National Emergency Management Agency
Te Rākau Whakamarumaru

22 October 2024

[redacted]

Reference: OIA-2024/25-0314

Dear [redacted]

Official Information Act request relating to Catastrophic risk

Thank you for your Official Information Act 1982 (the Act) request received on 4 October 2024. You requested:

> *This is an Official Information Act 1982 request relating to the May 2024 conference referred to in this article: https://www.rnz.co.nz/news/national/516720/earthquake-disaster-risk-from-nz-s-hikurangi-subduction-zone.*
>
> *May I please have:*
> 1. *All papers presented at the session on "catastrophic risk"*
> 2. *The document setting out NEMA's "planning scenario" relating to a 9.1 Hikurangi earthquake and tsunami*
> 3. *NEMA's "catastrophic handbook" (if this has been prepared yet)*
> 4. *If the "catastrophic handbook" has not yet been prepared, an estimate as to when it will be ready*

Information being released

For Part (1) of your request, please find attached a copy of the slides used by National Emergency Management Agency (NEMA) officials for "*Te Tai Whanake Panel 2*" at the "*National Science Challenges – the Resilience to Nature Challenge*" conference held in Wellington in May this year.

In addition, during this session, NEMA officials referred to statistics from the November 2023 Briefing to the Incoming Minister for Emergency Management and Recovery. The briefing is publicly available on the Department of the Prime Minister and Cabinet website at: www.dpmc.govt.nz/publications/proactive-release-briefing-incoming-minister-emergency-management-and-recovery-nema-nov-2023. The relevant statistics can be found at "*Annex 3: New Zealand's riskscape*". To the extent this part of your request is for this information, it is refused under section 18(d) of the Act as it is already publicly available.

We can only respond in relation to NEMA material from the relevant session at the conference. However, I note that other slides from the conference session have been published by the conference organisers on their website at: resiliencechallenge.nz/outputs/te-tai-whanake-panel-2-slides-the-evolving-approach-to-catastrophic-risk-for-aotearoa-nz.

For Part (2) of your request, please find attached a copy of a slide set prepared by NEMA's Chief Science Advisor, for the planning scenario relating to a 9.1 Hikurangi earthquake and tsunami.

The 'CATPlan Hik9 EQ and Tsunami scenario' was developed quickly over the course of a few weeks (usually this would take at least months), to provide a credible catastrophic disaster scenario to support the initial phase of NEMA's CATPlan programme in late 2022.

This scenario has not been written up in a full scientific report nor a plain language document.

It is only available as a slide pack. We respectfully note and caution that this slide pack is intended to be presented by a natural hazard risk modelling expert, rather than be a standalone, public-facing product. The intent is that the risk modelling expert presenter can present the material with the appropriate context, applications, and limitations. For example, the slide pack does not include many of the input assumptions or various other assumptions used in the development of the models, the limitations of the models and the results, nor does it contextualise this risk.

Given the context above, please be mindful that it is relatively easy to misinterpret or misrepresent these results, even for someone relatively literate in disaster risk science. The slides are a prop for the expert presenter to use to communicate the full content of the scenario. Finally – this is only a scenario, and a future event will almost certainly be different, but the planning and preparedness we undertake now for a scenario of this scale and complexity will be invaluable and essential for preparing Aotearoa New Zealand for any catastrophic event.

As set out in the table below, both sets of slides have been released to you in full.

Item	Date	Document title	Decision
1	13/05/2024	Perspectives on mobilising science in support of planning and managing catastrophic risks	Released in full
2	9/09/2024	Hikurangi-M9.1 CATPlan Scenario	Released in full

Parts (3) of your request is for a copy of NEMA's "Catastrophic Handbook" if it has been prepared and Part (4) asks when it will be ready if not yet prepared.

The handbook is currently under preparation, and so Part (3) of your request is formally refused under section 18(e) of the Act on the basis that the requested document does not exist at this stage.

Regarding Part (4) of your request, it is anticipated that the handbook will be made publicly available in December 2024. The Catastrophic Event Handbook is a framework that will guide a national response to a catastrophe. Once finalised, this Handbook will be published on NEMA's website at: www.civildefence.govt.nz/resources/publications.

For completeness, you have the right to ask the Ombudsman to investigate and review my decision under section 28(3) of the Act.

This response will be published on the Department of the Prime Minister and Cabinet's website during our regular publication cycle. Typically, information is released monthly, or as otherwise determined. Your personal information including name and contact details will be removed for publication.

Yours sincerely

Stefan Weir
Chief of Staff

Perspectives on mobilising science in support of planning and managing catastrophic risks

Tom Wilson
Chief Science Advisor | Kaitohutohu Mātanga Pūtaio Matua

13 May 2024
RNC Te Tai Whanake Symposium

National Emergency Management Agency
Te Rākau Whakamarumaru

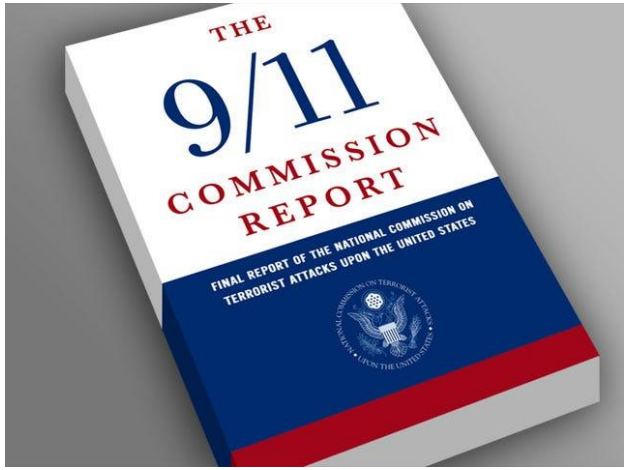
Can’t scale up. Don’t look up.

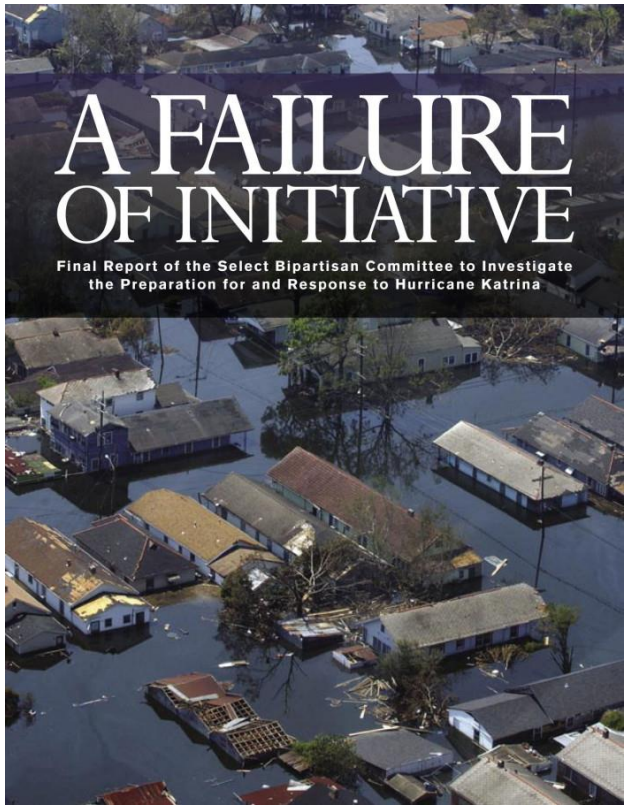
Overwhelms our current thinking, arrangement, experience and imagination

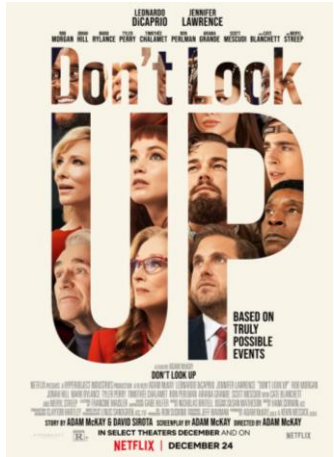
- “Failure of Imagination” 9/11 Commission (USA)
- “A Failure of Initiative” Hurricane Katrina (USA)

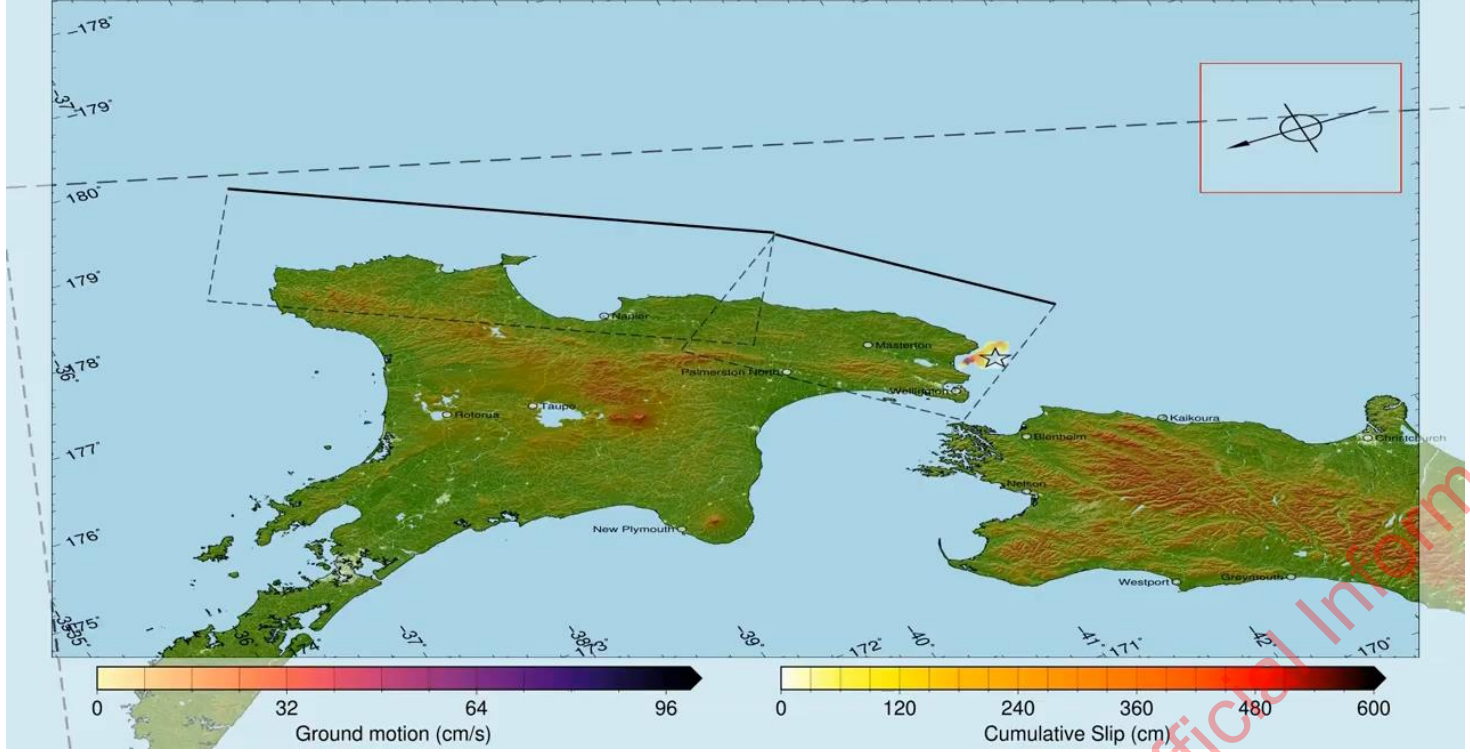
We needed a story to plan around and ‘provide the why’

- Which scenario?
- Maximum credible event → ***what is credible?***









Credit: M8.6 Hikurangi scenario. Brendon Bradley, UC

QuakeCORE
NZ Centre for Earthquake Resilience
Te Hiranga Rū

Maximum credible event: Mw9.1 Hikurangi Subduction Zone earthquake + upper crustal faults

Tsunami wave model: Hikurangi Mw9.1 scenario
Credit: Bill Fry, GNS

National impacts at a glance

- **Casualties:** Shaking + Tsunami (with % evacuation)
  - Injuries: 25,960 (70% evac) 32,030 (0% evac)
  - Deaths: 22,180 (70% evac) 68,670 (0% evac)
  - Likely overwhelm health system

- **Evacuated (displaced) population from tsunami alone:**
  - >400,000 people in activated tsunami evacuation zones (immediately)
  - >100,000 people in activated tsunami evacuation zones (24 hours)
  - >30,000 tsunami impacted residential homes

- **Built environment damage (all buildings types)** :
  - **Buildings**: shaking $130 B + tsunami $14 B = $144 B total
    - Approx. half of Great East Japan EQ (2011)
  - A lot of exposed **critical infrastructure** (yet to be modelled)

Christina Magill, Nick Horspool, Xiaoming Wang and Finn Scheele (GNS Science). 18 Oct 2022

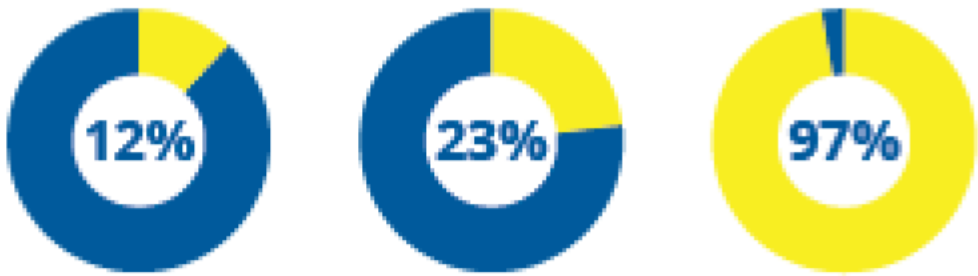
RISKSCAPE®

Modelled scenarios		Likelihood in next 50 years	Modelled building/ infrastructure losses	Likely consequences
Auckland volcanic eruption		10%	**$5bn-$65bn** (buildings only)	Potential full evacuation of Auckland City, with only days to week's warning.
Taranaki eruption	Small eruption	30%	~$1bn	Similar size to 1995-96 Ruapehu eruptions. Impacts dominated by ashfall and lahars; evacuations likely.
	Large eruption	1%	$10bn-$15bn	Similar size to 1886 Tarawera eruption. Likely severe impacts to
Hikurangi subduction zone earthquake and tsunami	M8+	25%	~$10bn-$20bn	
	M9.1	1%	$144bn (buildings only)	
Ruapehu / Tongariro / Ngauruhoe / Whakaari ash producing eruption		Almost certain	~$1bn	

Actual events

Cyclone Gabrielle equivalent event	80%
Kaikōura earthquake (2016)	1.7%
Canterbury Earthquake Sequence (2010-11)	<1%

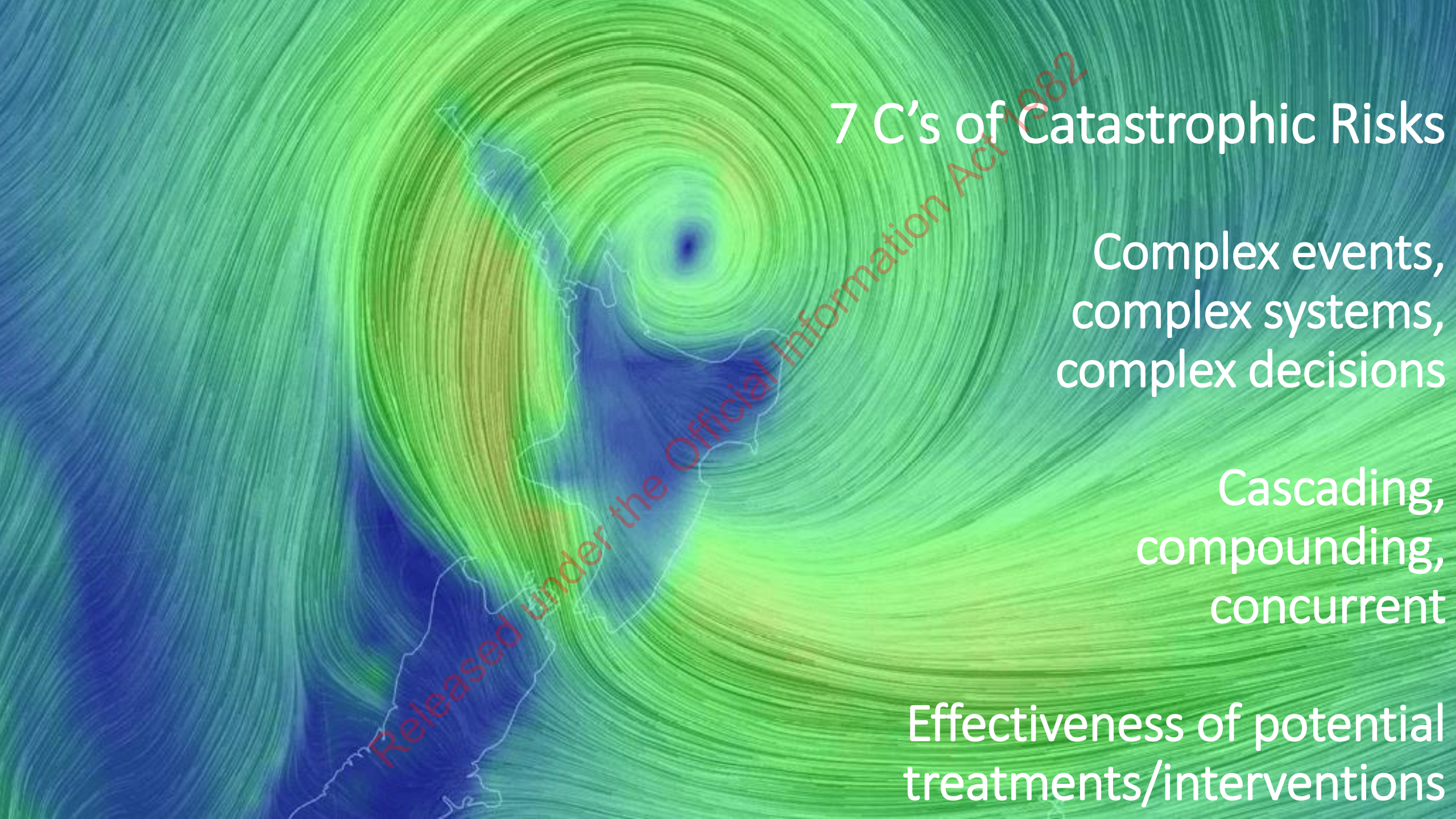
When we consider all of the modelled scenarios with >$10bn expected damage costs, the estimated probability of any one of these events occurring is:



in the next 3 years | in the next 6 years | in the next 50 years

Note – this is not an exhaustive list of possible scenarios. Modified from LGNZ 2014; updated and new data from GNS Science, NIWA, EQC, and Massey and Canterbury Universities

Source: NEMA Briefing for Incoming Minister 2023



7 C's of Catastrophic Risks

Complex events,
complex systems,
complex decisions

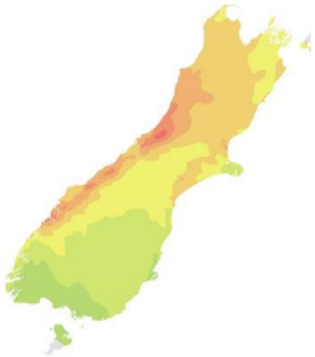
Cascading,
compounding,
concurrent

Effectiveness of potential
treatments/interventions

Final thoughts – understanding each other's worlds

- Understanding our risks is critical, in all their complexity...particularly for catastrophic risks
- Understanding how to reduce our risks is essential
  - Systems, tools, knowledge, planning
  - How to engage and influence
  - Communication and education must be at the heart of this

- Understanding and working within the complexities of communities
  - how they change through time and with different experiences?
  - and how this impacts awareness, knowledge, behaviour and action?
  - ensuring we are responsive to these dynamic changes



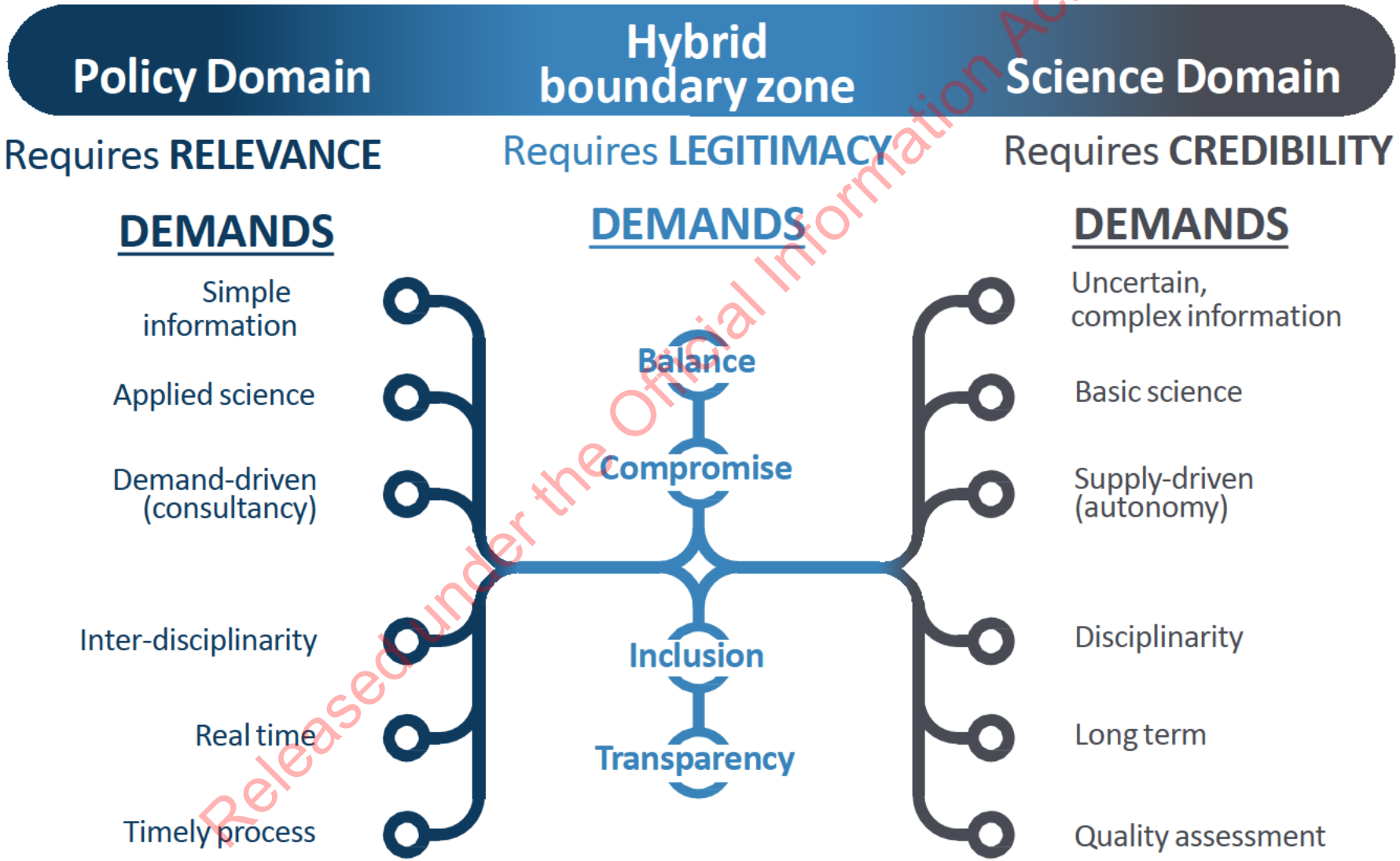
Hazard

Vulnerability

Exposed Elements

Impact/Risk

Where I now live: science - practice/policy boundary



Cash et al 2003; Parker & Crona 2012; Sarkki et al 2014, Dr Sarah Beaven – various outputs

LESSONS

Existing relationships make or break decisions in an emergency

Formal and informal preparations e.g. SAP

Wellbeing covers more than just life safety – it includes protecting environmental, built, economic and cultural / social aspects of lives and livelihoods.

The best science communication is served many ways

Emergency Management operators and policy makers are faced with a overwhelming number of 'important and urgent' issues – be quantitative and place advice in context

Credit: Ashley Spires

Prof. Tom Wilson

Chief Science Advisor | Kaitohutohu Mātanga Pūtaio Matua

National Emergency Management Agency (NEMA) | Te Rākau Whakamarumaru

National Emergency Management Agency

Te Rākau Whakamarumaru

Rotting feast of disaster science

Hikurangi-M9.1 CATPlan Scenario

Prof. Tom Wilson, on behalf of the wider team

Chief Science Advisor | Kaitohutohu Mātanga Pūtaio Matua

National PIM Coordination Group

9 Sept 2024

National Emergency Management Agency
Te Rākau Whakamarumaru

Catastrophic Disaster

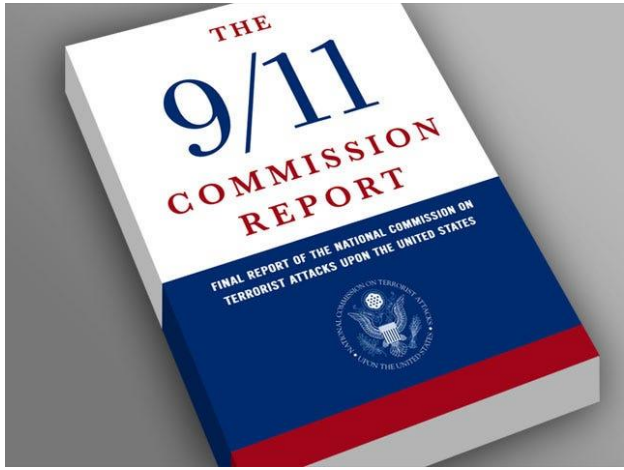
- *What is beyond our current arrangements, thinking, experience and imagination (e that has overwhelmed our technical, no-technical and social systems and resources, and degraded or disabled governance structures and strategic and operational decision-making functions).*
- *Catastrophic events differ from emergencies in that they exceed BAU emergency management systems and capability design parameters.*

NEMA's Catastrophic Planning (CatPlan) programme

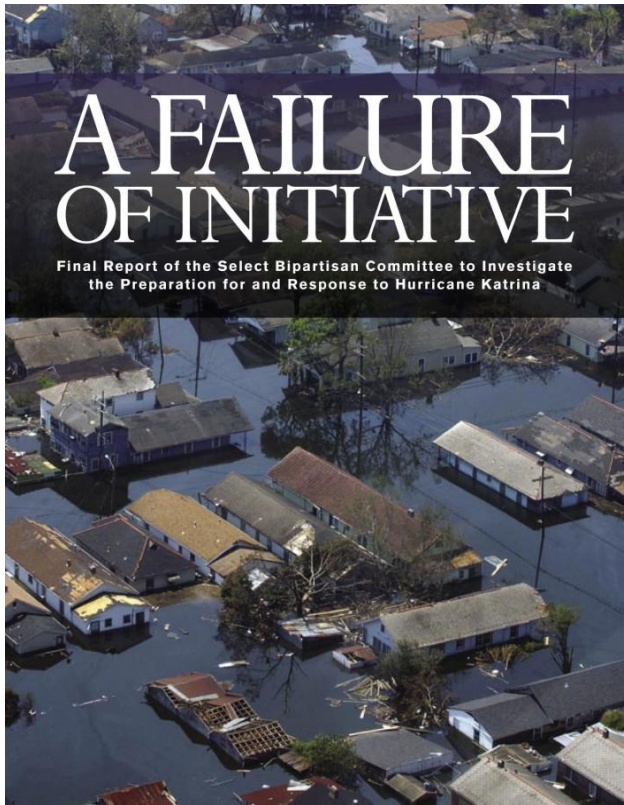
NEMA and partner agencies to determine how to deliver critical tasks and put necessary arrangements in place ahead of time for events which could generate **catastrophic consequences for Aotearoa New Zealand**.

Objectives :

1. Improve Aotearoa New Zealand's readiness for a catastrophic event across All-of-Government (AoG), Non-Government Organisations (NGOs) and central business partners.
2. Produce an operationally relevant, **hazard agnostic handbook** that can be utilised across any National response to enable better response outcomes.
3. Increase awareness among central agencies of response arrangements that are currently in place, and existing gaps in response arrangements.
4. In conjunction with partner agencies, business partners, regional entities and NGOs, develop a proposed work programme to close the identified readiness gaps.



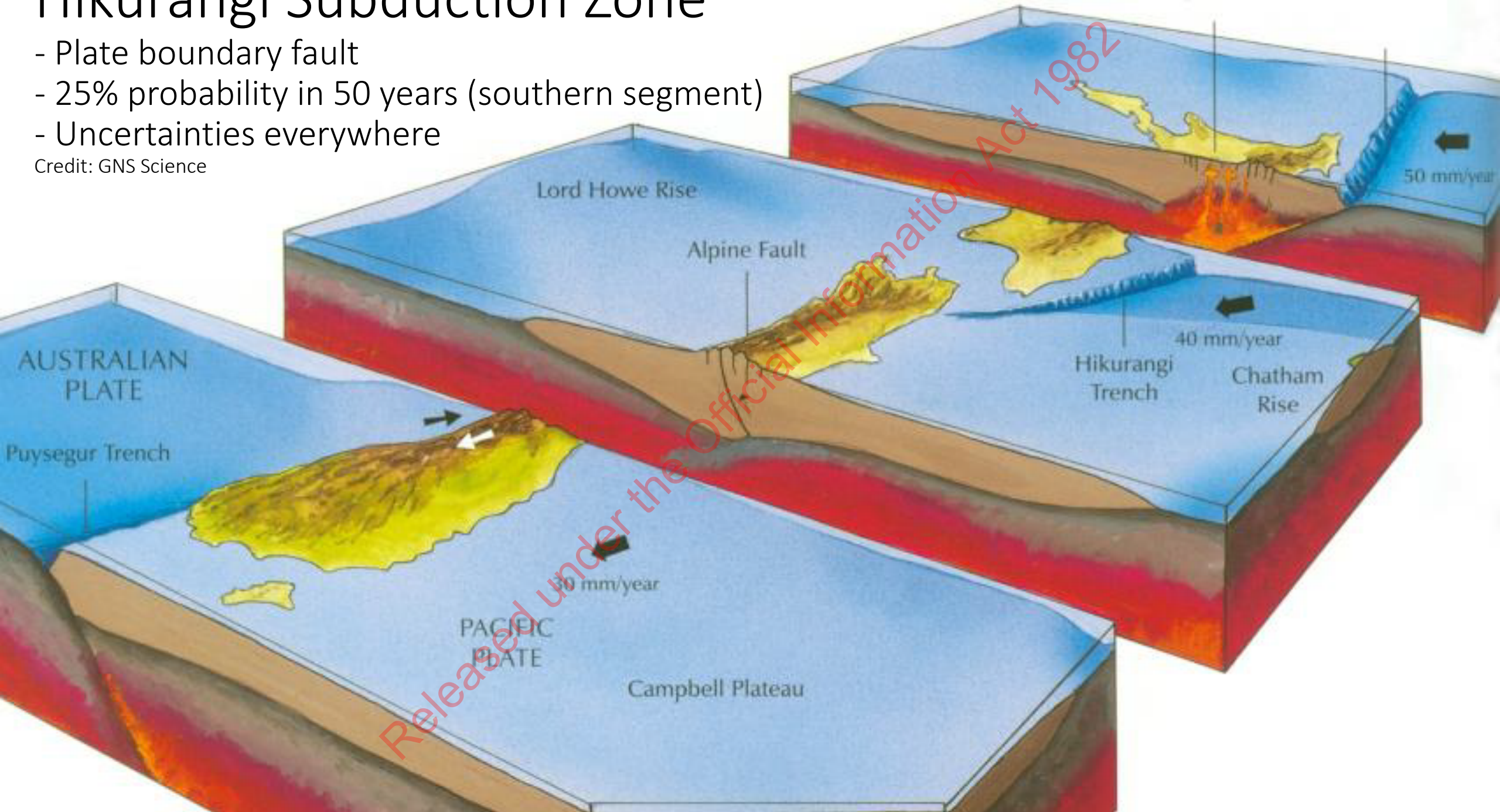
- Maximum credible event | reasonable worst-case scenario
- “Failure of Imagination” 9/11 Commission (USA)
- “A Failure of Initiative” Hurricane Katrina (USA)
- “Don’t Look Up”



Hikurangi Subduction Zone

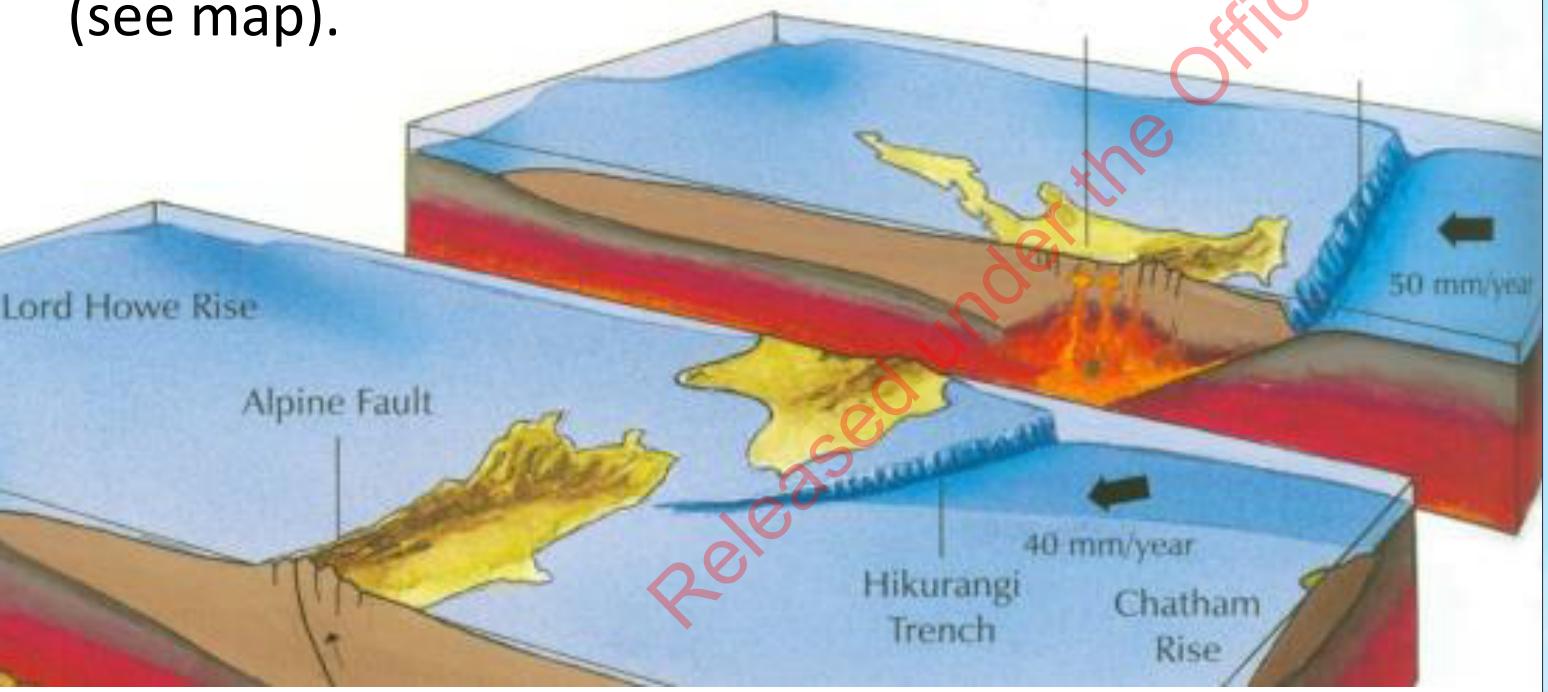
- Plate boundary fault
- 25% probability in 50 years (southern segment)
- Uncertainties everywhere

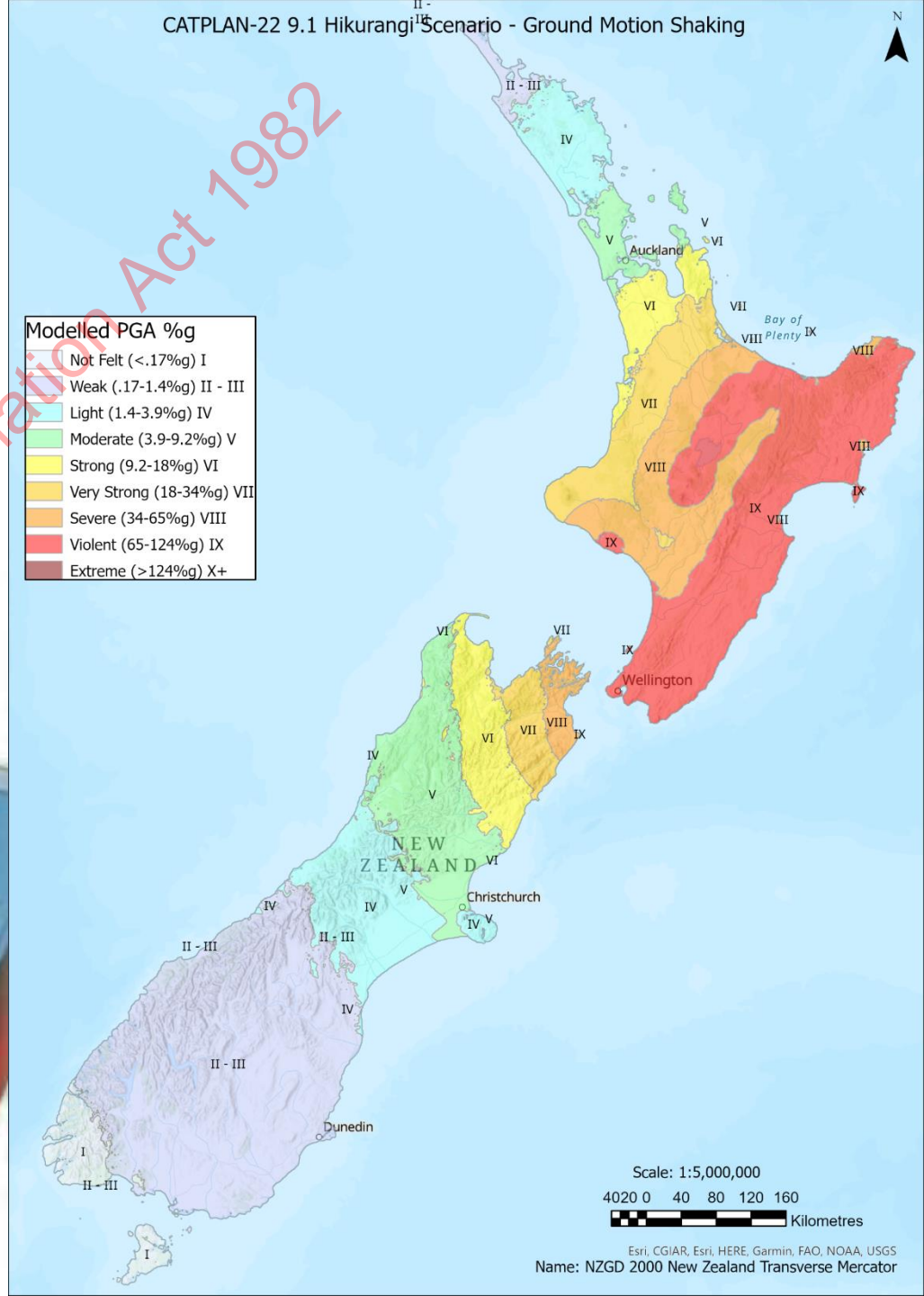
Credit: GNS Science

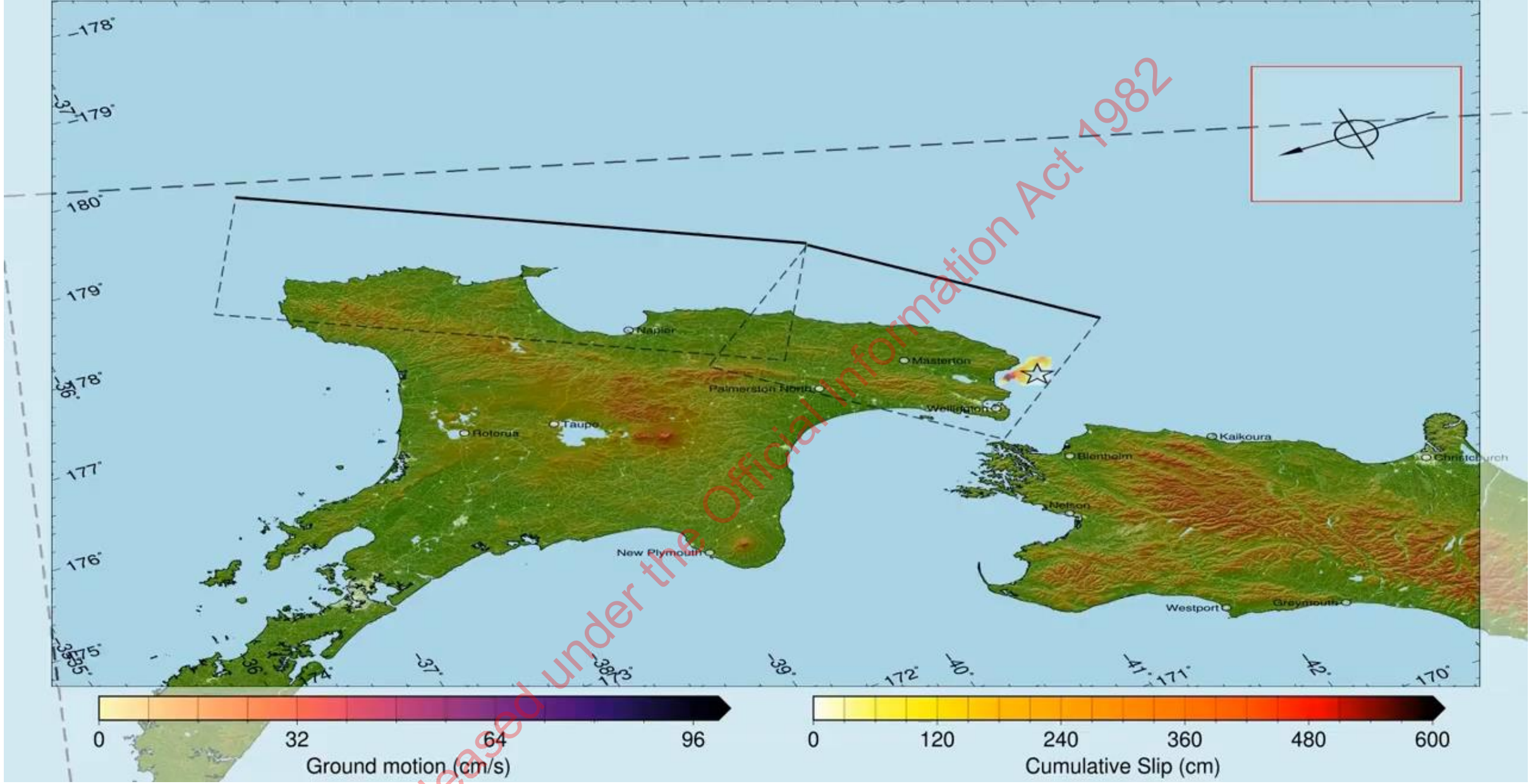


Ground shaking

- Maximum credible event
- Mw9.1 Hikurangi Subduction Zone earthquake + upper crustal faults
- 4-6 minutes of strong to violent ground shaking
- Violent shaking (65-124%g) IX for lower, eastern and parts of central and western North Island (see map).







Credit: Brendon Bradley, University of Canterbury

QuakeCoRE
NZ Centre for Earthquake Resilience
Te Hiranga Rū

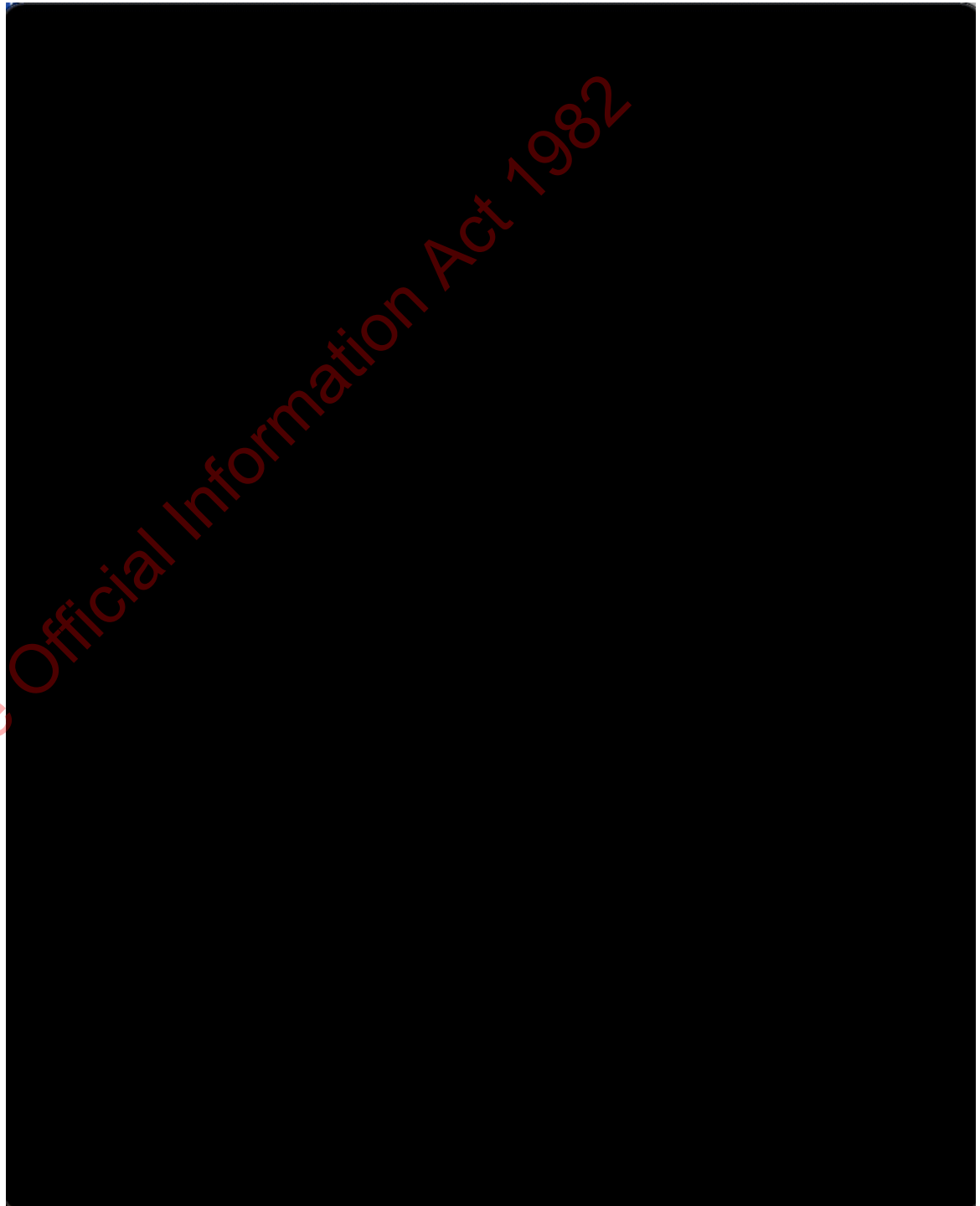
2011 Mw9.0 Tohoku Earthquake and Tsunami, Japan

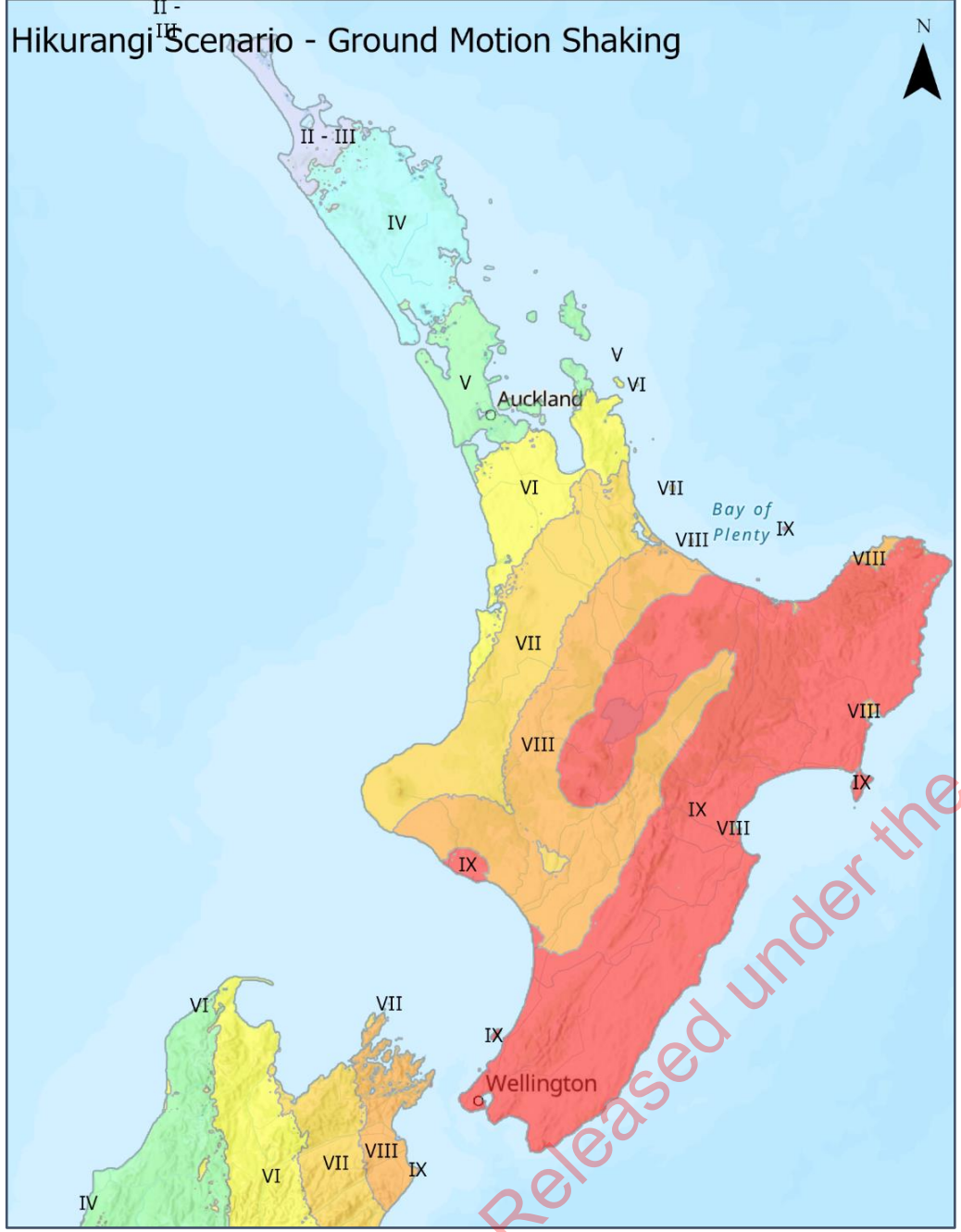
Tsunami wave model

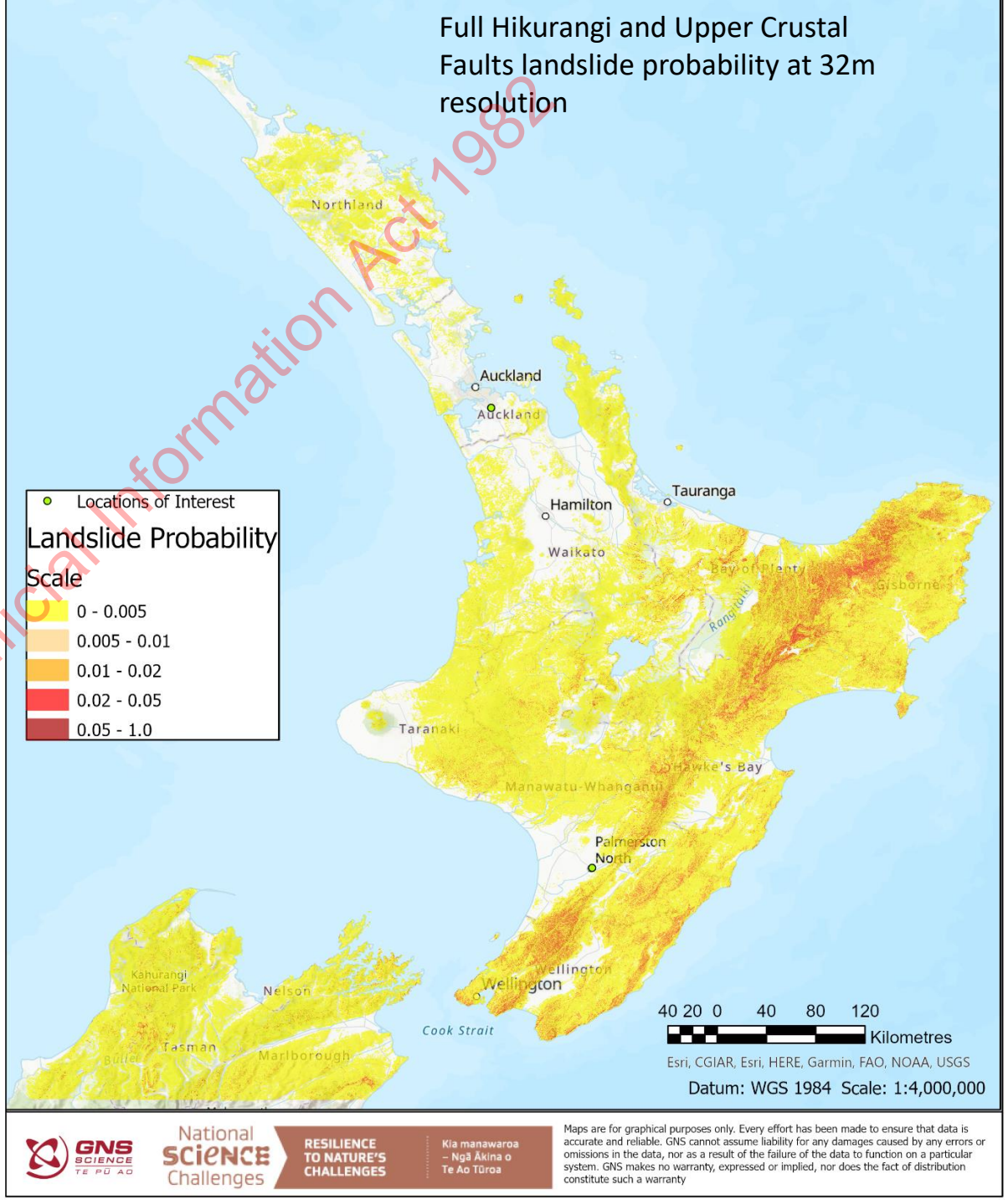
Hikurangi Mw9.1 scenario

DRAFT

Credit: Bill Fry, GNS







GNS SCIENCE TE PŪ AO | National SCIENCE Challenges | RESILIENCE TO NATURE'S CHALLENGES | Kia manawaroa – Ngā Ākina o Te Ao Tūroa

National impacts at a glance

- **Casualties:** Shaking + Tsunami (with % evacuation)
  - Injuries: 25,960 (70% evac) 32,030 (0% evac)
  - Deaths: 22,180 (70% evac) 68,670 (0% evac)
  - Likely overwhelm health system

- **Evacuated (displaced) population from tsunami alone:**
  - >400,000 people in activated tsunami evacuation zones (immediately)
  - >100,000 people in activated tsunami evacuation zones (24 hours)
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- **Built environment damage (all buildings types)** :
  - **Buildings**: shaking $130 B + tsunami $14 B = $144 B total
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Christina Magill, Nick Horspool, Xiaoming Wang and Finn Scheele (GNS Science). 18 Oct 2022

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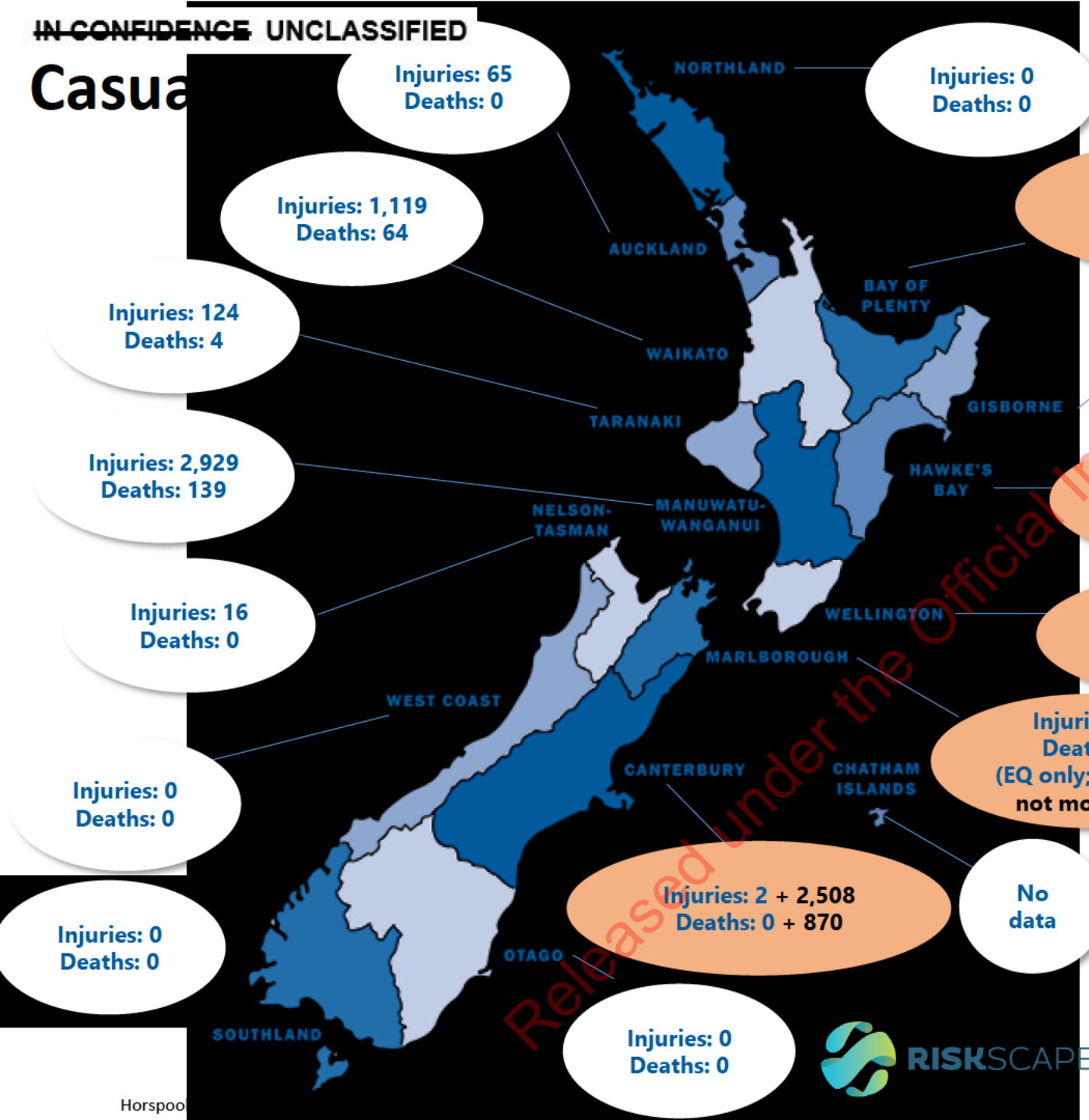
~~IN CONFIDENCE~~ UNCLASSIFIED

Casua



Regions with
tsunami land
on

Total national casualties:

Injuries Shaking: 19,050

*Injuries Tsu: 7,360**

Injuries Total: 25,960*

Deaths Shaking: 1,220

*Deaths Tsu: 21,040**

Death Total: 22,180*

*Tsunami casualties assumes 70% evacuation

- Modelled for n
  scenario: 10am)
- 'Injuries': injury which requires attention from a medical professional
- This modelling does not calculate cascading impacts (e.g. EQ + tsunami); final totals are reduced by 6% to account for this
- Time-of-day, day-of-week, and season strongly influences likelihood of casualties.

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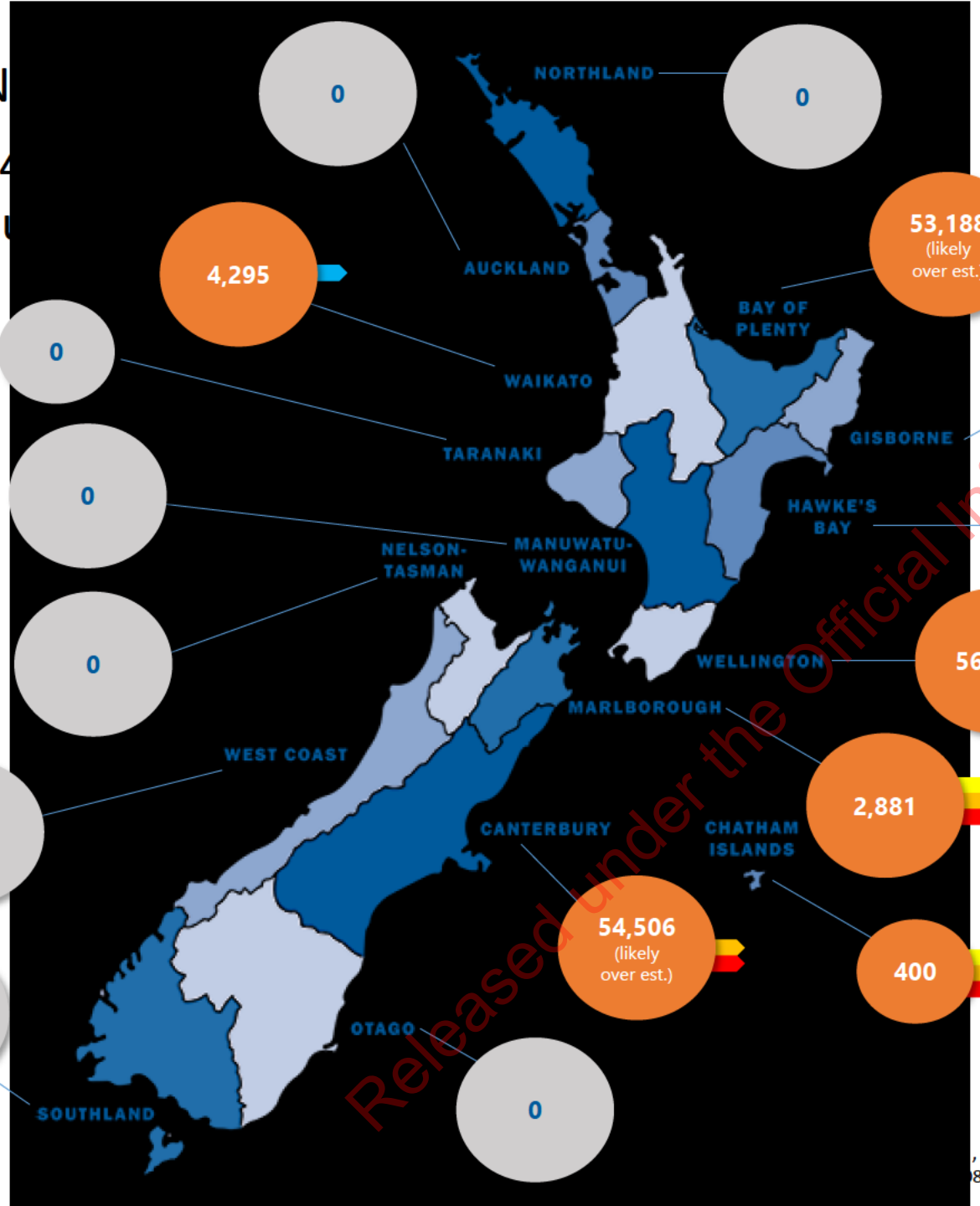
Horspool

Scale: N

Time: 24
(post-tsu

Evacuation



Regions with expected land inundation

Total evacuation numbers: 184,387
(likely over est.)

- Data from NIWA's national assessment of Population Exposure in Tsunami Evacuation Zones[1], which uses 2013 Census data. Current numbers likely to be slightly different/larger in many places.
- Tairāwhiti (and other locations) are largely underrepresented in the census.
- Time of day and season has immense influence on these figures.
- Potential land inundation of some other regions, but not modelled – Bay of Plenty, Marlborough, Chatham Islands, Waikato.

, B. (2020). A National-Scale Assessment of Population and Built-Environment Exposure in Tsunami Evacuation Zones.
80291

Population Displacement (AESAP Social Science Panel)

Initial

- >400,000 evacuated

24 hours

- >100,000 still evacuated
- Critical need: welfare support, city cordons, comms guidance on evac zones & ongoing aftershock risk
- International response support will be critical

1 Week

- Large scale relocations occurring, where possible
- Rural communities begin to need (more) assistance
- International response support will be critical

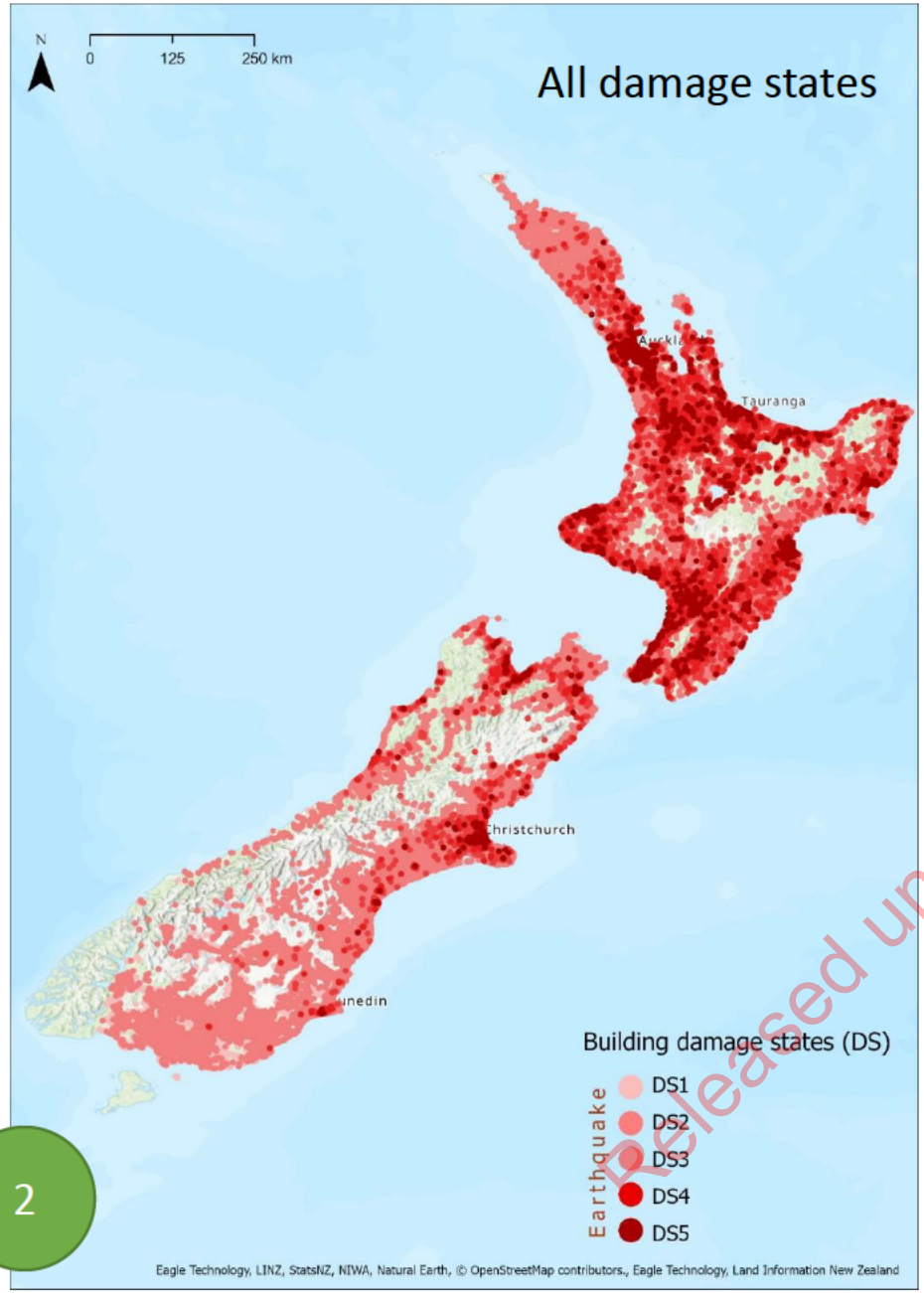
1 Month

- Potential public frustration with perceived inadequate support and action
- Media come into play strongly
- Psychosocial impacts need to be considered
- Populations facing vulnerabilities will need additional support (e.g. migrant communities with no support networks)

GENERAL: Displacements are generally highly contextual

- If feeling safe and welfare needs being met, people generally will want to stay
- **Push**: Ongoing perceived threat to life and wellbeing (e.g. aftershocks, tsunami, etc.)
- **Pull**: Availability of other options (e.g. second home, relatives/friends who can receive…)

CATPLAN-22: Building damage (by damage state)



DS1 **153,526**	**Light**: non-structural damage, or minor non-structural damage
DS2 **2,177,809**	**Moderate**: Reparable structural damage
DS3 **13,694**	**Severe** – Irreparable structural damage
DS4 **2,976**	**Partial Collapse:** Structural integrity fails
DS5 **881**	**Collapse:** Structural integrity fails

Scale: National
Time: Immediate (post-tsunami)

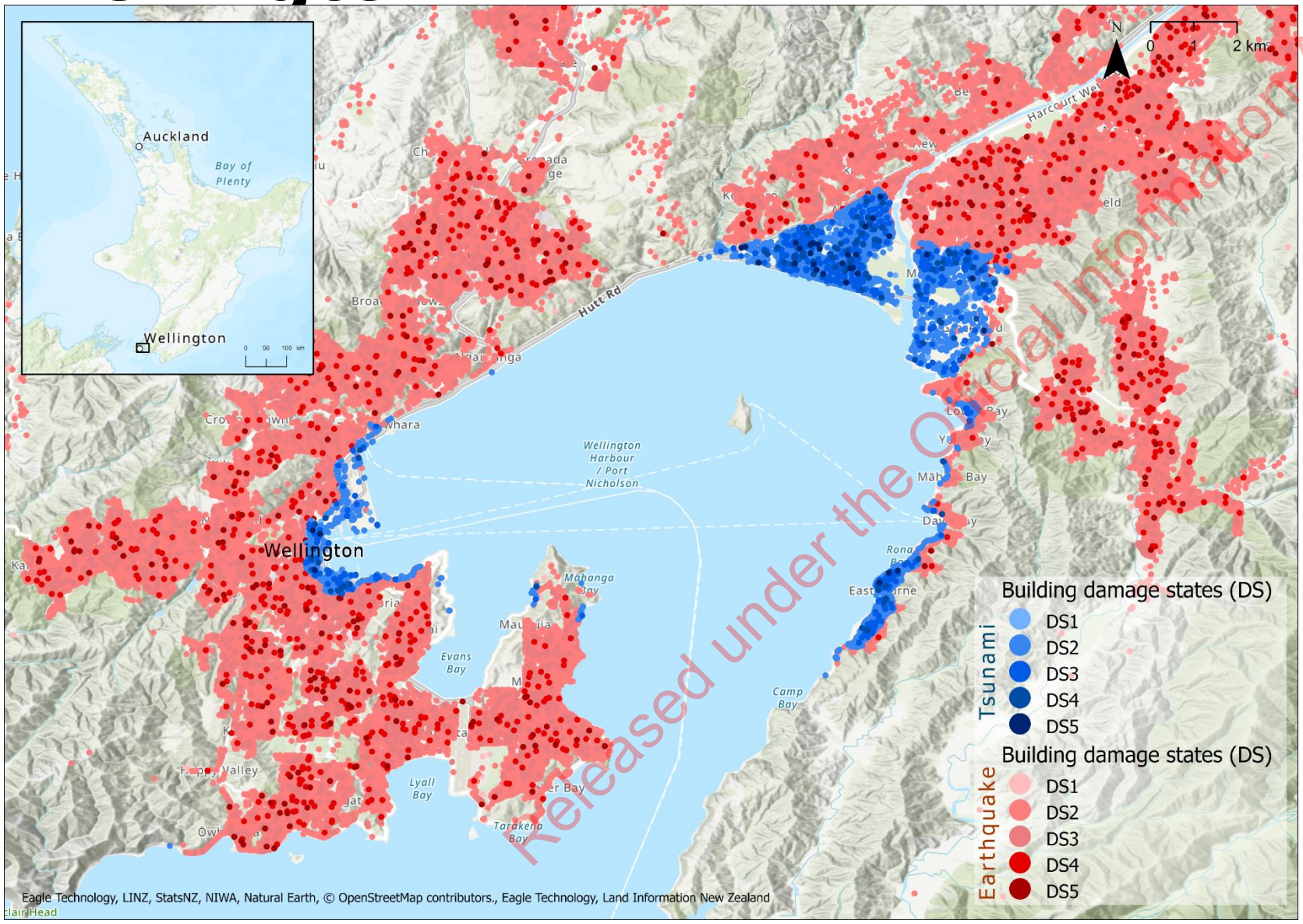
EQ Shaking:	$130 B
Cascading tsunami:	$14 B
TOTAL:	**$144 B**

- Modelled exposure $813 B
- Shaking damage is at the upper limit of what is expected
- Loss is approx. 50% of 2011 Great East Japan earthquake

IN CONFIDENCE

CATPLAN-22: Building damage
Wellington

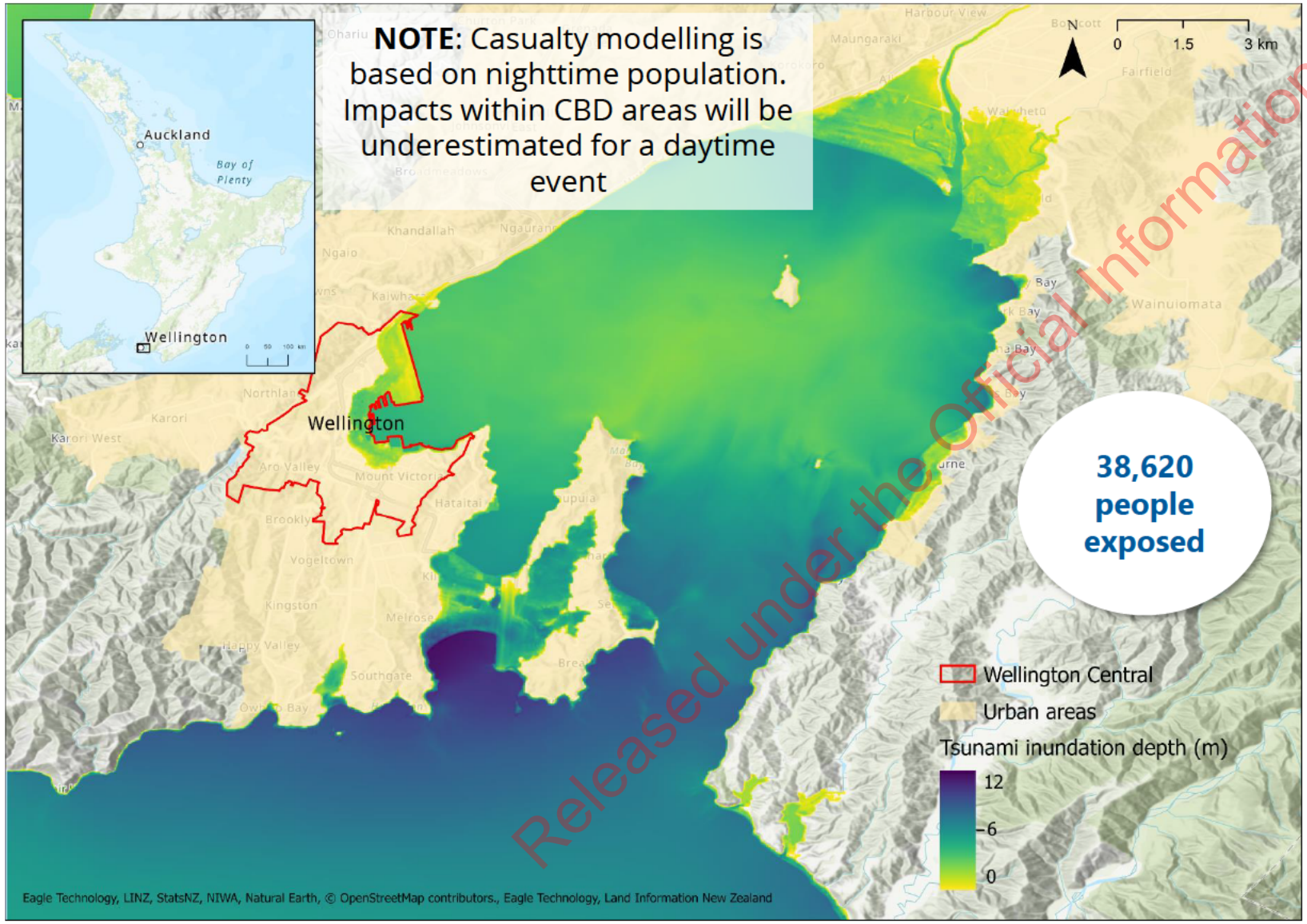
Scale: Regional (Wellington)
Time: Immediate (post-tsunami)

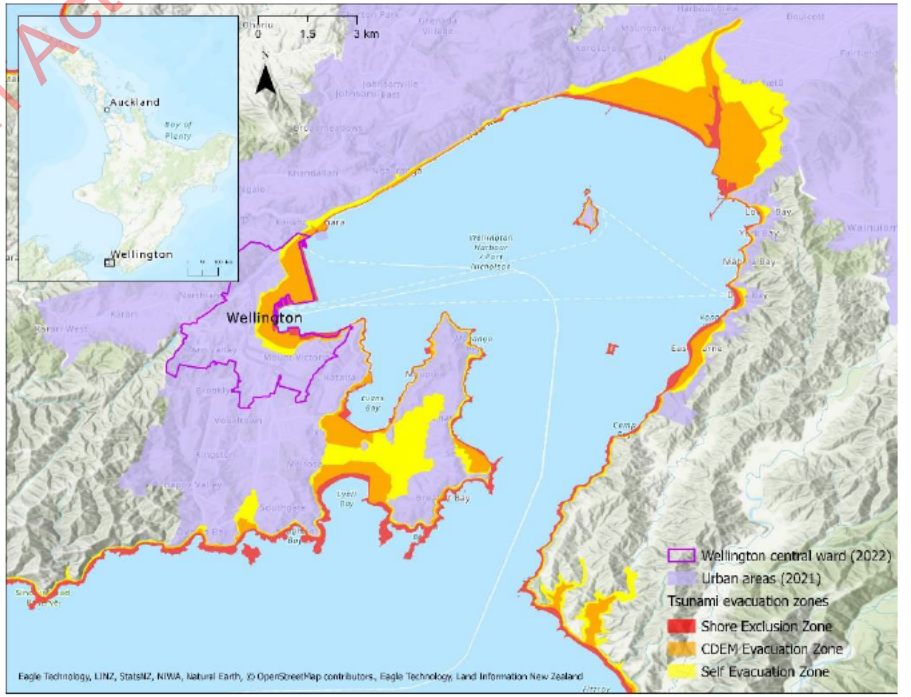


Tsunami	Ground shaking	
DS1 1,214	**DS1** 26,100	**Light**: non-structural damage, or minor non-structural damage
DS2 8,085	**DS2** 185,625	**Moderate**: Reparable structural damage
DS3 445	**DS3** 8,226	**Severe** – Irreparable structural damage
DS4 95	**DS4** 1,712	**Partial Collapse:** Structural integrity fails
DS5 35	**DS5** 612	**Collapse:** Structural integrity fails

Wellington: Population Displacement

Scale: Regional (Wellington)
Time: Immediate (post-tsunami)

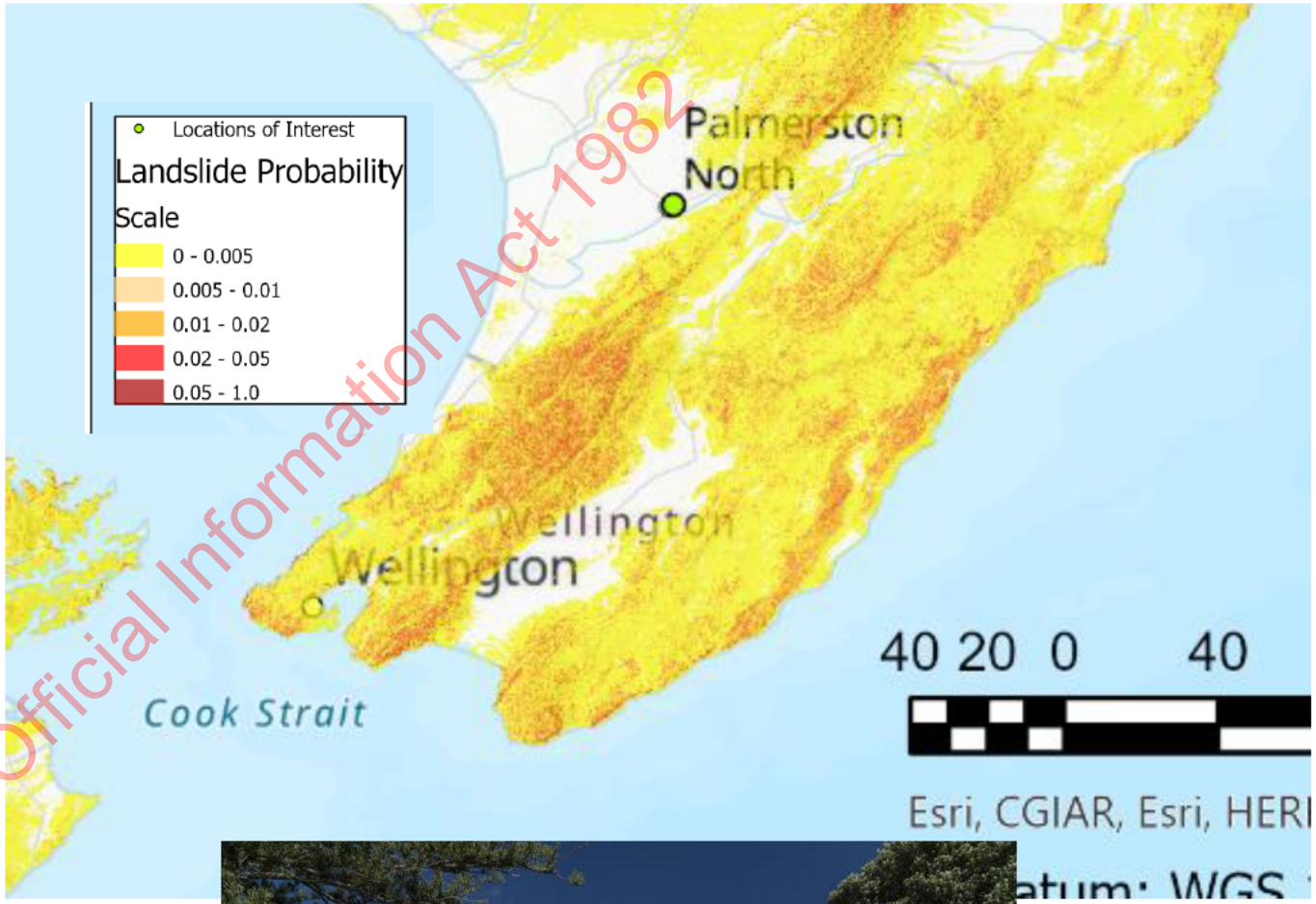




Cause of casualty	Injuries	Deaths
Earthquake shaking	7,400	490
Tsunami (70% evacuation)	2,380	8,530
Tsunami (0% evacuation)	7,770	28,070

RISKSCAPE®

Figure 6: State Highways 1 and 2, and the railway line linking Wellington City to the Hutt Valley & Wairarapa along the Wellington Fault line, circa 1985 (Source: Lloyd Homer, GNS Science)



Modelled scenarios		Likelihood in next 50 years	Modelled building/ infrastructure losses	Likely consequences
Auckland volcanic eruption		**10%**	**$5bn-$65bn** (buildings only)	Potential full evacuation of Auckland City, with only days to week's warning.
Taranaki eruption	**Small eruption**	**30%**	**~$1bn**	Similar size to 1995-96 Ruapehu eruptions. Impacts dominated by ashfall and lahars; evacuations likely.
	Large eruption	**1%**	**$10bn-$15bn**	Similar size to 1886 Tarawera eruption. Likely severe impacts to oil/gas production and farming sector; mass evacuation probable.
Hikurangi subduction zone earthquake and tsunami	**M8+**	**25%**	**~$10bn-$20bn**	Strong and long ground shaking for east coast of North Island, and large tsunami produced.
	M9.1	**1%**	**$144bn** (buildings only)	Catastrophic scenario. Est. potential fatalities >20,000 (tsunami).
Ruapehu / Tongariro / Ngauruhoe / Whakaari ash producing eruption		**Almost certain**	**~$1bn**	Disruption mostly from ashfall to aviation, electricity transmission, and tourism and primary industry sectors.
Hutt River flood (over stopbank design event)		**5%**	**$5bn-$10bn**	Hutt city – greatest exposure for any flood plain in New Zealand.
Wellington Fault M7.5 earthquak		**5%**	**~$16bn** (buildings only)	Likely serious and prolonged damage and disruption to Wellington, including government.

Actual events

Cyclone Gabrielle equivalent event	**80%**	**$9bn-$14bn** (est. actu
Kaikōura earthquake (2016)	**1.7%**	**$2bn-$3bn** (actual)
Canterbury Earthquake Sequence (2010-11)	**<1%**	**$40bn** (actual)

When we consider all of the modelled scenarios with >$10bn expected damage costs, the estimated probability of any one of these events occurring is:

in the next 3 years | **in the next 6 years** | **in the next 50 years**

Note – this is not an exhaustive list of possible scenarios. Modified from LGNZ 2014; updated and new data from GNS Science, NIWA, EQC, and Massey and Canterbury Universities

Source: NEMA Briefing for Incoming Minister 2023

Final thoughts – understanding each other's worlds

- Understanding our risks is critical, in all their complexity
- Understanding how to reduce our risks is essential
  - Systems, tools, knowledge, planning
  - How to engage and influence
  - Communication and education must be at the heart of this

- Understanding and working within the complexities of communities
  - how they change through time and with different experiences?
  - and how this impacts awareness, knowledge, behaviour and action?
  - ensuring we are responsive to these dynamic changes

Ngā mihi maioha | Thank you with appreciation

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On behalf of the wider team

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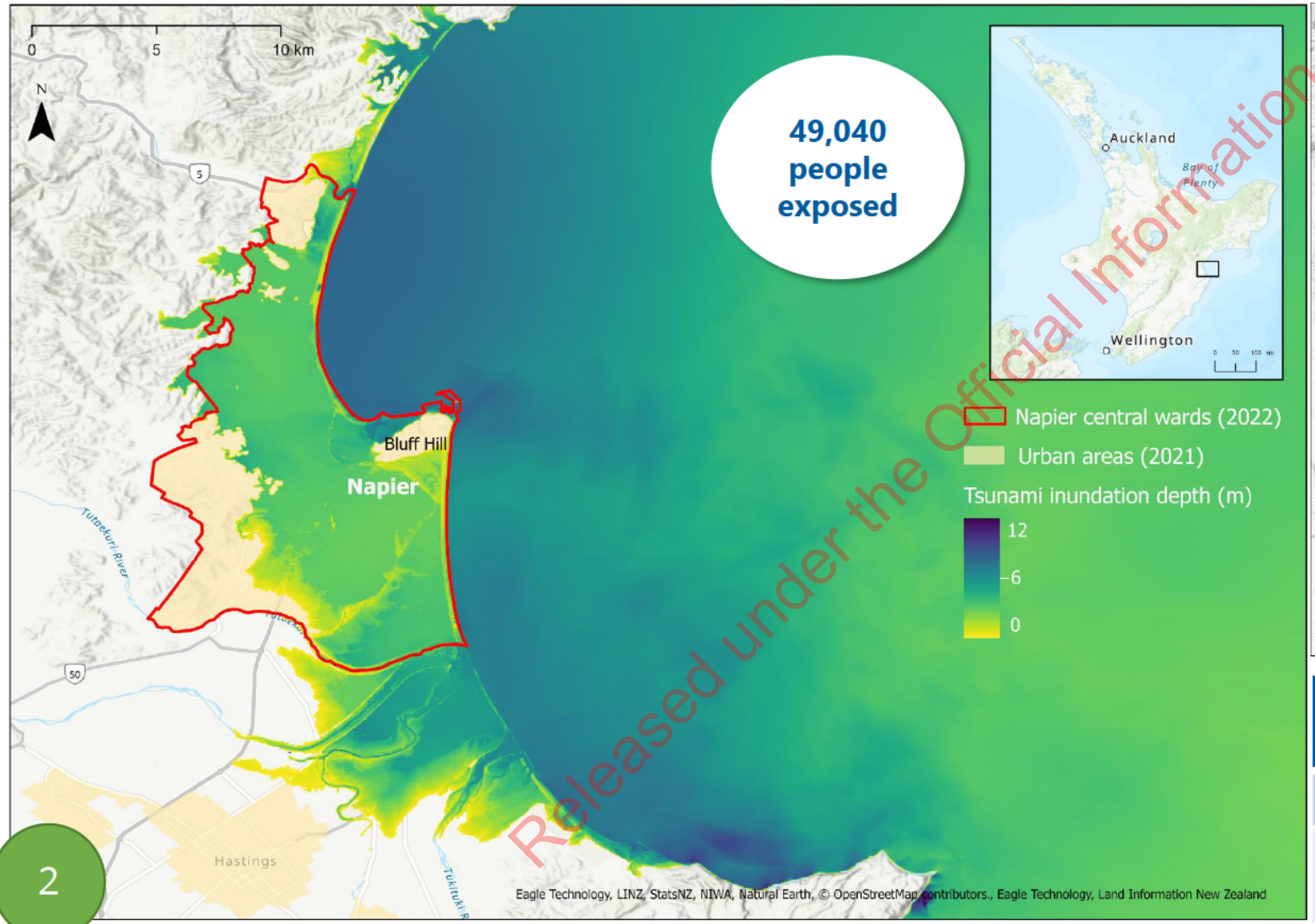
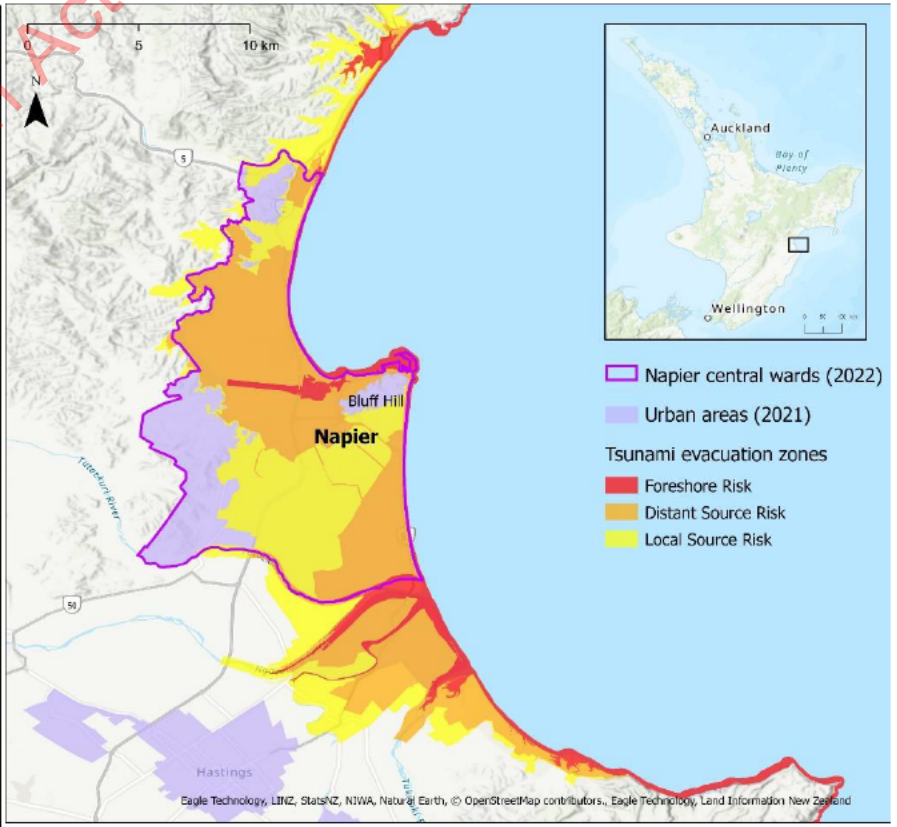
Grant Wilson, NEMA

Napier: Population Displacement

Scale: Regional (Napier)
Time: Immediate (post-tsunami)





Cause of casualty	Injuries	Deaths
Earthquake shaking	2,860	190
Tsunami (70% evacuation)	2,280	11,530

CATPLAN-22: Building damage

Scale: Regional (Napier)
Time: Immediate (post-tsunami)

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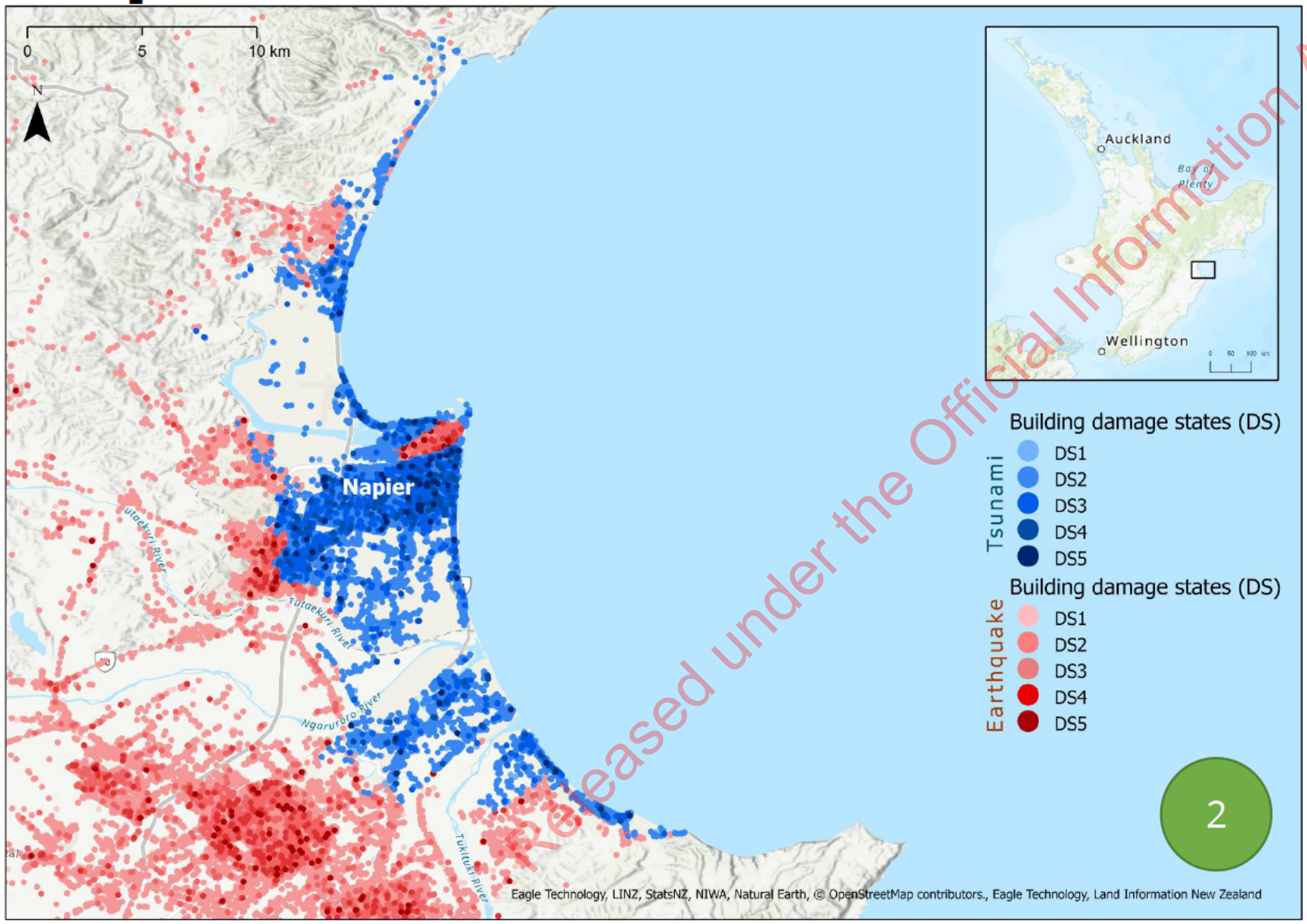
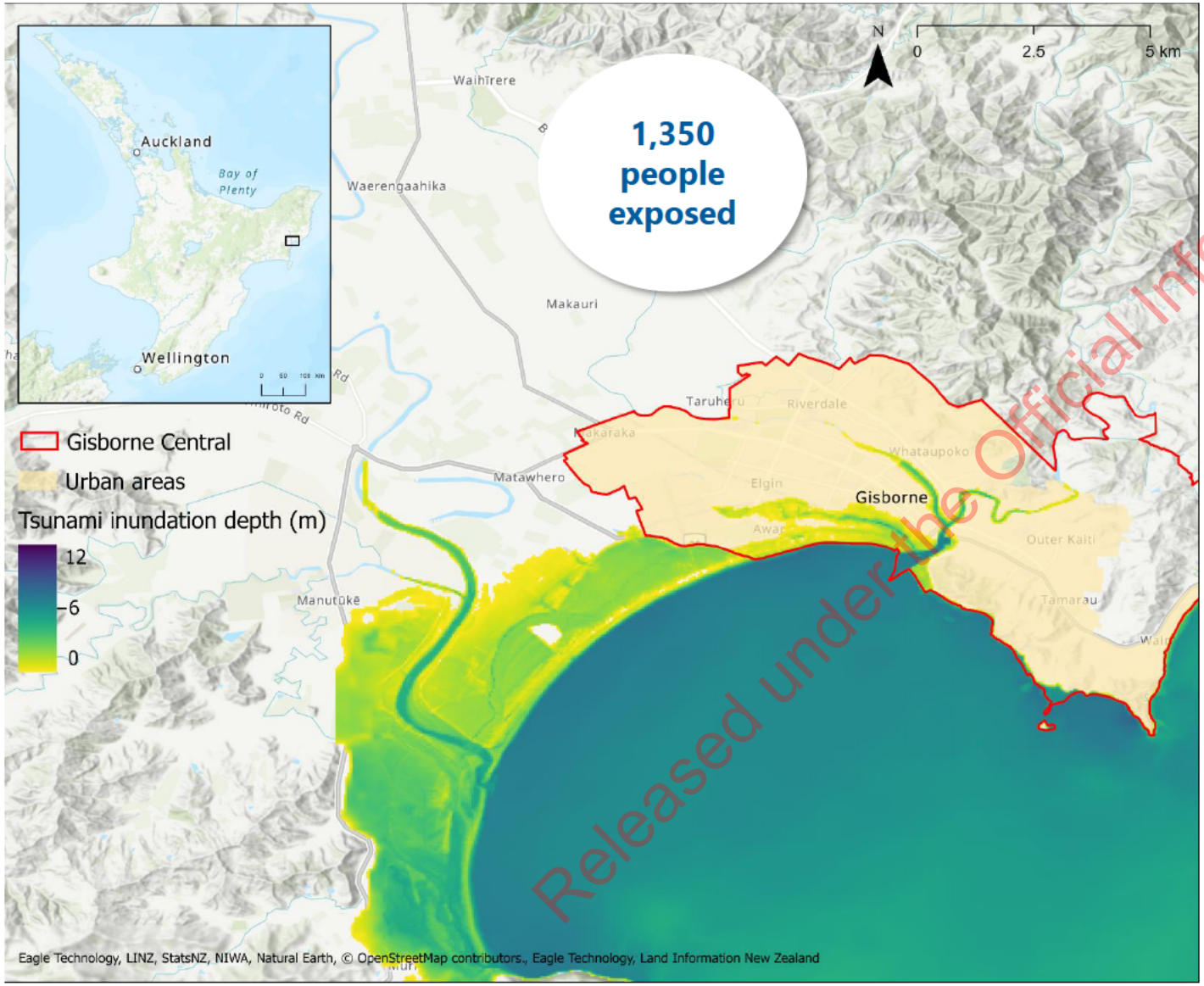
Napier

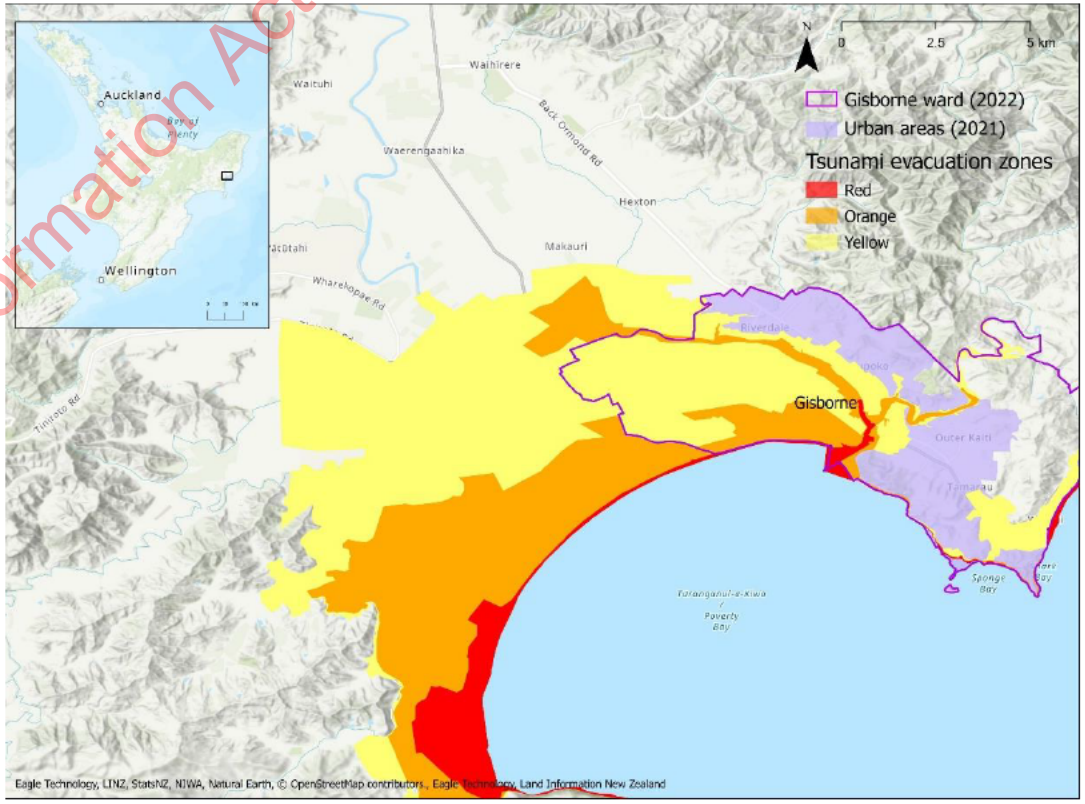


Tsunami	Ground shaking	
DS1 5,431	**DS1** 14,683	**Light**: non-structural damage, or minor non-structural damage
DS2 30,793	**DS2** 88,231	**Moderate**: Reparable structural damage
DS3 977	**DS3** 2,977	**Severe** – Irreparable structural damage
DS4 197	**DS4** 639	**Partial Collapse:** Structural integrity fails
DS5 68	**DS5** 191	**Collapse:** Structural integrity fails

Gisborne: Population Displacement

Scale: Regional (Gisborne)
Time: Immediate (post-tsunami)





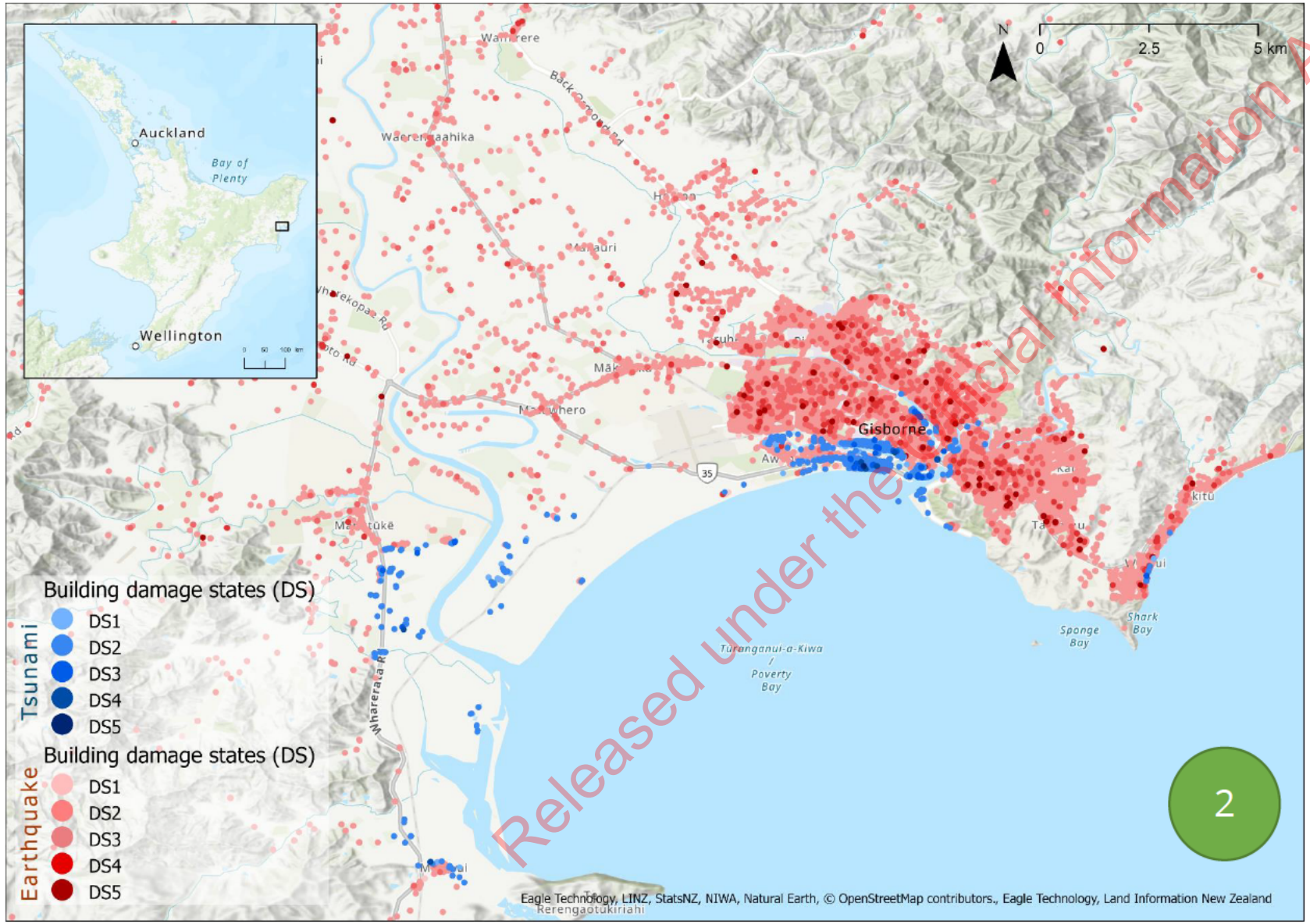
Cause of casualty	Injuries	Deaths
Earthquake shaking	810	50
Tsunami (70% evacuation)	220	50
Tsunami (0% evacuation)	670	150

2

CATPLAN-22: Building damage
Gisborne

Scale: Regional (Gisborne)
Time: Immediate (post-tsuanmi)

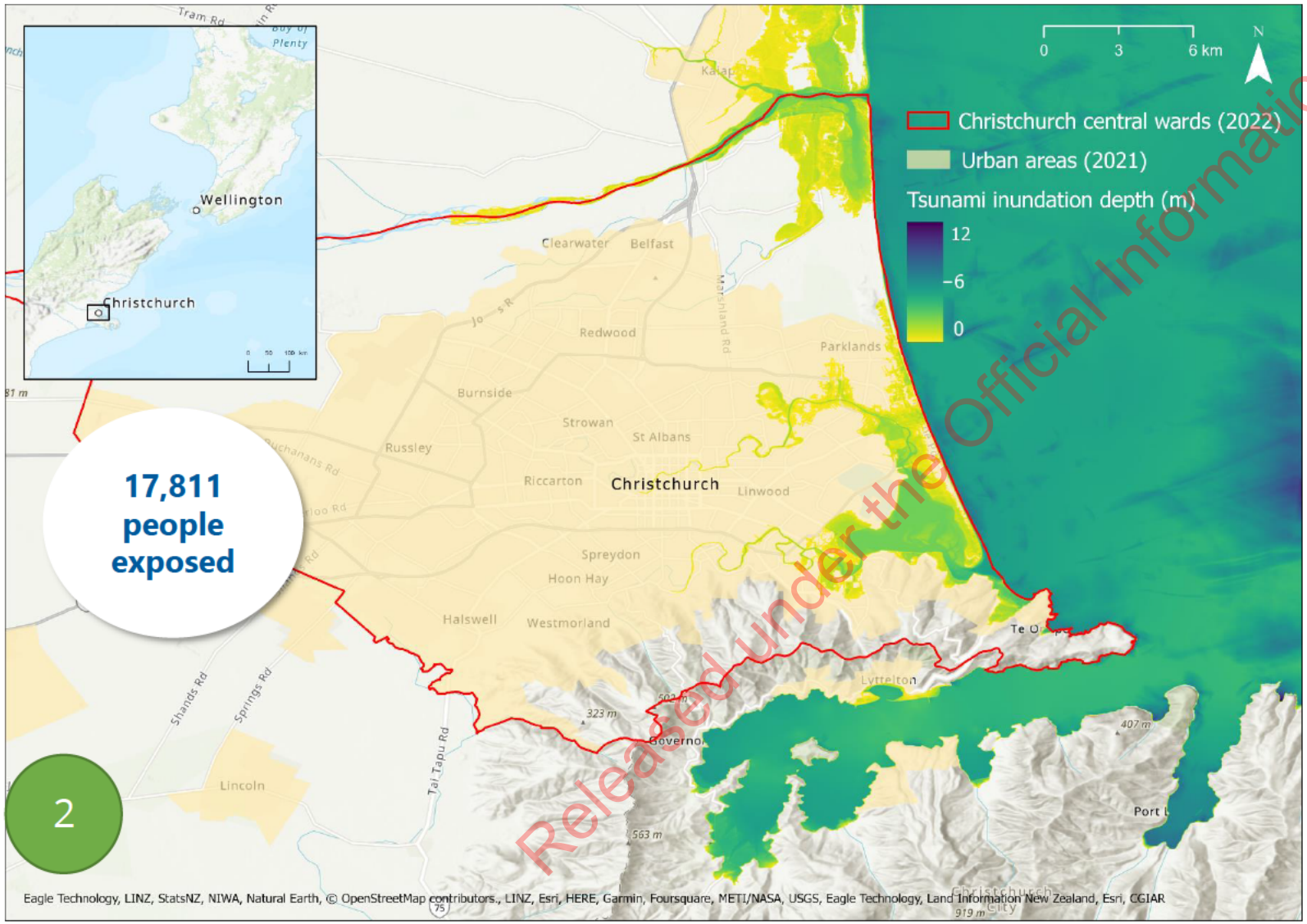
Tsunami Ground shaking ~~IN CONFIDENCE~~ UNCLASSIFIED



DS1 157	**DS1** 4,816	**Light**: non-structural damage, or minor non-structural damage
DS2 819	**DS2** 28,909	**Moderate**: Reparable structural damage
DS3 42	**DS3** 1,206	**Severe** – Irreparable structural damage
DS4 8	**DS4** 242	**Partial Collapse:** Structural integrity fails
DS5 1	**DS5** 78	**Collapse:** Structural integrity fails

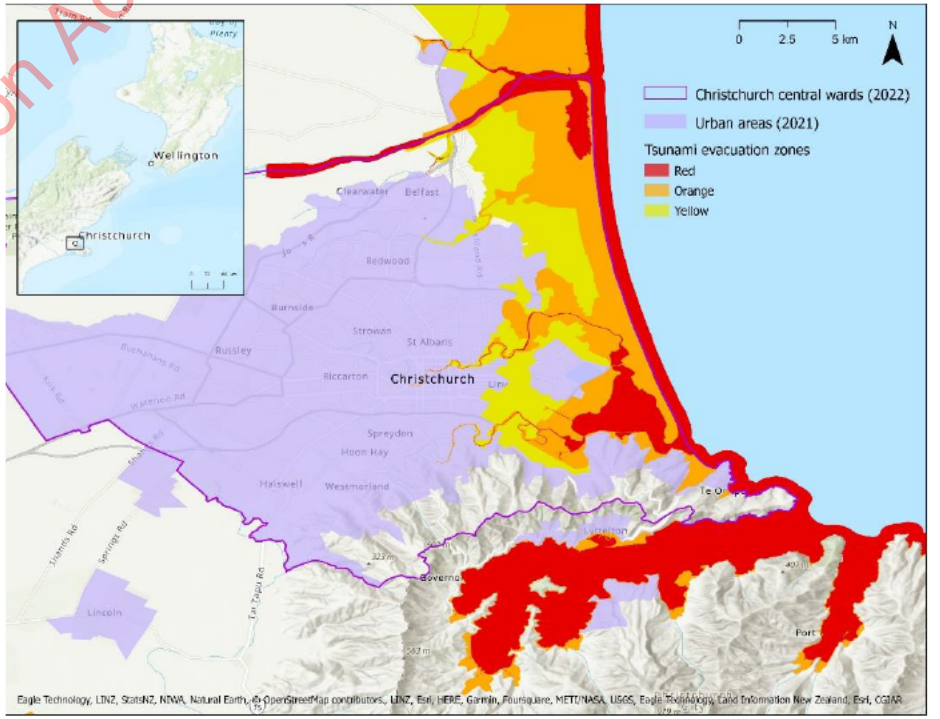
Christchurch: Population Displacement

Scale: Regional (Christchurch)
Time: Immediate (post-tsunami)



17,811 people exposed

2



Cause of casualty	Injuries	Deaths
Earthquake shaking	2	0
Tsunami (70% evacuation)	2,480	940
Tsunami (0% evacuation)	8,3	

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CATPLAN-22: Building damage
Christchurch

Scale: Regional (Christchurch)
Time: Immediate (post-tsunami)

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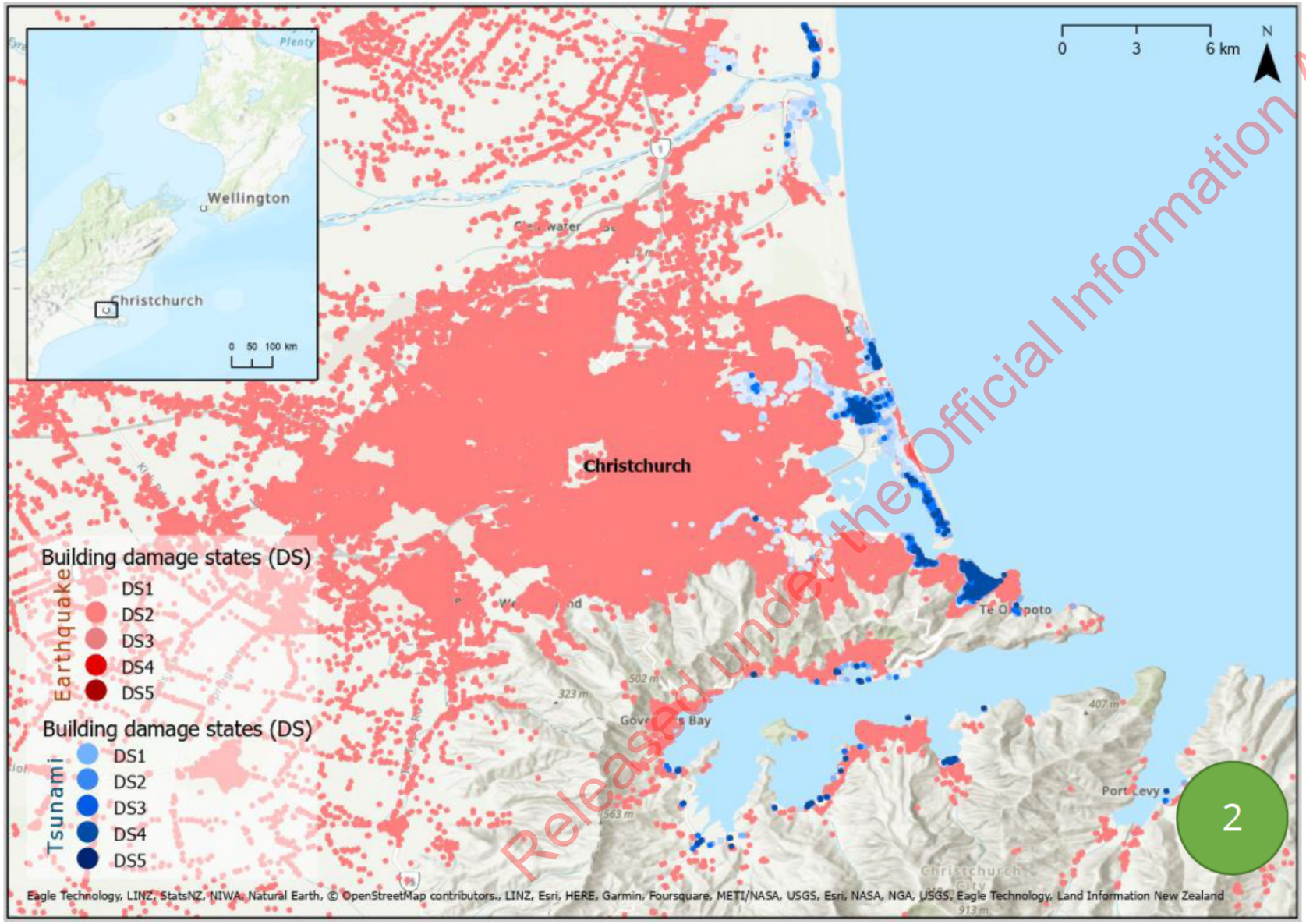

	Tsunami	Ground shaking	
DS1	**3,904**	**DS1** ***>4,000***	**Light**: non-structural damage, or minor non-structural damage
DS2	**2,613**	**DS2** ***>2,000***	**Moderate**: Reparable structural damage
DS3	**1,645**	**DS3** ***few***	**Severe** – Irreparable structural damage
DS4	**710**	**DS4** ***Few, if any***	**Partial Collapse:** Structural integrity fails
DS5	**584**	**DS5** ***none***	**Collapse:** Structural integrity fails

Event timing:
~10am, Monday 8th August 2022

- Population generally at **work** (rather than at home)
- **Winter** conditions
  - Greater need for shelter
  - Landscape more prone to slips
  - High rivers (will affect access and tsunami inundation)
  - Greater usage of vehicle transport and electricity

- Considerable resilience will be exhibited by local communities. How best to enable this?

- Be mindful of disasters (& catastrophes!) exacerbate pre-existing vulnerabilities and capacities

- The last mile (local roads, power distribution) will be harder hit and slower to restore than those of national agencies – picture is likely worse than what's shown