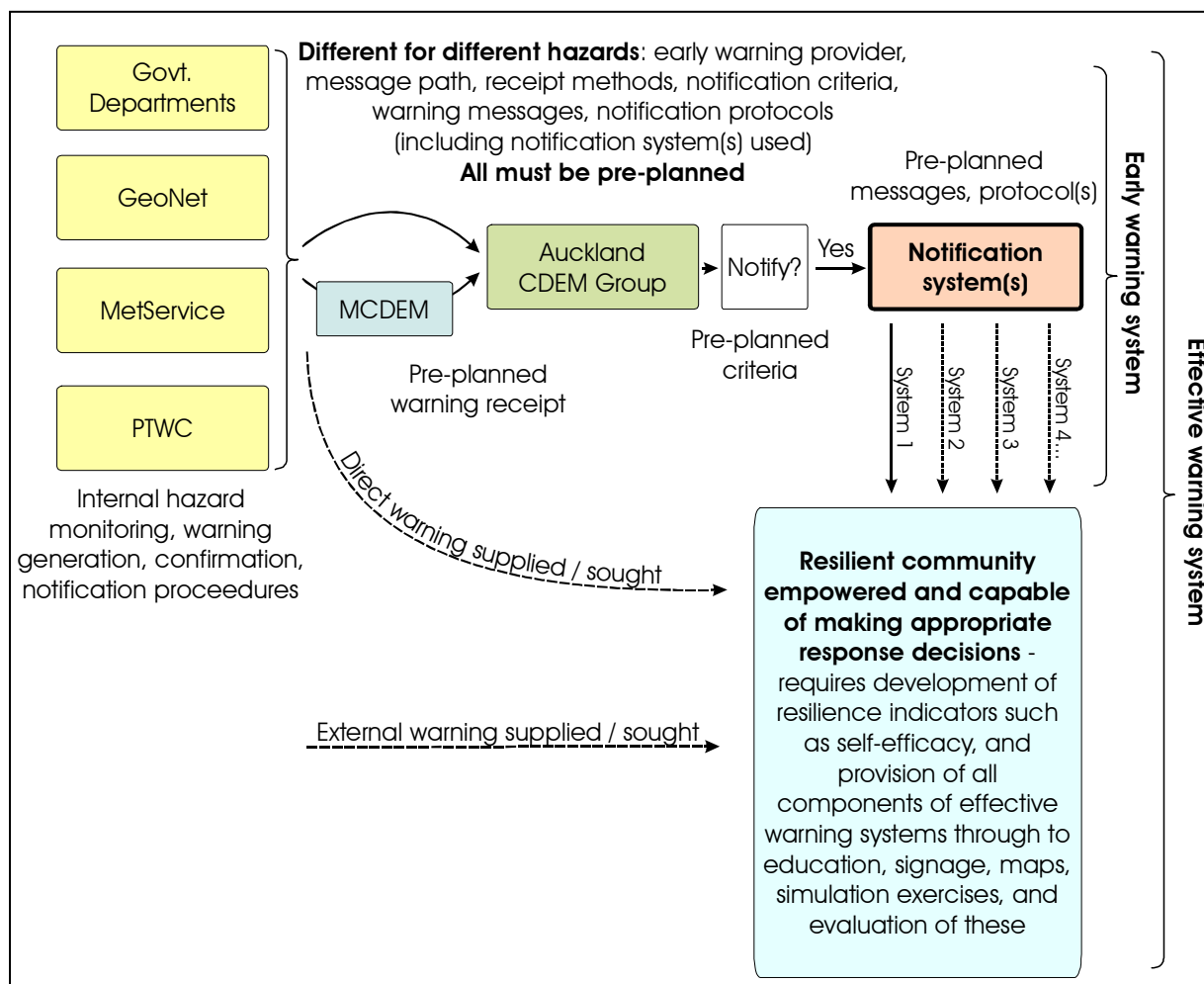


Figure 3 Flow diagram for warning messages into, and public notifications from, Auckland CDEMG, and the way in which warnings reach (or are sought by) the community.

3.2 Hazards to warn for

The Auckland CDEM Plan lists 28 distinct hazards (Table 4); with so many it is worth considering focusing public notification system development on those with higher priority first. The Plan identifies 8 higher, 10 moderate and 10 lower priority hazards. This classification is based on the SMUG prioritisation model, being seriousness, manageability, urgency and growth. It is limited by how much is known about the risk from each hazard. For example distantly-generated and locally-generated tsunami are considered moderate and lower priority, respectively, but new tsunami risk modelling may well change this status (Auckland CDEM Group, pers comm., 2005).

It is important to note that ranking hazards high, medium and low priority poses difficulties for CDEM Groups, as often very little resourcing will be directed towards the low and some of the moderate hazards.

Table 3 CDEM Group Plan hazard priorities (Auckland CDEMG, 2005) and hazard characteristics (modified after unpublished work of the Federal Emergency Management Agency, 2001)

	Hazard	Predictability	Detectability	Certainty	Lead Time	Duration of event	Visibility to majority of the public
'Higher Priority'	Biological – animal disease/epidemic	M	H	M	Days		
	Biological – human epidemic*	M	H	M	Days		
	Cyclone*	H	H	M	Days	Days	Visible
	Earthquake	L	H	L	Seconds	Seconds	Limited
	Lifeline utility failure*	L	M	L	Variable	Hours to days	Variable
	Major crash – aircraft	L	M	L	Minutes	Minutes	Limited
	Volcanic – Auckland Volcanic Field	L	H	L	Variable	Hours to days	Visible
	Volcanic – distant volcanic eruption	M	H	M	Variable	Hours to days	Visible
'Moderate Priority'	Biological – introduced species/pests*						
	Coastal – beach erosion and flooding*	M	M	M	Hours	Hours to days	Visible
	Coastal – cliff erosion/coastal instability*	H	H	M	Variable		
	Coastal – sea level rise*	H	M	M	-		
	Coastal – tsunami – distantly generated	M	M	M	Hours	Minutes	Visible
	Computer systems failure				Seconds		
	Criminal acts	M	M	L	Variable		
	Fire – catastrophic wildfire	L	M	M	Variable	Hours to days	Visible
	Fire – urban structure fire	L	M	M	Minutes		
'Lower Priority'	Hazardous substances	L	M	L	Minutes	Minutes to days	Limited
	Coastal – tsunami – locally generated	M	M	M	Minutes	Minutes	Visible
	Dam failure	L	M	L	Minutes	Hours	Visible
	Drought – agricultural drought*	H	H	M	Days		
	Drought – water supply drought*	M	H	L	Variable		
	Flooding*	H	H	M	Hours	Days	Visible
	Land instability*	L	M	L	Hours	Minutes	Visible
	Major crash – rail	L	M	M	Minutes	Seconds	Limited
	Major crash – road	L	M	M	Minutes	Seconds	Visible
	Major collision – marine	L	M	M	Minutes	Seconds	Limited
	Tornado*	M	M	L	Minutes	Short	Some

*potential to be exacerbated by climate change

The above matrix describes the characteristics of various hazards. The easiest hazards to issue warnings for are those with a high level of predictability, detectability, and certainty, that have long lead times and are visible. The most difficult are those with the opposite characteristics: low level of predictability, detectability, and certainty and with short lead times and no visibility. Such hazards require rapid response and notification capabilities. Long duration events require plans to frequently update warning information.

Table 4 Potential secondary hazards resulting from specific primary hazard events

Primary Event	Biological – animal disease/epidemic	Biological – human epidemic*	Cyclone*	Earthquake	Lifeline utility failure*	Major crash – aircraft	Volcanic – Auckland Volcanic Field	Volcanic – distant volcanic eruption	Biological – introduced species/pests*	Coastal – beach erosion and flooding*	Coastal – cliff erosion/coastal instability*	Coastal – tsunami – distantly generated	Computer systems failure	Criminal acts	Fire – catastrophic wildfire	Fire – urban structure fire	Hazardous substances	Coastal – tsunami – locally generated	Dam failure	Drought – agricultural drought*	Drought – water supply drought*	Flooding*	Land instability*	Major crash – rail	Major crash – road	Major collision – marine	Tornado*
‘Higher Priority’																											
Biological – animal disease/epidemic	X																										
Biological – human epidemic*					X					X	X		X	X		X	X					X	X				
Cyclone*				X																						X	
Earthquake				X									X	X		X	X		X	X			X				
Lifeline utility failure*													X														
Major crash – aircraft															X	X	X										
Volcanic – Auckland Volcanic Field					X	X							X	X	X	X	X		X				X				
Volcanic – distant volcanic eruption					X	X							X														
‘Moderate Priority’																											
Biological – introduced species/pests*	X																										
Coastal – beach erosion and flooding*					X						X						X					X	X				
Coastal – cliff erosion/coastal instability*					X					X													X				
Coastal – sea level rise*					X																						
Coastal – tsunami – distantly generated					X					X	X						X						X	X			
Computer systems failure					X																						
Criminal acts													X			X									X		
Fire – catastrophic wildfire					X												X										
Fire – urban structure fire					X												X										
Hazardous substances																X											
‘Lower Priority’																											
Coastal – tsunami – locally generated					X					X	X			X		X	X					X	X				
Dam failure					X												X					X	X				
Drought – agricultural drought*															X						X						
Drought – water supply drought*															X	X				X							
Flooding*					X					X	X		X	X			X		X				X				
Land instability*										X	X																
Major crash – rail																	X										
Major crash – road																	X										
Major collision – marine																	X										
Tornado*					X								X	X		X	X										

Any all-hazard public notification system needs also to recognise the possibility of multiple hazard events occurring concurrently, possibly with one or more secondary hazards being caused by a primary hazard event (Table 5).

3.2.1 Spatially varied hazards

Hazards events potentially affecting the Auckland region (Tables 4 & 5) have varied possible spatial extents within the region. As an example Figure 4 demonstrates the difference in the locations of coastal hazards (erosion, sea level rise, tsunami, inundation/flooding), local Auckland Volcanic Field eruption hazards, pastoral hazards (animal disease outbreak, catastrophic wildfire) and the state highway system (major road crash with or without hazardous substance discharge), lifeline failure, needed for evacuation in some other hazard events. Flooding and slope instability can affect specific areas over most of the region.

In contrast several hazards can potentially affect any part of the region equally (far-source volcanic ash fall, drought, human disease epidemic, cyclone, tornado, earthquake (although secondary earthquake effects such as liquefaction, amplified shaking and slope instability affect specific areas distributed across the region). The Auckland metropolitan area is the most likely locus of large scale urban fires.

3.2.2 Varied hazard warning time-frames

Issues to be considered here include the means by which a potential problem is detected. That is, what monitoring capability exists for each hazard, who monitors, and is it monitored 24/7? A second issue concerns the criteria for determining what constitutes a problem or potential problem and who make this call. The next issue concerns issuing a warning and the content/media etc used. When doing so, is it intended to signal a 'watch' or a 'warning'. Other issues: How is the time frame between detecting to warning to impact handled? How are long precursory periods handled? How to ensure warnings are received against a backdrop of activity (e.g., volcano warning in Auckland against several weeks of seismic experience)? How to handle escalation and diminution of hazard activity? How to handle false alarms? Refer to Table 4 outlining different warning lead-times for hazards.

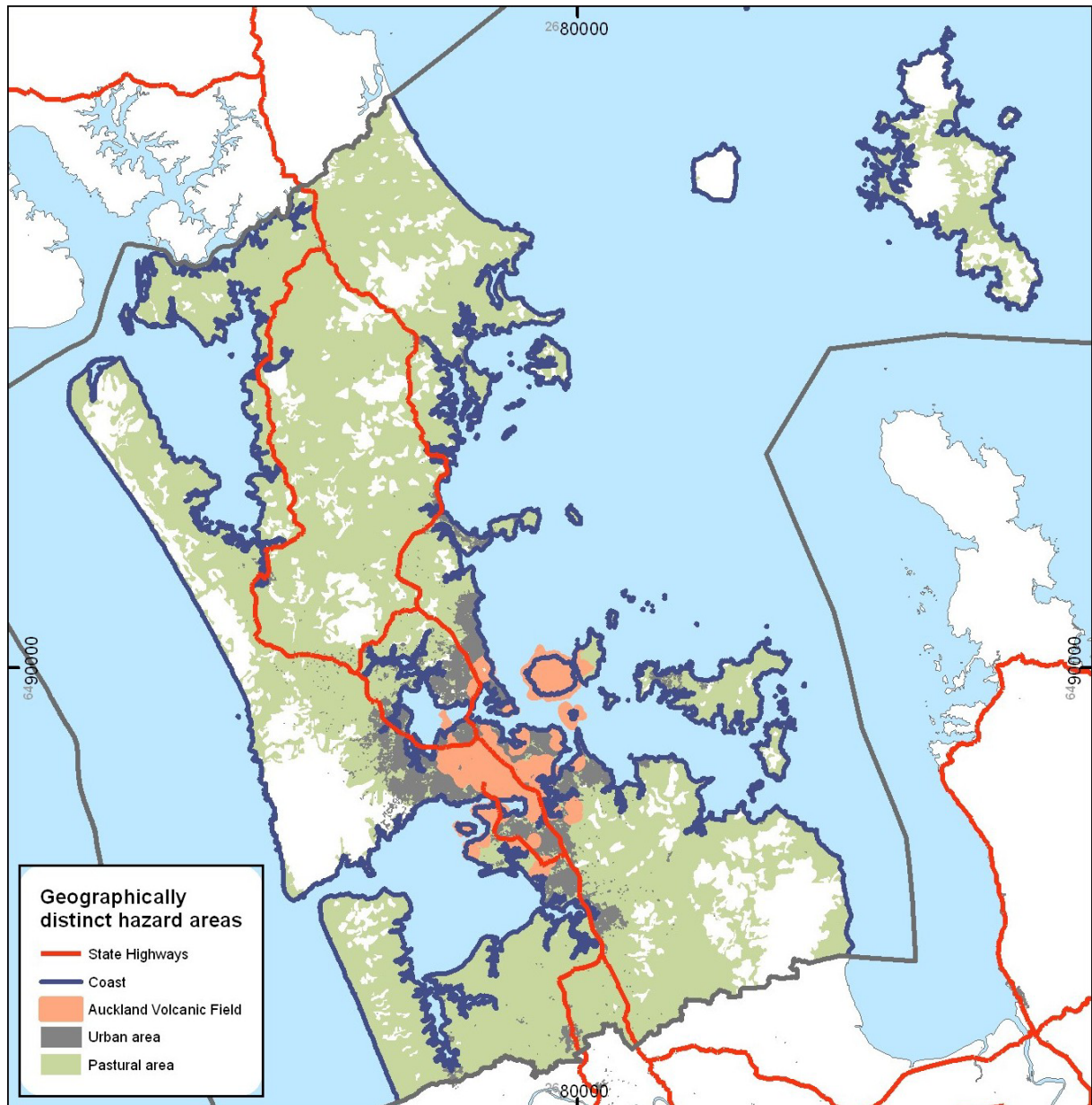


Figure 4 Map of Auckland region displaying five locations of potential hazard events, to illustrate the large variation in spatial distribution between hazards. Pastoral area is assumed to be that not in urban, bush, forest or scrub classes.

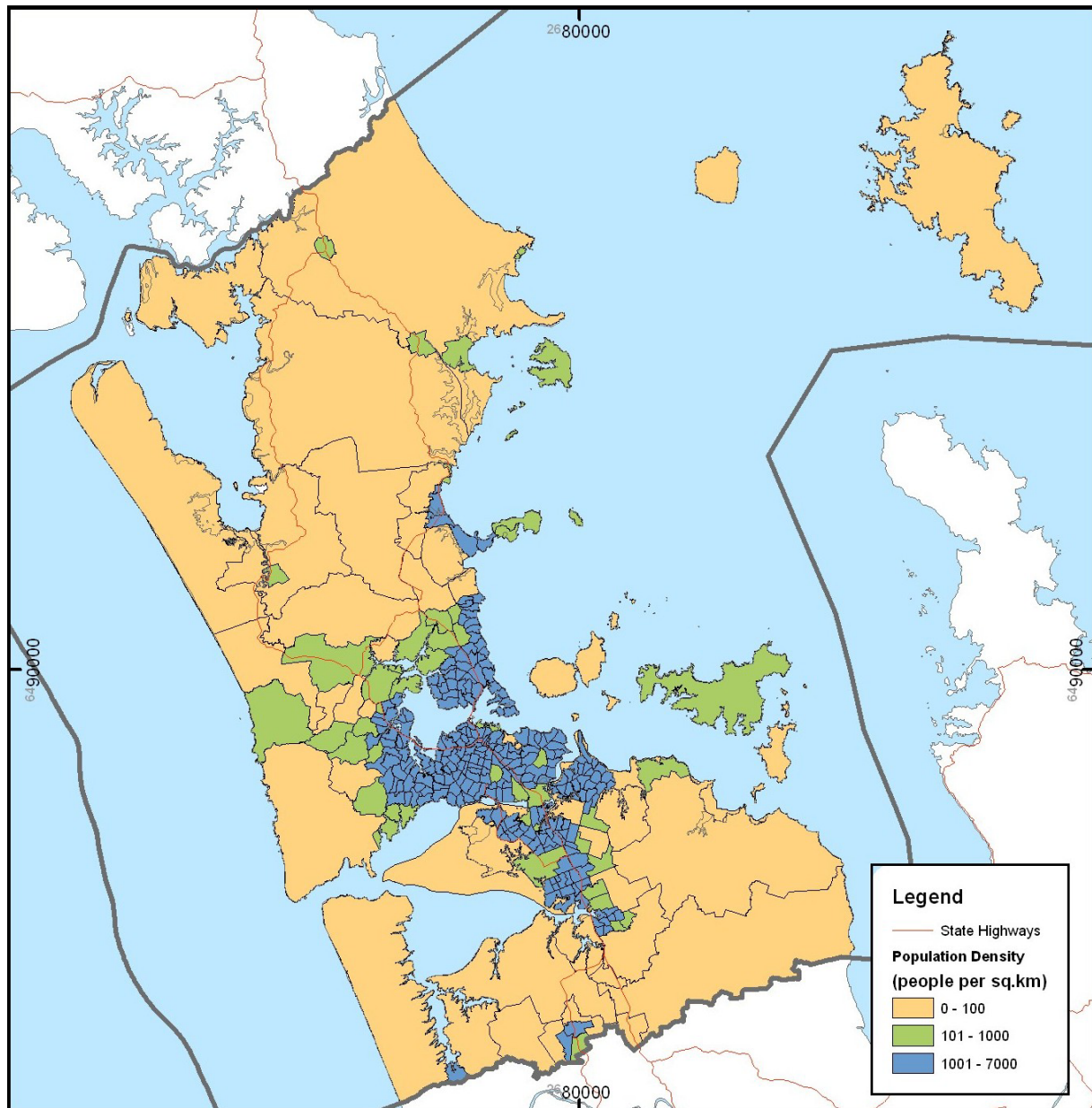


Figure 5 Residential population density (people per square kilometre) for Auckland region based on the 2001 census area units. Brown represents densities below 100, green from 100 to 1000 and blue from 1001 to 7000.

3.3 Warning system end-users and purpose

An issue in the application of warnings research concerns the assumptions that underpin its development. When developing a warning system it is pertinent to ask who it is intended for. For example, is the warning intended for emergency response groups, citizens, or business, or is it intended to reach all sectors of society? Because these groups differ with respect to their needs, expectations, capabilities and objectives. A second question relates to the function a warning is intended to fulfil. For example, is it intended to signal a need for evacuation, or to signal a need for people to stay where they are? Considering this issue

introduces a need to consider not just the warning system but also the intended objectives of a warning and the capacity of its intended recipients to act in the anticipated manner. It is also pertinent to consider what it is that a warning is intended to warn people of. For example, warnings for volcanic hazards cover ash, lava, gas, not to mention the impacts of these hazards on infrastructure, health etc. The effectiveness may require clear understanding of the consequences that people/businesses must protect themselves from. It is thus important to link warnings with the capability to understand the implications of warning and the capacity to act in an appropriate way. Furthermore, given that the distribution of hazard consequences can change with topographic and meteorological conditions, identifying the objectives of warnings, with regard to informing recipients, is challenging.

3.3.1 Spatially varied end-users - Rural vs. City

Urban and rural community populations (high and low population densities, Figure 5) lend themselves to group notification through such means as PA loudspeakers and sirens more easily than rural diffuse populations. There are also locations that have populations that swell at specific times (holiday areas, beaches) and remote populations on the water around the Auckland region. Therefore, more than one notification system is likely to be necessary to reach the majority of the region's population.

3.3.2 Different end-user types

The target audience for a warning can vary greatly, and many people will have different needs and undertake different actions on the receipt of the same warning. Therefore, notification systems and the warnings they disseminate will need to be tailored to the community that is being warned. For example, urban populations are generally less self-sufficient than rural populations and in warnings expect 'someone will take care of it'. Rural populations often have high self-sufficiency and in warnings may have higher awareness of personal responsibility, both in detecting a natural/official warning, and in responding to it. Understanding the make-up of the at-risk population is important in deciding what type of systems are required and how to operate them.

The activities individuals are doing at the time can also greatly affect how quickly they receive a warning and also their response (e.g. are they at home, work or school?; is it a week day or weekend?; are they sleeping, listening to the radio, watching TV or out shopping?). This also needs to be accounted for in the planning and type of notification systems adopted.

Another issue is the spatial and temporal variations in population in high risk zones. Much emergency management planning is based around residential populations; however at times at-risk populations can increase markedly in certain locations (e.g. coastal motor camps in summer, crowds at sports events etc).

Institutional populations

An important group are those in institutions. Institutional populations include schools, hospitals, nursing homes, prisons and other facilities with client populations (this includes tourists). Research has shown that many of these institutions, despite low preparedness, are very adaptive responding to warnings and moving their clients if required (Vogt, 1990). However many difficulties have been encountered highlighting the need for pre-event planning with these institutions (Mileti and Sorensen, 1990; Ronan and Johnston, 2005; Sorensen, 2000).

Elderly and Disabled Populations

Recent research has shown that a number of age-related deficits in the abilities of older adults can potentially impact on their response to warnings (Mayhorn, 2005). Mayhorn highlights that perceptual changes in older adults can impair their ability to notice warnings during the alerting phase whereas limitations in cognitive abilities such as text comprehension and memory might limit understanding in the decision making and response phase. These issues also apply to other disabled groups, as well as issues around physical disabilities. Those responsible for the care of such people need to ensure that appropriate information and support is provided during a warning notification for an appropriate response to be undertaken.

Schools

A number of issues specific to schools need to be addressed in the implementation of an effective warning notification system. All schools in New Zealand are required to have detailed plans on how to respond to a range of incidents and have procedures in place for both evacuation and sheltering within the school. It is important that schools understand the nature and type of warnings they will receive in their local environment and link those closely with their response plans (Ronan and Johnston, 2005). During any warning phase the separation of children from parents and caregivers is a cause of much anxiety. Experience has shown that if schools are in evacuation zones the movement of parents and caregivers to collect children, often moving in from outside an evacuation zone, can cause traffic congestion and hinder the evacuation process (Johnston, Paton, Crawford, Ronan, Bürgelt and Houghton, 2005; Ronan and Johnston, 2005). This needs to be accommodated in the planning process.

Tourists and other transient populations

Research conducted during the last decade has highlighted the difficulty in preparing tourists and other transient populations to effectively respond to warning messages (Drabek, 1996; Drabek, 2000; Leonard, Johnston and Paton, 2005; Leonard, Johnston, Paton and Kelman, 2004; Sorensen, 2000). Issues around lack of knowledge of the hazards, warning systems, evacuation procedures; language and cultural differences and being in an unfamiliar

environment all reduce the effectiveness of warnings. The research highlights the important role of staff training as they most often provide key guidance during a warning notification. Lack of this training has been shown to be a significant issue (Johnston et al., in press).

3.4 Cost limitations

Relative magnitudes of start-up and ongoing cost are estimated in Table 6 for each reviewed option, with the basis explained in Appendix 3. These are based on known examples where available, or are assumed. Table 6 highlights the different cost categories that must be considered.

Table 5 Start-up and ongoing cost considerations for warning systems

	Financial cost	Labour costs (has an associated \$ value for commercial organisations, time for volunteers)
Initial start-up	\$ one-off	Effort one-off
Ongoing (will in total exceed start-up cost at some stage)	\$ per year	Effort per year

In contrast, 'benefit' (reduction in loss, Table 7) is difficult to quantify until a wide range of hazard events have occurred to test the system effectiveness in terms of type of loss.

Table 6 Categories of loss that can be reduced, i.e. benefit

Measurement	Type of loss	
	Direct (Physical damage)	Indirect (Flow-on consequences)
Tangible (Monetary values)	Damage to infrastructure, buildings and contents, vehicles, etc.	Production losses, lost salaries and wages, clean-up costs.
Intangible (Non-monetary values)	Death, loss of memorabilia.	Disruption of social services, incl schooling. Stress-induced illness.

Evaluated exercises conducted on an ongoing and regular basis will provide some estimation of effectiveness in the interim, and can and should be fed back into the system design to continue to increase effectiveness in terms of the cost-benefit relationship.

4.0 AUCKLAND REGION PUBLIC WARNING NOTIFICATION OPTIONS

This section summarises the relative merits of the 26 public notification system options reviewed, and compares these against the requirements for recommending system(s) laid out in Section 1. This section focuses on public notification of warnings, but must be considered in the context of the wider issues and components associated with effective warning and community resilience outlined in previous sections. Notification options are presented in Section 4.6 as a matrix for easy relative comparison, but care should be taken not to rely upon that table alone, as it necessarily simplifies aspects of the systems. More detailed analysis of each option is given in Appendix 3.

The options are summarised and compared under the following five categories:

- Natural warning notification
- Notification via structured organisations and groups to the public
- Notification via institutional staff to those in their care
- Notification to public using third-party organisation hardware
- Notification using warning-dedicated hardware

It is clear that no single system will fulfil all requirements and needs, so the reader should keep in mind a combination of systems when reading these summaries. A combination also provides redundancy in case of individual system failure. The key is the integration of all the systems and resources into one manageable procedure to effect a warning within an identified time period. Any procedures will need to be part of the National Warning System.

4.1 Natural warning notification

Natural warnings may accompany most hazards. For example disturbance and noise in the ocean may precede a tsunami, tremor or ground deformation may precede a volcanic eruption, smoke indicates a fire, etc. Natural warnings should be heeded, not discounted in the absence of an 'official warning'. This is a community resilience issue, and awareness of the potential for multiple warning sources comes with an aware and empowered community (Section 2).

Public education campaigns to promote awareness of natural hazards should include information regarding appropriate response to natural warnings, as well as details of any official notification system(s). Similarly education material associated with an official notification system should include material on the contribution, or otherwise, of any other notification systems, including natural warnings.

4.2 Notification via structured organisations and groups to the public

Using structured organisations and groups with self-maintaining contact networks can be effective if the message conveyed is accurate (seen with Australian flood warnings, Appendix 2). However, they can also easily disseminate disinformation. The initial source of warnings to these groups can be natural or hardware-based (via the CDEM Group or direct).

For this concept to be maximally effective, resilience work is important, raising communities' ability to decide what information is useful, correct etc.. The general process for assimilation of information is positively influenced as community resilience improves. This is especially important for prolonged warning situations such as volcanic eruptions – in this case, for example, media interpretations and dissemination of ongoing messages may result in incorrect information available to structured organisations and groups, as well as to the general public.

Use of these networks is only as reliable as the communication methods which they employ. Loss or overloading of phone lines may render some of these networks ineffective. Reliance on, or expectations of warnings from, these networks by the public may decrease resilience in the event of the network failing, if other complementary notification systems have not been implemented, or are ignored.

Surf clubs, with 1,500 volunteers in the region in 2005, rural fire with over 200 staff² and volunteers on call, St Johns, the Department of Conservation (DoC), Ambulance, Transit and Council staff are all particularly well suited because they have members 'on-duty' at some or all times, and are used to rapid communication across their networks. Appendix 3 includes details of surf lifesaving as a case study.

4.3 Volunteer and community organisations

- Surf clubs
- Neighbourhood support
- Rural fire
- Royal New Zealand Volunteer Coastguard
- St Johns
- Red Cross
- Salvation Army
- 1st response call trees in remote areas (Piha)

² A large proportion of the rural fire staff on call are derived from the Department of Conservation

4.4 Government organisations

- DoC
- Army / defence
- Ambulance
- Transit
- Council staff (operational)

4.5 Notification via large companies and institutional staff to those in their care

In many instances, tourism operators, those in institutional care (hospitals, retirement homes etc.) and those working in large companies (factories, port companies etc.) have an obligation to provide for the safety of those in their care or custody. A list of those large companies/institutions is provided below as an example of where direct notification to them will potentially affect large numbers of people:

- Tourism and hospitality operators, especially for transient populations
- Schools
- Hospitals
- Retirement homes
- Department of Conservation – those using the conservation estate
- Factories
- Port Companies

4.6 Notification to public using third-party organisation hardware

This requires using their hardware and communications systems, which is a reliability, coverage and maintenance issue; it is also potentially a cost-sharing issue. All of these third-parties will also need to commit some level of staff time as well as hardware. Detailed analysis of each option is given in Appendix 3. Development of existing organisation's roles through detailed agreements and planning will probably be the most readily achieved (Police, Fire, Radio, Television). Cell broadcasting, radio and television provide the ability to warn the most quickly, especially if automatic 'break-in' hardware were installed with radio and television (as is required by law in the USA). Pagers, telephone land-line-based systems and SMS systems are limited by the need for a list of contacts to be maintained. High traffic requirements also limits land-line and SMS text message further. Door-to-door route alerts are commonly used overseas, but again only reach a limited number of people per minute.

Systems that rely on end-user hardware, such as websites, radio, phone, email, phone-line messaging etc, will always be limited by the number of users with that equipment and whether they are in a position to be warned by it.

Aircraft have substantial equipment, pilot and craft availability limitations, and billboards would require a substantial time (hours to days) to have any effect. Both of these systems require substantial pre-planning and will probably only reach a minority of the urban and rural populations.

By relying on third-party(s) the CDEM Group would be introducing another 'link' in the warning chain, and consideration must be given to failure of this link. This may be at the stage of communication to the third party, if applicable, or in a failure in planning and/or hardware within that third party.

Warning to end-user groups

- New Zealand Police (mobile PA loud-speakers)
- New Zealand Fire Service (mobile PA loud-speakers)
- Radio and television stations
- Aircraft
- Websites
- Amateur radio
- Billboards
- Travel Advisory Radio
- Call-in phone line
- Radio data systems

Individual end-user receives warning

- Police (door-to-door route alert)
- New Zealand Fire Service (door-to-door route alert)
- Telephone (call lists, auto-dial, telephone trees)
- Pagers
- Cell broadcasting
- SMS text messaging
- E-mails
- Power line messaging

4.7 Notification using warning-dedicated hardware

These systems all notify groups of end-users at one time. Systems which can notify individuals directly are all owned by third part organisations (listed above). Dedicated systems include:

- Sirens
- Fixed PA Loud-speaker announcements
- Mobile loud speakers
- Flares, explosives
- Tone-activated alert radio

Sirens, Fixed PA loud-speaker systems and Tone-activated alert radio have the potential to reach the majority of the population, but cost (quickly reaching millions of dollars) and complexity of the systems (and thus ongoing maintenance and testing; and intensive awareness issues in the case of sirens) are likely to be the major limiting factors.

Sirens are the most commonly suggested form of public notification, however developing understanding and response, and maintenance and testing requirements, make sirens a relatively difficult option to make effective. Existing siren infrastructure provides a valuable complement to other options that can more easily be made effective by themselves. Such sirens already present within the community are also imbedded within the culture and awareness of that community; they have a valuable part to play in supporting warning notification – they should be maintained (with public education and testing) as part of a wider set of systems, not disestablished. However, within a constrained spending environment the provision of new sirens should probably be well down the list of priorities for new expenditure.

4.8 Relative merits of reviewed notification systems

Table 8 is a summary guideline, it should be read in conjunction with the more detailed analysis in Appendix 3 and all options must be considered in the context of effective warning systems and community resilience improvement (Section 2). Both must be read with caution, because more structured work is required to both investigate the feasibility of individual options in detail, and develop the capacity of the community to respond to warnings delivered by these system(s) with appropriate decisions.

Legend to Table 8 (previous page)

MEETS REQUIREMENT?

- ✓ Meets requirement well
- Doesn't meet requirement well
- [Blank cell] Doesn't meet requirement
- ? Uncertain - would require detailed scoping in the Auckland context

SUITABILITY TO HAZARD

- ✓ Suited
- May be suited in longer lead-time situations if system works well and quickly
- [Blank cell] Not suitable
- * Would potentially create inappropriate response
- A Requires a long term awareness and education campaign
- ? Uncertain relationship - would require detailed scoping in the Auckland context

COST

- 0 No cost
- L Low cost (less than \$10k?)
- M Moderate cost (\$10k to \$100k?)
- H High cost (\$100k to \$1M+ ?)
- H! Very high cost (\$10M+ ?)

SOCIAL & INSTITUTIONAL EFFORT REQUIRED

- L Low - fit within existing work load?
- M Moderate - substantial work load increase for one person?
- H High - substantial multi-person

Limitations: System comple(X)ity, (M)eaning awareness, (A)greements required, (E)xposure to public, (L)ist availability, (T)imeframe, external (S)ystem-reliance, (P)lanning, (C)ost, (Tr)aining

Time-range to reach the first end-users and total pool of end-users capable of receiving warning by this notification system: (S)econds, (M)inutes, (H)ours, (D)ays, (W)eeks

Notes for hazard names:

* potential to be exacerbated by climate change

Notes for notification system options:

† May need separate local, regional and/or national level arrangements for events at these different scales,

¹ Assumes free transmission agreement, expensive option for automated 'transmission break-in' system,

² Assumes material costs only (free advertising agreement – possibly feasible for days, but would likely have to pay advertising for longer period warnings), A – Awareness campaign rather than typical 'warning'

4.9 Options compared to review requirements and other considerations

4.9.1 ‘Best practice’

Basing the analysis on examples of best practice from elsewhere in New Zealand and overseas is limited by a lack of ‘best practice’ for all hazard public notification, let alone effective warning systems. This report has highlighted options that have achieved some success here and overseas, and reviews that evidence.

International examples are given in more detail in Appendix 2, but come from:

- Australia (flood warnings, media, telephone and community organisations)
- Hong Kong (mobile phones)
- Japan (Television-integrated messaging, tsunami)
- New Zealand (Sirens, loud-speakers, radio, planning for response)
- Mexico (seismic alert)
- USA (Mainland and Hawaii, all systems summarised above in Table 8)
- UK (Flood alert systems, cell broadcasting)

4.9.2 Public understanding of notifications

The ease with which a public notification system may be correctly understood or interpreted depends on the capacity developed within the community, and the message methodology (Section 2.1.2). Some notification systems make this capacity development easier – especially those that can carry a detailed and hazard/location specific message – sirens score poorly against this criteria.

It is critical to expect and plan for unofficial warnings as well: especially via the media and direct phone calls and personal contact.

4.9.3 Suitability to Auckland hazard context

All of the reviewed options are to some extent suitable to the Auckland hazard context (as summarised in Section 3.2), but those which can be applied in a spatially varied way, and can contain varied and detailed messages lend themselves best to multiple geographically varied hazards and populations that exist in the Auckland region context.

Multiple systems in combination

A combination of systems can realistically be expected to be needed to effectively cover most of the population in most hazard instances. The use of multiple systems also provides redundancy in the event that one or more fails.

Multiple notification systems expected by the public to be active in a single warning may, however, reduce response if one or more fail. Include in education the message that people should respond if one or more system relays a message, or even if natural signs indicate a response is suitable and the official system has not activated at all.

4.9.4 Timeframes for notification options within effective warnings

The time taken by all components of an effective warning system (Figure 1), including the notification system, directly affects the amount of time left for mitigation actions (warning response) to be taken (Figure 6). Therefore, the shorter time-frame notification systems options are most appropriate for the widest range of hazards facing the Auckland region. However, longer lead-time systems are still capable of being effective for hazards with a greater lead-time, and also in reinforcing and providing redundancy for shorter lead-time systems if in combination (multiple systems suggested above).

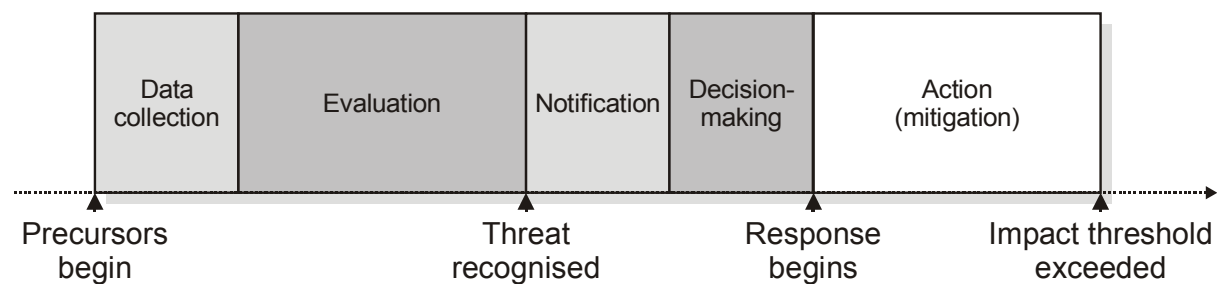


Figure 6 Warning timeline (modified from Carsell, 2004).

Resilience: faster and more appropriate end-user decision-making

The Decision-making step that the end-user goes through also affects their time available for action. Community resilience is important here. The more resilient an end-user is (the more able to expect, understand and act upon warning messages) the faster this decision-making process, the more likely the action taken will be appropriate, and the more time available for this action.

Speed of initial data collection and evaluation

This action time is also influenced by the data collection and evaluation stages within the CDEM Group, and for National Warning System sourced warnings an additional earlier iteration of these two steps at MCDEM level. Therefore the speed and reliability of the early warning system prior to public notification (and thus also the planning, communication and exercising of that system), are as critical to the time available for action as the speed and reliability of the notification system itself.

4.9.5 Ability to apply nationally

The ability to apply recommended notification options consistently throughout New Zealand depends on the appropriateness of the system to the national hazard profile, the capacity of the nation's CDEM Groups to implement it and the capacity for communities to make appropriate decisions and effectively respond. The options recommended here for Auckland are applicable to the nations hazards, because (a) Auckland has identified for review most or all hazards that threaten New Zealand as a whole, and (b) this review has had to consider all

of these somewhat equally because criteria for hazard ranking is somewhat arbitrary even within the Auckland region alone. Capacity of CDEM Groups to implement options is heavily influenced by the cost, complexity and ability to maintain them. Therefore the cheapest, simplest options will be most easily implemented nationally.

4.9.6 Targeting specific geographic audiences

The coverage of some reviewed notification systems could be physically targeted to specific geographic audiences (sirens, loudspeakers, cell broadcast etc.), whereas the remaining options with a single region-wide application (radio, TV, internet etc.) are able to contain area-specific messages.

4.9.7 Cost-effectiveness

Each option reviewed has different cost-benefit parameters (Section 3.4, Appendix 3), making this a highly variable criteria and comparison highly subjective; it is difficult to forecast effectiveness quantitatively for comparison against a system cost. A system cost must include implementation cost, ongoing maintenance costs and effort/labour, and any social costs around the community having capacity to respond to the system (physical impact of presence of equipment, disruption from exercises, level of awareness needed).

4.9.8 Speed of implementation

The level to which systems can be implemented quickly and easily varies, so this requirement could affect the chosen options heavily if it is given a strong weighting. Development of existing notification system options (awareness of natural warnings, media, Police and Fire, volunteer organisation networks) will likely have some improved effectiveness in the shortest time-frame. Effectiveness of these systems should continue to improve with continued and ongoing planning, application, exercising, evaluation and iterative improvement. In the medium term new technologies with very short lead-times, detailed message content, and wide reach may be implemented if they are still seen to be cost effective based on detailed scoping (cell broadcast, tone alert radio etc.). Longer lead-time options with a similar detailed message and varied audiences may also be considered to augment other systems (e.g. websites, email, telephone auto-diallers). Some of the resilience-building initiatives will be very effective in the long term, but are not as fast or technically easy as bolting up hardware. Therefore recommendations are given for three broad time-frames with different, complementary, options and expected outcomes within each.

5.0 RECOMMENDATIONS

Recommendations for public notification of warnings in the Auckland region are made for the short, medium and long term. This allows for (a) some substantial improvement in terms of effectiveness within as little time as one year, (b) detailed cost benefit analysis of potential

new options in the medium term and (c) community resilience improvements that can be seen over decades, rather than years.

Short term (as little as 1 year)

- Develop the potential of existing notification systems within the Auckland region. This requires mostly planning, not expensive new equipment. Any advances here will support and enhance new equipment/systems that may or may not be deemed suitable based on detailed analysis in the medium term (below)
 - Natural warnings
 - Via third-party organisations' staff and hardware: Radio and TV broadcast stations; Police and Fire mobile PA loud-speaker announcements, and/or route-alert door-to-door.
 - Via community/volunteer organisations' existing networks to the public (e.g. Surf Lifesaving, Rural Fire, Neighbourhood support)
 - Via institutions to those in their care (e.g. hospitals, large companies such as ports and airports, tourism, Department of Conservation)
- Develop effective warning components (response planning; communications and discussion; education, maps and signage; exercising; underpinning research and effectiveness evaluation) to respond to this (Section 2). Education includes: maps, signage, printed material (posters, brochures etc.), public meetings, community groups support. Note that exercises also act as education. Education materials should contain: The range of hazards and their timeframes, natural warning signs, official warning channels, warning types and content, existence of multiple, warning channels, and that some may fail, what to do in response to warnings, location-specific information (More details within
- Further investigate and plan for improved resilience, including ability to understand and make decisions upon, and the motivation to act upon, warning messages (refer to the parallel community resilience project underway in the region).

Medium term (1 to 5 years)

- Detailed feasibility analysis of new technologies should be carried out to determine if the cost-benefit is acceptable. Effective response to such systems would require a more resilient community with greater awareness of hazards, warning systems, potential warning messages and appropriate response to them; without this, panic and other inappropriate decisions based on receipt of a warning message may produce a worse response than would occur without implementation of any new technologies. Bimodal population density means group notification may not be the most efficient, or even possible, for rural diffuse-population areas; whereas individual notification may not be as fast or practical for high-density urban areas. The best available new technologies to directly reach the large majority of the population are cell-broadcast and/or tone-alert radio for rural diffuse areas, and these two and/or radio-activated PA loud-hailers for urban areas, but all are cost-limited (see also 'Time-lag', below). This must carefully consider the limitations of hardware warning systems and allow for ongoing costs and

effort required to maintain the system as effective (this must be exercised and evaluated). Suggested options for priority detailed scoping are:

- Cell broadcasting (or similar) – The technology to notify the large majority of the population with a detailed message exists, the best method currently available seems to be cell broadcasting, at this stage of investigation. However, it is noted that cell broadcasting capability is not present in all consumer handsets (see Appendix 3). We recommend a national working group between CDEM Group representatives, MCDEM, communication providers and warning supply agencies to brainstorm this option and other new mobile communications technologies possibly on the horizon. Using existing mobile technologies is likely to be the most cost-effective method of delivering detailed warning messages to the majority of the population.
- Fixed PA loud-speaker announcements are a feasible, fast and effective option for communities that could also be analysed in detail as a priority. The cost is likely to be orders of magnitude higher than using mobile communication technologies. This is not practical for rural diffuse populations, and requires substantial ongoing maintenance and exercise work.
- Tone-alert radio is feasible for all populations, including rural diffuse, but again the cost and complexity is high, and it relies on end-user hardware. Nevertheless, beyond mobile communication technologies it is another technology that would warrant detailed analysis.
- Implement refined methods of improving community resilience that are outcomes of the current resilience project.

Long term (5 to 10+ years)

- Target wider community resilience. Improved resilience reduces the impacts of natural hazards through several community-driven means including, but not limited to, the ability and motivation to receive, understand and make decisions based on early warning messages. Such changes to the awareness motivation of the community take place over decades rather than years.

5.1 Time-lag

The time-lag between initiation of notification and receipt by all available end-users is the critical success factor for a major new all-hazard technology-based system. It needs to accommodate as best as possible short time-frame hazards such as earthquake (seconds – limited implementation in Mexico City, possibly never feasible in New Zealand); and dam failure, tornado, local or regional source tsunami (minutes). The criticality of time-lag means that the time taken to initiate an early warning prior to notification, and for people to respond, should also be a focus of effort by the CDEM Group.

It is unclear whether mobile communications technologies such as cell broadcast can, with full automation of the system, notify all end-users in seconds, but minutes is certainly feasible. Technological advances in the next few years may well improve this. Development of a major dedicated hardware system such as tone-alert radio or fixed PA loudspeakers

may take years, and then in short order be superseded by cheaper and faster mobile communications as the optimum system.

5.2 Implementation

The Group Controller is responsible for ensuring that the following recommendations are implemented. The people listed below will lead implementation, but may require additional support or assistance.

Task	Person Responsible
1 year+	
<i>Consider additions to list of channels that currently exist for warning, starting with those detailed above under: Third party organisations' staff and hardware; Community/volunteer organisations' networks; Institutions with others in their care.</i>	Warning Systems Working Group
<i>Contact and develop protocols with each willing group, including procedure documents</i>	Group Controller
<i>Write effective warning system response planning including operational details to address all aspects of the effective warning system model (Figure 1) for the Auckland Region. Consider effective warning message content requirements (Sections 2.1.2 & 3.2) and planning for the 'all-clear'. Consider the limitations of early warnings (Section 2.1.6). Allow for operation protocols, including message content, trigger situations, etc.. As well as the early warning system itself includes planning and ongoing regular maintenance of the following tasks:</i>	Group Controller
<i>Foster regular communication amongst all people involved in effective warning notification and response. Exercising plays a big part in this, but we suggest additional regular communication building relationships and communicating individual expectations in a warning event.</i>	CDOs
<i>Develop public education, maps and signage as detailed above to improving warning response</i>	Public Education Group
<i>Develop an exercise schedule maximising involvement of all agencies and community, with highest acceptable frequency</i>	Group Controller
<i>Design evaluation of exercises, warning effectiveness and levels of public awareness of hazards and warning procedures</i>	EMO
<i>Evaluate level of underpinning hazard and risk knowledge and plan research programmes to improve this, supporting nationwide research underway where it exists and applies to the Auckland region</i>	ARC
<i>Feed back results to improved protocols</i>	Group Controller
<i>Discuss needs for warning response with resilience steering group and align outputs of both projects, considering warning system end-users and purpose (Section 3.3)</i>	EMO
<i>Push setting up, and participate in, a national working group on mobile communication warning notification</i>	EMO
<5 years	
<i>Review Appendix 2 options and confirm the CDEM Group is in agreement with the recommendation of loudspeaker announcement systems and tone alert radio systems as the two most suitable warning-dedicated hardware options to scope in detail.</i>	Warning Systems Working Group
<i>Contact current operators of loudspeaker and tone alert radio systems and discuss their experiences</i>	National Working Group
<i>Contact and further research hardware suppliers to get a cost basis for these systems that the CDEM Group is comfortable with</i>	National Working Group

<i>Cost regional deployment</i> using on this cost basis and experience from discussions with users of existing systems elsewhere	National Working Group
<i>Decide</i> if either recommended system is acceptable in terms of cost vs. benefit	Warning Systems Working Group
<i>Plan and implement</i> , for any dedicated hardware system deemed acceptable: Purchase and installation Ongoing and regular maintenance of hardware and effective response And all of the tasks from “Write effective response planning...” to “Feed back results of evaluation” under ‘1 year+’ tasks above.	Group Controller and CDOs
<i>Exercise the full warning system</i> (including multiple notification channels) regularly with effectiveness evaluation and feedback to improve response	Group Controller
<i>Maintain</i> hardware and public education regularly and in an ongoing fashion	Group Controller, CDOs and Public Education Group
<i>Implement recommendations from resilience project</i> that relate to improving warning response	CDOs
5+ years	
<i>Exercise the full warning system</i> (including multiple notification channels) in an ongoing regular fashion with evaluation and feedback to improve response	Group Controller
<i>Maintain</i> hardware and public education regularly and in an ongoing fashion	Group Controller, CDOs and Public Education Group
<i>Evaluate resilience indicators</i> that relate to warning response and feed results back to modify the long-term approach to improving resilience in the Auckland Region.	EMO

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7.2 Internet Resources

Several internet resources can be considered broad further reading when considering public notification of warnings. These were all drawn upon in the preparation of this review:

United Nations / International Strategy for Disaster Reduction Platform for the promotion of early warning <http://www.unisdr.org/ppew/>
 Partnership for Public Warning <http://www.partnershipforpublicwarning.org/ppw/>
 Federal Emergency Management Agency (FEMA) library
<http://www.fema.gov/library/dizandemer.shtm>
 First Mile Solutions <http://www.firstmilesolutions.com/>
 Natural Hazards Centre <http://www.colorado.edu/hazards/>
 NOAA Warning decision training branch <http://www.wdtb.noaa.gov/workshop/wdm/>
 Resources on emergency notification and communication (Accessible Emergency Notification and Communication: State of the Science Conference)
[http://tap.gallaudet.edu/Emergency-Resources.htm#Emergency Notification and Communication](http://tap.gallaudet.edu/Emergency-Resources.htm#Emergency%20Notification%20and%20Communication)
 Subcommittee on Natural Disaster Reduction (SNDR) is a Subcommittee of the Committee on Environment and Natural Resources of the *National Science and Technology Council* <http://www.usgs.gov/sndr/>
 UK Emergency Planning College <http://www.epcollege.gov.uk/index.htm>
 UK National Steering Committee: Warning and Informing the Public: <http://www.nscwip.info/>
 UK Resilience Exercise Planners Guide
[HTTP://WWW.UKRESILIENCE.INFO/CONTINGENCIES/BUSINESS/EXERCISE PLANNERS GUIDE.HTM](http://www.ukresilience.info/contingencies/business/exercise_planners_guide.htm)

7.3 People and agencies contacted, and ‘suppliers’ reviewed

Auckland Regional Council (Jane Olsen, Acting Team Leader, Hazards Management)
 ALERT <http://www.alertsystems.org/>
 American Signal Corporation <http://www.americansignal.com/>
 Cell-alert (cell broadcasting) <http://www.cell-alert.co.uk/>
 Common Alerting Protocol <http://www.incident.com/cap/what-why-how.html>
 Commtech Services, Taumarunui (Shane Mail, Manager) (fixed PA loud-speaker announcements – referred to by DoC Whakapapa).
 Department of Conservation, Whakapapa (Peter Blaxter, Programme Manager, Biodiversity & Public Safety)
 Federal Warning Systems <http://www.federalwarningsystems.com/>
 Hawke’s Bay CDEM Group (Lisa Pearce, Emergency Management Coordinator)
 Philipson Smith Ltd., Auckland (sirens), (via Barry Lowe, Western BoP CDEMO)
 Ministry of Civil Defence and Emergency Management (David Coetzee, Emergency Management Planner (Intelligence))
 MetService (Rod Stainer, Manager National Weather Services)
 Neighbourhood Support New Zealand <http://www.ns.org.nz/>
 Natural Hazards Centre, Boulder Colorado (Prof. Denis Mileti, warning message and notification expert, retired/emeritus)
 New Zealand Fire Service (Bill Ellis, Chief Fire Officer, Waitakere)
 New Zealand Police (Senior Sergeant Garth Stockley and senior officer(s), Inspector Brent

Holmes – !still to make contact)

Reverse911 (auto-diallers) <http://www.reverse911.com/>

Royal New Zealand Coastguard
<http://www.iserve.co.nz/users/jois4/nzcoastguard.org.nz/htdocs/>

Rural Fire Service (Nobby Reeki, DoC) <http://nrfa.fire.org.nz/contacts/rfa/doc/auckland.htm>

Surf Lifesaving New Zealand (Dean Storey, operations and services)
<http://www.slsnz.org.nz/>

Tauranga and Western BoP CDEM Office (Barry Lowe, Manager)

Telecom New Zealand (Brian Potter, Manager, New Zealand Business Risk)
<http://www.telecom.co.nz>

Vodafone New Zealand (Alisha Jewett, Leader, Business Continuity)
<http://www.vodafone.co.nz>

Warning systems UK <http://www.warningsystems.gb.co.uk/>

Washington State, USA, Military Dept., Emergency Mgmt. Div. Mitigation Section (George Crawford, Earthquake Program Manager)

APPENDIX 1 — PART 8(60-62) OF THE NATIONAL CIVIL DEFENCE EMERGENCY MANAGEMENT PLAN ORDER 2005

General warnings

60 Objective

- (1) The objective is to issue warnings so that local authorities, agencies, and people can take action to reduce loss of life, injury, and damage.
- (2) Warnings about predictable events (for example, severe weather, volcanic eruption, tsunami) are to be given as quickly as practicable.
- (3) For unpredictable events like earthquakes, where warning is not possible, the objective is to inform emergency response by providing assessments of the likely impact on any affected areas.
- (4) The responsibility for issuing warnings rests with the agency that through its normal function is involved with the identification and analysis of the particular hazard or threat (see Appendix 1).
- (5) Relevant government agencies, CDEM Groups, local authorities, and lifeline utilities must maintain arrangements to respond to warnings.

61 Scope

- (1) Warning systems are to provide warnings about significant hazards with the potential to affect human populations, geographical areas, or social or economic activities.
- (2) This plan does not cover—
 - (a) localised, long-term, or slowly-evolving threats; or
 - (b) the local actions and procedures required to disseminate or respond to warnings.
- (3) The effectiveness of a warning depends on its delivery and receipt, recipients' understanding of what they should do under the particular threats, and readiness and response at all levels.

62 National warning system

- (1) The national warning system establishes a process for the receipt of general warnings and communication of civil-defence-emergency-management related information for warning purposes at all hours by MCDEM.
- (2) MCDEM maintains the national warning system to issue civil defence warnings received from responsible agencies.
- (3) The standard operating procedure under this system specifies the principles and methods for disseminating national warnings.
- (4) National warnings must be provided by MCDEM to CDEM Groups, local authorities, police, certain government departments, lifeline utilities, and certain broadcasters.
- (5) Different hazards require different types of warnings and procedures. The civil defence emergency management hazards for which national warnings may be issued are listed in Appendix 1.
- (6) CDEM Groups are responsible for—
 - (a) disseminating national warnings to local communities; and
 - (b) maintaining local warning systems.
- (7) If arrangements are made with the duty officer of MCDEM, the national warning system is available to issue warnings with respect to hazards for which warning arrangements are decided and maintained by other responsible agencies.

APPENDIX 2 — INTERNATIONAL EXAMPLES

Warning systems have been constructed in many countries for a wide range of events that pose a risk to populations. However, there is considerable variation in methods of notification, costs, effectiveness, monitoring and evaluation. There appears to be little universal guidance as to what constitutes “best practice”. In addition, technologies are advancing rapidly and with recent events such as the 2004 Boxing Day Tsunami in the Indian Ocean and 2005 Hurricane Katrina in the USA, many local and national systems are under review.

This section reviews several examples of warnings systems in place at regional and local levels. Several reviews of national systems are available elsewhere but are not the focus of this report. Systems range from very elaborate, in the case of Japanese tsunami systems, to more simple community-based alerting systems.

A2.1 Japan: Tsunami

Japan has an elaborate tsunami warning system, delivering a range of messages to at-risk coastal populations (Doi, 2002). The table below (from (OEM&ODGAMI), 2001) summarises the system.

Japan Tsunami System – Reproduced with permission from State of Oregon

The Japanese Meteorological Agency (JMA) is responsible for issuing tsunami warnings. There is one main observatory (in Tokyo) and five regional observatories, all capable of issuing a warning. Data is continuously collected using satellites and cellular communication techniques to avoid failures associated with landline and Internet technologies. The goal is to broadcast a tsunami warning less than five minutes from the initial sensing of the earthquake.
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If an earthquake occurs off shore, the observatories close to the epicentre will issue tsunami bulletins to their areas of responsibility. The bulletins will go to the prefectures (similar to U.S. states) through the Local Automatic Data Editing and Switching System (L-ADESS). L-ADESS will also send forecast results (tsunami heights) to the main observatory will issue bulletins to other prefectures and alert other government agencies through the Central Automated Data Editing and Switching System (C-ADESS).

There are three types of tsunami bulletins (warning, watch, information). The bulletins are well defined and are similar to those of the United States Tsunami Warning Centres.
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Ministries and agencies at the national level that contribute to disaster mitigation are linked together in the Central Emergency Management Communication Network (CEMCN). Members of the CEMCN include Ministry of Construction, Tokyo Electric Power, and Nippon Broadcasting Corporation. Once notified by the Japanese Meteorological Agency, the CEMCN transmits tsunami bulletins to their own
--

regional offices. Redundancy is built into the Japanese system, so no one will be missed.

The prefecture receives the bulletin at the same time as the CMCN. The prefecture then transmits the bulletin to the local governments (cities, towns) for action.

The following are local notification methods:

Simultaneous Announcement Wireless System (SAWS)

SAWS is a dedicated system of transmitters and receivers installed by local authorities for all types of messages. The transmitters are located in the local government office and receivers are found in hospitals, schools, fire stations, emergency management offices and other places. Many residents have purchased receivers for their homes, the receivers are activated when a message, such as a tsunami bulletin, is being transmitted. Receiver towers or posts with loudspeakers are also installed on streets and roof tops of prominent government and commercial buildings. SAWS effectiveness is reduced (as much as 15-20% in urban areas) during inclement weather, when people close their windows. There is also an attachment to the telephone that can serve as a dedicated radio receiver. A triggering signal from the broadcast source will turn on the loudspeaker and the SAWS message can be heard. SAWS is known as tone alert radio in the United States.

Mobile Announcer System

This system is designed for those areas without SAWS Fire trucks mounted with loudspeakers cruise their area of responsibility to announce the warning that they receive.

Television and Radio

Tsunami warning announcements have priority to cut into ongoing programs on government and commercial television and radio stations. Stations receive tsunami bulletins from the main and regional observatories by C-ADESS or L-ADESS, respectively. On television the message is either a subtitle on the bottom of the screen or a window. Later, the window has a map where the watch or warning applies. However, the map would not be shown fast enough in the case of a local tsunami. In the case of the radio, an ongoing program is interrupted with the message. This would have more impact than a message on a television screen.



Tsunami warnings shown on Japanese TV.



Sirens and bells

Sirens are found in some villages. The sirens prompt residents to turn on their radio or television for further information. Some villages stick to traditional ways by clanging a bell to announce tsunami warnings.

Telephone network and word of mouth

Some communities have formed telephone networks to spread important information. In some communities, the only way to reach people is by going from house to house. Both methods are time consuming, but are necessary to reach populations that lack the other systems.

Finally, local communities have extensive training, allowing them to respond automatically to tsunami warnings. Tsunami awareness is part of coastal Japan's culture – to the extent that upon sounding a "high level" tsunami warning, the majority of the at-risk population, even if asleep, have evacuated to safe ground within five minutes.

Discussion – elevation of effectiveness

The Hokkaido-Nansei-Oki earthquake on 12 July 2003 produced one of the largest tsunamis in Japan's history. Within 2-5 minutes, extremely large waves engulfed the Okushiri coastline and the central west coast of Hokkaido (pers. comm. L. Kong, 2002). Tsunami warnings were issued six minutes after the initial shock. There were a number of cases of residents ignoring the warnings and this prompted considerable discussion in the media. As an editorial put it "*technological advances cannot save people if they put themselves in harm's way after a tsunami warning is issued.*" It was reported that some people walked on bridges near the mouths of rivers and went to ports to check their boats immediately after the earthquakes.

A2.2 Mexico: Seismic alert

A Seismic Alert System (SAS) operates in Mexico City to alert the population to the arrival of earthquakes (Lee & Epinosa-Aranda 2002). The system was introduced following the tragic 1985 earthquake and provides around seventy seconds warning before the arrival of seismic waves. The September 1995 activation warned over 4 million following the M7.3 "Copala" earthquake with warnings broadcast at public schools, on AM/FM radios, and a housing complex. In addition the warning was received by the Subway Metro command centre who received train speeds (Lee & Epinosa-Aranda 2002). Such system highlights the possible use of technology for providing rapid near-real time warnings.

A2.3 USA: All hazards

The City of Seattle has recently upgraded the warning system and this provides a good example of a modern audible warning system within an urban area. The table below summarises the system.

Seattle Audible Warning System

Reproduced from: (<http://www.seattle.gov/html/citizen/audiblewarningga.htm>)

The Audible Warning System is an all-hazards system that can be used by first responders (police and fire) to warn the public via a broadcast message of any life-threatening hazard that can affect their safety. The current system has towers with tone alarm and public address equipment installed at the following three locations: Cruise Ship Terminal 30, Fire Station 5, and Myrtle Edwards Park.

Citizens should know that before a message is broadcast, strobe lights will activate from the towers and an audible tone to get peoples' attention will be followed by a succinct verbal message that will give specific instructions on immediate actions people should take related to the specific hazard.

What is the Audible Warning System?

The City of Seattle is committed to making Seattle the most-prepared city for disasters, and continues to strengthen its preparedness capabilities. The Audible Warning System complements other systems that the City first responders have to notify the public about hazards, such as the Community Notification System, the Emergency Alert System, as well as the announcement capability that police and fire personnel have from their vehicles.

The Audible Warning System is a way to broadcast public safety messages to notify large gatherings of people outdoors of any life-threatening hazard that can affect their safety. The system is targeted to reach crowds that regularly congregate at Cruise Ship Terminal 30, Colman Dock and Myrtle Edwards Park on the Seattle waterfront.

What kinds of emergencies is the system designed to warn against?

The Audible Warning System is an all-hazards system that can be used to warn the public of any life-threatening hazard that can affect their safety. This may include any number of types of hazards, such as a gas leak, fire, earthquake, radiation, tsunami, bomb, chemical hazard, biological agent, radiological hazard and others.

How does the system work?

Should a life-threatening hazard be detected by first responders, they would notify the City's Emergency Operations Center (EOC) about the need to utilize the Audible Warning System. The system is activated from the EOC.

Before a message is broadcast, strobe lights would activate from the towers and an audible tone to get peoples' attention would be followed by a succinct verbal message that will give specific instructions on immediate actions people should take related to the specific hazard.

To reach everyone who may be affected, there could be other systems such as the Emergency Alert System (EAS) and the City's Community Notification System used in conjunction with the Audible Warning System to gain total coverage people outdoors, indoors and in vehicles.

Who determines when the system is used and activates the system?

The system will be activated whenever a life-threatening hazard is detected by first responders and it is determined that people in the surrounding area need to be notified in order to protect their safety.

First responders then notify the City's EOC about the need to utilize the Audible Warning System. The system is then activated from the EOC, where it is monitored by Seattle Police Department and Emergency Management staff housed in the City's EOC.

At the EOC, Emergency Management staff can assess the situation, gather the best information from all City departments and choose appropriate messages to be either broadcast using the Audible Warning System or using a combination of systems.

Regular tests of the system will be done silently and audibly to ensure that the system is functioning.

Where did the money come from to pay for this system?

Financial resources to fund the Audible Warning System came from three sources. The majority of the money (\$179,000.00) was from an Urban Area Security Initiative grant from the Department of Homeland Security. The second source (\$90,000.00) was from a National Oceanic Atmospheric Administration tsunami grant via the Washington State Emergency Management Division. Another \$6,000.00 was provided by the Washington State Emergency Management Division to pay for portions of the system at Fire Station 5.

What should people expect to hear during an emergency?

A loud tone followed by a voice message giving instructions.

Where are the locations of the Audible Warning System towers?

Cruise Ship Terminal 30, Fire Station 5, and Myrtle Edwards Park.

Why were the locations chosen for the three sites?

These three sites were chosen due to the large number of people who congregate outside on a regular basis and the variety of hazards that could occur along Seattle's waterfront.

Are there plans to install more Audible Warning Systems throughout the city?

The funding for the Audible Warning System initially covered enough for the installation at three sites. The system is designed to be easily expanded as money becomes available to cover other critical areas.

Depending on the funding, Phase II of the system would examine choosing additional locations for the system where large groups of people gather outside. Phase II would also include adding activation equipment at the 911 Call Center and Fire Alarm Center to enable them to make announcements from their locations.

Are there other ways the city is looking to use new technologies for emergency management?

We are always exploring new technologies to help make Seattle the most-prepared city in America. Currently we use a variety of communications tools, such as phones, cellular phones, blackberry devices, 800mHz radio, 450 mHz radio, ham radio, email, web-based systems, the Emergency Alert System, Community Notification System, and the new Audible Warning System.

All police vehicles and fire engines and trucks are equipped with on-board computers.

In addition, the EOC is introducing a new earthquake warning system called Shakecast / Shakemap that can tell us specific areas of the city that have received the strongest ground shaking and thereby indicate where the most severe damage exists.

A related modeling tool (HAZUS) that can predict the extent of damage from any destructive threat is under development and should be ready when the new EOC opens in 2007.

The City is also planning to install state-of-the-art multi-media technology in the new EOC to help collect and analyze critical information in order to respond to the public's needs immediately. This new technology will also help us communicate easily with King County, the State of Washington and the federal government during an emergency.

Reproduced from: (<http://www.seattle.gov/html/citizen/audiblewarningga.htm>)

A2.4 USA: Tsunami

The states of Oregon, Washington and California contain various notification systems and procedures for tsunami (Crawford, 2005b; Darienzo, Aya, Crawford, Gibbs, Whitmore, Wilde and Yanagi, 2005). These systems range from advanced siren and audible alarms to community response systems with little hardware. Nevertheless, once they receive the tsunami warning from the WC/ATWC (West Coast/Alaska Tsunami Warning Centre), they all issue a local evacuation notification over whatever system they have. The table below outlines the standard procedures that take place. (from OEM&ODGAMI, 2001).

Oregon, Washington and California tsunami warning system

Reproduced with permission from State of Oregon

Warning is created and disseminated.

The WC/ATWC issues a tsunami warning through its standard notification protocol. This includes distribution of a text bulletin through NOAA Weather Wire Service (NWWS) and a verbal notification, for state warning points via the National Warning Service offices immediately receive the text warnings.

Response agencies receive and further disseminate the warning.

State emergency management agencies receive the bulletin via NWWS and rebroadcast over state owned teletype systems, e.g. Law Enforcement Data System (LEDS) in Oregon. They also receive a verbal notification directly from WC/ATWC via NAWAS. Once the text bulletin is received, the state agency makes verbal notification to local jurisdictions via NAWAS, telephone, or other communication systems.

Local agencies receive the warning

Local jurisdictions on the coast receive a hard copy of the warning via the state-owned teletype system, typically within about 3-4 minutes from when the state receives the message. Local jurisdictions most often receive these bulletins at 911 centres where NAWAS equipment would be ideally located. However, not all coastal 911 centres have dedicated NAWAS drops, although there is usually one per coastal county.

Very few local agencies receive warning bulletins independent of the state-owned teletype. However, NWWS and a similar wireless system known as EMWIN, are available at moderate or very low cost. Both are satellite-based and require no landlines or telephone connections.

Warning goes to the general population

The general public can receive an audible voiced warning directly from NOAA Weather Radio and the Emergency Alert System (EAS). Local NWS offices maintain a network of NOAA Weather Radio stations that continuously broadcast weather forecasts and special warnings along the West Coast. In Oregon, approximately 70% of the at-risk population are within range of one of these transmissions.

NOAA Weather Radio transmission of the Tsunami Warning will activate alarms on specially designed receivers. Similarly, the EAS system receives the warning from NOAA Weather Radio and can automatically rebroadcast the message over commercial radio, television, and cable TV systems. All radio and television stations and cable systems with at least 10,000 subscribers are required by the FCC to have EAS equipment installed and functional. Commercial broadcast of state and local warnings, including tsunami warnings, is voluntary. However, if the local EAS plan specifies that a particular message type requires activation of EAS, broadcasters must either carry the message or go off the air. A community relying on EAS must be vigilant about encouraging broadcaster participation, periodic testing, and maintenance of complementary public education program.

Local action is directed by designated authorities

Communities may choose to evacuate on receipt of a tsunami warning. However, this would likely be problematic and lead to a perception of over-warning. In nearly all communities, at least some part of the warned area will not be affected. Local officials can use the EAS system, sirens, telephone calls, or other means to give explicit evacuation directions, or other pertinent instructions, following the warning.

A2.5 Hawaii: Tsunami (modified from Gregg, Houghton, Paton, Hamnett and Johnston, (submitted))

The sirens in Hawai'i were installed as a network of pole-mounted sirens in populated coastal and inland areas following the 1946 tsunami (Gregg, Houghton, Paton, Hamnett and Johnston, (submitted)). Historically, there have been frequent modifications to the siren system because of technical issues and changes in the philosophy of use. A siren signal specific to tsunami existed between 1960 and 1966, but the signal was changed in 1967 to an Attention Alert Signal linked to all major emergencies. However, this excluded enemy attack, which retained a distinct signal. Between 1960 and 1967, researchers discussed the need for clarification of public response to the tsunami siren signal. The switch from a hazard specific tsunami siren signal to an Attention Alert Signal for multiple hazards meant people would need to tune to a radio station to receive information about the type of emergency occurring, such as tsunami.

Currently there remains one siren tone the "Attention Alert Signal", which is a steady 3-minute tone. The current siren system has been most commonly used for tsunami and hurricanes and was last used to warn of a hurricane in 1992 and a tsunami in 1994. Hawai'i has 168 fully functional electronic sirens, 166 additional sirens that need further upgrading, and 167 areas with gaps in coverage. The network of sirens supplements the Federal Emergency Alert System, which disseminates messages over radio, television and cable television. Civil Defence messages, such as those to evacuate, also may be disseminated through police, fire department, civil defence, and civil air patrol aircraft. If sirens are sounded, messages informing the public about the reason for activation of sirens are activated.

Discussion of effectiveness of Hawaiian system

The 22 May 1960 tsunami swept across the Pacific from Chile, and despite at least 10 hours warnings and sirens sounding four hours before, 61 people were killed in Hilo, Hawaii. Post-event research showed that public understanding of the meaning of the siren was very low — about 5% understood the meaning of the siren (Lachman et al., 1961). In addition, a number of people who initially evacuated returned to areas later affected by the tsunami after the first two waves had arrived believing the worst was over, only to be affected and in some cases killed by a third larger wave (Dudley and Lee, 1998).

The 1986 tsunami generated in the Aleutian Islands prompted issuance of a state-wide tsunami warning in Hawai'i. Evacuations efforts resulted in thousands of people being moved inland. However, this event was also marked by major traffic jams and a "solid line of traffic" heading towards the beach. In many areas residents and business people refused to leave (Dudley and Lee, 1998). A review of the event made suggestions on improving the evacuation zones, communications systems and the role and responsibilities of various government agencies (Dudley and Lee, 1998).

The 1994 Shikotan tsunami also resulted in a state-wide tsunami warning in Hawai'i, resulting in thousands of people evacuating (Dudley and Lee, 1998). A number of lessons from the 1986 response had been taken on board in the planning and partly due to the timing of the warnings in the early morning, much of the traffic congestion observed in 1986 was avoided. Some non-compliance to evacuation orders was observed but this was not widespread. A number of problems with the siren system were identified and this highlights the need for continual improvement of systems following testing and real activations.

Recent work by (Gregg, Houghton, Paton, Hamnett and Johnston, (submitted)) found that there remains some uncertainty in the level of public understanding of the sirens and their implications for behavioural response. The study showed that amongst Hawai'i residents awareness of the siren tests and test frequency is high, but these factors do not equate with increased understanding of the meaning of the siren, which remains disturbingly low (13%). Furthermore, the length of time people have lived in Hawai'i is not correlated systematically with understanding of the meaning of the sirens.

A2.6 Australia: Flood warnings

In many rural New South Wales communities flooding is a significant hazard and flood warnings are disseminated by the State Emergency Service from information provided by the Bureau of Meteorology. Flood information and warnings are broadcast by local radios and are supplemented by door-to-door knocking by SES volunteers and police when evacuations are required. Police often use loud hailers on cars to disseminate warnings. The effectiveness of these systems has been under review in recent time (Handmer, 2002; Pfister, 2002) due to the often low evacuation compliance. In the review of the 2001 Grafton floods in New South Wales (Pfister, 2002) around 97% of residents surveyed reported hearing the flood warning and evacuation order, however only around 18% complied with the request to leave.

A2.7 Hong Kong

Six million SMS messages were sent over a period of hours, but didn't reach all users (<http://www.wired.com/news/business/0,1367,58334,00.html>).

Other information pending

A2.8 Singapore

Information pending

A2.9 UK

The cell broadcast concept is currently in juvenile stages via Cell-alert (<http://www.cell-alert.co.uk/>)

Other information pending

APPENDIX 3 — ANALYSES OF PUBLIC NOTIFICATIONS SYSTEMS

A3.1 Notification via natural warnings

Limitations	Awareness of meaning, exposure of natural warnings to the public, timeframe for response given natural warning, planning, informing and motivating suitable response.
Time-frame	Seconds to hours
Cost basis	Development of community resilience (capacity, intention and action) through education and other interventions (see parallel resilience project underway).
Cost (all areas)	Startup: depends on method Ongoing: methods and evaluation
Areas suitable	All
Not suitable	None
Hazards	Possible for all hazards, but suits those with distinct signs giving adequate lead-time for response (i.e. better for near-source tsunami generated from felt earthquake, than for far-source tsunami where the sign, sometimes absent, is disturbance in the water seconds to minutes before impact)
End-user(s)	Residents and organisations, more difficult for visitors/tourists – see warning via institutions to those in their care (below)

A3.2 Notification via institutional staff to those in their care

Limitations	Communications channels to institutions, planning and exercising within those organisations, only reaches those under care of organisations who receive and act on warning
Time-frame	Minutes to hours
Cost basis	Development of staff training and resilience (capacity, intention and action) through training, education and other interventions (see parallel resilience project underway).
Cost (all areas)	Startup: depends on method Ongoing: training and evaluation
Areas suitable	All
Not suitable	None
Hazards	Possible for all hazards, but very difficult to make effective
End-user(s)	Those in institutional care – hospital patients, staff of major institutions, port companies, visitors/tourists etc.)

Acts to warn tourists and those in institutional care (hospitals, retirement homes etc.) and those working in large companies (factories, port companies etc.). In many instances these institutions have an obligation to provide for the safety of those in their care or custody. These institutions include:

- Tourism and hospitality operators, especially for transient populations
- Schools

- Hospitals
- Department of Conservation (DoC) - little estate in Auckland region. Great Barrier Island has four campgrounds, with staff in summer. Reasonable proportion of island in estate. Rangitoto has staff at the campground year round. DoC has a 24/7 duty officer, which would be the first point of contact in CDEM warning.

A3.3 Notification via structured organisations and groups to the public

Limitations	Hardware (e.g. telephone) relied upon, contactability of members, potential to disseminate disinformation	
Time-frame	Minutes to hours	
Cost basis		
Cost (all areas)	Startup:\$0, but effort and planning	Ongoing: plans, exercises
Areas suitable	All, particularly helps rural communities and diffuse areas	
Not suitable	None	
Hazards	Possible for all hazards, but may not suit very short time frames	
End-user(s)	Residents and organisations and any visitors/tourists members are in contact with	

Surf clubs, with 8,300 volunteers in the region in 2005, rural fire with over 200 staff³ and volunteers on call, St Johns, the Department of Conservation (DoC), Ambulance, Transit and Council staff are all particularly well suited because they have members 'on-duty' at some or all times, and are used to rapid communication across their networks.

Volunteer and community organisations include:

- Surf clubs - Northern region Volunteer Lifeguard Service Summary 2002 – 2003, total Lifeguards in region 1,500
(http://www.lifesaving.org.nz/about_slsnr/statistics.php)
During summer there are 65 paid lifesavers who work a 40 hour week, Mon-Fri work hours, with 7 year round permanent staff at Auckland main office. Their regional radio network is privately owned with multiple repeaters. It is based out of the marine rescue centre, Mechanics Bay, where surf lifesaving share a communications centre with the coastguard (who work 24 hours a day, and cover surf lifesaving radio outside of standard hours). They are currently half-way through a complete upgrade of the radio system for about \$0.5M. Some repeaters are completely solar, some battery, and some mains with likely battery backup. At first enquiry there would be no problem with a new warnings notification procedure added to the operations manuals. Each of the 17 locations have an emergency call-out team, with lists updated by the locations kept at the communications centre.
- Neighbourhood support
- Rural fire - 150 volunteers, +40 staff in other organisations. Most or all call-out systems pager-based, 24/7. Some may use sirens – Great Barrier likely does. Community

³ A large proportion of the rural fire staff on call are derived from the Department of Conservation

volunteer brigades, and their equipment/vehicles/sirens come under NZFS. All appliances have PA systems

- Royal New Zealand Volunteer Coastguard
- St Johns
- Red Cross
- Salvation Army
- 1st response call trees in remote areas (Piha)

Government organisations include:

- Department of Conservation (DoC)
- Army / defence
- Ambulance
- Transit
- Council staff (operational)

A3.4 Third-party hardware (and staff): Aircraft hailers/banners

Limitations	CAA Regulations (flight path and equipment certification; Tauranga states that the latter is not required if carried on cargo hook), Agreements with operations, craft and pilot availability, limited coverage - prioritise	
Time-frame	Minutes to hours	
Cost basis	Equipment and flight costs for one craft	
Cost (for each craft)	Startup:\$20k+ effort and planning	Ongoing: \$5k+ in event, planning and exercises
Areas suitable	All – better for remote areas with some population clustering	
Not suitable	None, but less effective per minute over rural diffuse populations	
Hazards	All hazards (difficult to mobilise for warning times of a few tens of minutes)	
End-user(s)	All within audible range (not the deaf, unless carrying visual warning banner and seen)	

A3.5 Third-party hardware (and staff): Amateur radio

Limitations	Exposure only to radio users	
Time-frame	Seconds to minutes	
Cost basis	Single transmitter – repeaters may be needed	
Cost (urban)	Startup:\$5k+, planning end-user-development	Ongoing: End-user development, exercises
Areas suitable	All (especially remote diffuse populations)	
Not suitable	None	
Hazards	All hazards	
End-user(s)	All within audible range (not the deaf)	

A3.6 Third-party hardware (and staff): Billboards

Limitations	Time to erect, exposure only to those who view message	
Time-frame	Hours to days	
Cost basis	Single billboard	
Cost (urban)	Startup:\$5k+ (printing)	Ongoing: \$5k+, planning
	planning, agreements	
Areas suitable	All, for longer time-frame hazards this can reach people in both high and very low population density areas	
Not suitable	Rural areas with diffuse populations	
Hazards	All hazards	
End-user(s)	All that pass billboard and can see it (not the blind)	

A3.7 Third-party hardware (and staff): Call-in phone line

Limitations	Lines available, congestion, access to phone, awareness of system, awareness of hazard and need to call	
Time-frame	Minutes to days	
Cost basis	100 lines, plus hardware	
Cost (all areas)	Startup:\$20k+	Ongoing: \$20k+/yr and testing
	awareness effort	awareness effort
Areas suitable	All	
Not suitable	None	
Hazards	Hazards with hours or more-suitably days of lead-time, and with a primary system to have notified the existence of a risk	
End-user(s)	All with access to a phone (can operate for disabled if special telephony catered for)	

A3.8 Third-party hardware (and staff): Cell broadcast

Limitations	Technology implementation cost and feasibility (Vodafone and Telecom), new Telecom phones needed that can receive broadcasts. System reliability and capacity, complexity of system to initiate broadcast	
Time-frame	Minutes to hours (apparently untested internationally at the moment, but theoretically can get down to few minutes to tens of minutes)	
Cost basis	New technology and development estimates only (no running/use costs)	
Cost (whole country)	Startup:<\$1M Vodafone,	Ongoing: Depends on
	agreement	
	unsure Telecom, programming	maintenance cost,
	planning and agreement	testing and exercising, end-user
	end-user awareness develop.	awareness maintained

Areas suitable	All with mobile coverage (can be region/area specific)
Not suitable	Areas with no coverage
Hazards	All hazards
End-user(s)	All with mobile phone

A3.8.1 Telecom SMSCB

(CDMA standard)

Short Message Service Cell Broadcast (SMSCB) appears to be ideally designed for warning message notification. It is efficient for network resources and the Telecom CDMA has basic support for the feature in New Zealand. Very few handsets have this capability, so a number of years of handset 'churn' (replacement) would be required for capability to reach most or all phones.

A3.8.2 Vodafone Cell Broadcast

(GSM standards GSMTS 3.41 and 3.49, some common standards with CDMA under recent 3GPP partnership include 3GPP TS 3.41 (Appendix 5))

Cell broadcast standard has basic support for two types in New Zealand: (1) customers subscribe (unused at the moment) and (2) cell site domain (e.g. 'Wellington CBD' on the main screen of a Vodafone phone).

Type 1 limitations initially identified:

Don't use but is compatible with system; could be a fair amount of work (equipment and especially programming and system development). A very cursory estimate from Vodafone suggests that about \$500k of equipment would needed to be added at a national level. Other limitations are unknown at this stage.

Type 2 limitations initially identified:

Doesn't beep. Limited number of characters on screen: 11 on old phones, about 36 on new phones. Will arrive within 30 minutes to first people because it takes time to put into systems, plus there are currently call in and set up delays as there is no formal arrangement here.

A3.9 Third-party hardware (and staff): E-mails

Limitations	Exposure only to those with and connected to email, relies on internet and related hardware systems, maintenance of email list, timeframe to emailing region.	
Time-frame	Minutes to hours	
Cost basis	Free national emails, internet hardware in place	
Cost (all areas)	Startup:\$0, list development	Ongoing: list maintenance, awareness

Areas suitable	All with internet access
Not suitable	No internet access
Hazards	All hazards for those connected to internet, delays in email delivery may exclude hazards with minutes of warning time
End-user(s)	All with and attached to email

A3.10 Third-party hardware (and staff): Pagers

Limitations	Exposure only to those with pagers, time to initiate/send and transmit pages, list of pager numbers needed, relies on third-party hardware, system coverage
Time-frame	Minutes
Cost basis	Depends on volume of pages and agreement with carrier
Cost (urban)	Startup: may be free, list Ongoing: \$variable in event, development, agreements, list maintenance, testing
Areas suitable	Areas within range
Not suitable	Areas not within range
Hazards	All hazards
End-user(s)	Those with pagers in range

A3.10.1 Third-party hardware (and staff): New Zealand Police and Fire Service – mobile PA loudspeakers

Limitations	Available staff and equipment, deployment times, planning
Time-frame	Realistically 30 minutes or more, theoretically a few minutes
Cost basis	Planning and prioritising existing Police roles
Cost urban	Startup:\$0, effort and planning Ongoing: planning and exercises
Cost rural communities	Startup:\$0, effort and planning Ongoing: planning and exercises
Cost (rural diffuse)	Possibly not feasible (focus limited resources to higher population densities)
Areas suitable	Urban and rural communities, coastal strips
Not suitable	Expansive rural areas with diffuse populations
Hazards	All hazards, but response will take minutes
End-user(s)	All

Both the Police and Fire Service are a CDEM Group member, but the people and hardware used are not specifically part of the Group plan as a public notification system. However, there is a common expectation (of Fire, Police and other Group members) that they will be part of most, if not all, public notifications.

A3.10.2 New Zealand Police

This summary results from discussion with Senior Sergeant Garth Stockley, and verification by his senior officer.

There are three primary policing districts within Auckland region:

1. North Shore /Waitakere/ Rodney (NSWR) policing district;
2. Auckland City policing district; and
3. Counties Manukau policing district,

In addition there is the Auckland Motorways (including the Traffic Alcohol Group) under auspices of the NSWR District and an Auckland Metro Crime District (AMCOS) encompassing specialist operations sections (i.e. Dogs, Air Support, Armed Offenders etc).

The 'districts' are overseen by a District Management team lead by a District Commander (Superintendent) and Area Controllers (Inspectors). The wider Auckland Metropolitan Area is 'co-ordinated' by the Auckland BOM (Board of Management) comprised of the three district commanders supported by an Administrative Officer and staff. The national Police command is the next level of management above this.

There is a modest amount of experience in emergency management across Metropolitan Auckland. There is little experience for most staff working on broader multi-agency events, with most staff generally dealing with low-level short term events within each district working on a single event, or working across multiple districts on mostly Police controlled or managed events; although there have been large scale events of national significance run in Auckland (APEC, CHOGAM etc.) in a quasi-multi-agency approach.

Experience and/or knowledge in natural hazards or technological hazards or related events are low although the Asian Tsunami created some opportunities to gain such experience.⁴

⁴ MCD Review of Police Operations during 2004 Manawatu Floods revealed shortcomings in the Police response, emphasising how staff resources were exploited and exhausted early on and that there was limited scope for relief.

A3.10.3 Resource example - NSW District

There are about 22 Police bases within the NSW district, including two 24/7 Stations with 24 hour coverage provided in Rodney. This district has a total of 624 staff across policing and traffic and related functions. About ¼ of these are on duty during an average weekday, and half of that, at night (1/8 of the total staff on duty at night).

During an average day up to 50 units (vehicles) are distributed across the NSW district, so the total number of units in the region might be between 75 and 100, with half (or less) as many at night. Some units are two-person, some are one-person and most of the vehicles have public address systems as part of their patrol warning systems, particularly on 'marked' vehicles.

Public warning notification

These 'on-duty staff' also have six other statutory planned roles, besides "dissemination of Civil Defence warning messages" (Table 9). Warning notification is one of the first four roles (1.1 to 1.4) that could be expected to be operational at all times, even during a very short warning time-frame. For this reason G. Stockley estimates that only about half of the already 'on-duty staff' would be able to be made available for warning notification (between 25 and 50 cars during the average day across the region)⁵

Table 8 **Police roles in civil defence emergencies (from NSW district Policing plans) Police in Civil Defence Emergencies**

1. Police responsibilities:
1.1 Participate in the dissemination of Civil Defence warning messages in accordance with instructions for Civil Defence warning systems maintained by the Ministry of Civil Defence. (Readiness ⁶)
1.2 Maintain law and Order (Readiness and Response)
1.3 Deploy and control Emergency Police volunteers as required. (Probably no longer exist)
1.4 Take all measures within their power and authority to protect life and property. (Response and Recovery)
1.5 Facilitate movement of rescue, medical, fire protection and other essential services. (Readiness and Response)
1.6 Facilitate the registration and identification of casualties. (Response and Recovery)
1.7 Arrange for the identification of the dead. (Response and Recovery)

Call-back of staff to duty

Off-duty officers that are able to be contacted by mobile and/or landline could be brought in

⁵ This is to allow for the BAU (Business as Usual) component to be left out of additional operations

⁶ Indicating the 'action' as per CEM (Comprehensive Emergency Management)

to active duty within approximately two to four hours. (This is speculative as it has not been tried recently) It is estimated that (a call-back) this could up to double the on-duty force (theoretically), and thus double the number of vehicles on the streets (assuming enough vehicles exist: 100-200 vehicle available pool would be needed)⁷.

G. Stockley suggests that putting up to 3 or 4 officers in each vehicle may be better than separating out to 1 per vehicle, allowing officers to be dropped off and door-knock. (Police staff generally work as part of a section or squad of an NCO plus 4 to 6 staff). Refer to Scanlon's book on Mississauga Evacuation by the Peel Regional Police Force for some guidance on this.

Due to the above summarised tightness of police resourcing, not all communities, let alone rural areas ⁸, could be covered within a few hours. Planning for prioritisation for each hazard scenario⁹ is therefore essential. Police public alert cannot, therefore, be the only form of public notification of warnings for the region, but could be targeted to have a significant effect in key populated areas.

For the purposes of distributing an evacuation warning or pre-empting the impact of a hazard by giving any other such warning, the giving and distribution of 'warnings to move etc' would need to be a multi-agency co-ordinated approach particularly in the development of plans for an evacuation.

Also consideration needs to be given to the 'presentation' to the persons giving the warning i.e. person appearing to be in authority, preferably say someone in uniform or from a known and recognised agency rather than say 'someone in plain clothes with an ID card'. The delivery of the warning via the media perhaps should be given by an authorities based media organisation i.e. a known and respected TV personality (if there is such a thing nowadays), or radio broadcaster etc.

A3.11 New Zealand Fire Service

This summary of capability is based on a discussion with Bill Ellis, Chief Fire Officer (CFO), Waitakere. Approximate Waitakere statistics are quoted here to provide an indication of resources available.

Most fire-response vehicles, but not all, have PA loud-speakers installed. There are about 35 vehicles in Waitakere. CFO and Deputy CFO cars' sirens can be modified for PA for about NZ\$10, but not all are at this stage.

There are about 540 NZ Fire Service officers in the Auckland region, with a total pool of about 45 in Waitakere. Eight of these are at the two 24/7 operated stations, and a further 8

⁷ A moot point, if the keys for all vehicles could actually be located

⁸ particularly on the coastal margins

⁹ Any hazard that has a warning time i.e. long onset v short or sudden onset: Tsunami, flooding, volcanic eruption etc

across two more day crews. There are a further 8 volunteer chiefs in Waitakere, some of which operate sirens for call-up of staff; however siren time-of-day lockouts operate on some of these to avoid community disturbance at night.

Call back of staff to duty

The NZ Fire Service call-back system is more often used than that for the Police, so is more regularly tested, verified and updated. It contains contact details for next-of-kin phone numbers to increase the likelihood of reaching off-duty officers. There are likely to be about 130 paid fire staff on duty in the region at any one time, and this might be able to be more than doubled within only one hour; the first off duty call-backs would begin arriving within minutes.

A3.12 Third-party hardware (and staff): Power line messaging

Limitations	Hardware to transmit and receive messages available but not implemented in New Zealand. Agreement with carrier, relies on third-party power network, Exposed to only those with a receiver and near that receiver	
Time-frame	Seconds to hours (apparently untested technology for this purpose – is used for internet overseas)	
Cost basis	Further research would be needed to look at the feasibility and cost structure for New Zealand	
Cost (all areas)	Startup: \$M potentially	Ongoing: unknown
Areas suitable	All with mains electricity	
Not suitable	Those without mains electricity	
Hazards	All hazards	
End-user(s)	All near receiver on mains electricity	

A3.13 Third-party hardware (and staff): Radio and TV stations

Limitations	Planning and agreements, possibly changes to warning message, time-lag, only reaches those listening or watching	
Time-frame	Realistically with current technology in place 30 minutes or more, theoretically seconds to a few minutes with dedicated automated tested broadcast 'break-in' technology.	
Cost basis	'Public good' role for stations (no cost to CDEM Group)	
Cost (all areas)	Startup:\$0, effort and planning	Ongoing: planning, exercises
Areas suitable	All	
Not suitable	None	
Hazards	All, but takes a minimum of minutes	
End-user(s)	All 'tuned in'	

No formal arrangements currently exist with any broadcast agency in the Auckland region.

There are currently national-level arrangements being discussed by MCDEM with National Radio and Radio Broadcast Networks at a national and for-regions level. Note that in the USA dedicated automated broadcast 'break-in' technology is required for a broadcaster to receive a licence. When and what is issued is a question. The protocol agreed with radio stations in Hawke's Bay is summarised in Appendix 4. Note that media have their own interpretation of information they are given, and the opportunity they have to modify messages needs to be clearly discussed and discouraged.

A3.14 Third-party hardware (and staff): Radio Data Systems

Limitations	Agreements, hardware for transmission, exposure to only those with compatible receiving radios, potentially cost	
Time-frame	Seconds to hours (untested technology for this purpose in New Zealand)	
Cost basis	Further research would be needed to look at the feasibility and cost structure for New Zealand	
Cost (all areas)	Startup: \$100k+ potentially	Ongoing: unknown
Areas suitable	All with suitable receivers	
Not suitable	Those without receivers	
Hazards	All hazards	
End-user(s)	All near receiver who can hear/view it	

A3.15 Third-party hardware (and staff): Route alert (door-to-door)

Limitations	Staff available and number of locations those staff can visit per minute	
Time-frame	Minutes to days	
Cost basis	Using available response staff	
Cost urban	Startup:\$0, planning effort	Ongoing: planning and exercises
Cost rural communities	As above	
Cost (rural diffuse)	Likely not feasible except for hazards with days of lead time	
Areas suitable	Urban and rural communities (likely rural diffuse only for hazards with days of lead time)	
Not suitable	Rural areas with diffuse populations except in long lead-time hazards	
Hazards	All hazards with hours or more of lead time	
End-user(s)	All within reach of staff	

Would in the first instance comprise staff from Police and Fire, and possibly CD volunteers. Door-to-door notification is commonly used in Australia via Police and State Emergency Service (SES) volunteers.

A3.16 Third-party hardware (and staff): SMS text messaging

Limitations	Time, more time to be spatially-specific, third-party hardware reliance, Exposure to only those with mobile phones	
Time-frame	4-6 hours nationally, more to break out regions or cells	
Cost basis	Depends on agreement with carriers	
Cost (whole country)	Planning and agreements	Ongoing: planning and testing
Areas suitable	All with mobile coverage (can be region/area specific)	
Not suitable	Areas with no coverage	
Hazards	All hazards with hours of lead time	

There has been only partial delivery to users, taking hours, during overseas trials of this to thousands (French Polynesia; D. Coetzee pers comm., 2005)) and millions (Hong Kong, <http://www.wired.com/news/business/0,1367,58334,00.html>) of people.

A3.16.1 Telecom

Difficulty with list of numbers to text – ‘mobile to cell-site resolution’. Would probably have to use mobile last-call record and that would mean sending messages to mobiles no longer in the area but with the last call there, and no messages to mobiles in the area that have not yet made a call there. Would take hours to push out the messages.

A3.16.2 Vodafone

Would currently take about 4 to 6 hours to get an SMS out to the whole country. Get a list of all customers, then send out to all of them – most of time is in pushing out to them. If relying on SMS routing need redundancy over multiple systems, multiple paths. E.g. two differently-routed numbers for CDEM warning supply. Region or specific cells would take much longer - 6-10 hours, 10 likely.

A3.17 Third-party hardware (and staff): Telephone auto-dialler

Limitations	System failure, lines available, system capacity (overload, especially in specific small areas with acute hazards), time per call, number list availability and maintenance, coverage. See detailed analysis E097-06-01 for CDEM Group by Ross McLeod and Fred Wilson.	
Time-frame	Hours to days, first calls in minutes.	
Cost basis	Equipment, software and 100 lines	
Cost (all areas)	Startup:\$20k+, list Development, agreements planning	Ongoing: \$ and exercises list maintenance, planning
Areas suitable	All	
Not suitable	Will miss people not near a ‘land-line’ or not on the list	
Hazards	Only those with long lead-time	

End-user(s) All near a phone that is listed

A3.18 Third-party hardware (and staff): Telephone trees

Limitations	Major time cost in maintenance of list, relies on third-party hardware, time, needs redundant check calls across branches to allow for failures in tree	
Time-frame	Minutes to hours	
Cost basis	Labour to develop and maintain list only	
Cost (all areas)	Startup: list development	Ongoing: list maintenance
Areas suitable	All with phone coverage	
Hazards	All hazards	
End-user(s)	All phone coverage (disabled only if specialised telephony allowed for)	

A3.19 Third-party hardware (and staff): Tourist Advisory Radio

Limitations	Radio station coverage, agreement, Exposure only to those listening to this station	
Time-frame	Seconds to minutes	
Cost basis	Agreement with station	
Cost urban	Startup: planning	Ongoing: planning and exercises
Cost (rural communities)	Startup: planning	Ongoing: planning and exercises
Cost rural diffuse	Not feasible (many \$M)	
Areas suitable	All within range	
Not suitable	Those outside of range	
Hazards	All hazards	
End-user(s)	All listening to this station (has the advantage of targeting tourists)	

A3.20 Third-party hardware (and staff): Websites/WAP etc.

Limitations	End-user hardware and required to be connected and waiting for message (end-user alerting software may work, but would need to be installed).	
Time-frame	Seconds to hours	
Cost basis	Existing hardware, some programming	
Cost (all areas)	Startup: <\$10k, awareness	Ongoing: \$ and awareness
Areas suitable	All with connection to internet	
Not suitable	Any with no connection to internet	
Hazards	All hazards	
End-user(s)	All connected to internet, with some alerting software installed	

A3.21 Warning-dedicated hardware: Fixed PA loud-speakers

Limitations	Cost, coverage, complex system, resource consent required,	
Time-frame	Seconds	
Cost basis	Whakapapa village systems (\$6k, limited range), and larger USA-supplied systems (US\$45k, larger range)	
Cost urban	Startup:\$10-100M+ planning	Ongoing: \$, maintenance and exercises
Cost rural communities	Startup: \$1-10M+ planning	Ongoing: \$, maintenance and exercises
Cost rural diffuse	Not feasible (many \$100sM)	
Areas suitable	Urban and rural communities	
Not suitable	Rural areas with diffuse populations	
Hazards	All hazards	
End-user(s)	All within audible range (not the deaf)	

Loud-speaker announcements are probably the most effective form of warning message transmission to groups. They do, however, have a substantial cost and ongoing testing and exercising cost and work-load associated. They are not likely to be feasible for rural diffuse-population areas. Examples of use: Whakapapa ski area and Village, New Zealand (lahar). Coastal Pacific northwest, USA (tsunami).

A3.22 Warning-dedicated hardware: Flares, explosives

Limitations	Safety and potential to cause panic, public understanding of meaning, coverage	
Time-frame	Seconds to hours	
Cost basis	Consumables alone, would take unknown hardware to remotely trigger within seconds.	
Cost urban	Startup:\$10k-100k+ awareness, testing	Ongoing: \$, exercises, awareness
Areas suitable	All, given limitations above	
Not suitable	None in theory	
Hazards	All hazards	
End-user(s)	All within audible/visible range (not the deaf for explosives). Not visitors/tourists unless aware of meaning	

A3.23 Warning-dedicated hardware: Mobile PA loud-speakers

Limitations	Vehicles and people available to carry, cost, complex system reliance. Exposure to only those that can be reached during lead time.
Time-frame	Minutes to hours
Cost basis	NZ police use loud-hailers

Cost (per vehicle)	Startup:\$ [TBA]	Ongoing: \$ and exercises
Areas suitable	Urban and rural communities	
Not suitable	Rural areas with diffuse populations, unless long lead times	
Hazards	All hazards for areas that can be reached	
End-user(s)	All within audible range (not the deaf)	

A3.24 Warning dedicated hardware: Sirens (tone, no voice capability)

Limitations	Cost, coverage, complexity and maintenance/testing, understanding meaning, differentiating hazards, need for resource consent	
Time-frame	Realistically minutes, theoretically a few seconds (but significantly longer for appropriate response in reality, as extra information is sought)	
Cost basis	Recent siren development in Tauranga (NZ\$10,000 per siren unit, plus transmission and repeater equipment, latter has been 'piggy-backed' off of fire service in Tauranga)	
Cost urban	Startup:\$1-10M+	Ongoing: \$ and exercises
Cost rural communities	Startup: \$1M+	Ongoing: \$ and exercises
Cost rural diffuse	Not feasible (\$10s-100sM)	
Areas suitable	Urban and rural communities	
Not suitable	Rural areas with diffuse populations	
Hazards	Possible for all hazards, but very difficult to make effective	
End-user(s)	Residents and organisations (NOT visitors/tourists)	

Cheaper than voice PA loud-hailers, and technically a little less complex, but understanding the meaning of the siren relies entirely on public awareness; this is a major problem. One could assume that a community would eventually seek the meaning of a siren if it continued indefinitely, but the timeframe is uncertain – maybe at least 30 minutes? Therefore, this should not be considered for short time-frame hazards with minutes of warning time. It is difficult to differentiate different warning message codes with a siren, especially with the slow tone-variable 'air-raid'-style siren most commonly used in New Zealand. Sirens are likely to be affordable and feasible in urban and rural communities, but most likely not in rural areas with diffuse populations. This means that they are inappropriate as the primary source of warning for rural hazards such as bushfire or biological disease outbreak.

Sirens can enhance a warning message, or act as backup, but may not be worth the cost and effort if no system already exists. Expectation that sirens will be involved may reduce response if the sirens fail.

A3.25 Warning-dedicated hardware: Tone-activated alert radio

Limitations	Cost, exposure to only end-users with receivers or near PA receivers who can hear it, complex system, testing requirements	
Time-frame	Seconds	
Cost basis	USA Pacific northwest [Broadcast costs To Be Advised]	
Cost (all areas)	Startup:\$[TBA] Awareness, planning	Ongoing: \$[TBA] and exercises Awareness, planning, exercising
Cost (users)	approx US\$30 for a range of radios that receive service	
Areas suitable	All areas with reception	
Not suitable	Areas out of reception	
Hazards	All hazards	
End-user(s)	All within audible range (not the deaf, unless visual notification capable hardware)	

See international examples in Appendix 2 (Crawford, 2005a).

APPENDIX 4 — HAWKES BAY CDEM GROUP RADIO STATIONS MOU

AUTHORISED CIVIL DEFENCE MESSAGES FOR BROADCAST

Prepared by Hawke's Bay Regional Civil Defence Staff

Updated July 2003

Distributed to:

All Hawke's Bay Radio Stations

All CD/Emergency Managers

SOP – Public Information Management

To the Reporter or Announcer

AUTHORISED CIVIL DEFENCE MESSAGES FOR BROADCAST

The Hawke's Bay Regional Civil Defence team, in association with local radio station managers, has produced these standardised scripts for use during a CIVIL DEFENCE EMERGENCY. This is to make it easier for you, as local media, to get information to the public, particularly in the early stages of an emergency when control centres are still being established. We will contact you with news information as well during the course of an emergency.

Intro pages

Each script series has an introductory page which outlines the types of emergency covered and Civil Defence response expectations. Announcers may use some of this information to keep people informed.

Emergency scope

- For information on **localised** emergencies contact the Civil Defence Officer for your area (*see list page 2*).
- For **regional** emergencies (which cover **two or more districts** such as a flood or storm) contact the Regional Emergency Centre at the Regional Council.

[TABLE OF CONTENTS]

The management of public information for Hawke's Bay in the period leading up to and in a declared State of Civil Defence Emergency (as defined in the Civil Defence Act 1983) is detailed in both the Hawke's Bay Regional Civil Defence Plan and the Territorial Local Authorities Civil Defence Plans. In addition the Hawke's Bay District Health Board operates an Interagency Media Management Response for the Hawke's Bay District Health Board, Eastern Police District, Eastern Fire District and the HB Ambulance Service.

This set of Standard Operating Procedures for public information has been developed by the Hawke's Bay Emergency Management Team to assist regional and local Public Information Managers with management of information between organisations. A summary of responsibilities prior to and during a declared State of Civil Defence Emergency is shown below:

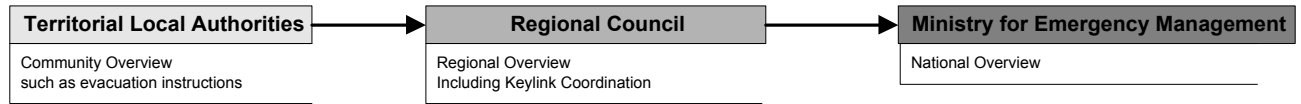
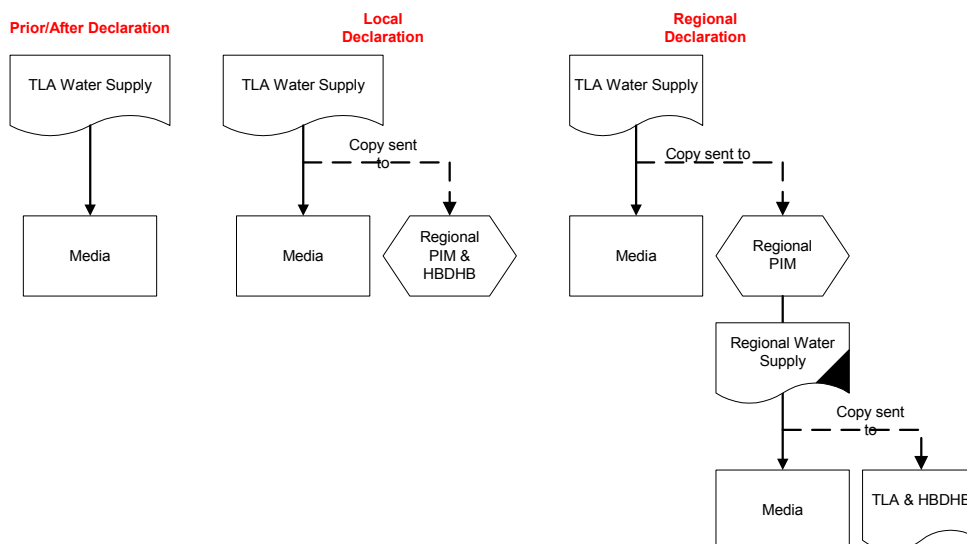


Chart of Responsibilities for Issuing Public Information for State of Civil Defence Emergency

Service Provision	Prior/After	Local Declaration	Regional Declaration
Airports	Airport Authority	RC	RC
Animal Welfare	MAF	MAF	MAF
Flooding - City Drainage	TLA	TLA	TLA
Flooding - Isolated Surface	TLA	TLA	TLA (RC Overview)
Flooding – Rivers	RC	RC	RC
Flooding - Widespread Surface	TLA	TLA (RC Overview)	TLA (RC Overview)
Gas - Local Network	Companies	TLA	TLA
Gas – Regional	Companies	RC	RC
Health/Diseases	HB District Health Board	HB District Health Board	HB District Health Board
Power - Local Network	Companies	TLA	TLA
Power – Regional	Companies	RC	RC
Public Radio	Radio Stations	RC	RC
Rail	Tranzrail	RC	RC
Roads	TLA	TLA	TLA (RC Overview)
Sewage	TLA	TLA	TLA
State Highways	Transit	RC	RC
Telecommunications	Companies	RC	RC
Water Supply	TLA	TLA	TLA (RC Overview)

Example of Flow of Public Information regarding service for Territorial Local Authority



CIVIL DEFENCE INFORMATION CONTACTS

[List of contact details]

INTRODUCTION TO EARTHQUAKE SCRIPTS

EARTHQUAKE AFTERMATH - SIGNIFICANT EARTHQUAKE

EARTHQUAKE AFTERMATH - AT NIGHT

EARTHQUAKE AFTERMATH - TELEPHONE

EARTHQUAKE AFTERMATH - DRIVERS

EARTHQUAKE AFTERMATH - SECOND STEPS

EARTHQUAKE AFTERMATH - WORKPLACE

EARTHQUAKE AFTERMATH - PEOPLE CHECK

EARTHQUAKE AFTERMATH -SAFETY

EARTHQUAKE AFTERMATH - WATER STORAGE

EARTHQUAKE AFTERMATH - ON YOUR OWN

EARTHQUAKE AFTERMATH -SECURE AT HOME

INTRODUCTION TO VOLCANIC ERUPTION SCRIPTS

VOLCANIC ERUPTION - EARLY NOTICE

VOLCANIC ERUPTION - RURAL WATER SUPPLIES

VOLCANIC ERUPTION – FARMERS

VOLCANIC ERUPTION - MOTOR VEHICLES

VOLCANIC ERUPTION - HOME & WORK

INTRODUCTION TO HIGH WIND SCRIPTS

HIGH WIND FORECAST

HIGH WIND FORECAST - DRIVERS

HIGH WIND FORECAST - WINDOWS

INTRODUCTION TO TSUNAMI, HIGH SEAS & FLOOD SCRIPTS

TSUNAMI, HIGH SEAS - EVACUATION ALERT *[included below]

FLOOD WARNING - EVACUATION

FLOOD WARNING - EVACUATION

FLOOD WARNING - PHONES

INTRODUCTION TO FIRE EVACUATION SCRIPTS
FIRE EVACUATION
FIRE HAZARD

INTRODUCTION TO MAJOR CHEMICAL SPILL SCRIPTS
MAJOR CHEMICAL SPILL – IN HOUSE SHELTERING
MAJOR CHEMICAL SPILL - EVACUATION

MISCELLANEOUS SCRIPTS
RESTRICT USE OF PHONES
LIFELINES
VOLUNTEERS
VOLUNTEERS
RETURN TO NORMAL

* Example script: [Surfie#1]

AUTHORISED CIVIL DEFENCE MESSAGE FOR BROADCAST

TSUNAMI, HIGH SEAS - EVACUATION ALERT

AIR TIME: As advised by CD

REPEATS: As often as possible as required

FOLLOW ON WITH WET#2 AND #3 - CHANGE WORDING FROM “FLOODING” TO “HIGH SEAS”.

INTRO: CD STING

1. This is a Civil Defence message from(CD agency).
2. A [select one] heavy swell/high sea/Civil Defence warning has been issued for Hawke’s Bay/East Coast which may affect the following areas:
.....
3. Residents living in these areas should immediately move to high ground or at least one kilometre inland. Everyone must depart the area by [.....time]. Please obey the instructions given by Emergency Services, Civil Defence and District Council staff in the area.
4. If you need assistance to move out, alert evacuation staff by displaying a sheet or towel out a window or gate that can be seen from the road. They will help you as quickly as they can.
5. Police have restricted access to these communities and checkpoints are being set up to stop entry. Do not go sightseeing.
6. To repeat, the following areas have been ordered to evacuate by [district] Civil Defence

Stay tuned to this station for further Civil Defence announcements.

FOLLOW ON WITH WET#2 AND #3 - CHANGE WORDING FROM FLOODING TO HIGH SEAS.



www.gns.cri.nz

Principal Location

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F +64-4-570 4600

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764 Cumberland Street
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Dunedin
New Zealand
T +64-3-477 4050
F +64-3-477 5232

Wairakei Research Centre
114 Karetoto Road
Wairakei
Private Bag 2000, Taupo
New Zealand
T +64-7-374 8211
F +64-7-374 8199

National Isotope Centre
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New Zealand
T +64-4-570 1444
F +64-4-570 4657