THE UNIVERSITY OF WAIKATO
Te Whare Wānanga o Waikato

Natural Hazards Commission
Biennial 2024 Grant Closing Report

November 5, 2025

Geological Modelling of Hamilton Basin to Improve Earthquake Ground Motion Simulation

This project set out to develop a new way of representing how sedimentary basins influence earthquake shaking. Focusing on the Hamilton Basin (central North Island), the research aimed to build high-resolution 3D geological and seismic velocity models that capture the complex layering and structure of the basin. These models would then be embedded into advanced, physics-based earthquake simulations to better understand how future earthquakes might affect the Waikato region. Through integration of historical geophysical, borehole, and geological datasets with new field and seismic measurement, we aimed to produce more realistic and locally tailored ground motion predictions than those currently available. The main outcomes were to be a stochastic 3D basin model, a set of ground motion maps, and a new workflow. These would be available to engineers, planners, and local and regional councils to strengthen seismic resilience and inform land-use planning. Bridging the gap between geological realism and earthquake engineering practice will advance how seismic hazard is modelled in Aotearoa New Zealand.

Although ultimately the project was cut short, the investment produced some useful outcomes. These included technical training of postgraduate students, collection of new datasets, and facilitation of fruitful discussion about seismic resilience amongst universities, Waikato Regional Council, NZ Civil Defense, and mana whenua. A PhD student at the University of Waikato was trained on cutting-edge basin modelling software, while both University of Waikato and University of Auckland PhD students gained experience in field data collection of mHVSR and seismic refraction surveys. Historical datasets were compiled for basin modelling, including petroleum well logs, seismic reflection profiles, and geotechnical and water-bore records. New data collected includes digitized 2D seismic reflection profiles from Hamilton Basin, expanded biostratigraphic analysis of petroleum borehole chips samples, and new mHVSR and seismic refraction results (Fig. 1 and attached data pack). These collectively will enable future workers to build a robust stratigraphic framework for the basin, construct 3D geological models, and predict the shear wave velocity characteristics of selected sites around Hamilton Basin. A final benefit of the

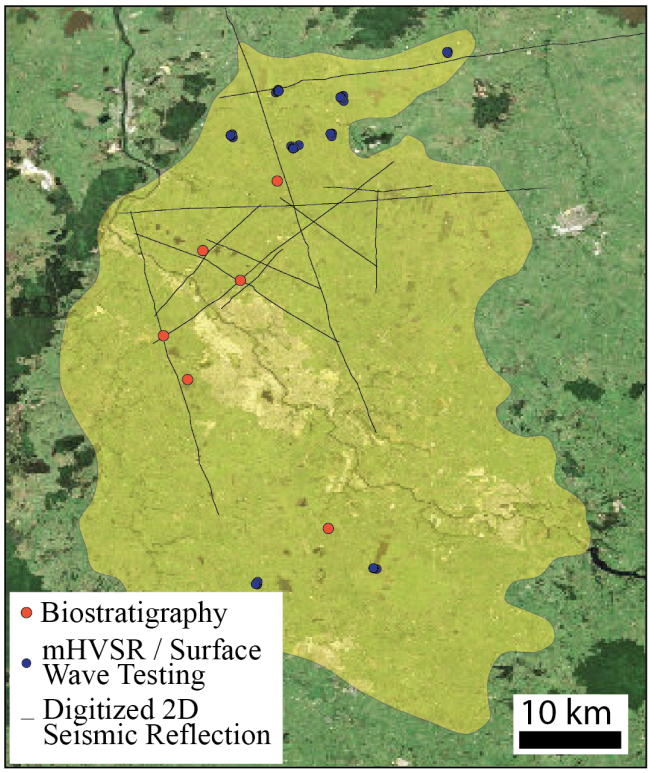

Figure 1: New data collected from Hamilton Basin.

project was public awareness of Natural Hazards Commission investment and its impact on earthquake research, resulting from national news coverage of the project (1 News, March 2025).

Overall, the project funds were valuable for generating new data, training emerging researchers, and building momentum toward improved seismic understanding of the Hamilton Basin. We are grateful for the support which has laid a strong foundation for future scientific work and collaboration in this important area.

Dataset can be accessed here.