

Review of the Tsunami Evacuation in Christchurch City on 14 November 2016

March 2017

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Executive Summary

This report has been prepared as a result of the tsunami evacuation along the Christchurch City coastline on 14 November 2016, following a 7.8 magnitude earthquake on land near Culverden, Canterbury. The residents of Christchurch and Christchurch City Councillors raised various queries following the evacuation. Predominantly, the queries focused on why messaging appeared inconsistent between agencies, how the evacuation decision-making process works, how evacuation of coastal communities can be better coordinated, what information communities require and how they can access such information.

It was determined (in early December 2016) that a review of the tsunami evacuation would best provide responses to these queries and identify any issues. The review was undertaken by way of interviews (with the Mayor of Christchurch City, internal Council staff and external parties), workshops with the Community Boards in coastal areas, subject matter research and written correspondence with various parties. Some delays have occurred as a result of the Port Hills Fire and the challenges to gain time for interviews. It was also decided that both the Ministry of Civil Defence & Emergency Management (MCDEM) and the regional Canterbury Civil Defence Emergency Management (CDEM) Group referred to as “Group” should be invited to provide feedback on the draft report.

The conclusions drawn can be summarised as follows:

1. Christchurch Civil Defence Emergency Management (CDEM) tried to gather as much information as quickly as possible regarding the tsunami risk specific to Christchurch, to determine whether to activate an evacuation. Overall, the CDEM team did its best. There are, however, areas of improvement which should be implemented.
2. Whilst CDEM received all the national warning messages issued by the MCDEM, the messaging across agencies and media was inconsistent. The media reported the tsunami warning and recommendation that people evacuate from ‘low-lying areas’ before a national warning message was issued by MCDEM to the local civil defence groups confirming that a “land threat” was present.
3. The sirens were not activated in Christchurch until the national warning message issued by MCDEM at 2:01am made it clear that the tsunami threat was not only to marine and beach areas but included land. The national warning message issued by MCDEM was followed by a telephone direction from MCDEM to Group that an evacuation of Christchurch coastal residents was necessary. MCDEM has advised that they do not recommend the use of tsunami sirens for local source tsunamis, especially those that do not have voice capability.
4. Although it is not clear how many residents actually evacuated before the tsunami sirens were activated, most Christchurch coastal residents relied on the sirens to signal an evacuation was required.
5. The Christchurch Police’s evacuation plan for coastal areas has been in place for over 10 years, but as an operational document, there is no public knowledge of it. On 14 November, a tsunami evacuation map was available on Council’s website¹. Residents were not immediately directed to the map; nor were they provided with a procedure to follow in order to evacuate. Many residents were unclear whether they needed to evacuate or not and where the evacuation zones started and finished.
6. Residents want clear, concise, consistent messaging across all agencies in all forms of media including letterbox drops, social media, internet, seminars, and information on noticeboards in

¹ <http://www.ccc.govt.nz/services/civil-defence/what-to-do-in-an-emergency/tsunami/distant-source-tsunami/>

their local areas. They want to be involved in the collation of this information to ensure that the presentation of the information meets the needs of their specific communities.

7. Residents want information which includes evacuation maps (exactly how far do they need to go?), evacuation routes (where do they need to go and how best to get there?), scientific information on the probability of a tsunami or inundation event specific to their area (how high will the waves be?) and information on the different types of tsunamis (how much time do they have to evacuate?).
8. Residents are looking to CDEM to coordinate the other agencies and residents to co-create the information which will be disseminated to residents. Residents want to and should participate in the creation of community specific evacuation plans. This will require strategic planning, resources and commitment from all those involved.

Background

The tsunami evacuation on 14 November 2016 and related messaging from various agencies caused confusion not only amongst Christchurch residents but right across New Zealand. This statement is based on input from Christchurch residents and many comments posted on social media. The large scale evacuation (which covered almost the entire country) as directed by MCDEM was unprecedented.

Different regions responded differently to the national warning messages issued by MCDEM. In some regions (i.e. Auckland), local authorities did not activate evacuations on the basis that it was unnecessary in their region. Their decisions were based on tsunami modeling, tidal gauges and visual assessments undertaken at a local level to determine the response required to the threat.

In Christchurch, an evacuation was activated at 2:11am following the national warning message (issued by MCDEM) received at 2:01am which clarified that the tsunami threat also related to land (not just marine and beach areas) and following a telephone call from CDEM to Group at 2:05am where it was made clear to CDEM that the National Controller was directing an evacuation of Christchurch coastal areas.

As advised by MCDEM, *"the 14 November event has now been described by scientists as the most complex earthquake in historical times worldwide, with 21 separate faults over 140kms rupturing in sequence. During the event tsunami waves severely damaged a property in Little Pigeon Bay, Canterbury. No-one was present in the house at the time. Given the degree of damage to the building, the depth and velocity of the water, and the movement of very large furniture inside the house, it is possible that if people were present, there would have been casualties and potentially fatalities. It is essential that a precautionary approach be taken when lives are at risk. MCDEM's message to evacuate was based on best scientific advice at the time"*.

Scope of Review

The report writer was selected on the basis that she has no involvement in civil defence or emergency matters.

The terms of reference of the report was to seek clarification on why messaging was inconsistent between agencies and the media, how the evacuation decision-making process works, how evacuation of coastal communities can be better coordinated, what information communities require and how they can access such information.

The terms of reference envisaged the report writer corresponding with any internal Council staff required, as well as external people within the Christchurch region who could provide relevant

information. The report writer did not contact MCDEM directly or make enquiries at a national level. The draft of this report was made available for feedback to Group, MCDEM and the Civil Defence Minister prior to it being finalised. Minor feedback was received from Group and was incorporated into the finalised report. More substantial feedback was received from MCDEM (copy attached in Appendix III). Some feedback was incorporated into the finalised report. Some feedback was outside the scope of the reviewer's terms of reference or the report writer did not feel it was required within the finalised report. The Minister responded encouraging all CDEM Groups to adhere to the guidelines and follow the advice from MCDEM.

The parties interviewed were encouraged to express their views in a free and frank manner in order to provide sufficient depth of information to piece together the events that occurred on 14 November and identify any improvements that could be implemented.

Guide to National Civil Defence Emergency Management Plan

The Guide to the National Civil Defence Emergency Management Plan 2015 ("Guide"), is the guiding document provided by MCDEM to "identify core functions for national management of the consequences of emergencies". The Guide refers to the Civil Defence Emergency Management Act 2002 (the "Act") and details the role of MCDEM, CDEM Groups, the Police, and their response and recovery activities. Effectively, the Guide sets out the chain of responsibility in the management of emergency situations.

Ministry of Civil Defence & Emergency Management's Role

As detailed in the Guide, MCDEM's role includes to:

- activate and co-ordinate national-level response and recovery activities; and
- support and co-ordinate CDEM Group response and recovery activities; and
- issue emergency management information; including national warnings and advisories, national situation reports, and national response and recovery action plans; and
- issue public information.

Civil Defence Emergency Management Group's role

CDEM Groups have been formed across New Zealand as committees of elected councillors from each council within regional boundaries. They are a consortium of the local authorities in a region working in partnership with emergency services, lifeline utilities and government departments.

The Christchurch City Council is a member of the Canterbury Civil Defence Emergency Management Group, along with Kaikoura District Council, Hurunui District Council, Waimakariri District Council, Environment Canterbury, Selwyn District Council, Ashburton District Council, Timaru District Council, Mackenzie District Council and Waimate District Council.

The partner agencies in the Canterbury CDEM Group are: NZ Police, NZ Fire Service, Canterbury District Health Board, South Canterbury District Health Board, St John Ambulance, Canterbury West Coast Rural Fire Committee, Ministry of Primary Industries, Canterbury Chamber of Commerce, and Ministry of Social Development.

In accordance with the Guide, the functions of a CDEM Group include to:

- identify the hazards and risks in its group area that may result in an emergency that requires national-level support and coordination; and

- establish the means within its group area, in line with the national guidelines and in collaboration with its supporting agencies, to provide timely warning of hazards, and public information about them.

A CDEM Group may be requested or directed by the National Controller to activate its CDEM arrangements to the appropriate level, whether or not a state of emergency has been declared.

NZ Police Role

The Guide provides details of the role of the Police, which includes to:

- assist with the dissemination of warning messages; and
- assist the movement of rescue, medical, fire and other essential services; and
- coordinate movement control over land, including communications and traffic control; and
- conduct any initial evacuations to ensure protection of life.

The Act gives the Police certain powers during a state of emergency. These include to:

- evacuate any premises or place, or exclude persons or vehicles from any premises or place where such action is necessary for the preservation of human life; and
- totally or partially restrict public access to any road or public place.

The Role of Science and Research Organisations

Science and Research Organisations (universities, Crown research institutes, private organisations and international networks) also play a part. As detailed in the Guide, their role is to assist with:

- hazard monitoring; and
- the provision of hazard and risk information; and
- scientific advice to agencies managing an emergency; and
- public information on hazards and risks and safety measures.

National Warning System

The Guide covers national warnings and advisories which are intended to provide information about the potential or actual threat. The Guide identifies that “effectiveness of a warning or an advisory depends on:

- the timeliness of the warning or advisory; and
- the delivery and receipt of the national warning or advisory; and
- the recipients understanding of the necessary action to be taken in respect of the particular threat; and
- the readiness and response from the national, CDEM Group or local levels”.

National warnings and advisories are provided by MCDEM to CDEM Groups, local authorities, emergency services, agencies, lifeline utilities and broadcasters. CDEM Groups are responsible for disseminating national warnings to local communities and maintaining local warning systems. Warnings and advisories may be issued for any type of hazard. The type of warning or advisory will depend on the hazard type and potential impact. The Guide states that use of the national warning system should follow this procedure:

- An alert notification system feeds information about the environment to MCDEM.
- MCDEM analyses the information and decides what to do.

- On the instruction of the Director of CDEM or the National Controller to issue a warning or advisory, MCDEM will send the appropriate type of message by email and SMS text message to those registered with the national warning system and the news media.
- With respect to tsunami events, MCDEM may issue one or more of the following notifications:
 - National Advisory – Tsunami: No Threat to NZ
 - National Advisory – Tsunami: Potential Threat to NZ
 - National Warning – Tsunami: Threat to NZ
 - National Warning – Tsunami: Marine and Beach Threat
 - National Warning – Tsunami: Marine and Land Threat
 - National Advisory – Tsunami: Cancellation Message
 - National Warning – Tsunami: Cancellation Message
- MCDEM contact the MCDEM Regional Emergency Management Advisors to advise them that a message has been issued and allow them to call the relevant CDEM Groups to ensure they have received the message.
- When a “national warning message” is received from MCDEM by CDEM Groups, they analyse the information and decide what to do in their region. All recipients must respond as per their individual emergency response procedures.
- If the CDEM Group decides that a local warning is required, then a response (i.e. evacuation) is activated.
- MCDEM will follow up a national advisory message with either an hourly (or more frequent) update, or a national warning, or a cancellation message. A national warning message will be followed by an hourly (or more frequent) update or a cancellation message.

Distant and Regional Source Tsunami – lead agency is MCDEM

As detailed in the Guide, MCDEM and GNS Science receive tsunami information statements or threat messages from the Pacific Tsunami Warning Centre (PTWC) for earthquakes equal to or higher than magnitude 6.5 in the Pacific. GNS Science is responsible for local sea level monitoring. The MCDEM Duty Officer gives immediate consideration to information received from the PTWC by applying standard criteria related to the locality, magnitude, depth of the earthquake and by consulting with GNS Science. If time permits, GNS Science will convene a panel of national tsunami experts to give on-going advice to MCDEM as the situation develops.

Depending on the assessment, a recommendation is made to the National Controller or Director of CDEM and at their direction MCDEM issues an appropriate advisory or warning via the national warning system. CDEM Groups activate their respective local warning systems in response to warnings or advisories issued by MCDEM and decide on appropriate further action. Decisions about local responses are encouraged to be made in consultation with neighbouring Controllers and the National Controller.

Local Source Tsunami – lead agency is CDEM Group

The Guide provides details on local source tsunamis and advises that the lead agency is the CDEM Group. A tsunami generated in conjunction with a local large earthquake or undersea landslide may not provide sufficient time to implement official warning procedures. This is because the proximity of the tsunami source and its travel speed combine to give very little time for meaningful warnings to the areas closest to the source. Proper public education is therefore the principal preparedness measure for local source tsunami. The recommended public message is:

“People in the coastal areas should not wait for an official warning. Instead, let the natural signs be the warning. They must take immediate action to evacuate predetermined evacuation zones, or in the absence of predetermined evacuation zones, go to high ground or go inland. Natural signs include: experience strong earthquakes (hard to stand up), experience weak earthquakes lasting for a minute or more, or observe strange sea behavior such as the sea level suddenly rising and falling, or hear the sea making loud and unusual noises or roaring like a jet engine.”

As the tsunami propagates along the coast to other regions (depending on its nature), warnings to other parts of New Zealand may still be meaningful and may be issued via the national warning system.

Public Information Management

Information management is also covered in the Guide. As stated in the Guide, the National Controller appoints a public information manager to:

- oversee the relationship with and monitoring of the media;
- oversee the release of public information, including media releases, updates of the MCDEM website and social media, promotion of the 0800 Government Helpline and request of the broadcast of emergency announcements;
- support CDEM Groups by publicly acknowledging the territorial authorities and CDEM Groups involved, coordinating nationally-issued public information to ensure that it is consistent and complementary with that issued by CDEM Groups and providing assistance and advice to CDEM Groups.

During all responses CDEM Groups focus on communicating directly with communities. When there is a state of national emergency or emergency of national significance, CDEM Groups must liaise with the national public information manager so that statements can be coordinated, made consistent and, if need be, prioritised.

The Guide advises that MCDEM’s website has automatic links to CDEM Groups’ websites. When a CDEM Group changes the emergency status on its website, this is automatically displayed on the MCDEM website’s homepage. Group Controllers are responsible for the information their CDEM Group issues during emergencies.

Evacuations

It is acknowledged in the Guide that evacuations can produce long-term negative effects therefore evacuations should only be undertaken as a last resort and in a well-managed and organised manner. The Guide provides that mandatory evacuations can either be ordered before a state of emergency is declared (by the New Zealand Police or the fire services) if life or property is in danger, or after a state of emergency is declared (by the New Zealand Police, the National Controller, a CDEM Group Controller, or a person authorised under s 86 of the Act).

To ensure the effective management of evacuations, the decision to evacuate must be the product of consultation among the agencies involved (i.e. CDEM Group, New Zealand Police, New Zealand Fire Service and the relevant support agencies). The Guide details how information conveyed to the public by local authorities, CDEM Groups, or the National Crisis Management Centre must contain assurance of a well-managed emergency response; and the message that people should remain calm and follow the instructions of emergency services personnel. The Guide acknowledges that the public require regular information updates. These are to be kept simple, and must be disseminated in as many forms and to as many outlets as possible. The public must be provided with essential information including:

- issuing authority (which agency)

- the rationale behind the evacuation decisions
- the hazards and their potential consequences
- the area being evacuated
- the people to be evacuated (when not everyone within the area is being evacuated)
- destination for relocation of displaced people
- key times (evacuation, until next warning message, hazard impact)
- where and when to assemble if displaced people require transport
- the expected duration of the evacuation
- how and when ongoing information will be provided.

Duty Team Standard Operating Procedure

The Duty Team Standard Operating Procedure ("Procedure") is an internal Council prepared document which dovetails in with the Guide. The purpose of the Procedure is to outline the responsibilities and procedures to be followed by the CDEM Duty Team. The Procedure stipulates that at all times there is a CDEM Duty Officer and a Duty Public Information Manager (PIM). There is a chapter on the procedures relating to tsunamis which includes a step by step procedure of the actions required to be followed.

Observations and Recommendations

Decision Making

Observations

GNS Science consulted the panel of national tsunami experts between 1am to 2am on 14 November 2016. However, MCDEM advises that the tsunami panel of experts is not a critical part of the warning decision making process, especially in a local source tsunami. MCDEM acknowledges that “advising evacuation is a best-judgement precautionary measure during local source events when earthquakes and tsunami monitoring instrument readings may be conflicting, scientists are working with changing data and the threat is complex and difficult to understand. MCDEM operates on the best information available. If the threat turns out to be lower than initially estimated, there may have been unnecessary precautionary evacuations in some areas. This is the acceptable trade-off given the alternative, which is to underestimate a threat”.

Group has established a regional panel of scientists who are experts in natural hazard risks specific to the Canterbury region. Some of the regional panel members are also members of the national panel. When an event occurs, the regional panel members undertake their own analysis with specific reference to how it has or will impact the Canterbury region. The outcomes of such an analysis are provided by the regional panel to Group. The panelist(s) and Group discuss the best approach to be followed specifically for each area within Canterbury. The information and guidance regarding how Group should respond, as provided by the regional panel, is Canterbury-specific.

MCDEM has stated that it “does not support Groups developing alternate expert panels that operate during events to second-guess the official national advice provided by the national tsunami experts”. However, MCDEM “does support the use of tsunami scientific advice in the development of tsunami hazard maps and evacuation zones and pre-event tsunami planning”.

Group is able to communicate directly with MCDEM on behalf of all local authorities in Canterbury. On 14 November, Group participated in a teleconference with MCDEM where the tsunami risks were discussed and information was verbally disseminated by MCDEM to all CDEM Groups (who chose to participate in the teleconference).

Other than receiving the national warning and advisory messages from MCDEM, Councils’ CDEM Teams and MCDEM do not communicate directly. This is on the basis that the structure of Civil Defence and Emergency Management in New Zealand is such that it is deemed more efficient for MCDEM to liaise with CDEM Groups rather than each individual local authority. Therefore, CDEM largely relies on its communications with Group to receive and disseminate information from MCDEM. On 14 November, there was no direct communication from CDEM to MCDEM because this is outside the protocol established by MCDEM.

In accordance with the Procedure, the CDEM Duty Officer and CDEM team regularly communicated with Group and a regional panel member to gather as much information as possible regarding the tsunami risk. The information provided by the regional panel member (based on Canterbury-specific modelling and analysis of local tidal gauges) was that the wave in the Christchurch coastal areas would only be 0.5m high therefore an evacuation was not necessary as there was no land threat. On this basis, neither CDEM nor Group deemed it necessary to activate the sirens.

At 12:40am, MCDEM issued a national advisory message that there was no tsunami threat to New Zealand. Between 1am and 2am, MCDEM issued two national warning messages that there was a tsunami threat to New Zealand. The messages indicated that the tsunami threat was to marine and beach areas. The next national warning message issued by MCDEM at 2:01am referred to a “land threat” being present. In accordance with the Guide, CDEM Groups and local authorities were looking for the words “land threat” as confirmation that the tsunami risk was such that it would cause water

to inundate land. As soon as a message with the words “land threat” was received, at 2:05am CDEM responded by contacting Group to determine whether an evacuation was now necessary in Christchurch. Group advised that a direction had been issued by MCDEM to Group to evacuate Christchurch.

At 8am on 14 November, MCDEM issued a national warning message advising that the tsunami warning only applied to marine and beach areas. It appears that the basis for the continued “land threat” being present for so many hours was the risk of a large aftershock which could generate a tsunami which would affect land.

In response to the events of 14 November, MCDEM has issued updated national warning messages templates that will be used for local source tsunamis which make it clearer to CDEM whether an evacuation is to be activated. The draft templates issued in December 2016, now state:

“LONG OR STRONG, GET GONE: People in coastal areas should be self-evacuating immediately where the earthquake was felt EITHER for longer than a minute OR it was strong enough that it was hard to stand. In these areas a tsunami may have been generated and may arrive quickly, so evacuate immediately to the nearest high ground or as far inland as possible.

Walk, run or cycle if at all possible to reduce the chances of getting stuck in traffic congestion.”

Recommendations

A clear understanding of how MCDEM make decisions following input from the panel of national tsunami experts would assist Group, CDEM and the regional panel of scientists. Discussions should commence between MCDEM, Group and CDEM to clearly define how each agency and their respective panel of scientists will work together to determine risks and the appropriate responses within specific regions.

Clarity is required to determine whether the national warning messages issued by MCDEM are “directions” which Group and CDEM must follow or “guidance” to be taken into account as part of Group and CDEM’s decision making. By issuing correspondence to Group advising that the national warning templates are to change, it appears that MCDEM will now be the decision maker as to whether an evacuation is necessary for local source tsunamis. Further discussion regarding whether this approach is best for the residents of Christchurch should be entered into as soon as possible. It is questionable whether there is sufficient time available for MCDEM to direct an evacuation for a local source tsunami. Additionally, the risk of “over exposure” vs protecting the safety of residents must be carefully managed. If decisions to evacuate are made at a national level based on a worst case scenario approach (without taking into account specific regional knowledge) evacuations may be activated without need. This, in turn, is likely to result in residents becoming immune to evacuations and choosing not to respond when required to. Every time an evacuation is directed and no tsunami occurs, residents are likely to lose faith in the system and make their own decisions on how to respond to an evacuation. This is a significant risk that must be strategically and carefully managed.

It is fundamental that the Procedure and the Guide are perfectly aligned so that each agency’s role and responsibilities are clear. A review of the Procedure is required once the discussions referred to above are concluded. The Procedure must at all times be kept up to date to provide clear step by step actions to be followed by the CDEM team.

Sirens

Observations

Christchurch Police endorsed the installation of sirens. The sirens are seen as a useful tool to assist with evacuation by the Police. However, the installation of sirens has meant that most residents rely

on sirens sounding before they believe an evacuation is required. MCDEM, on the other hand, does not endorse, and advises against sirens (especially non-voice capable sirens) for local source tsunami events. MCDEM advises that “signal-only sirens provide an ambiguous message, and are particularly difficult to understand for visitors and new migrants. They provide no information on the nature of the threat or the correct actions to take”. MCDEM produced the Tsunami Warning Sirens Technical Standard in 2014. This standard outlines the minimum requirements for standards and the appropriate use for tsunami public alerting.

On 14 November, some residents in Christchurch evacuated before the sirens were activated. It is difficult to identify the percentage of those who did, but the Mayor did report hearing a constant stream of traffic on Queen Elizabeth II Drive (the main route through Burwood from the coast) from around 12.30am. In contrast, most residents in coastal areas of the Waimakariri District evacuated before their sirens were activated.

There are 45 sirens installed in Christchurch along the coastline from Brooklands to Taylors Mistake. The sirens are operated by radio which is located at the Pages Road wastewater treatment plant. The radio talks to two radio repeaters (one in the Port Hills, the other in Sumner). The repeaters then send a message to the sirens. It is possible to check the status of the sirens remotely by using the “SCADA” system.

The process to activate the sirens requires a person to enter a password to connect via VPN (virtual private network) to the Council’s server to enter the SCADA system. Once logged in, the person opens the alerting system software, enters another password and activates the sirens. It takes approximately a minute to activate the sirens.

Council’s CDEM staff have received training on how to activate the sirens. There is an instruction manual available which provides a step by step guide. To date, staff have not activated the sirens themselves. On 14 November, staff contacted the alerting system supplier in Auckland to activate the sirens. The supplier activated the sirens in less than 4 minutes of receiving the telephone call.

When activated the sirens make a low-pitch repeated tone, which depending on the weather conditions, can be heard within a few blocks from the coastline. The module Council currently has in place does not allow different tones to be sounded or voice capability to issue messages to residents. Prior to the sirens being installed in 2012, the then Unit Manager of CDEM at Council explored the siren options and deemed the current siren module as the best fit for Christchurch. The current module can be changed without requiring changes to the siren infrastructure.

There are other siren modules available which provide for different tones/signals and voice messaging. Different modules are used in other regions of New Zealand. For example, in Auckland, the siren module provides three different tones: alert (possible threat), evacuate (real threat), all clear (evacuation ended). In the Waimakariri District, the sirens sound a tone for a few seconds followed by a voice automated instruction advising there is a tsunami threat and evacuation is necessary. This is repeated continuously on a loop.

The sirens rely on battery power. As long as there is electricity supplied to the batteries, they recharge. Until 14 November, the sirens had not been sounded for an extended period of time. They had only been sounded for testing purposes. The exact running time of the batteries or how quickly they could recharge if the sirens kept sounding was not known. On this basis, it was determined that in order to ensure that the battery running time was optimised, the sirens would not be activated and left sounding until the batteries died. Rather they would be manually activated and deactivated with the sirens sounding for 15 minutes on the hour, until the national warning message was cancelled by MCDEM. The battery running time lasted much longer than anticipated. The sirens were able to be activated intermittently until the cancellation message from MCDEM was received at 8am.

All sirens (except one) sounded when they were activated on 14 November. The one malfunctioning siren (located in New Brighton) did not in any way impact on the alerting system because the other sirens are loud enough to compensate. It failed to sound because it had no mains power for weeks so the battery was not charged. Council was aware of this issue and had liaised with its siren installation contractor to reactivate the mains power. This matter has since been rectified.

When the sirens were installed, it is believed that the residual current device ("RCD") switches were faulty. Prior to 14 November, Council had requested the installation contractor to replace all the RCD switches. This is to ensure that the power supply to the batteries is not compromised. The switches had not been replaced by 14 November but this did not impact on the integrity of the sirens. The switches are in the process of being replaced.

The sirens are scheduled to be serviced this year. This will enable functionality issues to be identified, including whether use of the sirens for a long period of time on 14 November has damaged the life of the batteries.

Recommendations

Educating residents on the need to evacuate without waiting for sirens in an earthquake which could produce a local source tsunami is fundamental. Reliance on sirens sounding to indicate that an evacuation is necessary puts residents at significant risk. Furthermore, education on how the siren alerting system will be used (i.e. it will not sound continuously and the evacuation remains in place until otherwise notified) is required to minimise confusion and frustration.

In order to minimise risks that the sirens do not sound when activated, it has been proposed that a separate radio will be located in the Justice and Emergency Precinct (Precinct). This will enable the system to have a backup radio (on Pages Road) which is located in a different location to the main radio (in the Precinct). The Council should ensure that this proposal proceeds and another radio is installed within the Precinct.

Council should impress on the siren installation contractor the need to respond urgently to issues that may impact the integrity of the siren alerting system. If possible, specific service levels should be included in the contractual arrangements. These levels should stipulate the exact timeframe within which the contractor must action the service requirement. The immediate need is for the contractor to replace the faulty switches.

CDEM staff should activate the sirens themselves without the need to contact a third party. This would shorten the time taken to activate the sirens and minimise the risk of delay. Regular training and refresh of the activation process should be undertaken to ensure that staff are familiar and confident with activating the sirens.

The time taken to activate the sirens could be further shortened if the need to log into VPN was removed from the process. Council staff should explore the pros and cons of logging into the system via VPN to ensure that the activation process is as streamlined as possible.

The scope of this review did not extend to determining whether the current siren module continues to be fit for purpose. Council staff, with input from residents and Christchurch Police, should consider the pros and cons of the various modules available – in particular whether voice capability should be added. Discussion with other local authorities who use different modules may provide useful analysis. The Tsunami Warning Sirens Technical Standard produced by MCDEM should be taken into account when determining the use of sirens.

There is a need for CDEM to consider how to communicate an evacuation if the sirens cannot be activated (due to a mechanical failure) or if there is no telecommunication coverage. Alternative methods of communication should be included in the Procedure and communicated to residents. This

will somewhat counterbalance the heavy reliance by residents on waiting for the sirens to sound before evacuating.

Evacuation Plans

Observations

Christchurch Police have had a "Christchurch Coastal Evacuation Plan" in place for over 10 years ("Police Evacuation Plan"). The Police Evacuation Plan is not publicly available because it is an operational document used internally by the Police. As advised by Christchurch Police, with new LIDAR (light detection and ranging) information now available, the Police Evacuation Plan is currently under review by the Police and will be updated.

Christchurch Police have advised they have limited resources to implement the Police Evacuation Plan. The Police may not be able to reach the evacuation zone within the time available to coordinate the Police Evacuation Plan. This is particularly true for a local source tsunami where time is very short. Clarity is required regarding whether the Police will implement the Police Evacuation Plan in a local source tsunami.

A coastal evacuation map was available on Council's website by clicking through the various webpages: "Civil Defence" – "What to do in an emergency" – "Tsunamis" – "Tsunami categories" – "Distant Source Tsunami". The map highlighted the evacuation zone in red, provided information on the evacuation cordons and recommended evacuation routes by indicating traffic flow with arrows (Previous Evacuation Plan). It appears no maps were available on Council's website for local source or regional source tsunamis.

On 14 November, residents on Facebook were directed to the Canterbury Maps website² for information on low-lying areas. The Canterbury Maps portal is a joint data-sharing initiative provided by Canterbury's regional and territorial authorities and coordinated by Environment Canterbury. Additionally, the media release issued by PIM at 5am had evacuation area maps attached for New Brighton, Brooklands, and South Shore to Sumner highlighting the evacuation areas. MCDEM also released wave amplitude threat maps which were attached to the national warning messages which the media referred to. These maps were very high level without specific details for local Christchurch residents.

Despite the evacuation maps released by various agencies to date, most residents still do not understand where the evacuation zone is, what evacuation routes they need to follow or where they need to evacuate to.

Residents are concerned about the security of their homes once they have evacuated. A highly publicised burglary on 14 November of a family with a disabled child caused enormous additional stress not only on the family but also on the wider community.

NZ Police has its own lines of command which are followed in all circumstances. On 14 November, Christchurch Police received information and directions directly from the Deputy Commissioner of Police in Wellington. There appears to be instances where the timing of information provided to Christchurch Police did not align with the information received by CDEM Group and/or CDEM from MCDEM. This resulted in the Police implementing the Police Evacuation Plan before CDEM were directed to activate an evacuation. Subsequently, on direction from the Deputy Commissioner, Christchurch Police allowed residents to return into the evacuation zone, before MCDEM issued the

² <https://mapviewer.canterburymaps.govt.nz/?webmap=5169f2952c504dc4b24bb4cced6afbd3>

national warning cancellation message. It appears the Deputy Commissioner in Wellington had access to information from MCDEM earlier than the information being issued by MCDEM to CDEM Groups.

Prior to 14 November, CDEM staff had a process underway to update and communicate the Previous Evacuation Plan illustrating the evacuation zones. The review process was not complete and the updated maps were not yet signed off. Since 14 November, an updated interactive tsunami evacuation map has been posted on Council's website³. The current map provides for two different evacuation zones depending on the tsunami threat. Evacuation zone "red" relates to a tsunami threat for beach, foreshore and marine areas. Evacuation zone "orange" relates to a tsunami threat which impacts land areas. Evacuation zone "orange" covers the risks associated with local, regional or distant source tsunamis. In other words, the map is based on a worst case scenario in order to provide residents with one map to refer to. The Council's interactive map enables users to enter their address to determine whether that property is inside the evacuation zone. There are also pdf printable versions of the specific area maps available on the same webpage. They are high level maps which do not provide specific street names so are more difficult to apply to specific properties.

Recommendations

Residents require information and education on the differences between local, regional and distant source tsunamis and how to respond in each case. The reliance on activation of sirens should be addressed. Self-directed evacuation of residents in the evacuation zones must be encouraged to avoid delay. A good communication strategy is required to engage with residents and co-create material which covers the types of tsunami risk, the role sirens play, other methods of communicating an evacuation, evacuation procedures and routes to be taken by residents, etc. for each community.

All other relevant agencies (including Fire Brigade, CDEM Group, CDEM, Canterbury District Health Board, and Ministry of Education) with input from local communities, should be coordinated to assist Christchurch Police with the Police Evacuation Plan review. This will ensure that the Police Evacuation Plan dovetails in with any material and messaging issued by other agencies and seek endorsement from affected residents. The review should also consider how the security of residents' homes could be managed.

In addition to the Police Evacuation Plan, an evacuation plan specific to each community should be co-created with the other agencies and residents (Community Evacuation Plan). It should cover the different responses required depending on a local, regional and distant source tsunami. The Community Evacuation Plan should include methods of evacuation (running, cycling, etc.) and specific exit routes that evacuees can follow to reduce traffic congestion, where possible. Additionally, the Community Evacuation Plan should cater for the evacuation of vulnerable residents and visitors who are not able to self-evacuate. Consideration should be given to whether the Community Evacuation Plan should cater for night vs day scenarios. Additionally, the evacuation of pets should be incorporated into each Community Evacuation Plan. A specific welfare centre (which is as close as possible) outside the evacuation zone should be identified in the Community Evacuation Plan to provide a destination for those residents who need somewhere to stay and information on what resources will be provided at that centre.

Once agreed between the various agencies and residents, the Community Evacuation Plan should be made publicly available and disseminated in conjunction with other tsunami information to residents within that community in all forms to make it as accessible as possible.

Consideration should be given to exploring the idea of engaging contractors (and possibly volunteers) to assist Police with traffic management coordination in an evacuation. In the same manner that

³ <https://www.ccc.govt.nz/services/civil-defence/what-to-do-in-an-emergency/tsunami/evacuating>

contractors (such as City Care Limited) are engaged to assist with rural fire fighting services, contractors could provide support to the Police to implement the Police Evacuation Plan which in turn dovetails in with the Community Evacuation Plan.

A discussion with NZ Police, MCDEM and CDEM Groups should be encouraged to ensure that the timing of and information received by agencies is aligned. This will assist in ensuring that consistent and clear messaging is provided to residents by all relevant agencies.

A discussion with all relevant agencies should take place to ensure that each agency is familiar with the evacuation zone map provided by Council and that the map aligns with any messaging or maps issued by other agencies.

Evacuation maps are a useful tool. However, maps will not necessarily be readily available in situations where there are visitors or residents who have recently moved into coastal areas. Council should explore (with input from residents) other options of communicating the evacuation zones. Possible options include:

- lines painted on roads, or signs erected on roadsides or some other visual demarcation point;
- working with telecommunication providers so that hazard text alerts are issued to all mobile phone users within the evacuation zone.

Communications

Observations

In emergency events, Christchurch Police send a representative to the Group office - Emergency Coordination Centre (ECC) in order to have one point of contact directly within Group. This enables the dissemination of information received by Group from MCDEM and decisions made by Group to be communicated through that one representative back to Christchurch Police quickly.

The CDEM Duty Officer with support from the CDEM team managed public communications immediately after the earthquake on 14 November. Several messages were posted on the CDEM Facebook page providing residents with information, as it became available.

From 2:07am (when the EOC was activated) the PIM managed all public communications in various forms. The PIM relied on information received from CDEM to issue public communications. In some instances, the information issued was not accurate. For example, residents were directed to evacuate to a welfare centre but the welfare centre was not yet open and ready to receive residents when the message was communicated publicly.

In the last 12 months, Council implemented a "bulletin messaging" system which enables the CDEM Duty Officer to issue text alerts to the Emergency Operations Center (EOC), civil defence volunteers and others. This messaging system worked very well on 14 November. It enabled the Duty Officer to efficiently and quickly communicate with a large number of people at once and activate the EOC when required.

The Council call centre received approximately 600 calls from midnight to 8am on 14 November. The calls were all responded to by two call centre staff members. The average handling time for the calls was well within the service level requirements. The call centre staff did a superb job of managing the call volume and responding to every call received. Many residents called to complain about the sirens sounding for so many hours.

A process is currently being implemented whereby the call centre will provide more information to CDEM regarding the themes from calls received from residents. This will assist with understanding the concerns in the community which will enable better public communication to be issued. Additionally,

CDEM will provide more regular updates to the call centre to enable operators to give more detailed and up to date responses to callers.

The Mayor and Councillors require information and updates as soon as an event is being monitored by the CDEM Duty Officer. This enables them to provide assurance and direction to the residents and for the Mayor to be briefed to respond to media enquiries.

Recommendations

In the event the EOC is activated, CDEM should send a representative to the ECC to enable the dissemination of information received by Group from MCDEM and decisions made by Group to be communicated through that one representative back to CDEM and the EOC. This will be more easily achieved once the Precinct is established.

The CDEM Duty Officer and CDEM team should focus on communications from MCDEM, Group and other agencies in order to evaluate situations and make decisions. The Procedure should clarify that the CDEM Duty Officer will enlist the support of PIM, as soon as the CDEM Duty Officer begins to monitor an event. This will provide greater resources to enable clear consistent messaging to residents.

CDEM, PIM and EOC need to work together to streamline each of their processes and ensure that they nicely align. All processes should be reviewed and updated on a regular basis to keep them up to date and responsive to lessons learnt from previous events.

In order to avoid inconsistent messaging to the public, PIM should monitor messaging from other agencies/the media during an event to provide updates to the CDEM Duty Officer and the Local Controller.

The General Manager who manages Civil Defence within the Council should be responsible for keeping the Mayor and Councillors informed on a regular basis throughout an event. This means that the Duty Officer and Local Controller need to provide the GM with information on a regular basis.

To summarise the recommended lines of communication –

- the Duty Officer (with support from CDEM team) focuses on receiving and interpreting messages from MCDEM, Group, other agencies, call centre, welfare centres, and providing information to the Local Controller, Duty PIM, GM, call centre and welfare centres regularly.
- the Duty PIM focuses on receiving and interpreting information from the Duty Officer, Local Controller and the EOC, and providing regular information to the public and the media.
- the Local Controller focuses on receiving information from the Duty Officer and making decisions, then communicating those decisions to the Duty Officer, PIM and the GM.
- the GM focuses on receiving information from the Local Controller and the Duty Officer and keeping the Mayor and Councillors informed.

It is important that the above people are working within the same building, preferably the emergency operations centre, for ease of communication, and that they wear their civil defence vests so that people's roles can easily be identified.

Messaging to the Public

Observations

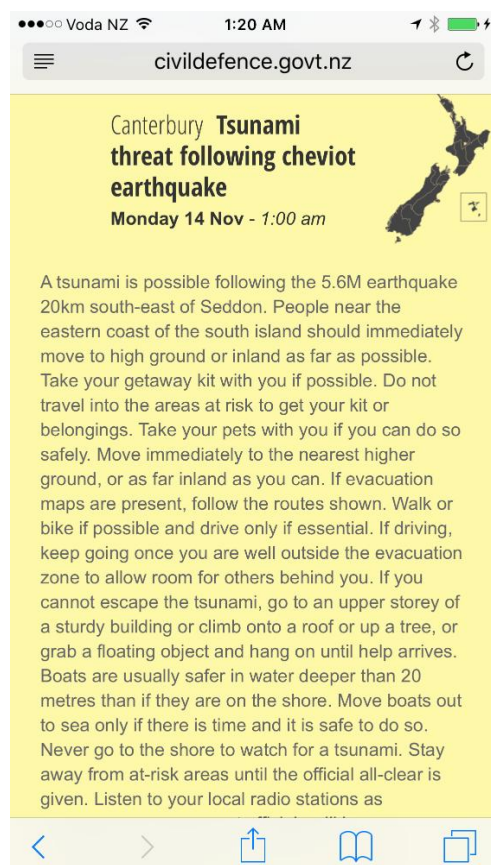
A concern expressed by residents is that on 14 November 2016, they were bombarded with information from all directions but the information did not align and was not clear.

On 14 November, residents in suburbs which were outside the evacuation zone did not understand whether they needed to evacuate. Some residents evacuated when they were not required to do so. This caused confusion and greater traffic congestion.

Various methods of communication were used on 14 November to issue messages to the public. The CDEM Facebook page was a useful tool to communicate with the public. As information was received by the PIM, Facebook messages were posted. It became difficult for the public to determine which information was relevant and what had been superseded. This occurred because in some cases the information was put on Facebook as new posts without a time stamp. These posts were then shared by users even though more recent information was being released.

It became evident early on 14 November, that the messaging on the MCDEM website, Facebook page and those made through the media were different from the messaging on CDEM Facebook page. Concern regarding the different messaging was expressed by the Mayor of Christchurch (and Councillors) to Council staff.

The Mayor took a screenshot at 1:20am of the public messages MCDEM were saying in their 1:00am update:



In accordance with protocol, CDEM staff are not permitted to contact MCDEM directly and are required to communicate with Group. It is unclear whether Group alerted MCDEM to the concerns regarding inconsistent messages issued by MCDEM, the media and CDEM.

Throughout the night of 14 November, Radio New Zealand kept reporting that there was an evacuation and interviewing highly stressed people in Christchurch, who did not know what to do or where to go. It is not clear if MCDEM were monitoring the media coverage which are essentially lifeline support networks that the public often rely on. It is also not clear whether MCDEM were checking why the confusion existed - either with the reporting of an evacuation or the local civil defence groups and local authorities for not activating an evacuation. The inconsistent messages should have been identified on 14 November and should have been resolved.

The public education campaign undertaken by MCDEM following 14 November, focused on "Long, Strong, Get Gone". Residents appear to understand that "long" means an earthquake lasting one minute or more. "Strong" means that the earthquake is such that it is difficult to stand up. However, the term "get gone" leaves many residents confused. MCDEM has provided guidance that "get gone" means "move immediately to the nearest high ground or as far inland as possible". However, it is unclear how far residents need to move before they are no longer in the tsunami evacuation zone.

It appears that there is significant focus on the PIM providing information to the media. This may be to the detriment of residents who then must rely on the media to receive information. The media should be utilised if it will assist and benefit residents but should not take priority over residents.

There are times when the messaging to residents from agencies including Council lacked human warmth and empathy. Personal contact with affected residents is as vital as public messaging.

Recommendations

Where possible, messaging to residents should be issued through one agency to enable consistency and clarity. To identify a process which would enable messaging through one agency, the CDEM team should liaise with Group and other agencies to coordinate how this could best be achieved. A process should be agreed and adopted by all relevant agencies.

During any event, one person should be tasked with providing regular messaging to the public with details of what's happening, where it's happening, what steps are being taken and any other useful information which impacted residents would want to know. One person holding the pen in Christchurch across all agencies will assist with clear, concise, consistent messaging.

Consideration should be given as to whether CDEM and Group should merge. This could more easily be achieved once the emergency agencies move into the Precinct. It would assist with consistent messaging, clear communication between MCDEM, Group and CDEM, as well as resourcing.

The term "get gone" should be clarified by MCDEM to mean "move immediately to the nearest high ground or as far inland as necessary". Additionally, the public should be directed to information which will tell them where that point is. MCDEM advises that the wording will remain "as far as possible" because:

- "Not all Groups have completed tsunami evacuation zone mapping/evacuation planning;
- "Necessary" requires the public to make an informed decision about where the zone boundaries are;
- If an evacuation is required for 1000s of people, it is necessary for people to not only get just outside the evacuation zone but to keep going to prevent congestion behind for those still evacuating (especially if evacuation is by vehicle)".

When information is posted on Facebook regarding an event, there should be one rolling post with a date and time stamp for each new entry. This means that when that post is shared by Facebook users, the post will update automatically and will enable the user to see the latest information and when it was posted.

In order to minimise the risk of IT technical issues occurring when information is being communicated by the PIM (e.g. through Twitter), an IT technician should be dedicated to the PIM to provide support.

CDEM should prepare (within the next 6 weeks) a draft plan detailing the public education and communication campaign to be provided to the GM of CDEM. The plan should include how CDEM will work with other agencies, community boards and residents to co-create the Community Evacuation Plans, as well as community recovery and resilience plans which are specific for each community. The support of community governance teams to assist CDEM to develop the community recovery and resilience plans should be enlisted. CDEM's draft plan should include specific deliverables and milestones and what resources are required. The recovery and resilience plans should include other risks (such as pandemics, severe weather, fire, etc.), not just tsunamis.

CDEM and EOC staff need to be reminded each day during an event that affected residents are the priority of any event. Responding to their needs is paramount. If their need is to receive information, then that should be the first priority. Where possible personal contact by way of phone calls to affected residents should be made.

Response following Evacuation and the EOC

Observations

It is difficult for agencies to know whether people have evacuated from the evacuation zones. Currently, there is no "evacuation register" where residents and visitors can register their details to confirm they have evacuated and how they can be contacted. Equally, it would be beneficial for agencies to know when evacuees have returned home.

The number of civil defence volunteers has declined over the years. Many who were previously volunteers have left. There is a concern amongst residents that there are insufficient volunteers and those that are volunteers do not have sufficient training.

On 14 November, welfare centres were opened to accommodate evacuees. These centres are managed by civil defence volunteers and resources are provided by the Council. It appears that public communication was issued that a welfare centre was open, yet when residents arrived at the centre, the centre was not yet open. Some residents gathered at Burwood Hospital thinking that it was a welfare centre, but Linwood College was in fact the welfare centre. There was also confusion amongst residents as to where they should go because schools are all sectors posts in an emergency but they are not all welfare centres.

Welfare centre staff were not provided regular updates on the status of the event. This meant that when asked by residents for information, they were not able to provide much. On one occasion, one welfare centre was advised that the evacuation was no longer required. Based on this information, residents tried to return to their homes only to be told that the evacuation was still in place and no access past the cordon was permitted.

The scope of this review did not extend to a review of how well the PIM and EOC function. However as part of this review, a number of observations came to light. The EOC databases do not appear to be up to date detailing which staff are trained, their specific skill sets and a duty roster. This meant that a large number of staff were called into the EOC on an ad hoc basis without clarity of the need, skills sets required and ensuing that there is capability within EOC as well as Council business as usual requirements.

EOC systems and processes were at times either not clearly understood or followed. This resulted in a lack of clarity regarding who was responsible for leading and delivering a particular action/function. The large number of staff called into the EOC at once meant that many ended up working very long hours with no fresh staff to replace them. There is a risk of staff burning out.

It appears that it was not always clear what the EOC's overall objective was for the event, or the specific objectives for each day and who was responsible for what functions and tasks.

The Local Controller has little capacity to manage the functions of the EOC because the Local Controller is extremely busy receiving information from CDEM, Group, etc. and making decisions.

On the completion of the Precinct, the various emergency agencies will be housed within the same building. The EOC will therefore be set up within the Precinct. This will likely result in some of the observations and recommendations relating to the EOC to be reviewed and streamlined.

Recommendations

The CDEM team should liaise with Christchurch Police and Group to discuss establishing an evacuation register as part of an existing civil defence website. The information provided would need to be managed in accordance with the Privacy Act 1993 to ensure confidentiality and security. Provision for evacuees who report to welfare centres to register themselves on the evacuation register should be explored.

A campaign should be undertaken to enlist more civil defence volunteers. Additionally, Council staff (with the necessary skills), should be regularly trained to respond to civil defence emergencies. Residents need reassurance that even when some volunteers leave, there are sufficient volunteers available to respond to an event. The Council should look to external parties (other agencies and residents) to enlist the assistance of specialised and skilled personnel to staff the EOC. This would reduce the pressure on the Council to resource the EOC as well as continue to provide business as usual services.

Before communication is issued to the public regarding the opening of welfare centres, the CDEM team need to:

- identify which facilities are appropriate to be used as welfare centres
- check that they are outside the evacuation zone
- liaise with the welfare staff to determine exactly what time the facility will be open
- check whether any specific resources are required to be provided.

A clear line of communication must be implemented between CDEM and each welfare centre with one person at each end responsible for keeping the other informed on a regular basis with updates.

Resources at welfare centres should be sufficient to provide evacuees with basic food and water provisions, something to sleep on and some form of entertainment (especially for children). A stock take of the resources available at each welfare centre should be undertaken regularly to identify deficiencies.

EOC systems and processes need to be reviewed to ensure that there is absolute clarity with respect to:

- who is the one person with overall responsibility for the EOC and the lines of communication to and from that person;
- who is responsible for each component of the EOC (i.e. Intel, Logistics, PIM) and what actions/functions that component is responsible for;
- the shift handover process;
- ensuring that templates, database and other resources are up to date.

EOC staff who are called in should be well trained. An organisational commitment is required to ensure there is sufficient provision for the EOC. Staff should only be required to work for a reasonable

period of time, be provided healthy food and given time to rest and recover. There should be a sufficient number of EOC staff to enable fresh staff to take over at the end of a shift.

At the end of each shift, the handover process should be closely followed to ensure that the new shift understands what has occurred in the last shift, what is yet to be done, etc.

Staff should not give out personal numbers to the public or other agencies. Information requests and dissemination should flow through the EOC, rather than individual staff members who may no longer be on shift when the information is required to be disseminated.

The overall strategic plan (with the objectives within that plan), should be written on a board in the EOC room and communicated by the Local Controller at every briefing so that all EOC staff have focus and clarity on their role. The EOC should spend more time planning the response rather than simply responding to individual issues.

The number of Local Controllers who are trained should increase from three to at least six. This would provide assurance that if staff leave, are ill, on holiday, etc. there are sufficient others to call upon and run three shifts through a 24 hour period.

Consideration should be given regarding which role is best placed to manage the EOC. The Local Controller's role is such that there is little time left for the overall management of the EOC. The Local Controller is constantly receiving information, making decisions, liaising with the media. The day to day management of the EOC would be better placed in the hands of another role (i.e. a person within CDEM). Options should be explored to ensure that the EOC is functioning at its optimum at all times.

Next Steps

In order to ensure that messaging is consistent and clear, CDEM must actively engage with all other relevant agencies to identify, agree and adopt a process which will be followed by the agencies with respect to public messaging.

It will be vital for CDEM to engage with all coastal communities regarding how an evacuation would proceed, given the range of different types of tsunamis that Christchurch could face. Additionally, it is important for CDEM to go through this Report with the coastal Community Boards and community leaders in each affected community/area and to assist them with the co-creation of evacuation material to be disseminated to affected residents.

Appendix I Timeline of Events

Time	Action	Agency/Person Involved	Reference
12:02am	Large earthquake felt in Christchurch		
12:02am	GeoNet App advises 6.6m, 39kms deep, near Culverden. On land	██████████ (CDEM Duty Officer at CCC) checks GeoNet App	Interview with ██████████ ██████████
12:03am	Initial report provided regarding status of earthquake: 6.5 magnitude, 25kms deep, on land near Hanmer Springs	GNS Science via GeoNet website	http://www.geonet.org.nz/quakes/2016p858000
12:04am	Updated report: 7 magnitude, 44 kms deep, on land near Culverden	GNS Science via GeoNet website	http://www.geonet.org.nz/quakes/2016p858000
12:05am	Updated report: 7.5 magnitude, 47 kms deep, on land near Culverden	GNS Science via GeoNet website	http://www.geonet.org.nz/quakes/2016p858000
12:05am	Telephone to ██████████ (Head of CDEM & Rural Fire, CCC) re a new event has occurred. Discussed location and size of event	██████████ (CDEM Duty Officer)	Mobile phone records supplied by Spark Interview with ██████████ ██████████ Interview with ██████████ ██████████
12:08am	Telephone to ██████████ (CDEM Duty Officer at CCC) Discussed the need to check in with CDEM staff to monitor	██████████ (Head of CDEM & Rural Fire, CCC)	Mobile phone records supplied by Spark Interview with ██████████ ██████████ Interview with ██████████ ██████████
12:08am	Updated report: 6.6 magnitude, 16 kms deep, on land near Culverden	GNS Science via GeoNet website	http://www.geonet.org.nz/quakes/2016p858000

12:11am	Telephone to [REDACTED] [REDACTED] Discussed the need to check in with Fire and Police Communication Centres to get information on event given it's not local. [REDACTED] to contact Fire and Police.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
12:13am	Message posted on CDEM Facebook page advising "An earthquake has struck Christchurch, Initial reports from Geonet say 6.6 Magnitude, 20km south-east of Hanmer Springs. Remember to Drop, Cover, Hold. More information to follow soon".	[REDACTED] [REDACTED] CDEM posted the message on Facebook	CDEM Facebook page Interview with [REDACTED] [REDACTED]
12:16am	Telephone to [REDACTED] [REDACTED] (Canterbury Regional Emergency Management Office) to discuss event and identify who the duty officer is for Canterbury CDEM Group. [REDACTED] advised duty officer is [REDACTED] [REDACTED] (Canterbury CDEM Group Team Leader)	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
12:17am	Text message from Mary Richardson to Mayor of Christchurch City and CEO of CCC – "Hi CDEM team currently checking for damage from this earthquake. At this stage all seeks ok for ChCh. Yet to hear how Waimakariri and Hurunui are. We may be asked to provide support. Mary"	Mary Richardson, CCC	Interview with the Mayor
12:18am	Text message from CEO of CCC to Mary Richardson and Mayor – "Thanks Mary"	Karleen Edwards, CCC	Interview with the Mayor
12:18am	Email to CDEM team and John Mackie (CDEM Local Controller) advising because earthquake on land there is no tsunami threat but monitoring the situation	[REDACTED] CDEM	Interview with [REDACTED] [REDACTED] Copy of email subject line: "6.6 earthquake near Culverden"
12:20am	Telephone to general Fire Communications telephone line. Fire Comms advises no damage in ChCh with few alarms set off. Damage reports in Blenheim.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED]
12:20am	Message posted on CDEM Facebook page advising "initial reports from GeoNet say 6.6 Magnitude, 20km SE of Hanmer Spring. Remember to Drop, Cover, Hold. More information to follow soon".	[REDACTED] [REDACTED] CDEM posted	CDEM Facebook page Interview with [REDACTED] [REDACTED]

		the message on Facebook	Interview with [REDACTED]
12:22am	Telephone to general Police Communications telephone line. Police Comms advised road damage reports especially in North Canterbury	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED]
12:23am	Telephone call to [REDACTED] [REDACTED] (CDEM team member, CCC) to discuss whether to meet in Civic Building to monitor situation. [REDACTED] suggested it would be good to head into Civic.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
12:24am	Telephone call to [REDACTED] [REDACTED] re whether to meet in Civic Building to monitor situation	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
12:25am	Email received by CDEM Duty Officer re "National Advisory: Earthquake No:01" advising "MCDEM has issued an earthquake advisory. An earthquake has occurred with these parameters: NZ Time: 0002 hours 14 November 2016 Location: 20kms SE of Hanmer Springs Co-ordinates: -42.63, 172.99 Depth: 16km Magnitude: 6.6 <i>No mention of tsunami</i>	National Controller (Shane Bayley), MCDEM issued email	Interview with [REDACTED] Interview with [REDACTED] [REDACTED] Copy of email subject line: "National Advisory: Earthquake – No:01".
12:25am	Telephone call to [REDACTED] [REDACTED] re the content of the email received from MCDEM.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]

12:27am	Telephone call to [REDACTED] [REDACTED] re monitoring situation best to be done from Civic Building. Agreed to meet in Civic.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
12:28am	Text alert received by CCC staff directing them to check email – “National Advisory – Earthquake No:01”	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
12:29am	Telephone calls to John Mackie. No response. Voicemail left.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED]
12:29am	Telephone call to [REDACTED] [REDACTED] (Operational Readiness Coordinator, CCC) re whether he’s available to draft and issue the bulletin message.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
12:29am	Text message from Mayor to Mary Richardson – “Thanks for that Mary. Can you arrange for me to get a situation report in the morning (buildings inspected etc.) just in case the media want any comment”.	Mayor of Christchurch City	Interview with the Mayor
12:30am	Text message from Mary Richardson to Mayor – “Will do”	Mary Richardson, CCC	Mobile phone records supplied by Spark. Interview with the Mayor Interview with Mary Richardson
12:32am	Telephone to John Mackie (Local Controller, CCC) to discuss that event had occurred and that CDEM would monitor the situation.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED]

12:33am	Telephone call from [REDACTED] (Deputy Team Leader, Registered Volunteer Response Team) through CCC Call Centre advising that he is responsible for co-originating the Response Team in [REDACTED] absence. Agreed to meet in Civic Building.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED]
12:34am	Telephone call to [REDACTED] to advise that [REDACTED] is on her way to Civic Building.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
12:35am	Bulletin messages sent to Emergency Operations Centre (EOC) roster advising: "We are currently monitoring following the m6.7eq. The EOC is NOT activated. Please remain on standby".	[REDACTED] CDEM	Interview with [REDACTED] Screen shot of text from [REDACTED] mobile phone
12:35am	Message posted on NZ Civil Defence Facebook page advising: "Hope everyone is safe after that. Remember to drop, cover and hold in any aftershocks."	NZ Civil Defence	NZ Civil Defence Facebook page
12:40am	Email received by CDEM Duty Officer re "National Advisory: No Tsunami Threat to New Zealand No:01" advising "the Pacific Tsunami Warning Centre (PTWC) has issued a Tsunami Information Statement in response to the earthquake. Only messages issued by MCDEM represent the official warning status for NZ. MCDEM has assessed the information with the assistance of scientific advisors. Based on the current information, the initial assessment is that the earthquake is unlikely to have caused a tsunami that will pose a threat to NZ".	National Controller, MCDEM issued email	Interview with [REDACTED] Interview with [REDACTED] Copy of email subject line: "National Advisory: No Tsunami Threat to New Zealand – No:01".
12:43am	Text alert received by CCC staff directing them to check email – "National Advisory: No Tsunami Threat to New Zealand No 1"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
12:44am	Telephone call to [REDACTED] re Civic Building should be safe to enter. Agreed to meet in Civic.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]

12:45am	Telephone call to [REDACTED] [REDACTED] re meeting in Civic Building	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED]
12:47am	Text message from Mayor to [REDACTED] [REDACTED] – “I’ve asked Mary for situation report in morning in case media want comment”.	Mayor of Christchurch City	Interview with the Mayor Interview with [REDACTED] [REDACTED]
12:48am	Text message from [REDACTED] [REDACTED] to Mayor – “RNZ already texting me to see if there’s any update from here. ECO not being activated... just monitoring”.	[REDACTED] [REDACTED] CCC	Interview with the Mayor Interview with [REDACTED] [REDACTED]
12:48am	Message posted on CDEM Facebook page advising “we are currently gathering situational awareness and will share information as it comes in. At this stage there are no significant reports of damage across the city. Expect aftershocks and look after those around you”.	[REDACTED] [REDACTED] CDEM posted the message on Facebook	CDEM Facebook page
12:51am	Telephone call to the [REDACTED] [REDACTED] (Duty Public Information Manager, CCC) to advise that PIM support may be required depending on status of event	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED]
12:56am	Telephone call to [REDACTED] [REDACTED] re plan to meet in Civic Building	[REDACTED] [REDACTED] CDEM	Interview with [REDACTED] [REDACTED]
1:00am	Text alert received by CCC staff directing them to check email – “National Warning: Tsunami Threat No 1”	MCDEM issued text	Screen shot of text from [REDACTED] [REDACTED] mobile phone
1:00am	Email received by CDEM Duty Officer re “National Warning: Tsunami Threat No:01” advising “MCDEM has issued a tsunami warning for all southern coastal areas of NZ. A tsunami is possible. The first wave activity may not be the most significant. Tsunami activity will continue for several hours and the threat must be regarded as real until this warning is cancelled. MDCDEM is still assessing the threat and will provide more information within the next hour. Meanwhile, people in coastal areas should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities. Warning will remain in effect until a cancellation message is issued by MCDEM”. <i>No mention of “evacuation of coastal areas”, “land threat” or “moving inland or to higher ground immediately”.</i>	National Controller, MCDEM issued email.	Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED] Copy of email subject line: “National Warning: Tsunami Threat - No:01”.

1:03am	Telephone call to [REDACTED] [REDACTED] re tsunami warning message has been received from MCDEM	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
1:05am	Text message from Mayor to Mary Richardson – “Tsunami warning reported RNZ news – all southern coastal areas – what does that mean?”	Mayor of Christchurch City	Interview with the Mayor
1:05am - 1:10am	Arrive in Civic Building	[REDACTED] CDEM [REDACTED] [REDACTED] CDEM	Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
1:07am	Text message from Mayor to [REDACTED] [REDACTED] – “RNZ stating Tsunami warning all southern coastal areas - http://www.civildefence.govt.nz ”.	Mayor of Christchurch City	Interview with the Mayor
1:08am	Telephone call to [REDACTED] [REDACTED] to advise that a tsunami warning message has been received from MCDEM and that CDEM staff are monitoring situation from Civic and PIM support is required.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
1:13am	Text message from Mayor to Mary Richardson – “Radio NZ are dreadful – here’s the CD website http://www.civildefence.govt.nz – who has to move? Are we using the Tsunami sirens?”	Mayor of Christchurch	Interview with the Mayor
1:13am	Text message from Mary Richardson to Mayor – “I think national crisis Mong centre in Wgtm assessing whether threat. Aim trying to find out more – will let you know” [Typo corrections - I think National Crisis “Management” Centre in Wellington assessing whether threat. “Am” trying to find out more – will let you know].	Mary Richardson, CCC	Interview with the Mayor
1:16am	Telephone call to [REDACTED] [REDACTED] (Geological Hazards Analyst, Environment Canterbury, Group natural hazards adviser) re what does the tsunami warning mean for Christchurch. [REDACTED] advised because the earthquake occurred on land, there was not tsunami risk. The message from MCDEM is a marine threat meaning there are likely to be unusual currents at shore. This means stay off the beaches and watch the tides.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED]

			Interview with [REDACTED]
1:17am	Text message from Mary Richardson to Mayor – “Hi getting scientific advise specific for ChCh. Will update asap”.	Mary Richardson, CCC	Interview with the Mayor
1:18am	In person discussion between [REDACTED] [REDACTED] and [REDACTED] [REDACTED] re advice from [REDACTED] [REDACTED]. Agreed that [REDACTED] would post update on Facebook of marine threat but no evacuation.	[REDACTED] CDEM [REDACTED] [REDACTED] CDEM	Interview with [REDACTED] Interview with [REDACTED]
1:18am	Text message from [REDACTED] [REDACTED] to Mayor – “Have spoken to our CD team. They’re going in to work and will call me about the tsunami warning shortly”.	[REDACTED] [REDACTED] CCC	Interview with the Mayor Interview with [REDACTED]
1:18am	Text message from Mayor to [REDACTED] [REDACTED] – “Mary is talking to Wgtn”.	Mayor of Christchurch City	Interview with the Mayor Interview with [REDACTED]
1:20am	Arrive in Civic Building	[REDACTED] [REDACTED] CDEM	Interview with [REDACTED] Interview with [REDACTED] [REDACTED]
1:21am	Message posted on CDEM Facebook page advising “Hi everyone, the Ministry of Civil Defence & Emergency Management have issued a tsunami threat message for the eastern coast of the South Island. People are advised to stay off the beaches, out of the water. We will continue to monitor and update you as we know more”.	[REDACTED] [REDACTED] CDEM posted the message on Facebook	CDEM Facebook page
1:23am	Messages posted on CDEM Facebook page from residents advising “Get Thru is saying to evacuate”, “Evacuate or stay indoors. Not very clear”, “How come there are no tsunami sirens going off?”, “Is this info out of date?”, “Sirens aren’t going but everyone is moving”, “I’m hearing conflicting warnings from several sources. This is far too confusing”.	Various residents	CDEM Facebook page
1:23am	Messages posted on NZ Civil Defence Facebook page from residents: “Ya’ll should delete the earlier tweets saying there’s no tsunami threat – they are still showing up as top hits under the eqnz hashtag”, “So is there a tsunami risk? Conflicting info – your site says no then it says situation has changed, you guys need to sort out what you are telling us so we can react”, “How far away from the coast should be considered safe?”, “Why isn’t anyone putting on the sirens?”, “Why don’t you sound the sirens?”, “Bloody hopeless CD THIS IS NO GOOD!”, “Can you be more specific please”.	Various citizens	NZ Civil Defence Facebook page

1:24am	Text message from Mary Richardson to Mayor – “Advise is Tsunami threat people are advised to stay off beaches and out of water. No evacuation required at this stage”.	Mary Richardson, CCC	Interview with the Mayor
1:29am	<p>Email received by CDEM Duty Officer re “National Warning: Tsunami Threat No 2” advising “MCDEM has issued a tsunami warning for Eastern coast of North and South Island including the Chatham Islands. It may arrive in the Eastern Coast of the North Island shortly. Move inland or to higher ground immediately. A tsunami is possible. The first wave activity may not be the most significant. Tsunami activity will continue for several hours and the threat must be regarded as real until this warning is cancelled. MDCDEM is still assessing the threat and will provide more information within the next hour. People in coastal areas should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities. Warning will remain in effect until a cancellation message is issued by MCDEM”.</p> <p><i>First notification advising to “move inland or to higher ground immediately” but other than advising that the warning covers the “Eastern coast of North and South island including Chatham Islands”, it doesn’t specify exactly which or if all coastal areas should be evacuated and no mention of “land threat” to alert readers that the tsunami threat is not just to marine and beach areas.</i></p>	National Controller, MCDEM issued email.	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: “National Warning: Tsunami Threat - No:02”.</p>
1:30am	Text alert received by CCC staff directing them to check email – “National Warning: Tsunami Threat No 1”	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
1:30am	Text message from [REDACTED] [REDACTED] to Mayor – “CD CHC just done update to say no marine threat here but to stay off beaches etc”.	[REDACTED] CCC	<p>Interview with the Mayor</p> <p>Interview with [REDACTED]</p>
1:30am	Telephone call from Police District Communications Centre through CCC Call Centre re MCDEM information is different from local information issued by CCC on CDEM Facebook page. Police asked if CCC was asking residents to evacuate. Advised no CCC was not asking residents to evacuate because information received from MCDEM advises it’s only a marine and beach threat.	[REDACTED] CDEM	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED] Christchurch Police</p>
1:32am	Text message from Mayor to [REDACTED] [REDACTED] – “Not updated on MCDEM website”.	Mayor of Christchurch City	<p>Interview with the Mayor</p> <p>Interview with [REDACTED]</p>

1:35am	Message posted on CDEM Facebook page advising "UPDATE: No evacuations have been issued at this stage and we are continuing to seek further clarification from MCDEM. Stay out of water, stay off beaches, Do not go sightseeing".	██████████ CDEM posted the message on Facebook	CDEM Facebook page Interview with ██████████
1:39am	Messages posted on CDEM Facebook page advising "No evacuations have been issued at this stage and we are continuing to seek further clarification from MCDEM. Stay out of water, stay off beaches, Do not go sightseeing".	██████████ CDEM	CDEM Facebook page
1:39am	Text message from Mayor to ██████████ – "RNZ have revised but now saying Tsunami generated – 2m recorded in Kaikoura – telling people to make way to higher ground".	Mayor of Christchurch City	Interview with the Mayor Interview with ██████████
1:40am	Telephone call to the ██████████ (Duty Public Information Manager, CCC) advising the need to get PIM to support communications to residents by providing updates on social media.	██████████ CDEM	Mobile phone records supplied by Spark Interview with ██████████ Interview with ██████████
1:41am	Telephone to ██████████ (CDEM Manager at Waimakariri DC) to discuss whether sirens had been sounded in Waimak DC. Waimak DC hadn't sounded sirens and were waiting to get clear direction from CDEM Group and a steer from CCC before Waimak DC would activate sirens.	██████████ CDEM	Mobile phone records supplied by Spark Interview with ██████████ Interview with ██████████
1:41am	Text message from ██████████ to Mayor – "CD CHC just done update saying no evacuation required".	██████████ CCC	Interview with the Mayor Interview with ██████████
Between 1:30am – 2am	Telephone discussion between ██████████ (Canterbury CDEM Group Team Leader) and ██████████ (Geological Hazards Analyst, Environment Canterbury, Group natural hazards adviser) re notifications received from MCDEM and what the risks are specifically to Canterbury and Christchurch. ██████████ advised it looks like a marine and breach threat, not a land threat. ██████████ asked whether the sirens should be activated and ██████████ advised, based on her local knowledge of tsunamis and the Canterbury topography, she didn't think that an evacuation was necessary given it wasn't a land threat. ██████████ had been checking the Christchurch tide gauge which indicated a half metre wave in Christchurch therefore an evacuation was not necessary.	██████████ Canterbury CDEM Group ██████████ (Geological Hazards Analyst, Environment Canterbury,	Interview with ██████████ Interview with ██████████

		Group natural hazards adviser)	
1:45am	Text message from Mayor to [REDACTED] [REDACTED] – “RNZ hosts still saying low lying coastal areas should move to higher ground”.	Mayor of Christchurch	Interview with the Mayor Interview with [REDACTED]
1:46am	Email to coastal communities Elected Members advising “advice is tsunami threat, people are advised to stay off beaches and out of the water. No evacuation required at this stage”.	Mary Richardson, CCC	Copy of email subject line “Tsunami Warning” Interview with Mary Richardson
1:47am	Telephone call to [REDACTED] [REDACTED] (Canterbury CDEM Group, Regional Emergency Management) because could not get through the normal CDEM Group telephone number. Requested CDEM Group to provide update on scientific advice from local hazards panelist and what this means for Christchurch	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
1:47am	Telephone call to [REDACTED] [REDACTED] (Geological Hazards Analyst, Environment Canterbury, Group natural hazards adviser) requesting advice on interpretation of the National Warning received from MCDEM and whether any potential for tsunami in Christchurch. Confirmation from [REDACTED] that Christchurch not required to be evacuated.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
1:49am	Message posted on NZ Civil Defence Facebook page advising: “Edit 1:49am A tsunami has been generated, the first wave has arrived in the North Eastern Coast of the South Island and it may arrive in Eastern Coast of the North and South Islands of New Zealand shortly (including Wellington, Christchurch and the Chatham Islands). The first wave may not be the largest. Waves may continue for several hours. Move inland or to higher ground immediately”.	[REDACTED] [REDACTED] CDEM	CDEM Facebook page Interview with [REDACTED]
1:50am	Updated report: 7.5 magnitude, 15 kms deep, on land near Culverden	GNS Science via GeoNet website	http://www.geonet.org.nz/quakes/2016p858000
1:50am	Text message from Mayor to Mary Richardson – “Councillors are getting worried – see Glenn’s email – RNZ still reporting people in low lying areas should move to higher ground. ChCh people are confused cause no tsunami sirens. They are interviewing New Brighton woman who has self evacuated. MCDEM still warning Tsunami”.	Mayor of Christchurch City	Interview with the Mayor

1:54am	Text message from Mary Richardson to Mayor – “Hi – I sent eastern councillors email about 10 mins ago with same message I txt you. I haven’t seen Glenn’s email. But will ask MCDEM can clarify message on website”.	Mary Richardson, CCC	Interview with the Mayor
1:57am	Text message from Mayor to Mary Richardson – “I have sent to you”.	Mayor of Christchurch City	Interview with the Mayor
1:57am	Email from Mayor to Mary Richardson “Trouble is that the two women hosting RNZ are urging people to go to higher ground at the end of the official announcement. People are very confused. The NB woman said her elderly neighbour was reluctant to leave because there was no tsunami siren. ”		
1:57am	Text message from [REDACTED] [REDACTED] to Mayor – “National CD about to change its messaging to say Kaikoura only affected by Tsunami risk. Just told [REDACTED] the conflicting info coming out from cd causing panic and abuse on social media”.	[REDACTED] [REDACTED] CCC	Interview with the Mayor Interview with [REDACTED] [REDACTED]
1:58am	Text message from Mayor to [REDACTED] [REDACTED] – “Will forward you email I just sent Mary – we need to fix this urgently”.	Mayor of Christchurch	Interview with the Mayor Interview with [REDACTED] [REDACTED]
2:01am	Text alert received by CCC staff directing them to check email – “National Warning: Tsunami – Threat No 3”	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
2:01am	Text message from Mary Richardson to Mayor – “MCDEM are expected to update their information shortly”.	Mary Richardson, CCC	Mobile phone records supplied by Spark. Interview with the Mayor Interview with Mary Richardson
2:01am	Email received by CDEM Duty Officer re “National Warning: Tsunami Threat #3 HAMNER SPRINGS EARTHQUAKE AND TSUNAMI No:03 MARINE AND LAND THREAT” advising “MCDEM has issued a tsunami warning for all of the eastern coast of the North Island and all of the east coast of the South Island including the Chatham Islands. Confirmation has been received that a tsunami was generated. Waves have been detected on the Geonet Tsunami Gauges. The first tsunami wave activity has been detected in the areas around Kaikoura and Wellington. The first wave activity may not be the most significant. Tsunami activity will continue for several hours and the threat must be regarded as real until this warning is cancelled. People in coastal areas	National Controller, MCDEM issued email.	Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED] Copy of email subject line: “National Warning: Tsunami Threat#3 HAMNER SPRINGS

	<p>should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities. Warning will remain in effect until a cancellation message is issued by MCDEM".</p> <p><i>First notification using the words "land threat" and advising that "low lying areas on the East Coast... move immediately to higher ground".</i></p>		EARTHQUAKE AND TSUNAMI".
2:03am	Telephone to Mary Richardson re National Warning received from MCDEM of tsunami threat	██████████ CDEM	Mobile phone records supplied by Spark Interview with ██████████ Interview with Mary Richardson
2:05am	Telephone to ██████████ (Canterbury CDEM Group Team Leader) to check that MCDEM were directing CDEM to activate the sirens. ██████████ confirmed yes, at the direction of the National Controller, CDEM must activate the sirens.	██████████ CDEM	Mobile phone records supplied by Spark Interview with ██████████ Interview with ██████████
2:05am	Text message from Mayor to Mary Richardson – "Can we send an email to all councillors".	Mayor of Christchurch City	Interview with the Mayor
2:07am	Bulletin messages sent to Emergency Operations Centre (EOC) roster advising: "The EOC has been activated in response to the earthquake situation. If you are on the EOC roster please report to the Civic Function Room".	██████████ CDEM	Screen shot of text from ██████████ mobile phone Interview with ██████████
2:07am	Telephone call to ██████████ (Director of Meerkat Alert Systems) to instruct sirens to be activated.	██████████ CDEM	Mobile phone records supplied by Spark Interview with ██████████ Interview with ██████████

2:07am	Telephone to [REDACTED] [REDACTED] (District Operations Manager, Chch Police) to request that the Police activate the "Coastal Evacuation Plan" because CCC is setting off the tsunami sirens. Informed by Police that the Police had started evacuating approximately half an hour before on the direction of the District Commander. The District Commander had been directed to activate the Coastal Evacuation Plan by the Deputy Commissioner of National Operations of Police based in Wellington.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED] Police
2:10am	Telephone call to [REDACTED] [REDACTED] to check that sirens were being activated and to advise that Police were already evacuating coastal areas.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
2:11am	Sirens activated manually	[REDACTED] [REDACTED] – Meerkat Alert Systems	Interview with [REDACTED] [REDACTED]
2:11am	Telephone call to [REDACTED] [REDACTED] to check that the sirens were activated. Confirmed that they were now activated and sounding.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
2:11am	Telephone call to [REDACTED] [REDACTED] (Geological Hazards Analyst, Environment Canterbury, Group natural hazards adviser) advising that the sirens have been activated as per MCDEM's directions. [REDACTED] agreed that in order to keep message to residents consistent, given MCDEM had directed an evacuation, residents in Christchurch should be evacuated but that it was unlikely a tsunami would impact Christchurch.	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
2:12am	Telephone to Councillor Livingstone to advise that tsunami sirens about to be activated	Mary Richardson, CCC	Copy of email subject line "Mary has run to say Tsunami sirens about to be activated" Interview with Mary Richardson

2:14am	Telephone to [REDACTED] (PIM) to advise that sirens had been activated and requesting PIM to issue communications to residents notifying them that evacuation is now required.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
2:15am	Message posted on CDEM Facebook page advising "UPDATE: 2:15am: NEW INFORMATION: We are evacuating low lying areas of Christchurch, including around the estuary. This is a precaution as we are not expecting large waves or substantial damage on land in Christchurch"	[REDACTED] PIM	CDEM Facebook page Interview with [REDACTED]
2:15am	"Can you be more specific re low lying areas?", "That took way too long to announce", "Can you please tell us what areas? We can hear sirens".	Various residents	CDEM Facebook page
Between 2.12am – 2.30am	Waimakariri DC activate sirens which sounds for a few seconds, followed by a voice automated instruction re tsunami threat and evacuation, this is repeated continuously on a loop. Many residents in Waimak DC had already evacuated because of media coverage on TV and radio advising evacuation was necessary.	[REDACTED] (CDEM Manager at Waimakariri DC)	Interview with [REDACTED]
2:19am	Telephone to [REDACTED] (Geological Hazards Analyst, Environment Canterbury, Group natural hazards adviser) requesting local technical knowledge regarding potential tsunami threat and whether [REDACTED] had any further information from the "National Advisory Panel". [REDACTED] advised that she was not receiving any more communication from the National Advisory Panel.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
2:24am	Message posted on CDEM Facebook page advising "If you live on low lying ground within one kilometre of the Christchurch coastline you are advised to evacuate inland or to higher ground. This is a precaution as we are not expecting substantial waves or damage on land. For more information of low-lying areas go to: http://canterburymaps.govt.nz/.../Tsunami_Canterbury.html	[REDACTED] CDEM	CDEM Facebook page Interview with [REDACTED]
2:34am	Telephone call to [REDACTED] – Meerkat Alert Systems to instruct sirens to be manually activated every 15 minutes until requested to stop or until the batteries die.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
2:39am	Email to Elected Members advising that Christchurch Civil Defence is asking people to evacuate low-lying areas within 1km of the coast. Tsunami sirens are being sounded. ECO is activated. Further updates will follow	[REDACTED] PIM	Copy of email subject line "Earthquake update" Interview with [REDACTED]

2:42am	Telephone call to [REDACTED] re [REDACTED] contacting Police DCC to advise that sirens will be activated every 15 minutes	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
2:44am	Text message from CEO to Mayor and Mary Richardson – “Just a constant stream of traffic coming up into the hills. Roads are clogging up. K”	Karleen Edwards, CEO, CCC	Mobile phone records supplied by Spark. Interview with the Mayor
2:46am	Text message from Mary Richardson to Mayor and CEO – “Hi – police are taking responsibility for traffic – as roads are disaster”.	Mary Richardson, CCC	Mobile phone records supplied by Spark. Interview with the Mayor Interview with Mary Richardson
2:49am	Message posted on CDEM Facebook page advising “UPDATE: 2:49am: If you If you live on low lying ground within one kilometre of the Christchurch coastline you are advised to evacuate inland or to higher ground. This is a precaution as we are not expecting substantial waves or damage on land. For more information of low-lying areas go to: http://canterburymaps.govt.nz/.../Tsunami_Canterbury.html	[REDACTED] CDEM	CDEM Facebook page Interview with [REDACTED] [REDACTED]
2:52am	Telephone to [REDACTED] [REDACTED] (Geological Hazards Analyst, Environment Canterbury, Group natural hazards adviser) requesting local technical knowledge regarding potential tsunami threat.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED] [REDACTED]
3:00am	Telephone to [REDACTED] [REDACTED] (Canterbury CDEM Group Team Leader) requesting an update on status and whether sirens should continue sounding. [REDACTED] confirmed sirens should continue until notification from MCDEM advises there is no longer a land threat.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
3:00am	Text message from Mayor to [REDACTED] [REDACTED] – “should I come in?”	Mayor of Christchurch City	Interview with the Mayor Interview with [REDACTED] [REDACTED]

3:20am	Text alert received by CCC staff directing them to check email – “National Warning#5: Tsunami - Threat to Marine and Land Areas”	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
3:20am	<p>Email received by CDEM Duty Officer re “National Warning#5: Tsunami – Threat to Marine and Land Areas” advising “MCDEM has issued a tsunami warning (marine and land threat) from East Cape to Southland, including Wellington (which also includes the Cook Straight area), Marlborough Sounds/ Tasman Bay and the Chatham Islands, and a marine threat for all other New Zealand coastal areas. See the map attached for affected areas. Areas under “Marine and Land Threat’ can also expect a threat to coastal inundation to land areas near the shore. Current assessments indicate that wave amplitudes of up to 3-5 meters along the coastlines closest to the earthquake epicenter (estimated from Blenheim to Banks Peninsula, and also including the Chatham Islands) can be expected in some areas (see attached map). People in coastal areas should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.”</p> <p>Map attached highlights Christchurch and Banks Peninsula as subject to a tsunami threat at a level of 3-5m.</p> <p><i>Notification no longer refers to the need to move inland or to higher ground. Notification introduces reference to local authorities interpreting information and advising public action.</i></p>	National Controller, MCDEM issued email.	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: “National Warning#5: Tsunami -Threat to Marine and Land Areas”</p>
3:21am	Email to [REDACTED] PIM requesting that a message is posted on Twitter as soon as possible	Mayor, CCC	Copy of email subject line “Earthquake update”
3:29am	Telephone call to [REDACTED] (Senior Sergeant, Christchurch Police) advising that there were residents in the evacuation zone who could not be contacted. Requesting Police assistance to make contact with those residents. Confirmation came later that Police were able to make contact with those residents.	[REDACTED] CDEM	<p>Mobile phone records supplied by Spark</p> <p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p>
3:30am	Message posted on CDEM Facebook page advising “The tsunami sirens have been sounding for some time but have currently stopped. They will be restarting in half an hour. The evacuation for people living in low lying areas within one kilometer of the Christchurch coastline remains in place. Where possible please make contact with family and friends who may live inland or higher ground as evacuation points”.	[REDACTED] PIM	<p>CDEM Facebook page</p> <p>Interview with [REDACTED]</p>

3:34am	Email to Councillors and CEO advising EOC has opened and the team will provide regular updates	Mary Richardson, CCC	Copy of email subject line "Mary has run to say Tsunami sirens about to be activated" Interview with Mary Richardson
3:35am	Telephone call to [REDACTED] [REDACTED] (volunteer Fire Fighter in Sumner) re gathering information of response from Sumner residents to inform whether messaging is effective	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
3:36am	Surely if the civil defence map has 3-5m waves for Canterbury coast then 1km is not far enough away for evacuation?	Resident	CDEM Facebook page
3:45am	Telephone call to [REDACTED] [REDACTED] re whether Sumner residents are evacuating	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
3:45am	Telephone to [REDACTED] [REDACTED] (Geological Hazards Analyst, Environment Canterbury, Group natural hazards adviser) requesting any updates. [REDACTED] confident that a tsunami in Christchurch was still very unlikely but that until MCDEM cancelled the tsunami warning, it was not appropriate for the sirens to be deactivated.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
3:50am	Media release by CCC advising residents that residents in low-lying coastal areas within 1km of the Canterbury coast are instructed to evacuate, sirens have been sounding for some time and their operation may be intermittent but the precautionary evacuation order remains in place. Media releases issued to a database of media contacts, elected members, community boards, etc.	[REDACTED] [REDACTED] PIM	Copy of media release subject line "3.50am Civil Defence earthquake update" Interview with [REDACTED] [REDACTED]
3:51am	Text message from [REDACTED] [REDACTED] to Mayor – "Updating on civil defence website and ccc website".	[REDACTED] [REDACTED] CCC	Interview with the Mayor Interview with [REDACTED]

3:56am	Message posted on CDEM Facebook page advising "3.56AM - LATEST UPDATE: Christchurch Civil Defence and Emergency Management has activated its Emergency Operations Centre and is currently responding to the earthquake. Civil Defence Controller John Mackie says people in low-lying coastal areas within one kilometre of the Canterbury coast are instructed to evacuate inland or head to higher ground. Tsunami sirens have been sounding for some time and there operation may be intermittent but the precautionary evacuation order remains in place".	■■■■ PIM	CDEM Facebook page Interview with ■■■■
3:59am	Text message from Mayor to NewstalkZB – "I've just arrived at council – will have to get briefing from EOC first. Will txt when I know".	Mayor of Christchurch	Interview with the Mayor
4:25am	Text alert received by CCC staff directing them to check email – "National Warning#6 NO CHANGE Tsunami Threat to Marine and Land Areas"	MCDEM issued text	Screen shot of text from ■■■■ mobile phone
4:03am	Message posted on NZ Civil Defence Facebook page advising: MCDEM has issued a tsunami warning and land threat from East Cape to Southland, including Wellington, Marlborough Sounds/Tasman Bay and the Chatham Islands, and a marine and beach threat for all other New Zealand coastal areas. The first tsunami waves have arrived but it is too early to know what damage or casualties there may have been. Further waves should be expected and may be larger or more dangerous. See the map for more information. New Zealanders should stay off the beaches, stay out of the water, and not go sightseeing. People are encouraged to keep themselves informed and follow the advice of their local civil defence groups as the situation develops across the country. Spread the word to any family or friends who are living or staying near the coast. Information can be found through radio, TV and social media. If you have been advised to evacuate, follow your local tsunami evacuation procedures. The response is currently being managed by local authorities."	MCDEM	NZ Civil Defence Facebook page

4:24am	<p>Email received by CDEM Duty Officer re "National Warning: NO CHANGE Tsunami – Threat to Marine and Land Areas No 6" advising "MCDEM has issued a tsunami warning (marine and land threat) from East Cape to Southland, including Wellington (which also includes the Cook Straight area), Marlborough Sounds/Tasman Bay and the Chatham Islands, and a marine threat for all other New Zealand coastal areas. See the map attached for affected areas. Areas under "Marine and Land Threat" can also expect a threat to coastal inundation to land areas near the shore. Current assessments indicate that wave amplitudes of up to 3-5 meters along the coastlines closest to the earthquake epicenter (estimated from Blenheim to Banks Peninsula, and also including the Chatham Islands) can be expected in some areas (see attached map). People in coastal areas should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if a land threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action. Local authorities will determine the implication of the expected wave heights for their areas and will decide on appropriate response actions (e.g. evacuations). Listen or check for this information from your local authority."</p> <p>Map attached highlights Christchurch and Banks Peninsula as subject to a tsunami threat at a level of 3-5m.</p>	National Controller, MCDEM issued email	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: "National Warning NO CHANGE Tsunami – Threat to Marine and Land Areas No 6"</p>
4:46am	<p>"Mairehau High opened as an evacuation point for those needing a place to go. You may wish to also go to family and friends located inland areas"</p> <p>Issues around evacuation points not being open when public messages were posted and only opened later.</p>	[REDACTED] PIM	<p>CDEM Facebook page</p> <p>Interview with [REDACTED]</p>
5am	Media release by CCC advising residents that 3 evacuation centres are open, Civil Defence has released maps showing the city-wide evacuation zone with maps attached, sirens continue to sound though they might be intermittent and providing explanation why there is a tsunami risk	[REDACTED] PIM	<p>Copy of media release subject line "5am earthquake update"</p> <p>Interview with [REDACTED]</p>
5am	Message posted on CDEM Facebook page advising "3 evacuation centres are open, Civil Defence has released maps showing the city-wide evacuation zone with maps attached, sirens continue to sound though they might be intermittent and providing explanation why there is a tsunami risk"	[REDACTED] PIM	<p>CDEM Facebook page</p> <p>Interview with [REDACTED]</p>

5:04am	Telephone call to [REDACTED] [REDACTED] (Welfare Volunteer in Akaroa) confirming consent to tea and coffee being provided to evacuees in Akaroa	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
5:14am	Telephone to [REDACTED] [REDACTED] (CDEM Manager at Waimakariri DC) to discuss whether sirens still sounding in Waimak DC. Yes, sirens continuing to sound and will not be deactivated until notification from MCDEM that there is no land threat	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
5:44am	Text alert received by CCC staff directing them to check email – “National Warning#7 Tsunami - Threat to Marine and Beach Areas”	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
5:44am	<p>Email received by CDEM Duty Officer re “National Warning#7: Tsunami – Threat to Marine and Beach Areas” advising “MCDEM has issued a tsunami warning (marine and beach threat) for the East Coast of New Zealand, from East Cape to Southland, and also the Kapiti Coast and Tasman Bay/Marlborough Sounds. See the attached map for affected areas. The Chatham Islands and the region between Blenheim and Banks Peninsula is still prone to a marine and land threat, and future maximum wave amplitude of approx. 1-3 meters can still possibly be expected to occur. Areas under “Marine and Beach Threat’ can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbor, estuary and small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over the period this warning is in effect. Current assessments indicate that coastal inundation (flooding of land areas near the shore) is not expected but this assessment may change. People in coastal areas should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p>Map attached highlights Christchurch and Banks Peninsula as subject to a tsunami threat at a level of 3-5m.</p>	National Controller, MCDEM issued email	<p>Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED] Copy of email subject line: “National Warning#7: Tsunami – Threat to Marine and Beach Areas”</p>

	<i>Notification title has changed from "marine and land threat" and does not make it clear that those areas should continue to move inland or to higher ground.</i>		
6.15am	Message posted on CDEM Facebook page advising "People living in white areas shown below may return home provided they do not need to pass through a cordoned area..."	■■■■■■■■■■ PIM	CDEM Facebook page Interview with ■■■■■■■■■■ ■■■■■■■■■■
6:36am	Telephone to ■■■■■■■■■■ (Canterbury CDEM Group Team Leader) requesting update on whether sirens still need to continue sounding	■■■■■■■■■■ CDEM	Mobile phone records supplied by Spark Interview with ■■■■■■■■■■ ■■■■■■■■■■ Interview with ■■■■■■■■■■ ■■■■■■■■■■
6:56am	<p>Email received by CDEM Duty Officer re "National Warning: Tsunami – Threat to Marine, Beach and Land Areas No 8" advising "MCDEM has issued a tsunami warning (marine, beach and land threat) for the East Coast of New Zealand, from East Cape to Southland, and also the Kapiti Coast and Tasman Bay/Marlborough Sounds. The Chatham Islands and the coastal areas between Blenheim and Banks Peninsula are still prone to a marine and land threat, and future maximum wave amplitude of approx. 1-3 meters can still possibly be expected to occur. Areas under "Marine and Beach Threat" can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbour, estuary and small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over the period this warning is in effect. A land threat still exists and these areas may result in coastal inundation to land areas near the shore. Current assessments indicate that wave amplitudes of up to 2m can be expected in some areas (Chatham Islands and the coastal areas between Blenheim and Banks Peninsula). People in coastal areas should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p><i>Map no longer attached.</i></p>	National Controller, MCDEM issued email	<p>Interview with ■■■■■■■■■■ ■■■■■■■■■■</p> <p>Interview with ■■■■■■■■■■ ■■■■■■■■■■</p> <p>Copy of email subject line: "National Warning: Tsunami – Threat to Marine, Beach and Land Areas No 8"</p>

	<i>Notification title changed to include "land threat" but does not clarify the need to continue to move inland or to higher ground.</i>		
6:57am	Text alert received by CCC staff directing them to check email – "National Warning#8 Tsunami - Threat to Marine, Beach and Land Areas"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
7am	Media release by CCC advising people who live outside the evacuation areas in the city can begin to make their way home	[REDACTED] PIM	Copy of media release subject line "Update:7am"
7:04am	Telephone to [REDACTED] re whether Waimak DC still sounding sirens	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
7:23am	Text alert received by CCC staff directing them to check email – "NCMC Sitrep #001 for Hanmer Springs EQ & Tsunami event issued at 07:15 hours, 14 November 2016".	National Crisis Management Centre	Screen shot of text from [REDACTED] mobile phone
7:28am	Text message to [REDACTED] (District Operations Manager, Christchurch Police) re Local Controller has heard that Police are pulling out of the cordons controlling the evacuation zones. Is this correct? "We still need to keep folk out of these areas until MCDEM have given the all clear". Followed by telephone discussion with [REDACTED] who advised he had received direction from Police District Commander that the evacuation was no longer require. Confirmed that Police would be available to assist with traffic management of residents returning to their homes once sirens were turned off.	John Mackie, CDEM Local Controller	Screen shot of text from John Mackie's phone Interview with John Mackie
7:59am	Text alert received by CCC staff directing them to check email – "National Warning#9 Tsunami - Threat to Marine and Beach Areas"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
8am	Email received by CDEM Duty Officer re "National Warning#9: Tsunami – Threat to Marine and Beach Areas" advising "MCDEM has issued a tsunami warning (marine and beach threat) from Napier to north Dunedin, Cook Straight coastal areas and The Chatham Islands. Please see map attached for affected areas. The threat for all other regions has been lifted. All previous threat regions will experience unusually strong currents for some time. Areas under "Marine and Beach Threat' can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbour, estuary and small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over the period this warning is in effect. Current assessments indicate that coastal inundation (flooding in land areas near the	National Controller, MCDEM issued email	Interview with [REDACTED] Interview with [REDACTED] Copy of email subject line: "National Warning#9: Tsunami – Threat to Marine and Beach Areas"

	<p>shore) is not expected but this assessment may change. People in Napier to north Dunedin, Cook Strait coastal areas and The Chatham Islands should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p>Map attached highlights Christchurch and Banks Peninsula as subject to a tsunami threat at a level of 0.2 -1m tsunami threat levels.</p>		
8:02am	Telephone to [REDACTED] (Canterbury CDEM Group Team Leader) to check that sirens can be deactivated. Confirmation that the cancellation message meant that the evacuation was no longer needed.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
8:08am	Text message from Mary Richardson to Mayor and CEO – “No longer land threat. Evacuation ended”.	Mary Richardson, CCC	Interview with the Mayor
8:10am	Message posted on CDEM Facebook page advising “people who were evacuated due to this morning’s earthquake are now able to go home”.	[REDACTED] PIM	CDEM Facebook page Interview with [REDACTED] [REDACTED]
8:11am	Text message from Mayor to Mary Richardson – “Good news”.	Mary Richardson, CCC	Interview with the Mayor
8:14am	Telephone call to [REDACTED] to deactivate the sirens from sounding because MCDEM advised there was no longer a land threat issued by MCDEM.	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED] [REDACTED]
8:15am	Sirens deactivated	[REDACTED] – Meerkat Alert Systems	Interview with [REDACTED] [REDACTED]
8:19am	Telephone to [REDACTED] (Canterbury Regional Emergency Management Office) to request any updates from Canterbury CDEM Group. Left voicemail message	[REDACTED] CDEM	Mobile phone records supplied by Spark

			Interview with [REDACTED] [REDACTED] Interview [REDACTED] [REDACTED]
8:20am	Media release by CCC advising people who were evacuated due to this morning's earthquake are now able to go home	[REDACTED] PIM	Copy of media release subject line "Update:8:20am" Interview with [REDACTED]
8:22am	Telephone to [REDACTED] (Canterbury Regional Emergency Management Office) to request update from Canterbury CDEM Group	[REDACTED] [REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
8:29am	Telephone to [REDACTED] (Canterbury Regional Emergency Management Office) to request further update from Canterbury CDEM Group	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
8.44am	Email from Mayor to Councillors and to Elected Members advising: "Thank you for your patience and understanding of the pressures on staff when confronted with an event like this. I'm glad the evacuation has ended and the EOC has been wound down. I'm sending this email to make a couple of observations. First, there was a difference between the notice Ministry of Civil Defence and Emergency Management (MCDEM) put on their website and what they communicated to our regional and local teams. Our local team responded entirely appropriately to this instruction (which remains on the CDEM site): People in all coastal areas should: 1. Stay out of the water (sea, rivers and estuaries, including boating activities) 2. Stay off beaches and shore areas 3. Do not go sightseeing 4. Share this information with family, neighbours and friends 5. Listen to the radio and/or TV for updates 6. Follow instructions of local civil defence authorities 7. If beach threat is forecasted for your area,	Mayor of Christchurch City	Interview with the Mayor

	<p>take appropriate evasive action The tsunami warning will remain in place until a cancellation message is issued.</p> <p>Our local Civil Defence staff took expert advice from ECan who's assessment was that an evacuation was not warranted.</p> <p>MCDEM then notified that people near the eastern coast of the South Island 'should immediately move to higher ground or inland as far as possible' just after 2am. That's when the decision was made to establish the Emergency Operations Centre (EOC) and to evacuate the coastal areas using the Tsunami sirens.</p> <p>Because Radio NZ was warning people to evacuate from 1am, there was considerable confusion. We need to follow this up with MCDEM, so there is a single source of truth in the future - and that it's accurate!!!</p> <p>As after every event there will be a debrief (which will include the need for pre-prepared maps based on scenarios).</p> <p>The second point is that images coming in from those inspecting the damage to State Highway 1 are starting to reveal the severity of this earthquake. It will take a long time for this vital transport link to recover. This could have major ramifications for us as a city and Canterbury as a region.</p> <p>I have sent a message of support and condolences to the Mayors of Kaikoura and Hurunui.</p> <p>Lianne Dalziel Mayor"</p>		
8:59am	Telephone to [REDACTED] (Canterbury CDEM Group Team Leader) to discuss support required by Hurunui DC and Kaikoura DC	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]
10:02am	Telephone to [REDACTED] [REDACTED] (Canterbury Regional Emergency Management Office) to request any updates from Canterbury CDEM Group	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] [REDACTED] Interview with [REDACTED] [REDACTED]

10:03am	<p>Email received by CDEM Duty Officer re "National Warning#11: NO CHANGE Tsunami – Threat to Marine and Beach Areas No 10" advising "MCDEM has issued a tsunami warning (marine and beach threat) from Napier to north Dunedin, Cook Straight coastal areas and The Chatham Islands. Please see map attached for affected areas. The threat for all other regions has been lifted. All previous threat regions will experience unusually strong currents for some time. Areas under "Marine and Beach Threat" can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbour, estuary and small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over the period this warning is in effect. Current assessments indicate that coastal inundation (flooding in land areas near the shore) is not expected but this assessment may change. People in Napier to north Dunedin, Cook Straight coastal areas and The Chatham Islands should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p>Map attached highlights Christchurch and Banks Peninsula as subject to a tsunami threat at a level of 0.2 -1m tsunami threat levels.</p> <p><i>Notification title states "#11" in heading but refers to "No: 10" and is unclear whether there continues to be a need to move inland or to higher ground.</i></p>	National Controller, MCDEM issued email	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: "National Warning#11: NO CHANGE Tsunami – Threat to Marine and Beach Areas"</p>
10:04am	Text alert received by CCC staff directing them to check email – "National Warning#11: NO CHANGE Tsunami Threat to Marine and Beach Areas"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
10:55am	Text alert received by CCC staff directing them to check email – "National Warning#12 Tsunami - Threat to Marine and Beach Areas"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
10:55am	<p>Email received by CDEM Duty Officer re "National Warning#12: NO CHANGE Tsunami – Threat to Marine and Beach Areas" advising "MCDEM has issued a tsunami warning (marine and beach threat) from Napier to north Dunedin, Cook Straight coastal areas and The Chatham Islands. Please see the attached map for affected areas. The threat for all other regions has been lifted. All previous threat regions will experience unusually strong currents for some time. Areas under "Marine and Beach Threat" can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbour, estuary and small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over</p>	National Controller, MCDEM issued email	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: "National Warning#12: NO CHANGE Tsunami – Threat</p>

	<p>the period this warning is in effect. Current assessments indicate that coastal inundation (flooding in land areas near the shore) is not expected but this assessment may change. People in Napier to north Dunedin, Cook Straight coastal areas and The Chatham Islands should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p>Map attached highlights Christchurch and Banks Peninsula as subject to a tsunami threat at a level of 0.2 -1m tsunami threat levels.</p> <p><i>Notification is unclear whether there continues to be a need to move inland or to higher ground.</i></p>		to Marine and Beach Areas"
11:22am	Telephone to [REDACTED] (Canterbury Regional Emergency Management Office) to request any further updates from Canterbury CDEM Group	[REDACTED] CDEM	Mobile phone records supplied by Spark Interview with [REDACTED] Interview with [REDACTED]
11:50am	Text alert received by CCC staff directing them to check email – "National Warning#13: UPDATE Tsunami -Threat to Marine and Beach Areas"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
11:51am	Email received by CDEM Duty Officer re "National Warning#13: UPDATE Tsunami – Threat to Marine and Beach Areas" advising "MCDEM has issued a tsunami warning (marine and beach threat) from Wellington to Banks Peninsula. Please see the attached map for affected areas. The threat for all other regions has been lifted. All previous threat regions may experience unusually strong and unpredictable currents for some time. Areas under "Marine and Beach Threat' can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbour, estuary and small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over the period this warning is in effect. Current assessments indicate that coastal inundation (flooding in land areas near the shore) is not expected but this assessment may change. People in Wellington to Banks Peninsula should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued	National Controller, MCDEM issued email	Interview with [REDACTED] Interview with [REDACTED] Copy of email subject line: "National Warning#13: UPDATE – Threat to Marine and Beach Areas"

	<p>by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p>Map attached highlights Christchurch and Banks Peninsula as subject to a tsunami threat at a level of 0.2 -1m tsunami threat levels.</p> <p><i>Notification is unclear whether there continues to be a need to move inland or to higher ground.</i></p>		
12:59pm	<p>Email received by CDEM Duty Officer re "National Warning#14: NO CHANGE Tsunami – Threat to Marine and Beach Areas" advising "MCDEM has issued a tsunami warning (marine and beach threat) from Wellington to Banks Peninsula. The threat for all other regions has been lifted. All previous threat regions may experience unusually strong and unpredictable currents for some time. Areas under "Marine and Beach Threat" can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbour, estuary and small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over the period this warning is in effect. Current assessments indicate that coastal inundation (flooding in land areas near the shore) is not expected but this assessment may change. People in Wellington to Banks Peninsula should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p><i>Notification is unclear whether there continues to be a need to move inland or to higher ground.</i></p>	National Controller, MCDEM issued email	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: "National Warning#14: NO CHANGE – Threat to Marine and Beach Areas"</p>
1:03pm	Text alert received by CCC staff directing them to check email – "National Warning#14: Tsunami Threat. No new information"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
2:08pm	Text alert received by CCC staff directing them to check email – "National Warning#15: Tsunami Threat. No new information"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
2:08pm	<p>Email received by CDEM Duty Officer re "National Warning#15: NO CHANGE Tsunami – Threat to Marine and Beach Areas" advising "MCDEM has issued a tsunami warning (marine and beach threat) from Wellington to Banks Peninsula. The threat for all other regions has been lifted. All previous threat regions may experience unusually strong and unpredictable currents for some time. Areas under "Marine and Beach Threat" can expect unusually strong currents and unpredictable water flows near the shore. This means a threat to beach, harbour, estuary and</p>	National Controller, MCDEM issued email	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: "National Warning#15: NO</p>

	<p>small boat activities. The severity of currents and changing water flows will vary within a particular coastal area and over the period this warning is in effect. Current assessments indicate that coastal inundation (flooding in land areas near the shore) is not expected but this assessment may change. People in Wellington to Banks Peninsula should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities, if beach threat is forecasted for your area, take appropriate evasive action. Warning will remain in effect until a cancellation message is issued by MCDEM. Local civil defence authorities will interpret this information for their areas and advise public action.</p> <p><i>Notification is unclear whether there continues to be a need to move inland or to higher ground.</i></p>		CHANGE – Threat to Marine and Beach Areas"
3:02pm	Email received by CDEM Duty Officer re "National Warning: Tsunami Threat CANCELLED" advising "MCDEM has cancelled the tsunami warning in place from Wellington to Banks Peninsula. Based on all available data, the tsunami threat has now passed. However, coasts may still experience unusual, strong currents and sea level fluctuations lasting for several more hours. People are advised to stay vigilant in and around coastal waters."	National Controller, MCDEM issued email	<p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p> <p>Copy of email subject line: "National Warning: Tsunami Threat CANCELLED"</p>
3:05pm	Text alert received by CCC staff directing them to check email – "National Warning#16: Tsunami Threat. CANCELLED"	MCDEM issued text	Screen shot of text from [REDACTED] mobile phone
3:17pm	Telephone call to [REDACTED] returning call re media queries received by CCC. [REDACTED] recommended that these are directed to Neville Reilly (Canterbury Civil Defence Emergency Group Controller)	[REDACTED] CDEM	<p>Mobile phone records supplied by Spark</p> <p>Interview with [REDACTED]</p> <p>Interview with [REDACTED]</p>
13 November	Updated report: 7.8 magnitude, 15 kms deep, on land near Culverden	GNS Science via GeoNet website	http://www.geonet.org.nz/quakes/2016p858000

Appendix II People Interviewed

Name	Position	Agency
Lianne DALZIEL	Mayor of Christchurch City	CCC
██████████	Head of CDEM & Rural Fire	CCC
██████████	CDEM (Duty Officer of CDEM on 14/11/16)	CCC
██████████	CDEM, Public Education & Comm Resilience Coordinator	CCC
██████████	CDEM, Operational Readiness Coordinator	CCC
John MACKIE	Head of Three Waters & Waste (Local Controller on 14/11/16)	CCC
Mary RICHARDSON	GM Customer & Community	CCC
██████████	Principal Advisor Communications (Duty Officer of PIM on 14/11/16)	CCC
██████████	Media Manager	CCC
██████████	Communications Advisor	CCC
██████████	Media Advisor (Social Media)	CCC

██████████	Community Development Advisor (Coastal-Burwood)	CCC
██████████	Community Development Advisor (Coastal-Burwood)	CCC
██████████	Real Time Analyst, Customer Services	CCC

Tsunami Evacuation Workshop Attendees - Coastal-Burwood Community Board - 31 January 2017

Name	Position	Agency
Kim MONEY	Chairperson	Coastal-Burwood Community Board
Tim BAKER	Board Member	Coastal-Burwood Community Board
Tim SINTES	Deputy Chairperson	Coastal-Burwood Community Board
David EAST	Councillor	Coastal-Burwood Ward
Glenn LIVINGSTONE	Councillor	Coastal-Burwood Ward
Linda STEWART JP	Board Member	Coastal-Burwood Community Board
██████████	Chairperson	Southshore Residents Association

██████████	Member	Southshore Residents Association
██████████	Chairperson	South Brighton Residents Association
██████████	Member	South Brighton Residents Association
██████████	Member	North New Brighton Residents Association
██████████	Member	Northshore Residents Association
██████████	Member	Northshore Residents Association
██████████	Community Governance Advisor	CCC
██████████	Community Development Advisor (Coastal-Burwood)	CCC
██████████	Community Development Advisor (Coastal-Burwood)	CCC

Tsunami Evacuation Workshop Attendees - Linwood-Central-Heathcote Community Board - 13 February 2017

Name	Position	Agency
Sally BUCK	Chairperson	Linwood-Central-Heathcote Community Board
Jake MCLELLAN	Deputy Chairperson	Linwood-Central-Heathcote Community Board
Alexandra DAVIDS	Board Member	Linwood-Central-Heathcote Community Board
Yani JOHANSON	Councillor	Linwood-Central-Heathcote Community Board
Sara TEMPLETON	Councillor	Linwood-Central-Heathcote Community Board
Deon SWIGGS	Councillor	Linwood-Central-Heathcote Community Board
Darrell LATHAM	Board Member	Linwood-Central-Heathcote Community Board
Tim LINDLEY	Board Member	Linwood-Central-Heathcote Community Board
Brenda LOWE-JOHNSON	Board Member	Linwood-Central-Heathcote Community Board

██████████	Community Board Adviser	CCC
██████████	Manager Community Governance (Lin-Cen-Hth)	CCC
██████████	Community Support Officer (Lin-Cen-Hth)	CCC

Persons External to CCC

Name	Position	Agency
██████████	District Operations Manager	Police
██████████	Senior Sergeant	Police
██████████	Director and Operator	Meerkat Alert Systems Ltd
██████████	Emergency Management Officer	Waimakariri District Council
Neville REILLY	Canterbury Regional Group Controller	Canterbury Regional Emergency Management Office
██████████	Canterbury Regional Group Team Leader	Canterbury Regional Emergency Management Office

██████████	Emergency Rescue Programme Coordinator	Canterbury Regional Emergency Management Office
██████████	Hazard Analyst	ECAN
██████████	Head of Emergency Management Operations	Auckland Council

Appendix III Ministry of Civil Defence & Emergency Management Feedback on the Draft Report

Page number	Section	Content	MCDEM feedback
N/A	All	<p>General comments on the earthquake and tsunami which could be added to the executive summary and in appropriate locations within the final "Review of the tsunami evacuation" report.</p> <p>Scientific advice and MCDEM response</p>	<p>It is important that these observations be prefaced with some context on how the scientific information available changed as the event unfolded. As explained below, these changes subsequently affected the type of National Warning System (NWS) messages issued. NWS messages are designed to prioritise threats to people and property, while also taking into consideration the inherent uncertainty of many hazard events.</p> <p>This event has now been described by scientists as the most complex earthquake in historical times worldwide, with 21 separate faults over 140 km rupturing in sequence (GNS Science live presentation to Media, March 12).</p> <p>Key points (expanded later):</p> <ul style="list-style-type: none"> • All decisions made regarding tsunami warnings by MCDEM are based on scientific advice using thresholds agreed between MCDEM and GNS Science. • All MCDEM plans and guidelines relevant to tsunami warnings state that official warnings will not be able to be provided for local source tsunami before waves arrive • MCDEM plans, procedures, technical standards and guidance stress the importance of pre-planning with communities and public education and exercises to support immediate self-evacuation following natural warnings of local source tsunami. <p>For an hour after the main shock, GeoNet, New Zealand's geological hazard monitoring agency was locating the earthquake as an on-land event with no chance of a tsunami being generated. This was the case until tsunami gauges showed that tsunami waves had been generated (40 minutes after the main shock).</p> <p>At this point it was recognised by GeoNet and communicated to MCDEM that the earthquake had also caused significant off-shore disturbance, large enough to trigger a threatening tsunami. This emphasises the complexity and uncertainty of very large earthquakes and the difficulties for scientists and emergency managers in assessing tsunami threat for local earthquakes. For this reason, messaging regarding warnings for local source tsunami from MCDEM has for many years (at least since 2008), been that for local tsunami threat official warnings are not reliable and may arrive after the first waves have already hit. MCDEM official advice is that natural warnings of long</p>

			<p>or strong earthquakes are the best warning for people in coastal areas to take action. Information on tsunami threats from local earthquakes is provided in as timely a manner as is possible in an environment of uncertainty, but it is essential that the public recognise and act on natural warnings rather than hesitate and wait for official warnings that may not be possible before waves arrive (Figure 1).</p> <div style="background-color: #f0f0f0; padding: 10px; border-radius: 10px;"> <p style="text-align: center;">SPECIAL CONSIDERATION – LOCAL SOURCE TSUNAMIS</p> <p>A tsunami generated in conjunction with a nearby large earthquake or undersea landslide may not provide sufficient time to implement official warning procedures.</p> <p>Persons in coastal areas who:</p> <ul style="list-style-type: none"> • experience strong earthquakes (hard to stand up) • experience weak earthquakes lasting for a minute or more • observe strange sea behaviour such as the sea level suddenly rising and falling, or hear the sea making loud and unusual noises or roaring like a jet engine <p>should not wait for an official warning. Instead, let the natural signs be the warning. They must take immediate action to evacuate predetermined evacuation zones, or in the absence of predetermined evacuation zones, go to high ground or go inland.</p> </div> <p><i>Figure 1 Excerpt from the National Tsunami Advisory and Warning Plan. Note this advice is repeated across multiple MCDEM guidelines, standards and websites.</i></p> <p>Section above from the national tsunami advisory and warning plan (page 6). Note all documents below are publicly available and MCDEM's expectation is that CDEM Groups are familiar with their contents.</p> <ul style="list-style-type: none"> • National Tsunami Advisory and Warning Plan (revised 2016) SP 01/09 • National Tsunami Signage (2008) TS 01/08 • Tsunami Warning Sirens (2014) TS 03/14 • Guide to the National Civil Defence Emergency Management Group Plan (revised 2015) • Working from the Same Page. Consistent Messages for CDEM (2010)
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			Nevertheless, when a local tsunami threat is detected, MCDEM will issue warning messages for New Zealand via the National Warning System, recognising that these messages will likely arrive after tsunami waves arrive in the closest locations to the earthquake. MCDEM reviews its processes and responses after every activation and have recognised that the first messages for this event could have been clearer. The review document for MCDEM's response will be provided to all CDEM Groups and publicly released in April 2017. There are several operational actions and message templates that have been updated as a result of this event, (combined with the review of the East Cape earthquake and tsunami of Sep 2 2016).
1	Cover page	Report Title	As this was a multi-region event make clear the review is for Canterbury evacuation, (specifically Christchurch City).
4	Executive Summary	<p>Bullet point 2. "There appears to have been a communication breakdown between the Ministry of Civil Defence & Emergency Management (MCDEM) and local civil defence groups, including Emergency Management Canterbury".</p> <p>Bullet point 3. Notes the timing and use of the Christchurch sirens during the local source tsunami event.</p> <p>Bullet point 4. "It is clear that most Christchurch residents relied on the sirens to signal an evacuation was required".</p> <p>Bullet point 5. No public knowledge of evacuation plan and no direction to tsunami evacuation zone maps.</p>	<p>Bullet point 2. Canterbury CDEM Group and Christchurch Emergency management received all National Warning System messages. Canterbury Group participated in teleconferences hosted by MCDEM during the event. The term breakdown does not reflect the communications that happened during the event.</p> <p>Message content from MCDEM was provided in an environment of rapidly changing advice and considerable uncertainty. Messages changed throughout the event as more information became known. That does not mean that messages were not sent and received. MCDEM requests that this sentence be removed. To ensure future messages are clear and ubiquitous, a new National Warning System Platform is currently being finalised and will be introduced in May 2017. This platform will rapidly and simultaneously send the same information via multiple channels (National Warning System messages, MCDEM websites, social media etc.) so all MCDEM messages will be consistent and updates issued at the same time across all channels.</p> <p>Bullet points 3 and 4. The timing of the use of sirens is from MCDEM's perspective aligned to Bullet points 4, 5, 6, 7, and 8. MCDEM produced the Tsunami Warning Sirens Technical Standard in 2014. This standard outlines the minimum requirements for standards and the appropriate use of them for tsunami public alerting. The Standard states "<i>The signals of existing sirens used for tsunami warnings at the time of publication of this standard should conform to this standard by 30 June 2020; all other aspects of this standard should be applied to existing sirens used for tsunami warnings from the date the standard is published</i>".</p> <p>MCDEM does not endorse, and advises against, the use of sirens (especially so for non-voice capable sirens) for local source tsunami events. Signal-only sirens provide an ambiguous message, and are particularly difficult to understand for visitors and new migrants. They provide no information on the nature of the threat or the correct actions to take. Their use in real events nationally and internationally and a significant body of research have shown that sirens can be</p>

		<p>Bullet point 6. Consistent messaging across agencies.</p> <p>Bullet point 7. Residents want evacuation maps and information on tsunami.</p> <p>Bullet point 8. The community should be involved in developing plans.</p>	<p>misinterpreted, can delay life-safety actions, and are not best practice for public alerting. Within the Standard it is explicitly stated that tsunami warning sirens:</p> <ul style="list-style-type: none"> • Are inappropriate (and may increase the risk to the public) when used for local source tsunami), • Are only suitable for use for regional and distant source tsunami when accompanied by targeted and continuous public education • Are not to replace official advice that natural warnings for local source tsunami are the best warning for the public • Where they are signal only (no voice capability) they should always mean seek further information and not indicate evacuation, all –clear, or any other meaning • Should be only one of a range of warning methods used by CDEM Groups to alert the public <p>Public education for the use of tsunami sirens should include information on how and when tsunami sirens will be used and have strong links to community response planning (including evacuation drills).</p> <p>Response planning for tsunami should include hazard and evacuation zone mapping, including sharing of these zones with the public, preparing operating procedures for the use of sirens and understanding the limitations of sirens.</p> <p>MCDEM is concerned that the draft Review of the Tsunami Evacuation report states community members in at-risk locations will not take action to evacuate (ignoring all other official warnings e.g. radio broadcasts and social media posts from official agencies) unless they hear a siren. MCDEM expects Christchurch CDEM to adhere to the Tsunami Sirens Technical Standard and work with communities to address this concern.</p> <p>Bullet points 5-8 cover public education and response planning. These are part of a wider process of planning for tsunami and are linked with the types of warnings systems used for tsunami, including understanding of natural warnings. Comprehensive guidance on engaging with the public, mapping evacuation zones, developing local tsunami evacuation plans, working with communities and developing clear maps and public education materials are provided in the documents referred to above. (See Figure 2).</p>
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			<p>5 Steps to Effective Early Warning Systems within Resilient Communities</p> <p>1 Early Warning System Hardware, electronics, communications and planning necessary to effectively detect a hazard, generate a warning message and transmit them to at-risk regions (including any use of public notification hardware). Multiple channels with consistent, officially-verifiable message.</p> <p>2 Planning Decision-making tools: thresholds, evacuation routes and maps, inter-organisational relationships and communication channels.</p> <p>3 Co-operation, Discussion & Communication Pre-planned and exercised communication between central government agencies, local emergency management agency staff, scientists, media and community representatives. Renewal of contacts must be regular and permanently sustained, to overcome common high staff turnover.</p> <p>4 Education & Participation Public education, staff training, maps, and signs. Designed with the community.</p> <p>5 Exercises Scenario development and simulations - table-top and preferably full, with observation and feedback.</p> <p>Research (vertical bar on the left)</p> <p>Effectiveness Evaluation (vertical bar on the right)</p>
5	Background	"caused confusion right across New Zealand"	<p>This is an opinion statement and not fact. The event was highly complex and during the first hour in particular the assessment of the hazard was very difficult for scientists. It was unclear until wave action was detected that there was a tsunami threat. This made the provision of clear messaging more challenging. It is acknowledged that the first two National Warning System messages in particular required more detail but stating there was "confusion right across New Zealand" is subjective and arguably inaccurate. Despite the uncertainty (which is to be expected in such complex geological events), many communities around New Zealand (including in Canterbury) self-evacuated following the natural warning of the earthquake. These people took the correct action under the circumstances and MCDEM applauds their actions. For any large earthquake (>M7) in New Zealand, getting clear information will always be both a challenge and a</p>

			reality as the shaking can be so great that instruments can provide conflicting or confusing information.
5	Background	States a tsunami threat and possible evacuation requirement was only made clear in the 2.01 am NWS message received from MCDEM	<p>The following message was sent via the National Warning System at 0125 on November 14th, 2016.</p> <p><i>"The Ministry of Civil Defence & Emergency Management (MCDEM) has issued a tsunami warning for Eastern coast of North and South Island including the Chatham Islands. It may arrive in the Eastern Coast of the North Island shortly. Move inland or to higher ground immediately."</i></p> <p>The Tsunami Advisory and Warning Plan and Guide to the National CDEM Plan make it clear that MCDEM will provide tsunami warnings describing threats to land, beach marine areas, and not evacuation advice for the public. This is the responsibility of CDEM Groups. However, given the scientific advice had changed since the earlier no threat message had been issued, a precautionary approach was taken due to the risk to life. MCDEM did advise evacuation in this case, as is within its remit. Up until November 14th there was no expectation from CDEM Groups that MCDEM would advise evacuation during any tsunami event.</p> <p>Note that for regional and distant source tsunami with hours of warning time available, MCDEM provide messages stating a threat to land and marine or beach and marine with expected wave heights at the coast. CDEM Groups then assess this based on their local knowledge and evacuation thresholds and advise the public to evacuate if required. During the November 14th event the evacuation message and land threat messages were distributed by MCDEM based on advice that waves could be significant and widespread.</p> <p>In such uncertain and potentially life-threatening events with very little response time and a threat already established, MCDEM expects all CDEM groups to act consistently with national warnings and not hesitate or take actions inconsistent with national advice.</p> <p>To promote consistent response, since this event MCDEM has created new warning templates for large subduction zone earthquakes that advise which areas should evacuate immediately.</p>
7	National Warning System	CDEM Groups are responsible for disseminating national warnings to local communities CDEM Groups analyse information and decide what to do in their region.	This is true for most hazards, but where an event is already occurring and a threat to life has been identified, MCDEM may include specific instructions to the public its warnings. These messages are sent to the media as well as CDEM Groups. MCDEM also uses its social media channels in time critical events.
8	Local source tsunami-lead	With regards to warnings from the Guide to National CDEM Plan	As stated in the Guide to the National CDEM Plan, warning for local source tsunami is the responsibility of Groups, this is because it should be strongly focussed on public education for natural warnings as per various tsunami-related MCDEM guidelines and technical standards.

	agency is CDEM Group		<p>However, during events that meet pre-determined thresholds, MCDEM may issue national warnings and advisories for any event which threatens people and property, for which CDEM is the lead agency. In this event, tsunami waves of a significant height (2.5 draw-down on tide gauges) were already recorded, they would likely continue for multiple hours and may still have not yet arrived in other parts of New Zealand further from the earthquake. Therefore, MCDEM took the step of using the National Warning System to issue a specific message regarding a threat on land and advising evacuation. It is acknowledged that national warnings from MCDEM to CDEM Groups which are then distributed to the public cannot be assumed to be delivered before the first tsunami waves arrive. This is explicitly stated in the Guide to the National CDEM Plan the Tsunami Advisory and Warning Plan as noted in the "Review of the tsunami evacuation" draft report.</p>
10	Decision Making	<p>"As referred to in the Guide, on receiving a PTWC message, MCDEM works with a panel of scientists to determine the risks and consider what information should be issued through the national warning system."</p> <p>Group establishing its own tsunami panel</p> <p>Timing and contents of national warning messages</p>	<p>GNS Science may convene a Tsunami Experts Panel to provide advice to MCDEM for regional and distant source events. MCDEM does not "work with" the panel, and the panel would not be involved providing advice for MCDEM for initial warnings during local source events.</p> <p>The National CDEM Plan, The Guide to the National CDEM Plan and the Tsunami Advisory and Warning Plan describe the role of the Tsunami Experts Panel in providing advice to MCDEM at the national level during tsunami events.</p> <p>MCDEM does not support Groups developing alternative expert panels that operate during events to second-guess the official national advice provided by the Tsunami Experts Panel of New Zealand.</p> <p>For local source events this is particularly problematic as clear scientific data is difficult to access, and the time period for action is compressed. MCDEM does support the use of tsunami scientific advice in the development of tsunami hazard maps and evacuation zones and pre-event tsunami planning, but consultation of scientists by Groups during local source tsunami events will likely be counter-productive. When national advice is that there is a land threat and the Group is providing alternative information to the public, this will subvert the objective of a consistent response and will reduce public trust and confidence in civil defence emergency management.</p> <p>MCDEM acknowledges that advising evacuation is a best-judgement precautionary measure during local source events when earthquake and tsunami monitoring instrument readings may be</p>

		New NWS Templates	<p>conflicting, scientists are working with changing data and the threat is complex and difficult to understand. In these instances, MCDEM operates on the best information we have available. If the threat turns out to be lower than initially estimated, there may have been unnecessary precautionary evacuations in some areas. This is the acceptable trade-off given the alternative, which is to underestimate a threat.</p> <p>During this event tsunami waves severely damaged a property in Little Pigeon Bay, Canterbury (see images in reference list). No-one was present in the house at the time. Given the degree of damage to the building, the depth and velocity of the water, and the movement of very large furniture inside the house, it is possible that if people were present, there would have been casualties and potentially fatalities. It is essential that a precautionary approach be taken when lives are at risk.</p> <p>MCDEM's message to evacuate was based on best scientific advice at the time. The advice to evacuate had been posted on the MCDEM website at 0100 to coincide with Tsunami Threat #1. The NWS message issued at 0125 stated that evacuation was necessary and included locations which cover Canterbury and Christchurch:</p> <p>No: 02</p> <p>Issued 0125 hours 14 November 2016</p> <p>The Ministry of Civil Defence & Emergency Management (MCDEM) has issued a tsunami warning for Eastern coast of North and South Island including the Chatham Islands. It may arrive in the Eastern Coast of the North Island shortly. Move inland or to higher ground immediately.</p> <p>MCDEM requests the "Review of the tsunami evacuation" draft report be corrected to show that evacuation based on a tsunami threat was advised for Canterbury via the NWS at 0125.</p> <p>MCDEM has updated NWS messages to include the Long or Strong, Get Gone message. MCDEM acknowledges that official warnings may not be timely for local source events and should not be expected before the first waves arrive. Inclusion of this message is to reinforce, via media and CDEM Groups distribution of NWS messages, that those whom have already evacuated have done the right thing and those that have not should move immediately. This is consistent with all current guidelines and technical standards on local source tsunami events.</p>
11	Recommendations	Clear understanding of the Tsunami Expert Panel and MCDEM decision-making process	<p>This is outlined step-by-step in the National Tsunami Advisory and Warning Plan [SP 01/09]. Recommend removal of the first paragraph under "Recommendations". To reiterate, GNS Science establishes a Tsunami Experts Panel to provide advice to MCDEM, they do not work with MCDEM on decision-making. MCDEM makes decisions regarding warnings.</p>

		Decision by MCDEM to provide rapid evacuation advice in NWS messaging	<p>This decision to provide National Level Evacuation advice was agreed between MCDEM and Groups following the November 14th earthquake and tsunami in response to:</p> <ul style="list-style-type: none"> inconsistent action taken by neighbouring Groups during November 14th event (i.e. some following MCDEM advice and advising evacuation and some not) creating confusion for the public The increased uncertainty and heightened probability of earthquakes in the Kaikōura earthquake aftershock zone which includes parts of the Hikurangi subduction plate margin a significant tsunami source for New Zealand. This source could produce tsunami similar to the Tōhoku earthquake and tsunami of March 2011. The very short time available for life-safety action (i.e. evacuation) should a large tsunamigenic earthquake occur off the East Coast of the North Island
12	Sirens	All of section	Include reference to the Tsunami Sirens Technical Standard, and other MCDEM Guidance materials which state that tsunami are not appropriate for use for local source tsunami events. See earlier comments for more detail.
13	Evacuation Plans	All of section	Evacuation mapping, planning and drills are an important part of tsunami preparedness. Such preparedness should be undertaken with the at-risk public. The tsunami evacuation zone mapping and tsunami signage technical standards provide comprehensive guidance on best practice for developing tsunami evacuation plans for and with communities.
14	Evacuation Plans	"MCDEM also released evacuation maps which were attached to the national warning system messages, which the media referred to."	MCDEM released wave amplitude threat maps during the November 14 event, not evacuation maps. Please correct this wording.
17	Messaging to the Public	Screenshot from MCDEM website	Also include screenshots or content from Christchurch CDEM Facebook page to demonstrate inconsistency.
18	Messaging to the Public	"The term Get Gone leaves residents confused."	This is a punchy slogan such as "C'mon guys, get fire wise" and is not intended to include all necessary information. Radio, television and social media advertising as well as MCDEM websites, guidance materials and technical standards describe in more detail the correct trigger for actions, and actions to take. This messaging has been developed by Communications professionals in conjunction with social scientists. The Long or Strong, Get Gone campaign is designed to complement long-term public education programmes for behavioural change.
19	Messaging to the public Recommendations	The term Get Gone should be clarified by MCDEM to mean "move immediately to high ground or inland as far as necessary"	<p>This depends on the public having full access and understanding of their tsunami evacuation zones prior to events. MCDEM fully supports all Groups providing such resources to the public but until this is possible, the wording will have to remain "as far as possible:" and not "as far as necessary". This is because:</p> <ul style="list-style-type: none"> Not all Groups have completed tsunami evacuation zone mapping/evacuation planning and of those that have not all have released these publicly

			<ul style="list-style-type: none"> • “Necessary” requires the public to make an informed decision about where the zone boundaries are. We know that not everyone knows their local zone and cannot expect travellers, tourists etc. to have that level of knowledge • If an evacuation is required for 1000s of people, it is necessary for people to not only get just outside the evacuation zone but to keep going to prevent congestion behind for those still evacuating (especially if evacuation is by vehicle).
30	Appendix 1	<p>1.29 a.m. entry “Email received by CDEM Duty Officer re “National Warning: Tsunami Threat No 2” advising “MCDEM has issued a tsunami warning for Eastern coast of North and South Island including the Chatham Islands. It may arrive in the Eastern Coast of the North Island shortly. Move inland or to higher ground immediately. A tsunami is possible.....”</p> <p><i>First notification advising to move inland or to higher ground immediately but doesn’t specify which coastal areas should be evacuated and no mention of “land threat”</i></p>	<p>The comment in italics is incorrect. The NWS message stated that the warning is for the “Eastern coast of the North and South Islands”. This therefore, includes all of the Canterbury Coast. Immediate evacuation is advised for these areas. People are not advised to evacuate if the tsunami will not inundate land therefore, this warning is advising a threat to land.</p>
33	Appendix 1	<p>2.01 a.m. Email received by CDEM Duty Officer re “National Warning: Tsunami Threat #3 HAMNER SPRINGS EARTHQUAKE AND TSUNAMI No:03 MARINE AND LAND THREAT” advising “MCDEM has issued a tsunami warning for all of the eastern coast of the North Island and all of the east</p>	<p>The comment in italics is incorrect. Evacuation has already been advised for Canterbury (and other parts of Eastern New Zealand) at 0125 in Tsunami Threat #2.</p>

		<p>coast of the South Island including the Chatham Islands. Confirmation has been received that a tsunami was generated. Waves have been detected on the Geonet Tsunami Gauges. The first tsunami wave activity has been detected in the areas around Kaikoura and Wellington. The first wave activity may not be the most significant. Tsunami activity will continue for several hours and the threat must be regarded as real until this warning is cancelled. People in coastal areas should: stay out of the water, stay off beaches, do not go sightseeing, follow instructions of local civil defence authorities. Warning will remain in effect until a cancellation message is issued by MCDEM".</p> <p><i>First notification that there is a "land threat" and advising that "low lying areas on the East Coast... move immediately to higher ground".</i></p>	
<p>Reference Documents listed in this feedback</p> <p>http://www.civildefence.govt.nz/assets/Uploads/publications/National-Tsunami-Advisory-and-Warning-Plan/National-Tsunami-Advisory-and-Warning-Plan-SP-0116-revised-August-2016.pdf</p> <p>http://www.civildefence.govt.nz/assets/Uploads/publications/ts-01-08-national-tsunami-signage.pdf</p> <p>http://www.civildefence.govt.nz/assets/Uploads/publications/Tsunami-Warning-Sirens-TS-03-14.pdf</p> <p>http://www.civildefence.govt.nz/cdem-sector/consistent-messages-for-cdem/</p> <p>http://www.civildefence.govt.nz/assets/Uploads/publications/dgl-08-08-tsunami-evacuation-zones.pdf</p> <p>http://www.civildefence.govt.nz/assets/Uploads/publications/is-10-09-public-alerting-options-assessment.pdf</p> <p>http://www.civildefence.govt.nz/assets/guide-to-the-national-cdem-plan/Guide-to-the-National-CDEM-Plan-2015.pdf</p>			

Images showing from Little Pigeon Bay tsunami damage – note the tsunami waves moved a refrigerator and an oven as well as moving the house off its foundations.
Source: <http://www.stuff.co.nz/national/nz-earthquake/86443298/Little-Pigeon-Bay-cottage-smashed-by-tsunami-waves>

