QUEENSLAND 2024
STATE EARTHQUAKE RISK ASSESSMENT

Queensland Government

Foreword

Queenslanders are well versed on the impacts of disaster events, particularly to our communities, the environment and the economy. Some disasters are becoming increasingly complex and extreme, exacerbated by continued population growth and our globally interlinked economies.

Although Queensland has not experienced a damaging earthquake in recent times, it is important to acknowledge that they are possible and will happen in the future. Earthquakes remain a rare yet constant risk to all communities across Queensland.

This assessment is an update to the 2019 Queensland State Earthquake Risk Assessment, updating our understanding of earthquake hazard across Queensland.

Recognising and understanding disaster risk to our communities is the first step towards fostering resilience. This aligns with the global emphasis on prioritising the understanding of disaster risk, as outlined in the Sendai Framework for Disaster Risk Reduction 2015-2030. By adopting this approach, we can effectively work towards building resilience and mitigating the impacts of disasters.

Queensland is susceptible to various natural hazards that can have severe repercussions for our communities - in the past decade we have witnessed many unprecedented natural disasters. These incidents serve as a strong reminder of the importance of effectively communicating appropriate risk information across all three tiers of the Queensland Disaster Management Arrangements (QDMA): local, district, and state. By doing so, we can enhance preparedness and ensure the safety of our communities.

Nikki Boyd MP

Minister for Fire and Disaster Recovery and Minister for Corrective Services

Steve Smith AFSM

Commissioner, Queensland Fire and Emergency Services

At the local level, it is essential to establish consistent risk information across all tiers of QDMA. This effective communication enables communities, government entities, emergency services, and all emergency management partners to make informed decisions.

As the Minister for Fire and Disaster Recovery and the Commissioner of Queensland Fire and Emergency Services (QFES), we greatly appreciate their unwavering commitment to building safer and more resilient communities. We extend our special thanks to Geoscience Australia and The University of Queensland for their partnership with QFES on this initiative. We also acknowledge the ongoing cooperation of local governments, whose collaboration has been instrumental in our collective efforts. Together, we can continue to work towards a safer and more resilient Queensland.

We strongly urge all Queenslanders who may be impacted by disaster risk to consider the information and strategies provided in this invaluable assessment and use it to inform management of risks applicable to their interests and responsibilities.

Executive Summary

State Earthquake Risk Assessment

Whilst it is acknowledged that earthquakes are a low probability hazard for Queensland, ranked as Queensland's ninth priority hazard within the 2023 State Disaster Risk Report, they still have the potential to result in significant consequences for Queensland's communities. It is essential that risks are better understood in order to appropriately mitigate identified vulnerabilities and consequences.

The Queensland State Earthquake Risk Assessment (SERA) provides a detailed assessment of earthquake risk in Queensland. Designed to be used by all levels of Queensland's disaster management arrangements (QDMA) it contributes to enhancing prevention, preparedness, response, and recovery efforts in anticipation of potential impacts of a major earthquake event.

By increasing our collective understanding of Queensland's earthquake risk, we are better positioned to deal with and respond to earthquake impacts that are more severe than our individual and collective knowledge, skills, experience, resources, and practices have anticipated or experienced.

Context

The SERA seeks to complement and build upon existing local, district and state earthquake risk assessments, disaster management planning, and business continuity planning by providing updated and validated information relating to the changes in understanding of Queensland's earthquake potential. Initially released in 2019, the SERA has been updated in 2024 to include:

- Simplification of technical information to assist in understanding of the hazard.
- Inclusion of Geoscience Australia products and services that improve situational awareness and inform risk planning.
- New research which has become available since 2019, including:
  - The 2023 National Seismic Hazard Assessment (NSHA23) and scenarios to support disaster risk management (Figure 1).
  - Re-evaluation of the magnitude 6.0 Great Queensland earthquake from 1918.
  - New data and information on locations of older unreinforced masonry buildings in Queensland, and new research on mitigation options for these vulnerable buildings.
- Past earthquake events have been reviewed and additional Australian examples have been included to describe impacts beyond the more widely known 1989 Newcastle event. Additional Australian examples include:
  - The 2010 Kalgoorlie earthquake in Western Australia and the 2021 Mansfield earthquake in Victoria, where older unreinforced masonry buildings were greatly affected.
  - The 1988 Tennant Creek earthquakes in the Northern Territory, which had significant impacts on gas pipelines.
  - The 1968 Meckering earthquake in Western Australia which significantly damaged roads and rail lines.
- Updates to information within the Prevention, Preparedness, Response and Recovery section.

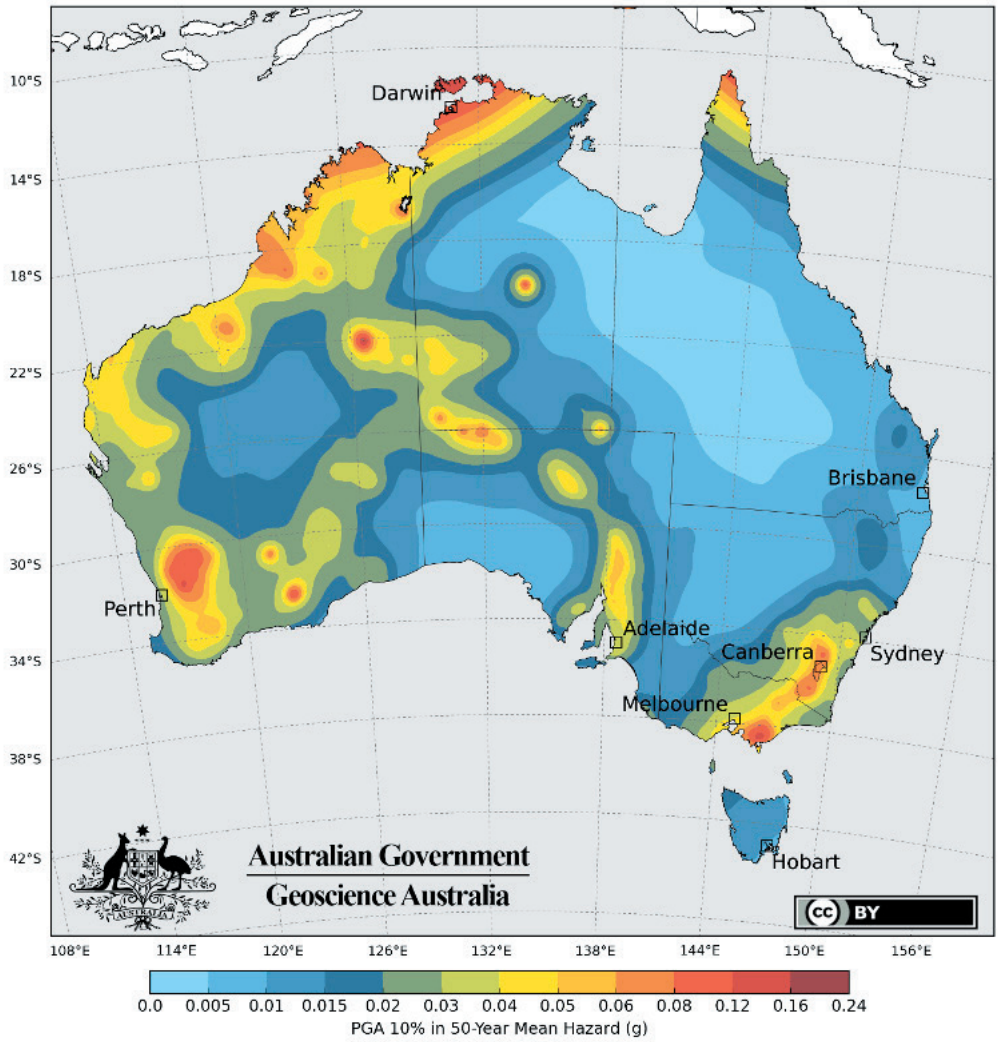

Figure 1: NSHA23 hazard map indicating the mean Peak Ground Acceleration (PGA) (expressed as a proportion of the acceleration due to gravity, g) for 10% probability of exceedance in 50-years on AS1170.4 Site Class Be (equivalent to V530 = 760m/s). Source: Allen, Griffin, Clark, Ghasemi and Ebrahimi (2023).

Development and Consultation

Engagement and consultation with stakeholders have been undertaken during the development of the 2024 SERA. Importantly, the development of this SERA was conducted in partnership with Geoscience Australia (GA) through the provision of expert advice, and relevant spatial datasets.

Consultation with The University of Queensland has been sought to incorporate their extensive research and study which has been undertaken by the university and the State of Queensland.

A robust scientific basis enhances the assessment and enables all levels of QDMA to inform their disaster management and business continuity planning.

Key Observations from the Assessment

Whilst the SERA examines earthquake risk to Queensland as a whole, a specific area was identified to be of greatest risk from significant earthquake occurrence and impact. This area includes Gladstone in the north, extending south to incorporate the Greater Brisbane area and Ipswich, and west to include areas bordering the Great Dividing Range. The SERA took into consideration several factors, including:

- Density of population in this area. The population of Local Government Areas (LGAs) within this area accounts for close to two-thirds of Queensland's total population and the highest average annual growth rate since 2022.
- The cross dependency of critical infrastructure within this area. A significant proportion of the state's transport and logistical network, power generation and transmission capability operate within this area.
- The Queensland Energy and Jobs Plan. Part of the Queensland Government's $11 billion investment in renewable energy will go towards the construction of a new pumped hydrogen plant near Gympie, renewable energy training centres in Brisbane and Beenleigh, and a potential export-scale hydrogen facility at Gladstone Port. These projects will generate over 5,000 job opportunities for regional Queenslanders.
- Economic activity. The Gross Regional Product (GRP) of LGAs within this zone accounts for approximately 60% of Queensland's total GRP.
- The historical record of earthquake activity and a higher level of seismic hazard as defined in the National Seismic Hazard Assessment.

As such, this area is assessed as Queensland's highest priority area for significant earthquake risk.

The risk in other areas of Queensland cannot be discounted. The economic and industrial activity in the areas of Mackay to Townsville, such as the construction of the world's largest pumped hydrogen plant in Mackay and the manufacturing hubs for renewable energy in Townsville, are assessed as the second priority area for significant earthquake risk. This area also has a historical record of earthquake activity, and regional towns and cities have a population of older buildings vulnerable to earthquakes. These buildings have often high heritage value with damage translating to an economic risk for those communities.

There is a continuing need for research into earthquake hazard and risk in Queensland given the gaps in our knowledge and the associated uncertainty. The recent location revision of a significant earthquake in 1918 in the South-East Queensland region for example gives reason to consider the implications for a recurrence of such a significant earthquake.

The key observations for communities across Queensland are presented below, categorised by different exposure categories. This list is not exhaustive and will not be applicable to every LGA within Queensland.

Essential Utilities:

- Water supply and sewage systems are highly vulnerable to damage.
- Restoration of power and communications following disruption will depend on the level of damage, site accessibility, availability of response personnel and equipment, and identified priorities.
- Aged in-ground gas and liquid fuel lines are vulnerable to rupture.
- Fuel and water tanks without baffling are vulnerable to damage or failure.

Road and Transport:

- Road and rail networks are vulnerable to considerable protracted damage from earthquake and landslide which may affect response and recovery activities.
- Fixed wing aircraft movements may be disrupted due to impacts on associated on-ground infrastructure.
- Port facilities, where available, may become the priority route for access and resupply, providing these have not been damaged.

Figure 2: Road buckled by the shifting earth from the Meckering earthquake 1968. Source: West Australian Newspapers Limited

Housing and Community Infrastructure:

- Vulnerability of poorly constructed and maintained buildings presents the most significant risk to public safety during an earthquake.
- Secondary (consequential) hazards such as fire, landslides, or infrastructure failure will exacerbate the risk to public safety.
- Buildings constructed prior to 1993 are at high risk of damage.
- Buildings constructed to comply with wind loading code for cyclonic areas are at least risk due to a high level of structural resilience.

Figure 3: Damage sustained in the town of Kalgoorlie-Boulder, Western Australia as a result of a magnitude 5 earthquake (20 April 2010). Source: Department of Fire and Emergency Services, Western Australia.

Human and Social:

- An earthquake may lead to a mass causality event, creating significant distress for the community.
- Sole reliance on external supply of utilities (e.g. power, water, fuel and sewage) increases vulnerability.
- Backup equipment may fail if it is damaged during the event or not adequately built and maintained.
- Psychological trauma or distress should be expected across large proportions of the population.

Economy:

- Heavy industry and manufacturing sites may suffer damage, become unsafe, and/or suffer significant productivity losses.
- Disruption to transport and logistics routes will likely have knock-on impacts to regional and state economies.
- Coastal tourism hotspots are likely to be vulnerable because of their construction type and location on softer soils. Vulnerability of tourists is also of concern.

Environment:

- Earthquakes and/or landslides can have devastating effects on wildlife and their habitats.
- Release of hazardous materials from damaged containers, pipes, or industrial sites is likely to have adverse effects on environmental health.

Risk Management Considerations

These considerations are not prescriptive or exhaustive, as it is expected other risk management strategies may be identified.

- Broad areas of strategic and economic importance identified during this risk assessment as being exposed to a higher potential of earthquake risk, may benefit from further in-depth earthquake studies. In-depth studies can identify specific areas exposed to amplified earthquake shaking and enable the development of adequate mitigation strategies to help manage the risk.

- In areas where uncertainty exists regarding the potential risks posed by localised tsunamis, and landslides being initiated by a close earthquake of moderate or greater magnitude, consideration should be given to research opportunities in partnership with relevant academic institutions, research bodies, and state and federal agencies, that could yield appropriate strategies to manage these risks.

- Awareness and education are fundamental to reducing potential risks and consequences associated with earthquake (and tsunami) occurrence. Engagement with relevant stakeholders to investigate opportunities within existing community education programs would be a key step toward enhancing resilience.

If further research, analysis or assessment is required after reviewing the SERA, a collaborative approach with subject matter experts is recommended to ensure consistency in evaluating the hazard in line with state and national assessments.

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