

COMPILATION AND ANALYSIS OF A NEW ZEALAND INVENTORY OF DAMS

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Characterising the New Zealand dam portfolio to inform industry needs, policy and long-term research.

Why are dams important to New Zealand?

New Zealand has a large number of water-retaining dams, many of which were designed from the 1920s through to the 1980s to enable hydroelectric power generation and provide reliable water storage. Given that hydropower generation accounts for approximately 55% of total electricity generation in New Zealand, earth embankment dams form a vitally important part of New Zealand's energy infrastructure. The agricultural and viticultural sectors of New Zealand increasingly rely on embankment dams for irrigation purposes; and many urban centres rely on large earth dams for reticulated water supply and flood protection.

Accordingly, earth dams are of significant economic importance to New Zealand. Any potential loss would be felt both functionally (power outages or failure of water supplies) and in terms of damage or death that could result from an embankment dam failure.

Why create an inventory of dams?

The Quake Centre Earth Structures (Dams) project was initiated in response to local industry demand for improvements in the state of geotechnical dam engineering. At the outset of the project, the team sought to define an objective basis for selecting and refining the properties of most importance to future geotechnical dam research. An understanding of the local dam asset portfolio was necessary to verify the research proposition and direction.

Historically, New Zealand has lacked a comprehensive inventory of dam assets. Instead, informal industry experience has been relied upon to characterise the dam infrastructure and its key properties, issues and risks.

In order to better understand the make-up of all dam assets in New Zealand, the Quake Centre project team set about creating a standardised **NZ Inventory of Dams (NZID)**. The intent of the project is to provide a single, reliable and spatially-referenced inventory in the form of the NZID. Statistical and spatial analysis of the NZID can inform basic properties of New Zealand dams (height, reservoir size, type, purpose, location) and enable broad-based risk and consequence assessments across the portfolio.

How was the NZID created?

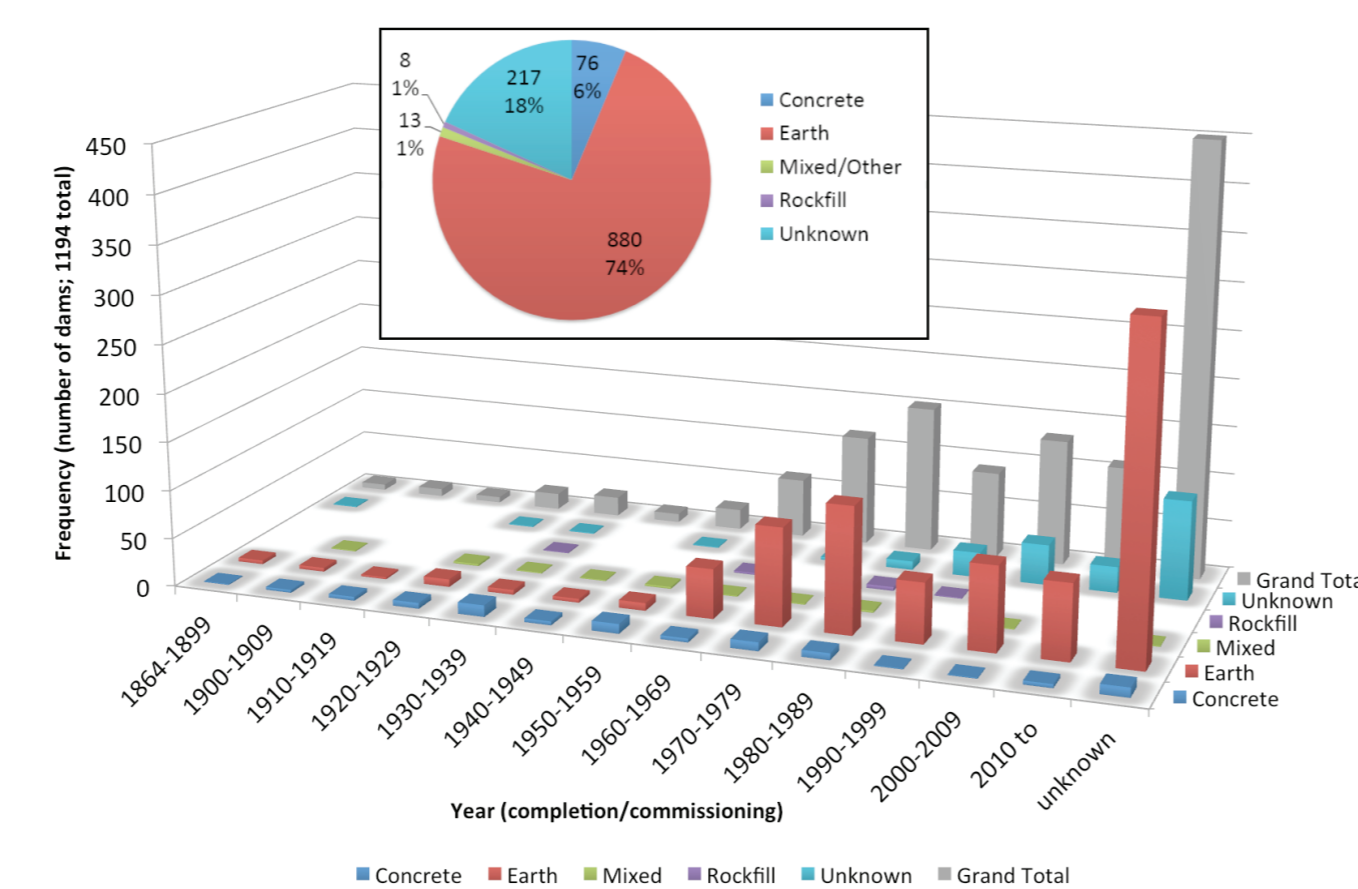
The development of the NZID involved the following steps:

- Compilation of existing dams lists, including information from NZSOLD, Ministry of Commerce, Consultants and owners, and Regional and Unitary authorities
- Combining and merging of lists
- Extensive quality assurance including verification and correction
- Preliminary synthesis by way of Excel PivotTable
- Ongoing spatial analysis using GIS methods.

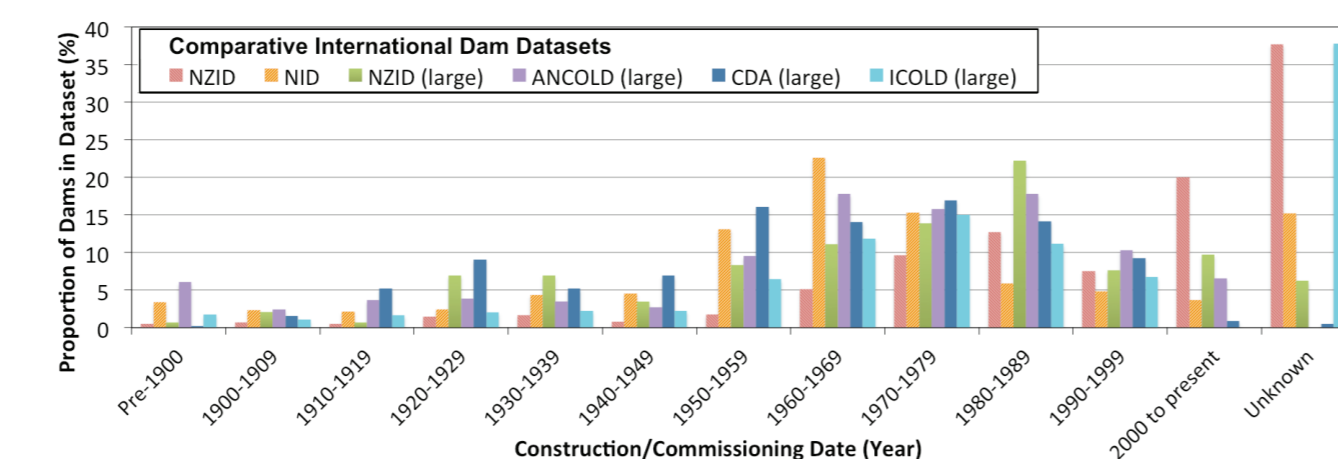
The **NZID includes 1,200 dams over 3 m in height**. Detailed geospatial analysis of the NZID is ongoing.

What can you tell us about New Zealand's dams?

Analysis of the NZID verifies that the vast majority (>74%) of NZ dams are earth dams. Concrete structures account for 6% of the total inventory (1194 dams), and 20% of the Medium and High Potential Impact Classification (PIC) structures (182 dams). **No Medium or High PIC concrete dams have been commissioned since 1990.**



The peak decade for Large Dam commissioning appears to have been the 1980s (13% of inventory structures), with the peak period of construction occurring a decade or two later in NZ than internationally. Like many large dams internationally, the majority of NZ earth dams were constructed prior to the development of 'modern' geotechnical criteria in the late 1980s.

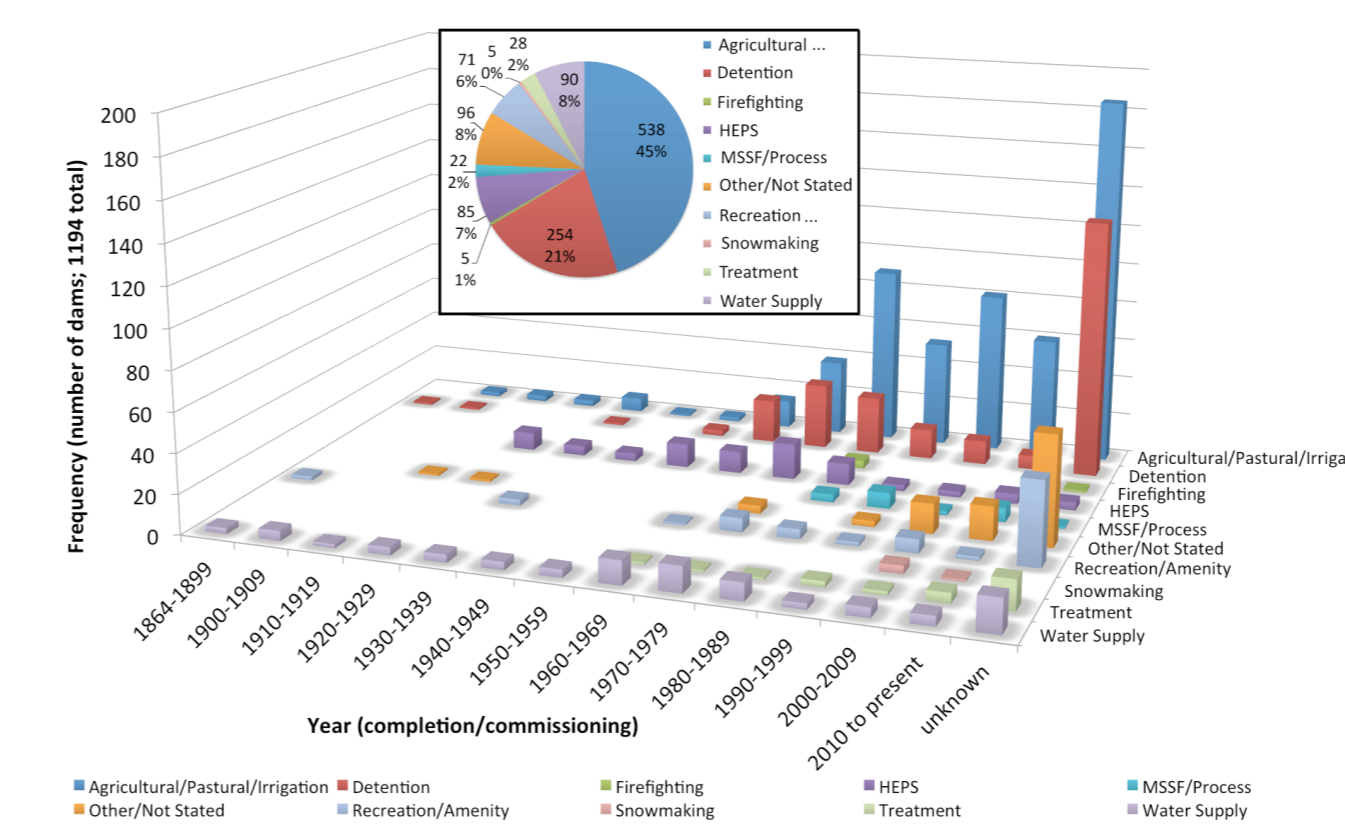


What does this mean for New Zealand? Who will benefit from the NZID?

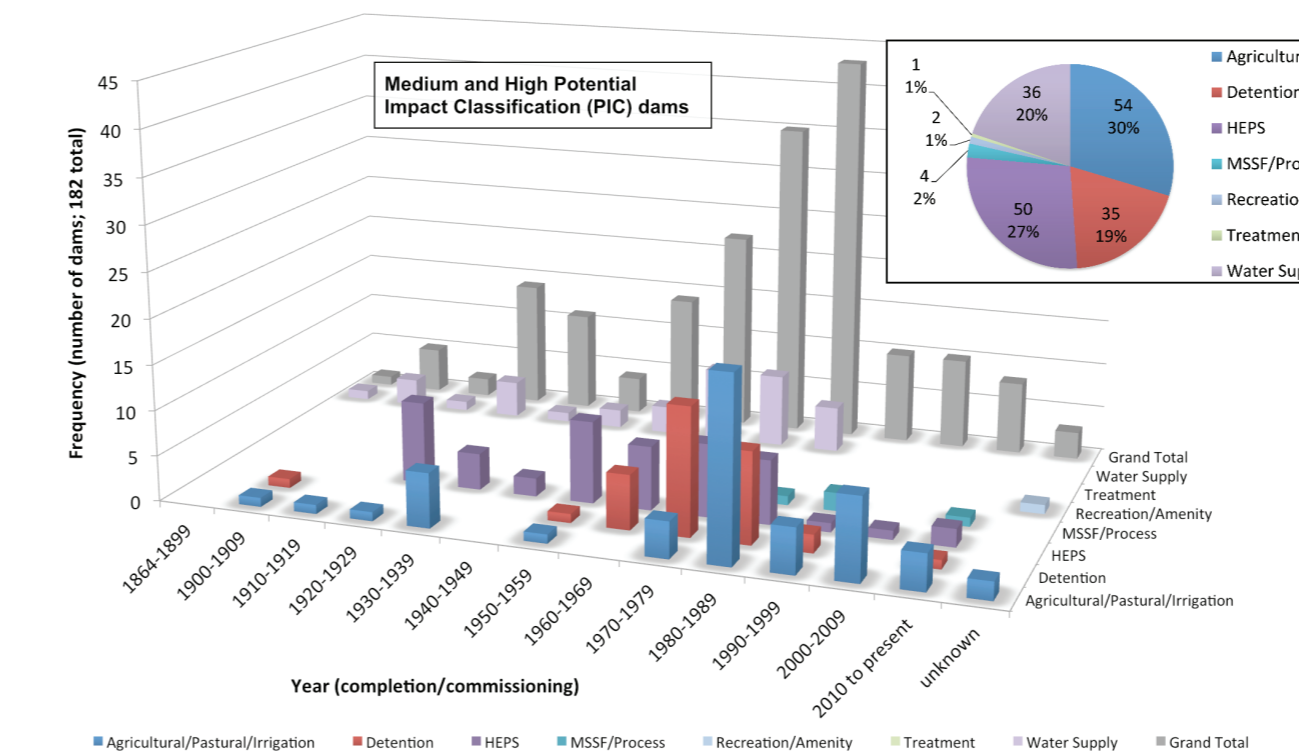
The NZID will set the stage for improved dam risk management in coming decades.

- **Regulatory authorities** (both national and regional) will gain an improved understanding of dam assets to help inform appropriate risk management measures.
- Outputs from analysis of the NZID will inform the **academic community**, refine future research foci, and help identify relevant international collaborations.
- The **New Zealand dam engineering community** can use the NZID to ensure that:
 - Dissemination channels target the full cross-section of dam owners
 - Engineering needs are addressed across the portfolio
 - Future dam engineering needs are anticipated.
- Through long-term research and governance, the **New Zealand public** will benefit by way of improved reliability of power and water supply, and safer dams.

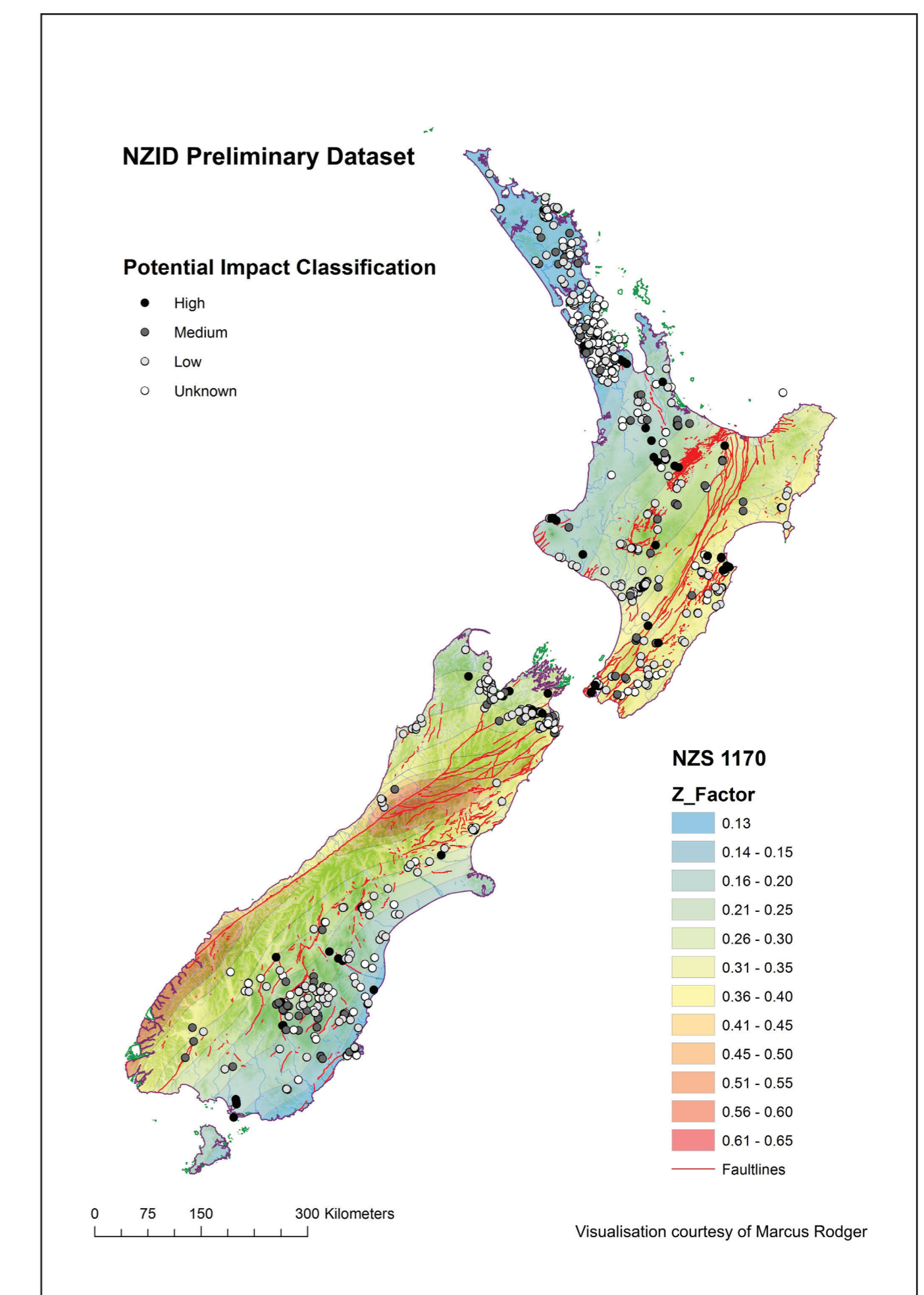
Agricultural dams account for the majority of recently-completed structures; however, newer dams serve a more diverse range of purposes in comparison to those structures built prior to 1980.



Medium and High PIC dams serve four main purposes: agriculture (30%), hydroelectric power supply (27%), water supply (20%), and flood protection (19%). Between six and 10 high-consequence dams have been built each decade (or part thereof) since 1990.



Ongoing geospatial analyses show that a large number of dams are built in close proximity to active fault lines. **Detailed geologic and seismic hazard analysis of the NZID is underway.**



Is the NZID complete?

The NZID is viewed as an evolving dataset. Future versions of the NZID will benefit from additional corrections and additions arising from updated information and Geospatial Information System (GIS) analysis. Specific studies are underway to inform end-users.

Acknowledgements

We wish to acknowledge the professional and financial support provided by the Quake Centre partners, particularly Genesis Energy, Meridian Energy, Mercury Energy and Trustpower.