Social vulnerability indicators for flooding in Aotearoa New Zealand:

Rationale, indicators and potential uses

2019

Environmental Health Indicators Programme
Massey University – Wellington

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For more information about this project, see the Environmental Health Indicators (EHI) website: www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

Contents

Introduction

This document provides information about the use of social vulnerability indicators for flooding, as a reference document for end-users. This document is part of a project to develop a set of social vulnerability indicators for flooding for New Zealand, carried out by Massey University.

The examples and case studies presented in this document include some ideas for how to use social vulnerability indicators. They were gathered while carrying out this research project, including through stakeholder workshops and previous New Zealand studies and reports

This document is part of a wider set of resources from the social vulnerability indicators project. For more information about this project, and to access additional resources, see the Environmental Health Indicators (EHI) website: www.ehinz.ac.nz/our-projects/social-vulnerability-indicators

About social vulnerability to flooding

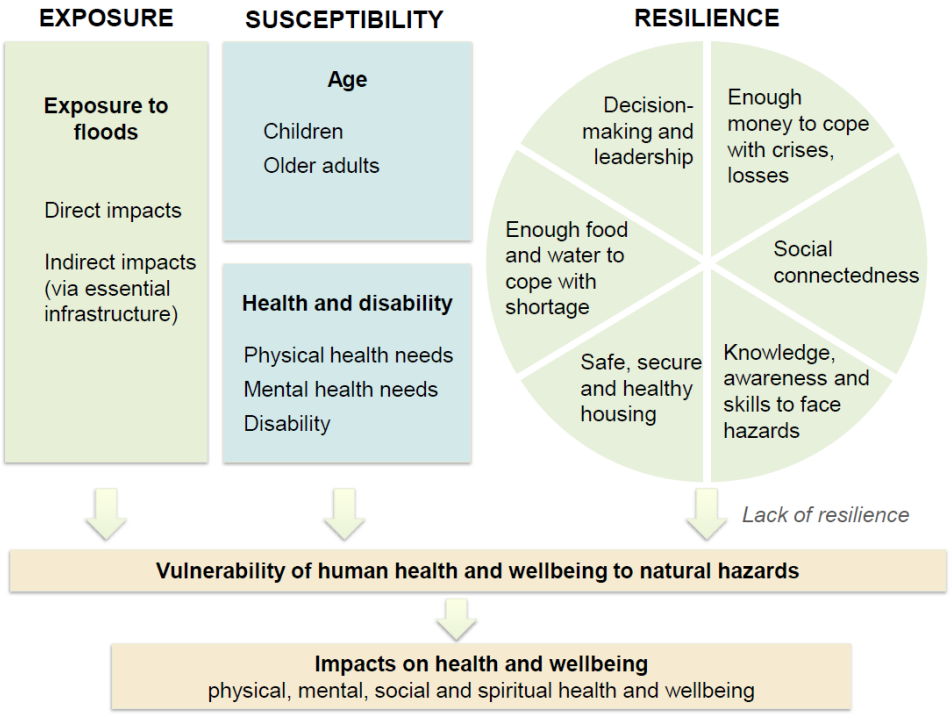
Some people are more vulnerable to the negative impacts of floods on their health and wellbeing due to their current circumstances. Understanding the vulnerability of a population allows civil defence emergency management (CDEM) and others responsible for disaster risk reduction to consider the specific needs of that population, and prioritise initiatives to reduce vulnerability.

Social vulnerability indicators are used to identify areas with people who are more vulnerable to these negative impacts of floods. In these areas, people may be less able to anticipate, prepare, cope and recover from a flood.

The social vulnerability indicators in this document focus on flooding, as flooding is one of New Zealand's most frequent and costly natural hazards. While these indicators have been developed for flooding, they are likely to be useful for other natural hazards.

Figure 1 presents our conceptual framework for social vulnerability to flooding, which includes social vulnerability dimensions in the three main components of exposure, susceptibility, and resilience. The dimensions of social vulnerability identified in this framework were the basis for the indicator selection.

Figure 1: Conceptual framework for social vulnerability to flooding in New Zealand



What is in this document?

In this document, for each dimension of social vulnerability in the framework, we provide the following:

1. reasons for why people are vulnerable to flooding, relating to that specific dimension
2. a list of indicators, including:
    a. indicators that are available in the national dataset
    b. point locations (such as schools and aged residential care facilities) that should be considered, as they relate to population vulnerability and/or resilience
    c. potential other sources of indicator data and social vulnerability information
3. examples of how the indicators and social vulnerability information could be used for that dimension, across the emergency management 4 Rs of risk reduction, readiness, response and recovery
4. case studies that give an example of how vulnerability has been reduced and/or resilience has been built for that population group previously in New Zealand.

It should be noted that this document is not an exhaustive list of actions and examples, and is not intended as a how-to guide.

Some of these examples and activities might not be appropriate for all end-users, might already be happening in some places, or could be refined based on information from the social vulnerability indicators. The information may be useful as a checklist for activities relating to vulnerable populations, or to prompt further ideas about how to reduce vulnerability.

In some cases, considering activities and actions from a social vulnerability perspective may simply provide additional rationale and weight for carrying out these activities, and/or targeting activities towards vulnerable population groups and geographical locations.

1. Exposure to flooding – direct impacts

Why are people in flood hazard zones vulnerable?

People who live in flood hazard zones are at higher risk of experiencing adverse impacts directly from floods.

- They are likely to be exposed to flood waters.
- Their lives may be put in danger by floodwaters, through drowning.
- They have an increased risk of injury or other health impacts, from contact with floodwaters and/or contaminated water.
- Floodwaters may damage their home and/or belongings.
- If their homes are affected, they may be displaced (temporarily or permanently) and need to find alternate housing.

Additionally, people working, attending an educational institute, or spending time in flood hazard zones may also be affected, if the flood occurs at a time when they are in these zones. The day of the week, and the time of the day, can influence who is likely to be directly impacted by floodwaters.

- On weekdays and at night-time, people may struggle to prepare their house for a flood, if there is little warning.

The type of flood hazard can also play an important role in people's exposure and risk.

- Deep floodwaters, fast-flowing floodwaters, and rapid onset flooding pose risks to life-safety, and evacuation may be necessary.
- Inundation and ponding floodwaters can cause damage to houses and property, from which people may struggle to recover.
- Low-lying areas may have ponding water for months after a flood, which can lead to damp and mouldy houses.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	**Point locations**	**Potential other indicators / data sources**
Usually resident population in small areas Number of households in small areas Note: Additional demographic information is also available in the dataset, including sex, ethnic groups, languages spoken, and population projections	Emergency meeting places, including: • Civil Defence Centres • marae Important community assets in flood hazard zone (and number of people), such as: • schools • early childhood education services • rest homes • marae • hospitals • health care centres • pharmacies • potential sites for emergency accommodation	Flood hazard zones, by type of hazard: • Fast-flowing water (eg stream corridors, overland flow paths) • Inundation areas • Deep floodwaters Estimated population vulnerable to floods: • Land area in flood hazard zone • Estimated number of people living in flood hazard zone • Estimated number of buildings / dwellings in flood hazard zone • Estimated number of people working (or studying at educational facilities) in flood hazard zone • Estimated number of children and youth attending ECEs / schools in flood hazard zone

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding in flood hazard zones.

Identify vulnerabilities

- Identify the different flood hazard zones in the local area, by flood hazard type (stream corridor, overland flow, inundation, and floodwater depth) to help interpret the social vulnerability indicators, and to inform the types of assistance that may be needed.
- Identify at-risk locations in flood hazard zones (such as schools, early childhood education (ECE) services, rest homes, marae, hospitals, health care centres, and pharmacies). Identify the type of flood hazard risk (eg life safety issues, ponding floodwaters).
- Identify local emergency shelters for communities, and if any of these sites are located in a flood hazard zone. These include any sites that local communities may go to during an emergency (such as marae, churches, community halls).

Support emergency planning and business continuity planning

- For at-risk locations in flood hazard zones (eg schools, ECEs, rest homes, health care centres, marae, Civil Defence Centres), support emergency planning and business continuity planning. Providing flood hazard maps and social vulnerability indicators may help engage with them and stimulate preparedness and emergency planning.
- Facilitate the development of marae emergency preparedness planning, particularly for marae in flood hazard zones.
- Provide flood preparedness information to homes that are located in flood hazard zones.

Inform communications and public health messages

- Public health messages for what people should do during floods to protect their health could be shared with people affected in flood zones. Some good examples for how to protect health and wellbeing during a flood are available from the Ministry of Health[1] and the World Health Organization (Menne & Murray 2013). Advice could be tailored to the social vulnerabilities present in the neighbourhood.

Improve infrastructure to reduce risk

- Prioritise and target stormwater infrastructure upgrades and hazard mitigation, for example in areas with deep inundation and in areas of high social vulnerability. For people outside of local council, this may involve making a submission on local council's Annual Plans and Long Term Plans (see the toolkit document for more details).

[1] See: https://www.health.govt.nz/your-health/healthy-living/emergency-management/protecting-your-health-emergency/floods-and-health

2. Exposure – indirect impacts

Why are people vulnerable?

As well as impacts from contact with floodwaters, flooding can also affect people through impacts on essential lifelines infrastructure and services.

Flooding impacts on the road network and public transportation. Floodwaters can lead to roads being blocked, slips may also occur during heavy rain, and train and bus services may stop running.

- Floodwaters may lead to people being cut off or isolated, even if their property is not in a flood hazard zone.
- Commuters may find it difficult to get to work and/or get home, if roads have been shut due to flooding, or if the train and bus networks are not running. People travelling to schools and early childhood education facilities to pick up their children may be impacted by floodwaters.
- Emergency services (ambulance, fire, police) may not be able to reach some properties due to flooding, road blockages and slips.
- People may not be able to access health services, such as pharmacies, GP services, and hospitals.
- People living in remote communities may be particularly vulnerable if the infrastructure that connects these communities, particularly roads and cellphone network, are affected.

Infrastructure issues with electricity, water, gas, telecommunications and fuel services can also lead to multiple risks.

- Live power lines increase the risk of electrocution.
- Power outages can lead to issues with food safety due to fridges no longer working, difficulties in boiling water and cooking food, difficulties heating the house, issues with keeping some medications (such as insulin) chilled, and disruptions to medical services (including home-based oxygen therapy).
- Mains gas could be damaged, so there may be gas outages or gas leaks. Gas outages may have similar consequences as for power outages, if people rely on gas for cooking and heating.
- Contaminated drinking water would need to be boiled or disinfected before being consumed, otherwise it may pose risks of gastrointestinal illnesses. People may struggle to do this if they do not have power, do not know how to disinfect water, and/or do not have bleach to disinfect the water.
- Outages to telecommunications systems (particularly the cellphone network) can cause major difficulties for people in contacting friends and family, and getting access to up-to-date information.
- Disruptions to fuel supplies can also impact on transportation. Infrastructure pinch-points and hotspots (where several networks intersect and rely on each other to function, such as bridges) are also vulnerable locations.

Floodwaters can also lead to contamination from wastewater, hazardous substances facilities/industries and/or contaminated sites. This represents a risk during the clean-up phase.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
People who work outside of the territorial authority they live in People who use public transport to get to work People living in rural and/or remote communities (urban/rural classification)	Important transport routes likely to be affected during a flood • Main/arterial roads • Bus routes • Trains tracks and train stations (including underpasses) Health and emergency service facilities • Fire station • Police station • Ambulance station • Hospital / Emergency Department • GP centres • pharmacies Important utilities • Power substations • Water pumping stations • Stormwater pumps • Sewerage pumping stations • Telecommunications infrastructure (including cellphone towers) • Petrol stations Infrastructure vulnerable locations (such as bridges), including: • Hotspots (co-location of critical infrastructure) • Pinchpoints (utility asset or site where a satisfactory alternative route is not available and which is therefore essential to service delivery) Hazardous substances facilities / contaminated sites in flood hazard zones	Use flood hazard zones to identify potentially vulnerable people, such as: • People living in an area likely to be isolated during a flood due to impacts on the transportation network (eg isolated from emergency services, health services, central business district, food stores) • People living in an area likely to experience water and/or electricity loss during a flood • People living in an area likely to experience telecommunications outages during a flood • People living in an area likely to be contaminated during a flood (eg by fuel or sewerage pipe leakage, or due to floodwaters affecting hazardous substances facilities or contaminated sites)

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for people who may be affected by flooding through impacts on essential lifelines infrastructure.

Identify vulnerabilities

- Identify major roads likely to be closed due to flooding. For affected suburbs, identify if there are alternative routes for people to get home.
- Identify schools, ECEs, health services and pharmacies that may be isolated due to flooding on the road network. Let these organisations and services know about these potential flooding impacts, to inform their business continuity planning and emergency preparedness planning.

- Identify rural and/or isolated communities that may be isolated during a flood. Use this information to target and prioritise resilience work in these areas.
- Identify important utilities and/or infrastructure hotspots and pinchpoints in flood hazard zones. Estimate the likely impact on the surrounding population (noting any service outages such as power, water, sanitation, telecommunications, fuel).

Inform emergency services planning

- Identify the areas where emergency vehicles (ambulances, fire appliances, police cars) may be unable to access in a flood. This analysis may need to incorporate flood depth information, and information on maximum flood depths for particular types of vehicles.

Inform communications planning

- For areas that may have a power outage, consider how to ensure that communications systems will keep working even without power.

Interpret other social vulnerability indicators

- Use exposure data in addition to the flood hazard maps, when interpreting the other social vulnerability indicator information. For example, the following social vulnerability indicators may be useful when considering service outages:
    - **Power outages**: medically-dependent people, people on dialysis, people using home oxygen therapy, people using insulin, the very young and the elderly (in terms of home heating)
    - **Contaminated drinking water**: children, older adults, people with impaired immune systems, pregnant women, people with chronic health conditions, people unlikely to have access to emergency water supplies, people likely to experience power outages (which will affect the ability to boil water)
    - **Lack of access to pharmacies**: people on essential medications, such as angina medication, anti-depressants, anti-anxiety medication, anti-psychotics, opioid substitution treatment (OST), epilepsy medication, and immunosuppression medication
    - **Lack of access to health services**: people with chronic health conditions, older adults, people with serious and persistent mental illness, children

3. Children

Why are children vulnerable?

Children, particularly young children, are vulnerable to the impacts of a flood.

- They rely on adult caregivers to protect them during a flood, and to move them out of harm's way. Babies and young children may need to be carried during an evacuation.
- Children are more susceptible to health impacts if they come in contact with floodwater and/or contaminated water. These health impacts include drowning, infections including diarrhoea, and gastrointestinal illness (which can lead to dehydration).
- Families with children can find the clean-up and recovery difficult, if they do not have childcare available.
- Parents are likely to want to pick up kids from daycares and schools in the event of an emergency. This may put them in the path of direct flooding impacts.
- Closure of schools and early childhood education centres (ECEs) after a flood - temporarily and/or permanently - can make recovery more difficult for parents (through a lack of childcare) and children (through changes to their routine), and have an impact on long-term recovery.
- Children are also more susceptible to the psychological impacts of flooding.

Children can also be a source of strength and resilience.

- Schools play an important role in terms of social connectedness in the community.
- Some schools may be the site of a Civil Defence Centre in an emergency event.
- Children and young people can share information that they have learned at school with their parents and family.
- In communities where many people do not speak English, young people may play an important role as a 'language bridge' for their parents and community elders.
- Young people tend to be technology-savvy, and are likely to be able to access information through social media and online information sources.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
Children aged 0–4 years Children aged 0–14 years Households with children aged 0–4 years Households with children aged 0–14 years Households with children aged 5–16 years Households with children aged 0–16 years	Early childhood education (ECE) centres • Daycares • Kindergartens • Kohanga reo • Playcentres and playgroups Schools • Primary schools • Secondary schools • Kura Kaupapa schools • Specialist schools (eg schools for high needs children) Other facilities for children, such as: • Care and protection residences for children • Youth justice facilities	Oranga Tamariki may have information on vulnerable children living in the local area

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for children.

Identify educational facilities at risk

- Identify schools and ECEs within flood hazard zones, and the type of flood hazard – particularly if there a life safety issue (such as deep water, fast-flowing water, flash floods).

Prioritise additional work for schools in (or near) flood hazard zones

- For schools and ECEs in flood hazard zones, check there are response and/or evacuation plans for floods as needed, which take into account the type of flood risk (life safety and/or inundation). Consider alternative sites for temporary schooling during/after a flood, as part of business continuity planning.
- Identify the main routes used by children to get to school, particularly if these areas may be dangerous for children to walk in during a flood.
- Reconsider whether schools are the best locations for Civil Defence Centres in the local community. Schools have many vulnerable children on site, and they will already be busy sites during a flood with parents coming to pick up children. Other local sites, such as local marae, community halls and churches, may be more appropriate sites.

Inform communications

- Use of school communication networks to share information about floods, flood risks, what to do in flood, and how people can protect themselves and their belongings. This could be particularly useful in flood-prone areas, where the school and/or neighbouring area is in a flood hazard zone.

Inform response and recovery

- The needs of schools may differ depending on the stage of the flood. In the response phase, schools that are exposed to high flood risk (such as deep floodwaters, rapid onset flooding, and/or fast-flowing floodwaters) are the key priority as a life safety issue. In the recovery phase, schools outside of flood hazard zones may still need support, if local families with vulnerabilities were affected by floodwaters.
- In areas with children and/or schools or ECEs, public health messaging can be tailored to children's needs. For example, to protect their health, let children know not to play or swim in contaminated flood waters/mud, as they might get sick. After a flood, children should be kept away from flood-contaminated grassy areas and playgrounds, until sunlight and soil have gotten rid of harmful bacteria. Children should also be kept away from contaminated areas until clean-up is completed. All toys should be disinfected.
- Have plans to decontaminate playgrounds in flood hazard zones after a flood.
- Consider how best to support children's psychosocial recovery after a flood, such as talking about the flooding event afterwards in school to help children process the event.

Case studies

Indicators help schools to pre-identify school travel routes that might be impacted by flooding and have thought through plans to address this. For example, before the 2017 Edgecumbe flood (and after days of heavy rain), the principal of Edgecumbe Primary School decided to close the primary school, before the flood hit. This decision meant that children were not walking to school in the flood hazard area (particularly the stopbank and township), which locals say helped to save lives. For more information, see: https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12216764

Indicators can emphasise the need to have thought through an alternative site, as part of a business continuity plan for educational facilities. For example, during the 2019 wildfires in Nelson, the township of Wakefield was evacuated for several days. However, Wakefield School was able to operate from Hope Community Church (10km from Wakefield), so that students could return to school. This enabled children to return to school and regular routines, and to be with friends and teachers to have the social support, as well as allowing working parents to return to their jobs. For more information, see: https://www.stuff.co.nz/nelson-mail/news/110485093/wakefield-school-to-operate-from-hope-community-church

A review of what worked well in Christchurch early childhood centres after the February 2011 earthquake has been compiled into the following document: https://www.ero.govt.nz/assets/Uploads/Stories-of-Resilience-and-Innovation-in-Schools-and-Early-Childhood-Services-Canterbury-Earthquakes-2010-2012-web.pdf

4. Older adults

Why are older adults vulnerable?

Many of the vulnerabilities that older adults experience are due to other types of vulnerabilities that become more common in the older ages.

- Older adults tend to be less mobile. This can make evacuation and clean-up activities more difficult for them.
- Older adults are more likely to have hearing and/or vision loss. This can make it more difficult for them to access information, evacuate, and clean-up their properties after a flood.
- Older adults are more likely to have pre-existing health conditions, such as coronary heart disease and diabetes. This puts them at risk of complications from these diseases after a flood.
- Older adults may also have limited social networks and be socially isolated, particularly if they live alone.
- Older adults may not have access to the internet, and therefore they may prefer to access information through other means.
- Given these vulnerabilities, older adults are likely to require more assistance to evacuate and/or clean-up. They may also need help dealing with insurance claims, repair works etc for their house.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	**Point locations**	**Potential other indicators / data sources**
Older adults aged 65+ years Older adults aged 75+ years Older adults aged 85+ years Older adults aged 65+ living alone	Residential facilities for older adults • Residential care facilities, for people who need a higher level of daily assistance (which include rest homes, long-stay hospitals, and dementia/psychogeriatric units) • Retirement villages (independent living) Social housing for older people • Housing New Zealand homes • Council flats • Other NGO social housing	DHB funding, disability support services InterRAI assessment data of the health of older people (held by DHBs and some DHB shared services)

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for older adults.

Identify vulnerabilities

- Identify rest homes / aged residential care facilities within flood hazard zones, and the type of flood hazard – particularly if there a life safety issue (such as deep water, fast-flowing water, flash floods).
- Identify rest homes / aged residential care facilities that may be cut off by floodwaters, which may affect the ability of emergency services to get to them.

Inform emergency planning and business continuity

- Check there are response and/or evacuation plans for flooding for at-risk aged care facilities. This could be coordinated within the health sector (Ministry of Health or DHBs) to contact vulnerable facilities, so that they can put plans in place.
- Identify rest homes and aged care residential facilities in flood hazard zones, where emergency vehicles (particularly ambulances) may be unable to access in a flood. Ambulances are often used to help evacuate rest homes during a flood. This analysis may need to incorporate flood depth information, and information on maximum flood depths for particular types of vehicles.

Promote knowledge-building and resilience-building

- In communities with higher levels of older adults, encourage community-led initiatives that are useful for providing support networks for older adults.
- Identify programmes that can increase the connectedness and resilience of older residents, to reduce the impact of flooding (see case study).
- Identify the need to connect with traditional knowledge of kaumātua (Māori elders) about the land, resources, to help understand and mitigate risk in the area.

Inform communications and public health messages

- In areas with higher numbers of older adults, consider using a range of communication methods (not solely the Internet) to share important information about emergency preparedness and early warning messages. Many older people (particularly those aged 75+ years) do not have access to the Internet.

Inform response and recovery

- Identify areas where there are large numbers of older adults living alone. These people may need additional support to access information, evacuate, and clean up after a flood. Adapt preparedness and response plans to account for this (for example, allowing more time and resources for evacuation; door-to-door knocking in these areas if possible).
- In the recovery stage, target volunteer clean-up groups (such as student army) to areas with higher percentages and/or numbers of older adults.

Case study

Many community-led initiatives work towards building the resilience of older adults in the community. For example, two marae in Lower Hutt (Wainuiomata Marae, and Te Mangungu Marae in Naenae) provide programmes for kaumātua (older adults) in their community, to help fight loneliness and improve their health. The marae have worked with Kōkiri Marae Health and Social Services to provide a programme that uses marae-based concepts such as waiata, wairuatanga, te reo māori and kotahitanga, and includes activities such as waiata, tai chi, meditation, dance fitness and preparing food. The programme relies heavily on volunteers, and helps to give 'kaumātua a sense of belonging and empowers them to become a voice for themselves'. By reducing older adults' social isolation and improving their health and wellbeing, this initiative is working to build resilience in older adults in their local community. For more information, see: https://www.stuff.co.nz/dominion-post/news/113598014/two-lower-hutt-marae-provide-escape-from-isolation-for-the-elderly

5. People with physical health needs

Why are people with physical health needs vulnerable?

People with certain pre-existing health conditions are more susceptible to health impacts from flooding. These people may also be more susceptible if there are issues with access to safe water supplies.

- People with coronary heart disease (also known as ischaemic heart disease) are at risk of experiencing a heart attack after a flood, due to stress and excess activity during the flood, evacuation and the clean-up process.
- People with diabetes are at risk of developing diabetic foot (such as an infection or diabetic foot ulcer) after contact with floodwaters.
- People with chronic lung diseases (including asthma and chronic obstructive pulmonary disease) are at increased risk of health impacts due to exposure to dampness/mould, particularly during the clean-up phase after a flood.
- People who have compromised immune systems (eg people with HIV/AIDS, organ transplants, cancer, sickle cell disease, and/or on immunosuppressant drugs) are at higher risk of getting an infectious disease.
- People with less common chronic health conditions (such as tuberculosis, sickle cell disease, and cystic fibrosis) may require certain medications, services or electricity to manage their condition during and after a flood.

Some types of medications and health services are essential for people's health. Any disruptions to this care could lead to major health impacts for these people. Disruptions may occur due to:

- people not being able to get home, to access essential medication, home oxygen therapy, or home dialysis
- power outages, which affect the ability to operate home dialysis and home oxygen therapy machines
- lack of access to healthcare services.

Pregnant women may be at increased risk during and after a flood. They face increased risk of premature delivery, underweight infants and infant mortality. Some women may have to deliver their babies without hospital care. Some women may be evacuated without access to medical records, or they may lose prenatal vitamins or essential medication. They may also have a poorer immune response than non-pregnant women.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
Pregnant women (Note: a proxy indicator has been used, of babies aged 0 years, to give an indication of areas with higher numbers of pregnant women). *Potential indicators that have been identified, but not yet developed:* People with a pre-existing health condition, who are at risk of worsening health due to a flood, such as: • People with coronary heart disease • People with diabetes • People with chronic respiratory diseases (such as asthma, COPD) • People with compromised immune systems (such as those on immunosuppressant drugs, having cancer treatment, or with HIV/AIDS) • People with other chronic health conditions (such as tuberculosis, cystic fibrosis, sickle cell disease) People requiring essential medication (within 1–3 days of the flood), such as: • People on angina medication • People with insulin-dependent diabetes • People needing inhalers (and/or other medications) for chronic lung conditions • People taking medication for epilepsy • People taking immunosuppressant drugs • People on anti-HIV drugs People requiring electricity and/or health services for medical purposes (within 1–3 days of the flood), such as: • People on dialysis (haemodialysis or peritoneal; at home or at a dialysis unit) • People using home oxygen therapy for lung conditions • People receiving cancer treatment	Primary medical care facilities (GP medical centres, A&M emergency clinics) Pharmacies Medical supply depots Hospitals Other health facilities (note: these may be already included as part of hospitals): • Dialysis units • Birthing units • Long-stay hospitals (including at aged care facilities) Location of emergency defibrillators (in relation to flood hazard zones and areas that might be cut off to emergency vehicles) Location of emergency services (eg ambulance stations)	Health services may have information on vulnerable patients, such as: • DHB funding, disability support services • PHO database on individual patients, particularly those who are vulnerable • DHB weekly update of community-based high needs clients (people receiving care packages) • Clinician records • Register of people on dialysis Analysis of roads that will be inaccessible to emergency services (including ambulances) due to deep floodwaters

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for health services and people with physical health needs.

Identify vulnerabilities

- Identify GP centres, pharmacies, hospitals and other healthcare centres within flood hazard zones.
    - Identify the type of flood hazard, particularly life safety issues (such as deep water, fast-flowing water, flash floods).
    - Identify indirect impacts of flooding on these facilities, such as likely closure of the road network, lack of clean water, and power outages.

    - Identify healthcare centres and pharmacies that will likely have to shut during a flood, and the impacts of these closures on at-risk patients.
    - Share maps with these health centres, to stimulate emergency preparedness.
- Identify areas with high numbers of people with chronic health conditions, and identify potential flooding impacts on these people (including indirect impacts such as lack of access to healthcare services, pharmacies, and hospitals).

Inform and support emergency planning and business continuity

- Check that pharmacies and health care facilities have business continuity plans that include potential direct and indirect impacts of flooding, such as power outages, lack of clean water, and displacement to alternative facilities.
- Coordinate with the local ambulance service provider. Provide analyses of which roads will be cut off due to floodwaters (and/or depth of water), to inform emergency services access issues to certain areas during a flood.
- Identify neighbourhoods where people with chronic health conditions will find it difficult to get to pharmacies, and develop plans for dealing with this.
- Consider putting defibrillators into higher deprivation areas, and/or also local marae, if they are not there already.

Build knowledge and resilience

- Support people with coronary heart disease, diabetes, and other chronic health conditions to know the health risks of a flood, and have personal emergency preparedness plans in place.

Inform communications and public health messages

- Set up information systems for contacting high-risk patients in the event of a flood if necessary. For example:
    - PHOs will have details of people on certain pharmaceuticals and/or with specific diagnoses, and might be able to contact them
    - a register of dialysis patients may be available through the DHB, so that these people can be contacted in the event of a major flood.

Identify and prioritise vulnerable people during response and recovery

- Use the list of vulnerabilities to query the Primary Health Organisation (PHO) database to identify vulnerable people, such as children, older adults, pregnant women, people with specific chronic health conditions. This could be done for preparedness and/or during the response.
- Prioritise power and safe water provision for people with physical health needs, and in areas with higher numbers of medically-dependent people. Data on medically-dependent people could be shared between the DHB/PHO and power companies, to identify high-priority clients during a power outage (if this is not already happening).
- During the response phase of a flood, mobile health services could be prioritised in areas with higher numbers of people with chronic health conditions. Health services could be coordinated between existing health providers in an area, including the local PHO, Māori health services, and Pacific health services, using knowledge of the most impacted areas and population groups.

Case study

In the aftermath of the February 2011 Christchurch earthquake, Māori health professionals contributed to the health response, working as ‘barefoot medical teams’ that moved from household to household, providing emergency health care to isolated residents. In this way, they provided medical assistance, as well as social support through face-to-face contact (kanohi ki te kanohi) to isolated people (Kenney & Phibbs 2015).

6. People with mental health needs

Why are people with mental health needs vulnerable?

People with pre-existing mental health issues are more susceptible to the impacts of flooding.

- They may have more difficulties in coping with the stress of flooding.
- If they also have other vulnerabilities (such as financial stress, or a lack of internet for accessing information and resources), they may find it particularly difficult to cope.
- People taking medication for mental health conditions (eg anti-depressants and anti-psychotics) are susceptible to adverse effects if they do not have access to this medication. Many of these medications are required daily, and disruptions can lead to a worsening in mental health status and/or people's ability to cope.
- People on opioid substitution treatment (OST) (methadone or buprenorphine) rely on being able to collect medication on a regular (usually daily) basis from pharmacies or OST service. These people are particularly vulnerable to disruptions to medication. Any disruptions to access to medication will be highly stressful for them, cause psychological impacts, affect their ability to get to a safe space, and may increase their health risks. There may also be impacts for their families and children, who may be relying on them to protect them during a disaster.
- People with substance abuse (e.g. excessive alcohol use and/or illicit drug use) are at higher risk of more substance abuse after a flood due to stress.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	**Point locations**	**Potential other indicators / data sources**
People with a psychological or psychiatric impairment *Potential indicators that have been identified, but not yet developed:* People with pre-existing mental health issues, who are at risk of worsening of mental health status due to a flood, such as: • People with a diagnosed serious and persistent mental illness • People with a psychological or psychiatric impairment People requiring essential medications (within 1–3 days of flood), such as: • People on antidepressants and/or anti-anxiety medication • People on anti-psychotic medication • People on opioid substitution treatment (OST) People with substance abuse issues	Mental health facilities (mental health services, in-patient mental health units) Primary health care facilities (GP medical centres) Pharmacies Hospitals	Health services may have information on vulnerable patients, such as: • DHB contracts for mental health services – links with people in supported accommodation • Pharmacies with data on who their regular OST clients are • PHO data on vulnerable patients (eg on specific medication) • DHB weekly update of community-based high needs clients (people receiving care packages)

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for people with mental health needs.

Identify vulnerabilities

- Identify pharmacies (particularly those that dispense for the methadone programme), mental health facilities, GP centres, hospitals and other healthcare centres within flood hazard zones. For these facilities, identify the type of flood hazard – particularly if there a life safety issue (such as deep water, fast-flowing water, flash floods).
- Identify health services that may not be able to operate during or after a flood, and/or may need to operate out of a temporary facility.

Inform emergency planning and business continuity plans

- For pharmacies and mental health service providers in flood hazard zones, check that their emergency management plan and business continuity plan addresses flood hazards.
- Check that emergency management plans have been developed to address access issues for mental health clients, if a health centre or pharmacy is likely to have little access due to flooding on the road network.
- Check that action plans have been developed for people receiving opioid substitution treatment (OST) and other restricted medication (such as antipsychotic medication that is only dispensed in small amounts).
- Check that hospital emergency departments are aware that people receiving OST may turn up to the hospital after a flood. These people may be experiencing withdrawal symptoms, and may also be on other medication (such as benzodiazepines), which may need to be considered for continuity of medication.

Inform response and recovery

- In the response phase, use the indicators to prioritise where mobile health services will need to be deployed.
- In the recovery phase, help people with mental health issues to access WINZ services to receive financial assistance if needed.

Case study

A New Zealand study interviewed service workers, health professional and emergency managers in opioid substitution treatment (OST) and disaster planning fields about their views on OST provision after a disaster (Blake & Lyons 2016). The following key themes emerged from the study.

- All the participants commented that OST clients' health and wellbeing was very important during a disaster, and that the approach of health professionals was about minimising harm.
- Given this, continuity of medication was vitally important: clients getting the right dose within a specific timeframe.
    - If clients did not get their medication (many of them need daily medication, mostly collected from pharmacies), they will go into physical withdrawals and experience psychological effects.

    - These impacts can affect their ability to get to a safe place, and do what is required of them in a disaster context.
    - This can also impact on their families and children, who may be relying on them to keep them safe, collect safe water etc.
    - During Hurricane Sandy, clients reported feeling sad and depressed, and when they were unable to access OST, they turned to street drugs to cope and avoid uncomfortable withdrawal symptoms.
- Three major concerns in a disaster context were (i) access to OST stock, (ii) scripting problems, and (iii) dose verification. Issues were identified about having stock on hand, getting a clients' script, and getting those scripts to appropriate pharmacies, to allow for dispensing of medications.
- Medication might be inaccessible if the clients cannot reach their pharmacy, or if they get to the pharmacy and it is not open, and the client cannot get their way to the OST clinic.
- Some OST clients might also be on other medication (such as benzodiazepines), which also need to be considered for continuity, as abruptly stopping these medications may lead to seizures and/or other major physical impacts.
- Study participants agreed that local areas need to have an OST emergency plan, which provides an alternative dispensing plan for clients. Participants agreed that the approach needed to be multidisciplinary, including community pharmacies, primary health carers, PHOs, and DHBs. Currently there is no global approach, fitting together plans for DHBs, pharmacies and PHOs, and there is variety in approaches between DHBs.

7. People with a disability

Why are people with a disability vulnerable?

People who have a disability includes people who are restricted in daily activities by a physical impairment (mobility, hearing, vision), intellectual impairment or psychological impairment.

People with a disability may have difficulties with:

- evacuating
- moving themselves out of the way of floodwaters
- accessing and/or understanding instructions
- getting into emergency shelters, if they are not accessible or if they do not allow service dogs
- clean-up activities.

People with disabilities living alone or in supported accommodation are particularly vulnerable to the impacts of floods.

- They are more likely to be dependent on caregivers to help them.
- They may find it difficult to know or understand what is going on (if they have a hearing or vision impairment, or learning difficulties).
- They may be hampered in protecting properties, evacuation and recovery.

The presence of a disabled family member can also put pressure on the household, and may mean the recovery process takes longer for these families.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	**Point locations**	**Potential other indicators / data sources**
People with a disability People with a physical disability People with a hearing disability People with a vision disability People with a psychological or psychiatric impairment	Facilities for people with disabilities • Community residential homes • Respite care facilities Specialist schools for children with disabilities and high needs	People with a service dog DHB contracts for disability support services – links with people in supported accommodation InterRAI assessment data of the health of older people (held by DHBs and some DHB shared services)

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for people with a disability.

Identify vulnerabilities

- Identify disability residential and day facilities in flood zones, and share flood hazard maps with these facilities, in order to stimulate preparedness planning.

Check that communications are accessible to everyone

- Check that during the preparedness and early warning stage, information is shared in a variety of means, for people who are visually and/or hearing impaired.
- Check that communications are accessible for everyone in the local area during a flood, aligned to those disability types with the highest numbers. For example, deaf people will not be able to hear information on the radio, and they will need NZ Sign Language interpreters for important information on TV. Visually-impaired people will find it difficult to access information on the internet (and would need a screen-reader). Check that web content meets accessibility guidelines (for example, will work with a screen-reader).

Consider the needs of people with disabilities in emergency planning and preparedness

- Include people with disabilities in disaster preparedness and response planning, to improve identification of and meeting their needs.
- Check that emergency shelters are accessible to people with disabilities, and can accommodate service dogs.

Prioritise response and recovery activities in areas with people with disabilities

- In areas with high numbers of people with a disability, use volunteer helpers (such as the student army) to help during the clean-up process.

Support accessible social housing for people with disabilities

- Check that, and work towards, social housing for people with disabilities is structurally safe, accessible and disaster-ready, so that people can ideally stay in their homes after a disaster.

Case study

After the February 2011 earthquake in Christchurch, some emergency shelters were not physically accessible to people with disabilities. Phibbs et al (2016) described the experiences of someone who had cerebral palsy and was in a powerchair. After the earthquake, this person went to their local emergency shelter, but were told that the emergency shelter could not accommodate people with disabilities. They were not asked any further about what support they were needed, nor were they given anywhere to go to.

8. Having enough money to cope with crises and losses

How does this relate to resilience and social vulnerability?

People with low incomes and/or not enough money to cope with crises/losses often do not have the money to protect themselves from flooding, such as with insurance or flood protection materials or works. They may not have sufficient emergency food and supplies. In some cases, they may have difficulties providing enough food for their household on a weekly basis.

People with not enough money to cope with crises may also struggle during the recovery stage after a flood, and may take a long time to recover.

- People may have difficulty being able to afford to replace all the damaged goods from their house.
- People may end up staying in damp and mouldy houses through an inability to repair damages or leave.
- For people who own their house but have low income, they may not be able to afford flood protection works, such as installing better drainage. This can lead to water ponding for months under the house, leading to mould issues that can impact on health.
- Financial stress can also lead to mental health impacts.

Some population groups are particularly vulnerable to financial stress.

- People who are unemployed can find it difficult to recover after a flood, due to a lack of income.
- Single-parent families have to bear all the financial costs on their own, meet all the basic needs (eg food, housing, and emotional support for children) and cope with the stress without emotional support.
- People in primary industries may be vulnerable to income loss after a flood, if they depend on the land flooded or cut off by floods for their livelihood.

There can also be a neighbourhood effect.

- If many households in an affected area suffer from financial hardship, this leads to less resilience in the neighbourhood, as people struggle to meet their household's own basic needs and have fewer resources to share. This impact may also be seen at Civil Defence Centres, given that some of these centres do not provide any resources for the local community except an emergency radio.
- If many people are unable to afford to leave their damaged housing, continuing to live in an area contaminated by floodwaters can be bad for morale and community resilience, as well as health.

It is important to note that 'having enough money to cope with crises/losses' may mean different things for different people, depending on their level of community support, access to other resources (such as home-grown food), and where they live (urban vs rural).

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
Socioeconomic deprivation (New Zealand Index of Deprivation, NZDep) Single-parent households Unemployed people People not in the labour force People with minimal education Households with no access to car People working in the primary industries	Social housing • Housing NZ homes • Council social housing • Social housing provided by other providers and NGOs (eg Salvation Army) Hazard areas where properties are uninsurable and/or prohibitively expensive to insure	Dynamic Deprivation Index - a deprivation index similar to the NZDep2013 and available at the meshblock level, updated monthly (see https://dotlovesdata.com/products/dynamic-deprivation-index/) WINZ data on local clients *Potential other indicators (depending on local data)* Households with no home or contents insurance

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for people who do not have enough money to cope with crises/losses.

Inform emergency planning and preparedness

- Work on emergency preparedness planning with social housing agencies and other networks supporting people on low incomes. Share the flood hazard maps to facilitate engagement and to identify likely problems for residents.

Inform communications messages

- Check that emergency preparedness messages are inclusive for people on low incomes. Suggest alternative preparedness practices for when people cannot afford to do 'traditional' preparedness practices.
    - Identify what people can do, if emergency survival items are unaffordable, unavailable or unacceptable to them.
    - Advise people on how to prepare for a disaster when they do not have the ability to purchase preparedness products such as food or a disaster kit, they do not have a car, or cellphone credit to make calls in an emergency setting.
    - Reconsider the use of the word 'easy' in terms of media communications about emergency preparedness for individuals, as this may be distressing for people who cannot afford it (Blake et al 2017).

Prioritise people during response and recovery

- After a flood, assess emergency food needs in areas of low incomes. Some households may have not much (if any) emergency food, and may not have the money or fuel to go to get more.

- Consider what support to provide for low-income areas after a flood. In particular, people may struggle to replace household goods, such as bedding, clothing, food, toys, cars etc.
- After a flood, align WINZ support to identified areas of low income. This might include outreach to evacuated and/or isolated communities, to make sure they can access the right support.

Support risk reduction activities

- For areas with high unemployment that are prone to flooding, encourage local employment initiatives. This can help to improve resilience in the local community.
- For areas with high levels of poverty that are prone to flooding, review other factors that might be influencing poverty in the region, such as the numbers of pokie machines.

Case study

Being aware of the areas where people may struggle the most may help target response efforts during a disaster. For example, the 2011 Christchurch earthquake hit the Eastern suburbs the hardest. These areas had a more socioeconomically deprived population. After the earthquake, these areas were without power, water, toilets, food, or money (as access to EFTPOS was down). People struggled, particularly if they had no petrol in their car to go get money out and buy food. In one study, a research participant described it as:

> *"[The father of one family] had no petrol in his car… so they were all at home. But there they are huddled around… they'd got a fire going in some tires outside the front door, and the kids were sleeping in the lounge and on mattresses on the floor, just terrified and nothing to eat … we went back the next day and nothing was better for them"* (Phibbs et al 2016).

In the recovery stage of the 2011 Christchurch earthquake, Ngāi Tahu recognised that high unemployment rates, particularly in young people who were not in training, education or employment, was a specific vulnerability in terms of future hazards. As a result, Ngāi Tahu, Christchurch Polytechnic Institute of Technology and Hawkins Construction set up a Māori trades training scheme. This scheme encouraged and supported Māori youth into trades training and employment, as part of the rebuild work. This scheme has been supported and further funded by the Ministry of Tertiary Education (Kenney & Phibbs 2015).

9. Social connectedness

How does this relate to resilience and social vulnerability?

Having strong social connections, networks and kinship ties can be very helpful for resilience, as it helps people to:

- know their neighbours and other people in the community
- help and support other people during and after a flood
- cope as a community during and after a flood.

By contrast, social isolation can make people vulnerable during and after a flood.

- People who are socially isolated may not have others to help them if needed, including for evacuation, and clean-up.
- People who are new to an area, and particularly people who have recently arrived in New Zealand, may struggle more after a flood. They may not know other people in their neighbourhood, or how to access official support.

Schools, early childhood centres, marae and places of worship are important places for social networks and social connectedness in a community. Other places of cultural/spiritual significance, such as urupā, are also important for the local people.

Communities and neighbourhoods may also have other 'bumping spaces', where people informally gather, meet, and/or literally 'bump into' other people in their community. These spaces may include open squares, local shops, community centres, parks, playgrounds, school gates, local libraries, green spaces, and local pubs and cafes. These places can help people make friends, build social connectedness, and increase local resilience.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	**Point locations**	**Potential other indicators / data sources**
Neighbourhoods where most people are new to the neighbourhood (within previous year) Older adults (65+ years) living alone Single-parent households Single person households Neighbourhoods with higher levels of people living in rental properties Neighbourhoods with fewer households with children Recent immigrants	Marae Schools Early childhood centres Churches Other places of cultural/spiritual significance (such as urupā)	Refugees Information about local social networks, including ethnic communities Information about local support networks

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for people who may be socially isolated.

Inform community resilience-building

- Focus community social connectedness-building exercises in areas where the indicators suggest that this work might be needed.
- Identify, support, and tap into, local community initiatives that build social connectedness, both for the purpose of building local resilience, and also to share information about emergency preparedness. These may include neighbourhood support groups, and existing support networks for vulnerable people in the community, such as refugee support networks, disability support services in the home
- In Pasifika communities, Pacific churches are a link to the local population. Churches could be used as Civil Defence Centres (official centres) or Community-Led Centres (hubs that spring up organically as part of community initiative/response).
- Check that immigrants and refugees have good support networks in the local area.

Support building meaningful relationships with local iwi and hapū

- Strengthen relationships and build partnerships with local iwi and hapū; this can help to increase resilience for iwi, as well as for the entire local community.
- Assist iwi and hapū to identify flood risk. Facilitate the development of marae emergency preparedness planning, to ensure that local iwi are well-resourced, with systems and processes to support communities during emergencies, if they are prepared to do so. Marae are integral part of New Zealand communities, and play an important role in disaster management and response.
- Understand the capacity and capability of local marae with iwi and hapū, and identify potential vulnerabilities in order to evaluate how to best support them to increase their capacity and capability to increase resilience.

Inform response and recovery

- During a flood, door-to-door knocking to check on local residents might be targeted to areas with potential low social connectedness, where people may be more isolated.
- If communities are permanently displaced after a flood, aim to keep people together with family, friends, neighbours and their local community, rather than separating them out; this helps maintain their social connections and helps with resilience (Hikichi et al 2017).

Risk reduction

- Create more 'bumping spaces' in local communities, where people can literally 'bump into' each other and build social connectedness. Bumping spaces can include school gates, playgrounds and parks, local libraries, local cafes and pubs, shops.

Case study

Marae provide important social connectedness during a disaster. For example, during the Edgecumbe flood, Rautahi marae at Kawarau helped people who were affected by the flood. Rautahi marae coordinator Hannah Edwardson described it as: "*It's very cool, it's very much a whānau atmosphere here… when you come in the gate, you get a hug, and then you tell us your story, and then we help you wherever we can*." They also gave food packages to families. "*We see people come in, and they are a bit hollow I suppose, and they are just needing some help. We help them where we can, and then you see that glimmer of hope, and that it's going to be OK*". For more information, see: https://www.youtube.com/watch?v=JiqHHJ5qTFM

10. Knowledge, skills and awareness of natural hazards

How does this relate to resilience and social vulnerability?

Understanding and being able to access hazard information is important for resilience. Having knowledge, skills and awareness of natural hazards can help people to:

- know how to prepare for a flood
- understand early warnings
- know where to evacuate to
- know how to cope during and after a flood
- know how to access services after an emergency.

Some groups of people may be particularly vulnerable, including:

- people who have limited proficiency in English
- people who are new to New Zealand, such as tourists, recent immigrants, and refugees
- people without access to telecommunications or internet, particularly if the internet is the main way that information is shared before, during and after a flood (eg how to get prepared for a flood, updated weather information, boil water notices, how to access help)
- people who do not have previous experience or indigenous knowledge of flooding impacts
- people who are new to the local area, such as seasonal workers, transitory workers (such as truck drivers), and tourists.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	**Point locations**	**Potential other indicators / data sources**
People who are new to the neighbourhood (within previous year) Households with no access to the internet Households with no access to a mobile phone Households with no access to a telephone People with limited English proficiency Recent immigrants Note: Additional demographic information is also available in the dataset, including ethnic groups and languages spoken.	Visitor accommodation, including: • hotels • motels • holiday inns • backpacker accommodation • camping grounds • freedom camping sites • holiday houses Flood hazard zones that have not experienced a flood in recent times (eg last 10 years) Refugee settlement centres and locations **TIP:** *For the accommodation locations, it is useful to include the likely number of people at each site, and any other relevant details about the people that might influence vulnerability*	Refugees Seasonal or transitory workers (such as fruit pickers, truck drivers) Tourists Information about languages spoken by local residents

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding for people who may not have knowledge, awareness and/or skills to face natural hazards.

Identify vulnerabilities

- Identify important facilities, institutions, marae, health services and other businesses in flood hazard zones, and provide these places with information about flooding risks, and what to do to prepare for floods.

Build meaningful relationships with local iwi and marae committees

- Assist iwi and hapū to identify flood risk. Marae are an integral part of New Zealand communities, and can play an important role in disaster management and response. Facilitate the development of marae emergency preparedness planning, to ensure that local iwi are well-resourced, with systems and processes to support communities during emergencies, if they are prepared to do so. For example, information sessions on emergency preparedness for flooding could be held at local marae, and toolkits such as Te Puni Kōkiri's Marae Emergency Preparedness Plan could be promoted (https://www.tpk.govt.nz/en/a-matou-mohiotanga/marae-development/civil-defence-marae-emergency-preparedness-plan-20).
- Discuss the local hazardscape with local iwi. They will have traditional knowledge (Mātauranga Māori) from their close connection with the local environment, that can add to and enhance the traditional science-based knowledge.

Inform community resilience-building

- CDEM community preparedness workshops could be targeted at areas where people are likely to need knowledge of local flood hazards. These workshops could be adapted to different cultures / languages, using information on local needs and vulnerabilities.

Inform communications

- Provide information about preparedness planning and public health messages in a range of different languages, using information about the needs of the local community.
- In areas with low levels of internet access, other communication methods may be needed for sharing information, such as through local support networks, schools and ECEs, local libraries, and community centres.
- In areas with large numbers of people who may not be aware of the hazards in the local area (and/or may not be able to understand the warnings), have a robust early warning system, with alerts and communications through a range of mediums.

Case studies

WREMO has recently translated their 'Earthquake Planning Guide' into a range of different languages, including Te Reo Māori, Samoan, Spanish, Chinese, Vietnamese, Burmese, Korean, Russian, Arabic, Khmer, Hindi, Farsi, Somali, Tamil, and Ethiopian (Amharic). For more information, see: https://getprepared.nz/personal-preparedness/earthquake-planning-guide-language-versions/

A review of the 2017 Edgecumbe flood found that residents were not aware enough of flood hazards, and there were no evacuation plans in place. Precautionary evacuation at a certain trigger point was recommended. For more information, see: https://www.boprc.govt.nz/media/773858/rangitaiki-river-scheme-review-april-2017-flood-event-final-report-as-supplied-to-by-of-plenty-regional-council.pdf

Local Mātauranga Māori (Māori knowledge) can be very valuable for understanding the hazards in a local area. For example, at Matatā, the local iwi Ngāti Awa describe how taniwha live in the local Awatarariki stream and Waitepuru stream. The taniwha in the Waitepuru stream is in the form of a lizard, and occasionally flicks its tail and washing everything downstream; for this reason, the iwi would not build in the floodplain. Dr Daniel Hikuroa has described the Waitepuru pūrākau (traditional story) as 'a codified form of knowledge, incorporating geomorphology with disaster risk reduction'. The Matatā settlement was hit by a large debris flood in 2005. For more information, see: https://www.stuff.co.nz/environment/climate-news/114282945/the-legal-threat-and-the-big-opportunity-in-mori-engagement-on-climate-change-response

Young people may act as a 'linguistic bridge' during a disaster. After the February 2011 earthquake, a young Afghan male described their role as helping their family and community elders understand information:

> "*You sort of forget the stress of the earthquake or anything, you just talk with your friends, sit at the table, you could speak well with them, you could speak with [your elder] because if you're speaking English with them they probably don't understand but you go there, you speak your own language and they really understand. You help them with any news and stuff. They get many feedback from you; you just tell them the news. You say hey like, the news said that will happen, this will happen, and they can prepare for whatever happens."* (Marlowe & Bogen 2015).

11. Safe, secure and healthy housing

How does this relate to resilience and social vulnerability?

Having safe housing after a flood is very important. Shelter, warmth and security are some of the basic needs for human survival.

- If houses are damaged after a flood, people can be displaced, or they may have to endure living in a broken home.
- Houses are more likely to be affected by floodwaters if their floor heights are not high enough to escape flood waters.
- People living in single-storey properties in flood hazard zones may have nowhere high enough to escape and/or store items.
- Floodwaters may pond under low-lying houses after a flood, leading to damp and mould issues.
- People who have previously experienced a flood may have difficulty rising to the challenge of dealing again with insurance companies to get their house repaired.

People's living situation can also make them vulnerable.

- Overcrowded houses can increase the number of people in a hazard zone, put pressure on emergency resources in a household, and increase the risk of infectious disease spread.
- People living in rental housing are at risk of having a lack of housing after a flood, for example if the owners need to do repairs.
- People experiencing homelessness or severe housing deprivation (which includes people living in emergency housing, camping grounds, boarding houses, marae and those in severely overcrowded households) are also particularly vulnerable.

If houses are not safe in a flood, people need to have an emergency shelter they can go to in their local area. This emergency shelter needs to be out of the hazard zone, accessible to all, and provide shelter from the weather. In many communities, marae have played a vitally important role in providing emergency shelter during disasters.

Māori also face some distinct challenges that make them more vulnerable. Māori freehold land lies in collective ownership, and therefore cannot be sold. This means that people living in houses on Māori land cannot relocate from vulnerable environments, or move if the property is damaged in a flood. These people may have difficulties in recovering after a flood, and may remain living in flood-damaged houses if they do not have the resources to repair the house or have alternative accommodation. Iwi may also have limited options for protecting marae in vulnerable areas (including in flood hazard zones), as it may be difficult to relocate them.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
People living in rental housing Crowded households People living in crowded households People in severe housing deprivation (homelessness)	Houses in flood hazard zones (by hazard classification zone: stream corridors, overland flow paths, inundation areas; deep floodwater depths) Houses on low-lying land Houses with a floor height below flood depth (particularly houses built 1980s–2000s, slab on ground, with no minimum floor height taking into account flood depths) Houses on Māori land in flood hazard zones Houses likely to be aggraded during a flood (ie where the river deposits mud, rocks, boulders, and/or erodes land under or around the house) Emergency housing, such as • Night shelter • Women's refuge Temporary accommodation • Camping grounds and motor camps • Boarding houses, hotels, motels Safe place for community to shelter out of flood hazard zone • Civil Defence Centres Marae	People living in houses on Māori land People living in low-lying properties in flood hazard zones People in single-storey properties (or on the bottom floor of multi-storey buildings) in flood hazard zones People living in damp and mouldy housing People who do not have house insurance

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding due to housing and emergency shelters.

Identify vulnerabilities

- Identify land, houses, and marae at risk of flooding, particularly deep water and flowing floodwaters (stream corridors and overland flow paths).

Build community resilience

- For existing housing in flood zones:
  - let people who are living in these houses know what they can do to improve flood resilience (such as installing better drainage, emergency preparedness, storing valuables up high)
  - check that rental housing meets rental warrant of fitness
  - consider cooperative insurance initiatives for low-income people

- consider options for moving houses and/or important buildings out of flood hazard zones (note this might be prohibitively expensive).

- Identify potential local sources of temporary housing after a flood, such as marae, visitor accommodation, and Airbnb.

Inform response and recovery

- If people are struggling to deal with insurance companies after a flood, hire an advocate/liaison person to help negotiate with insurers. This may be able to be co-funded by the district health board, as improving housing quality before the winter months can help to prevent hospitalisations due to illness.

Improve infrastructure to reduce the risk

- Prioritise and target stormwater infrastructure upgrades and hazard mitigation, for example in areas with deep inundation and in areas of high social vulnerability. For people outside of local council, this may involve making a submission on local council's Annual Plans and Long Term Plans (see the toolkit document for more details).

Support local iwi and hapū

- Assist iwi and hapū to identify flood risk to Māori-owned assets (such as marae, and houses on Māori land) with Māori communities to assist with their planning.

- Facilitate the development of marae emergency preparedness planning. Supporting marae preparedness can help ensure that local iwi are well-resourced, with systems and processes to support communities during emergencies, if they are prepared to do so.

- Understand the capacity and capability of local marae with iwi and hapū, and identifying potential vulnerabilities in order to evaluate how to best support them to increase their capacity and capability to increase resilience.

- Promote toolkits such as the Marae Emergency Preparedness Plan for marae, developed by Te Puni Kōkiri. For more information, see: https://www.tpk.govt.nz/en/a-matou-mohiotanga/marae-development/civil-defence-marae-emergency-preparedness-plan-20

Inform social housing

- Prioritise social housing improvements for vulnerable populations (such as older people, children, people with chronic health conditions, and people with a disability).

- Work to provide adequate social housing to meet the needs of the local community. Address issues such as homelessness in the community where possible, as getting people into stable housing will increase their resilience.

- During new housing developments (including social housing), consider how to better ensure houses are resilient to natural hazards. For example, check that houses:
    - are not located in flood hazard zones (particularly in overland flow paths, stream corridors, or in areas of deep inundation), and/or have minimum floor heights above certain flood levels
    - are structurally sound and will be as resilient to flooding
    - are accessible to people with disabilities
    - have emergency rainwater tanks, to provide emergency water during a disaster.

Case studies

The Marlborough region was hit by two major earthquakes in a few years (2013 Seddon earthquake and the 2016 Kaikoura earthquake). After the second earthquake, homeowners struggled to deal with insurance companies once again, and were often accepting less repairs than they were entitled to. As a result, the CDEM group and district health board helped to fund a full-time insurance advocate (insurance pathway coordinator), to visit houses, assess the damage and the repairs proposed by insurance companies, and advocate with or on behalf of residents for increased repairs if needed. This action helped to ensure houses were fixed in time for the winter months, so that people were no longer living in broken homes by wintertime. (Source: personal communications, Brian Paton, Marlborough region CDEM group manager).

In Porirua, Takapūwāhia Marae is located in a flood hazard zone. In previous floods in 2015 and 2016, the floodwaters reached the door of the marae, and whānau and the local community struggled to find sandbags at short notice to protect the marae. Since these floods, the marae committee has organised for sandbags to be located on site. This means that local iwi are not reliant on council or anyone else being able to reach the marae during a flood to deliver sandbags – they have the skills and equipment to protect the marae from floodwaters when needed.

After the 2011 Christchurch earthquake, over 110,000 homes were uninhabitable or were affected by power, water or sanitation service outages. In response to this, the Māori Earthquake Recovery Network opened the doors to all marae across the South Island (and a few in the North Island) to evacuees, as temporary accommodation (Kenney & Phibbs 2015).

During the 2019 Nelson fires, Airbnb hosts opened their homes for free to evacuated residents and relief workers, free of charge.

After the Edgecumbe flood, Kokohinau marae used the opportunity to kick-start a papakāinga housing development, to house whānau who lost their houses in the flood. Te Puni Kōkiri was involved in the emergency housing development, with support from the local council, regional council, and MBIE https://www.tpk.govt.nz/en/mo-te-puni-kokiri/our-stories-and-media/marae-housing-helps-edgecumbe-whanau-affected-by-f2

In the recovery phase after the 2011 Christchurch earthquake, prisoners at Rolleston Prison were involved in refurbishing damaged Housing NZ houses from the red zone. These houses were then returned to Rowses Road in Aranui, Christchurch. This project helped restore Housing NZ homes, and also helped give offenders valuable skills and training. For more information, see:
https://www.corrections.govt.nz/__data/assets/pdf_file/0005/766490/Corrections_Works_September_2014_PDF.pdf

12. Enough food and water (and other essentials) to cope with shortage

How does this relate to resilience and social vulnerability?

Having enough safe food and water, as well as ways of cooking food and ensuring that drinking water is safe, is essential for survival in the immediate days after a flood, as well as longer term.

- A lack of emergency water, emergency food supplies, electricity supplies (to cook food, boil water, and keep fridges and freezers going) and/or shelter can severely impact on people's health and wellbeing.
- Flooding and associated impacts may also affect people's food and water supplies. Food contaminated by floodwaters may need to be thrown out. Additionally, if the power goes out, fridges and freezers will stop working, and food may need to be thrown out. Tapwater might be contaminated, which means that people may need to boil water, disinfect it, or use safe emergency water. These issues may exacerbate existing shortages.
- Other important items during a disaster include essential medication, torches, batteries, emergency cooking facilities (and/or ability to boil water), a way of disinfecting water (eg bleach, if boiling water is not an option), and emergency food that is safe to eat. People with good emergency preparedness, including emergency plans in place, are more likely to have sufficient supplies to get through a disaster.
- People with food insecurity (a lack of access to safe, nutritious and affordable food) pre-disaster are also vulnerable. They are unlikely to have enough food to cope with shortages.
- Floods can also affect the ability to produce and gather food from the land, particularly in rural areas and/or isolated communities, which can impact on food security.
- If people need to shelter at emergency shelters, they will need to have a place to cook, and food to eat. This is an important consideration for Civil Defence Centres.
- Marae have played vitally important roles in previous disasters. Marae are important community locations that may provide food/kai for people in a disaster, as well as mattresses for people to sleep. Marae have cooking facilities, and the local people are very experienced at feeding many people during an emergency.

In New Zealand, some population groups are less likely to meet emergency preparedness requirements or have food security (Ministry of Health 2019, Statistics New Zealand 2012). These groups include:

- people with low household incomes
- people living in rental housing (particularly public landlords)
- single parents
- people receiving a means-tested benefit.

These factors have been used as proxy indicators to help understand the areas where people might be less likely to have enough food and water to survive after a flood, if neighbourhood-level data are not available for indicators of emergency preparedness and food security.

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
Possible proxy indicators: People living in rental housing Single-parent households Socioeconomic deprivation (NZDep2013)	Food stores • Supermarkets • Dairies • Other food stores Food banks Local emergency water supplies (such as water storage tanks, boreholes) WINZ offices Marae *Possible proxy point locations:* Rental housing owned by a public landlord (Housing New Zealand Corporation, local authority or city councils, other state landlords)	Households without emergency water supplies for 3-7 days Households without emergency food supplies for 3-7 days Households without an emergency plan Households without better levels of emergency preparedness (torch, portable radio, spare batteries, essential first aid, medication) Households experiencing food insecurity (ie adequate and nutritious food is often not readily available in the household) Use of local food banks People receiving a means-tested benefit

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding due to lack of emergency food and/or water.

Identify vulnerabilities

- Identify areas where people may struggle to have enough food to survive after a flood. This may correlate to areas where people regularly access food banks.
- Identify areas where there may be power outages in the event of a flood, and assess whether this may have an impact on people's food supplies.

Inform community resilience-building

- In areas likely to struggle with emergency water after a flood, install rainwater tanks in the community, for example attached to local community centres or other local buildings.
- Think not only about the household level in terms of preparedness. For some community groups, family/whānau or other groupings may be more relevant groups to consider when developing emergency preparedness messages.

Inform emergency planning and preparedness

- Check that storage of emergency supplies (including emergency food) is above flood levels, rather than on the floor or ground, in low-lying flood areas (eg in schools, institutions, local communities).

Inform communications

- Check that emergency preparedness messages are inclusive for people on low incomes. Suggest alternative preparedness practices for when people do not have enough money to afford emergency food.

Response and recovery

- During the response, organise welfare agencies to target areas with higher deprivation/low incomes for providing emergency food.
- Consider CDEM plans for distributing household goods and services to Civil Defence Centres during a response, and tailor this to likely areas where this assistance will be most needed, based on social vulnerability information.

Housing

- Provide rainwater tanks in social housing, to be able to be used as an emergency water source for the household in disasters.

Case study

During the 2017 Edgecumbe flood, Rautahi marae at Kawarau helped people who were affected by the flood. Rautahi marae coordinator Hannah Edwardson described how they gave food packages to families who were staying with whānau in Kawerau, to share at the house they were staying at, to take the financial pressure off, until they could get WINZ support sorted out. https://www.youtube.com/watch?v=JiqHHJ5qTFM

In Christchurch after the February 2011 earthquake, Māori had hangi (cooking with earth ovens) in the city, as a way to cook and provide food for people during the disaster (Kenney & Phibbs 2015). The Māori Recovery Network delivered over 1600 food packages to isolated residents during the response effort.

13. Decision-making and leadership

How does this relate to resilience and social vulnerability?

Decision-making and leadership, including people's ability to participate in, and influence, decision-making plays an important role in resilience.

- People without involvement in decision-making are likely to feel left out of the process. They are unlikely to have their needs listened to or fully met.
- Effective leadership is important when coordinating emergency management during and after a disaster. Having leadership structures already in place can play an important role in resilience during a disaster.
- Partnership and collaboration between local iwi, councils, government and CDEM groups can build and strengthen resilience.
- Being inclusive in decision-making, and building capacity in iwi/hapū as well as more vulnerable population groups, helps to build resilience and ensure that people's needs are met.
- At the individual level, self-efficacy and autonomy are important for making people feel like they have a sense of control over their situation. People also need to be able to access services and resources, and not be excluded or have major barriers to accessing these.

Decision-making can occur at many levels, including individual and household, iwi/hapū, CDEM groups, local government (council staff and Councillors), central government (MPs and Ministers), and everything in between. For example:

- Individual /household/whānau level – being autonomous, able to make decisions for yourself, and within your household and family/whānau
- Community level – able to participate in decision-making about things happening in the local community, being involved and included in community welfare group networks
- Iwi/hapū – ensuring Māori and local iwi/hapū have sufficient knowledge and information to be able to make autonomous decisions and build resilience; partnering with Māori and local iwi in decision-making and emergency preparedness
- Local government – participating in local council processes through submissions etc, such as infrastructure upgrade decisions
- CDEM response
- Central government.

Decision-making impacts can occur at all stages of the disaster management cycle, including risk reduction activities (eg infrastructure upgrades), readiness/preparedness, response activities during a flood (eg sharing weather updates, evacuation activities, emergency shelters), and recovery efforts (eg potential red-zoning of areas).

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
Level of voting participation (in the 2016 Local Body Elections)	Marae Civil Defence Centres	Inclusion of Māori, iwi, and hapū in civil defence emergency management planning and decision-making* Inclusion of vulnerable population groups (such as those with health needs and/or disabilities) in civil defence emergency management and decision-making* Inclusion of marae committees, and committees of other important assets (such as schools) in flood hazard zones, in CDEM response communications

* These indicators are important for measuring this social vulnerability dimension.

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding, relating to decision-making and leadership.

Inclusive CDEM welfare network

- Check that CDEM welfare groups include representatives of vulnerable people from across the social vulnerability dimensions, including people with disabilities, people with chronic health needs, older people, people who do not speak English, as well as local Māori, Pasifika (eg Pacific leader groups, Pacific churches), Asian groups and other ethnic communities.

Build meaningful relationships with local iwi, hapū and marae committees

- Build meaningful relationships and partnerships with local iwi / hapū, and include local iwi in CDEM disaster preparedness and emergency response planning.
- Given that marae will be the automatic place that many whānau and Māori communities will go to in a disaster, check that marae are incorporated meaningfully into regional and local civil defence policy and plans (Hudson & Hughes 2007).
- Understand the capacity and capability of local marae with iwi and hapū, and identify potential vulnerabilities in order to evaluate how to best support them to increase their capacity and capability to increase resilience.

Involvement in local government processes

- Encourage involvement in local government processes, including making submissions on infrastructure upgrades and hazard mitigation works in Annual Plans and Long Term Plans (see toolkit document for more information).

Case study

An example of how decision-making and leadership can help with resilience was the national Māori Earthquake Recovery Network, which was established within a day of the 2011 Christchurch earthquake occurring (Kenney & Phibbs 2015). The network was initiated by Te Rūnanga o Ngāi Tahu, and included Te Puni Kōkiri, Te Rūnanga o Ngā Maata Waka (the Christchurch Urban Māori Authority), New Zealand Police, and Te Tai Tonga (Southern Māori) electorate. The chair of Te Runanga o Ngāi Tahu, Sir Mark Solomon, was designated the media spokesperson, given that Te Runanga o Ngāi Tahu were kaitiaki (guardians) of the region. The response network was established quickly after the event, using pre-existing leadership structures, well-established relationships with key agencies, and linkages with the community. The community-led response network was established to help with and coordinate relief efforts. The network had a mission statement of 'aroha nui ki te tangata' (extend love to all people), which helped to unite and direct action. However, they faced some challenges; it took eight days, and an external mediator, for the Network to get in contact and start formally coordinating with the civil defence effort (Kenney & Phibbs 2015).

14. Other individual-level factors of social vulnerability

Who else are vulnerable, and why?

A few other factors can also contribute to social vulnerability and resilience to flooding at the individual level:

- **Healthcare workers and first responders**
    - These people are at higher risk of exposure to floodwaters and hazardous situations, and therefore higher risk of physical and psychosocial impacts.
    - People who have a family member involved in the response may also be indirectly affected.
    - Healthcare workers and first responders can also be an asset during a flood, particularly in isolated / cut-off areas.
- **People who have previously experienced domestic violence**
    - These people are at greater risk of experiencing domestic violence again after a natural hazard.
- **People in the justice system**
    - People in institutions (such as prisons) are more vulnerable, as they rely on others to look after them.
    - People serving community-based sentences or who are on parole may also be at increased vulnerability, if they are not aware of provisions that allow them to leave their home to avoid or minimise a serious risk of death.
    - However, people serving sentences such as community work can also be an asset after a flood, through helping with flood clean-ups.
- **People living in group quarters**
    - People living in group quarters, including prisons, rest homes, university dorms, and military quarters, may also be more vulnerable to the impacts of a flood. These people may also be an asset after a flood.
- **People who own (or are responsible for) animals, including pets and livestock**
    - People who own or are responsible for animals may put their life in danger in order to rescue animals. They may also be less likely to evacuate, or may have more difficulties in evacuating, particularly if they have multiple pets, an outdoor dog, or no cat carrier

Social vulnerability indicators and other potential sources of data

Indicators (available in dataset)	Point locations	Potential other indicators / data sources
Healthcare workers and emergency service workers (ambulance, fire, police) Households with a healthcare worker and/or emergency service worker Currently registered dog owners Currently registered dogs	Prisons Youth justice facilities Police stations Community corrections centres University dorms Military quarters Rest homes **TIP:** *For these point locations, it is useful to include the number of people at each site, and any other relevant details about the people that might influence vulnerability*	People who have previously experienced domestic violence People who are serving community sentences (such as home detention, community work) or who are on parole Households with one or more pets People who own or manage livestock *Potential other data sources:* Council dog registration records Department of Corrections data on people serving community sentences, on parole or on home detention Police local knowledge on households where domestic violence often occurs

Examples of how to use social vulnerability information

The following are some examples of how social vulnerability indicators and information might be used to reduce vulnerability to flooding, for people with these additional factors that may make them vulnerable.

Healthcare workers and first responders

- Provide health advice to workers and other first responders who will be in floodwaters about what they need to wear to protect themselves from health impacts of floodwaters.
- Provide psychosocial support for first responders after a flood event.

People in the justice system

- Use people serving community sentences as helpers after a flood (eg like student army).

People who own (or are responsible for) animals

- Evacuate animals alongside owners, according to international best practice. Animal welfare is indirectly a human life safety issue, as humans will often ignore police cordons to go into flooded areas to rescue their animals.
- Allow for animals at emergency shelters.
- Provide weather updates and early warning sufficiently in advance for farmers to move their animals to higher ground.
- Review the SPCA recommendations for improved response to animal welfare during disasters (https://www.researchgate.net/publication/324133239_SPCA_Rescue_Operation_Edgecumbe_After_Action_Report)

Case study

During the 2017 Edgecumbe flood, more than 1000 animals were rescued. One woman risked her life to swim through floodwaters to rescue her horse. A report on the animal rescues noted that people will risk their lives for their animals, ignoring emergency cordons to go back and get their pets. The report recommended that pets needed to be evacuated alongside their owners, or if they are left behind, they need to be rescued from within emergency cordons. The report contained 39 recommendations for improved response to animal welfare during disasters. For more information, see:
https://www.researchgate.net/publication/324133239_SPCA_Rescue_Operation_Edgecumbe_After_Action_Report

People serving community-based sentences in Northland helped with the clean-up from the storm and floods that hit the Northland region in July 2014. For more information, see:
https://www.corrections.govt.nz/__data/assets/pdf_file/0005/766490/Corrections_Works_September_2014_PDF.pdf

References

Blake B, Marlowe J, Johnston D. 2017. Get prepared: Discourse for the privileged? *International Journal of Disaster Risk Reduction* 25: 283-88

Blake D, Lyons A. 2016. Opioid Substitution Treatment Planning in a Disaster Context: Perspectives from Emergency Management and Health Professionals in Aotearoa/New Zealand. *Int J Environ Res Public Health* 13: 1122

Hikichi H, Tsuboya T, Aida J, Matsuyama Y, Kondo K, et al. 2017. Social capital and cognitive decline in the aftermath of a natural disaster: a natural experiment from the 2011 Great East Japan Earthquake and Tsunami. *Lancet Planetary Health* 1: e105-13

Hudson J, Hughes E. 2007. *The role of marae and Maori communities in post-disaster recovery: a case study*. Wellington: GNS Science Report 2007/15.

Kenney C, Phibbs S. 2015. A Māori love story: Community-led disaster management in response to the Ōtautahi (Christchurch) earthquakes as a framework for action. *International Journal of Disaster Risk Reduction* 14: 46-55

Marlowe J, Bogen R. 2015. Young people from refugee backgrounds as a resource for disaster risk reduction. *International Journal of Disaster Risk Reduction* 14: 125-31

Menne B, Murray V, eds. 2013. *Floods in the WHO European Region: Health effects and their prevention*. Copenhagen: World Health Organization Regional Office for Europe.

Ministry of Health. 2019. *Household Food Insecurity Among Children in New Zealand*. Wellington: Ministry of Health.

Phibbs S, Kenney C, Severinsen C, Mitchell J, Hughes R. 2016. Synergising public health concepts with the Sendai Framework for Disaster Risk Reduction: A conceptual glossary. *International Journal of Environmental Research and Public Health* 13: 1241

Statistics New Zealand. 2012. *How prepared are New Zealanders for a natural disaster?* Wellington: Statistics New Zealand.