# Research Aim 2: Flood Risk to the Built-Environment

NIWA, WSP, University of Auckland, Maanaki Whenua Landcare Research

June 2018
Gisborne District Council

Westport 2021 rnz.co.nz

Edgecumbe April 2017

Napier 2020 rnz.co.nz

Northland, July 2020

Waiho, March 2019
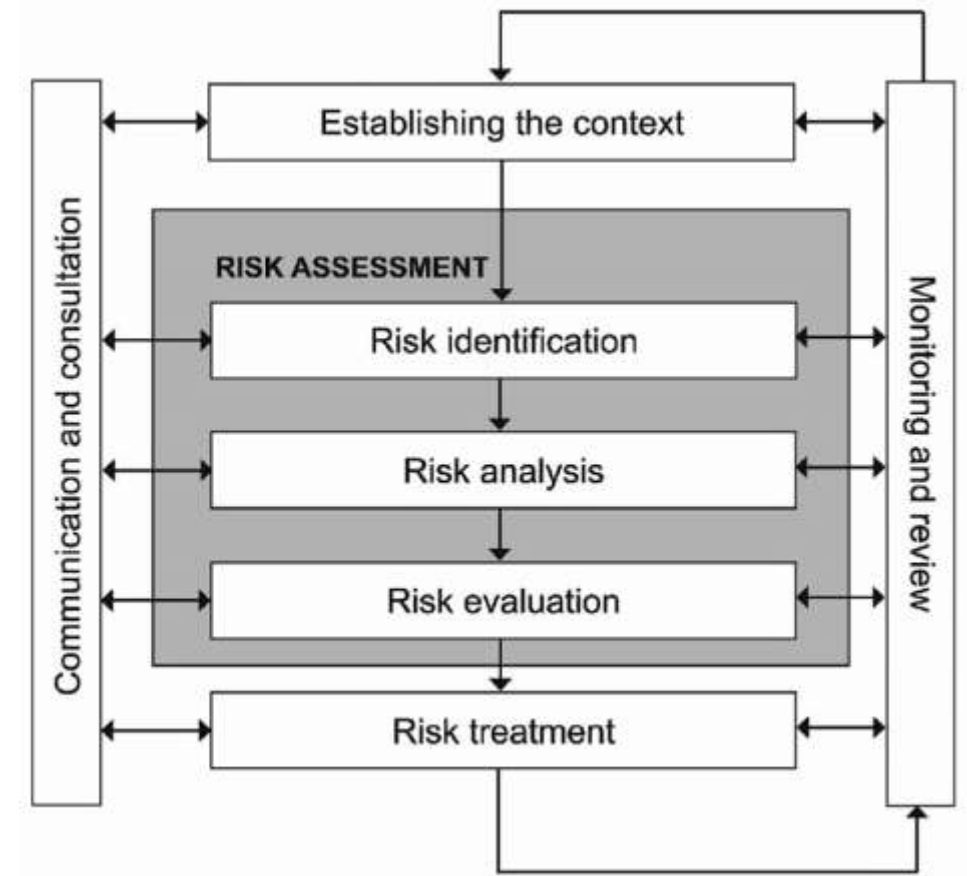
Rangitata, December 2019

Auckland 2017          rnz.co.nz

# Research Aim 2: Critical Steps and Timeline (Oct 2021 – Sept 2025)

CS2.1|2.7 A dynamic flood risk model and tool
(Year 2 - Year 5)

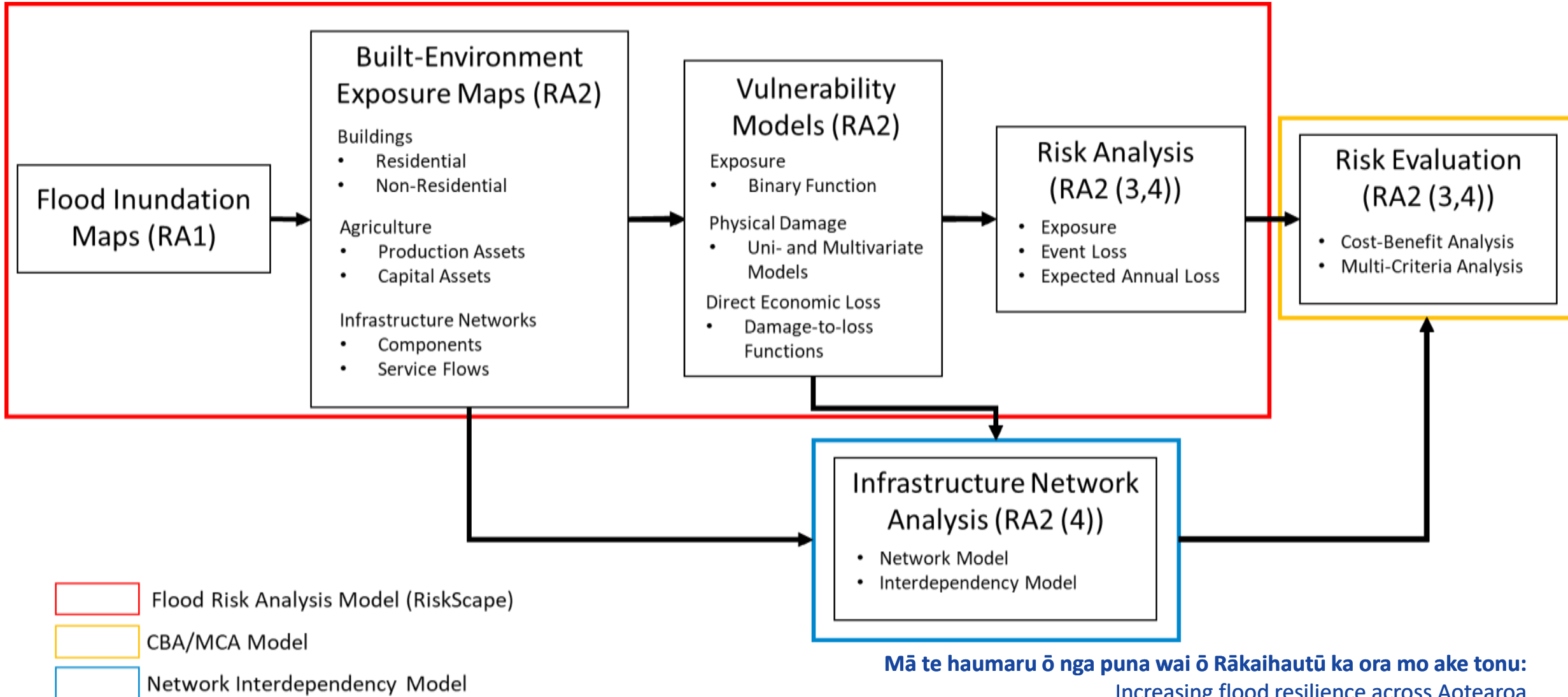CS2.2|2.3 Built-environment flood exposure and vulnerability
(Year 2 - Year 3)

CS2.4|2.6 National flood risk assessment
(Year 3 - Year 5)

CS2.5 Uncertainty in built-environment risk
(Year 4 - Year 5)



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Increasing flood resilience across Aotearoa

# CS2.1-2.7 A dynamic flood risk model and tool



**Flood Inundation Maps (RA1)**

**Built-Environment Exposure Maps (RA2)**

Buildings
- Residential
- Non-Residential

Agriculture
- Production Assets
- Capital Assets

Infrastructure Networks
- Components
- Service Flows

**Vulnerability Models (RA2)**

Exposure
- Binary Function

Physical Damage
- Uni- and Multivariate Models

Direct Economic Loss
- Damage-to-loss Functions

**Risk Analysis (RA2 (3,4))**
- Exposure
- Event Loss
- Expected Annual Loss

**Risk Evaluation (RA2 (3,4))**
- Cost-Benefit Analysis
- Multi-Criteria Analysis

**Infrastructure Network Analysis (RA2 (4))**
- Network Model
- Interdependency Model

Legend:
- Flood Risk Analysis Model (RiskScape)
- CBA/MCA Model
- Network Interdependency Model

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# CS2.1 Model Component: RiskScape

- Multi-hazard risk modelling software

- Open source engine

- Model functions for flood risk analysis at different spatial and temporal scales



https://riskscape.org.nz/

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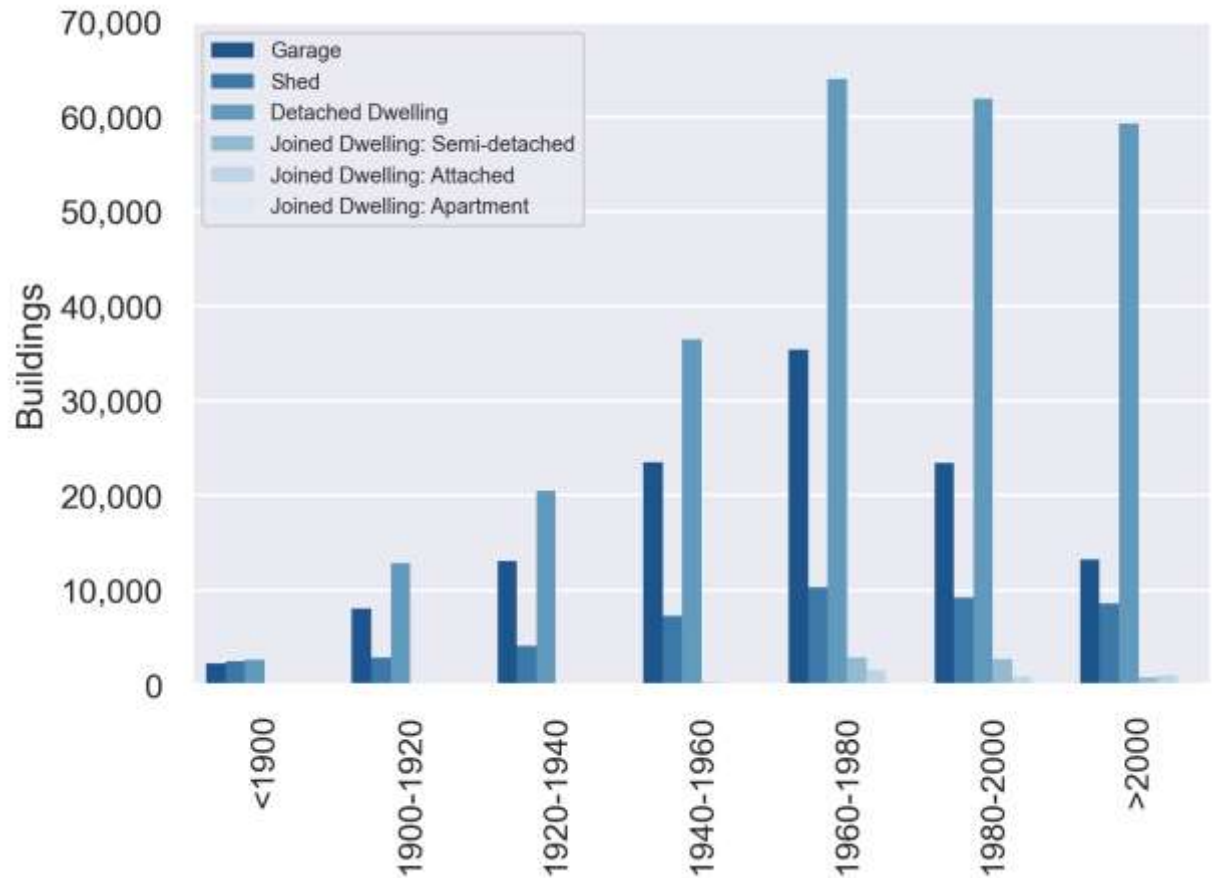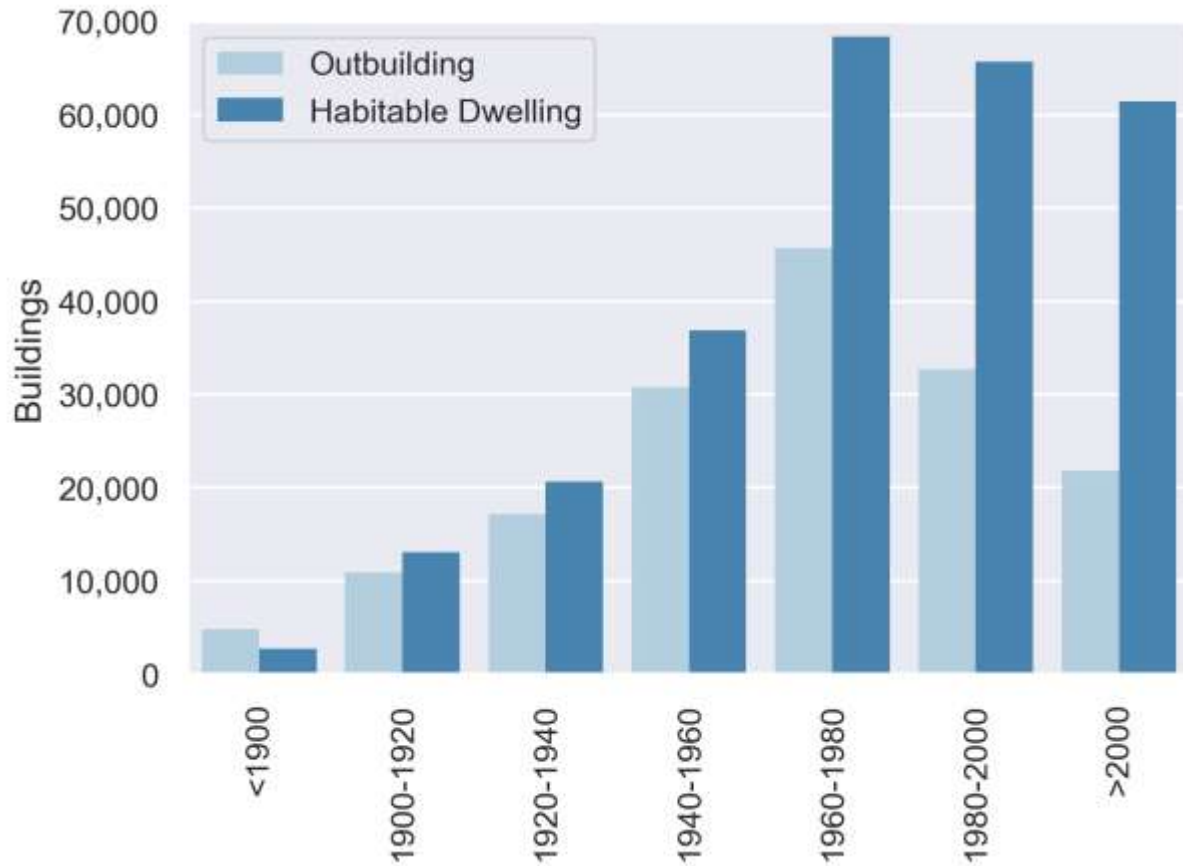
Scenario Model
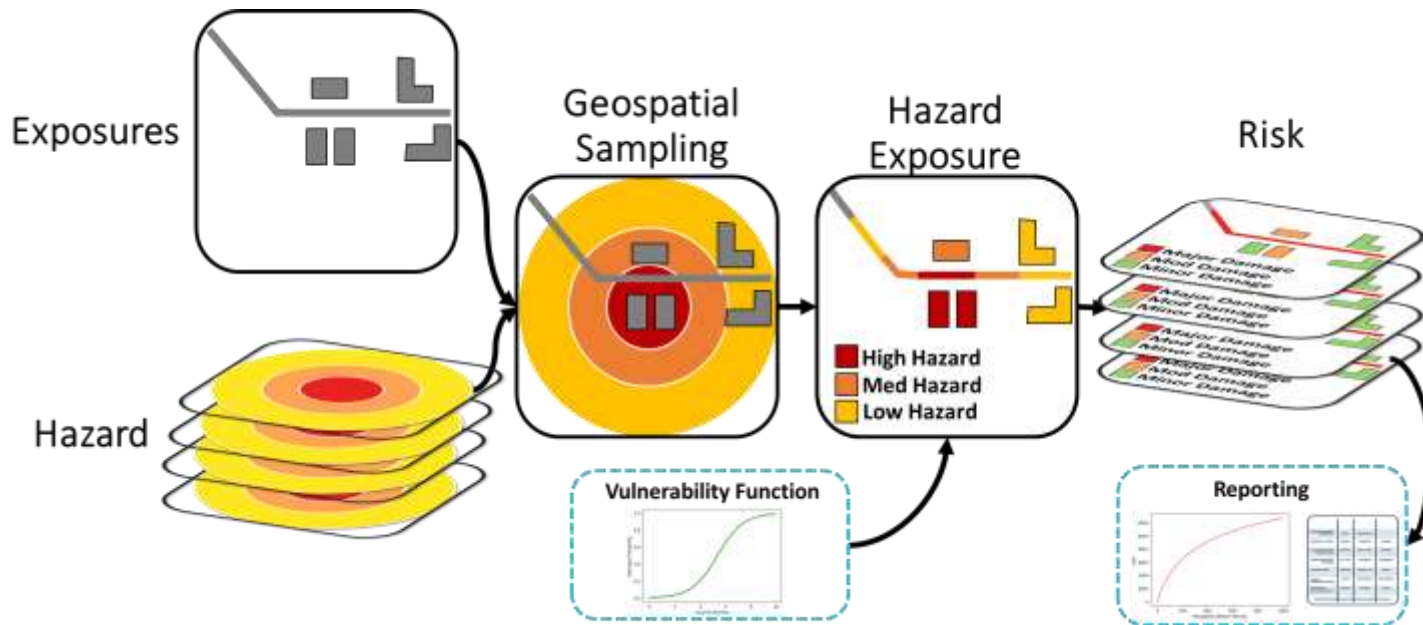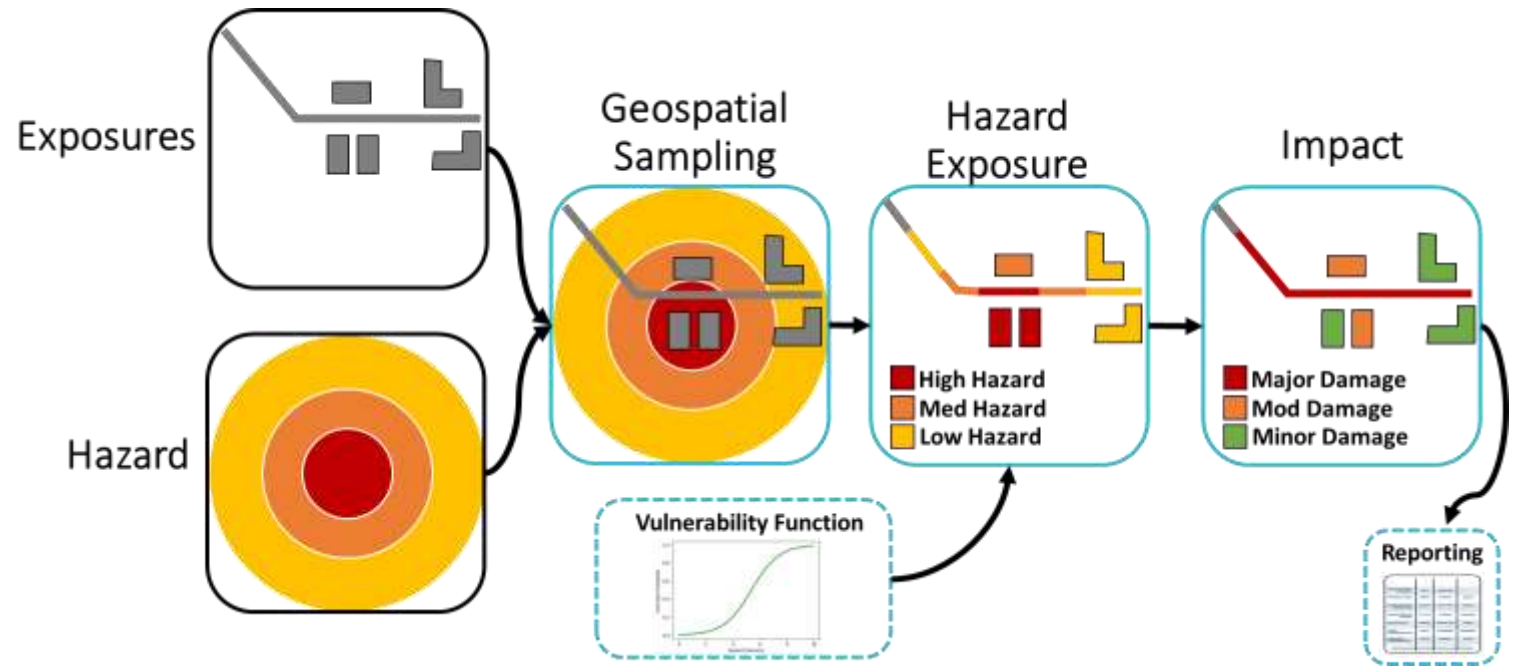
Probabilistic Model

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# CS2.2/2.3 Model Data: Residential Building Exposure

- Object-level database of floodplain buildings and attributes

- Building attributes influencing vulnerability and unit cost rates.

- Attribute spatial modelling and mapping for building objects in identified floodplains.
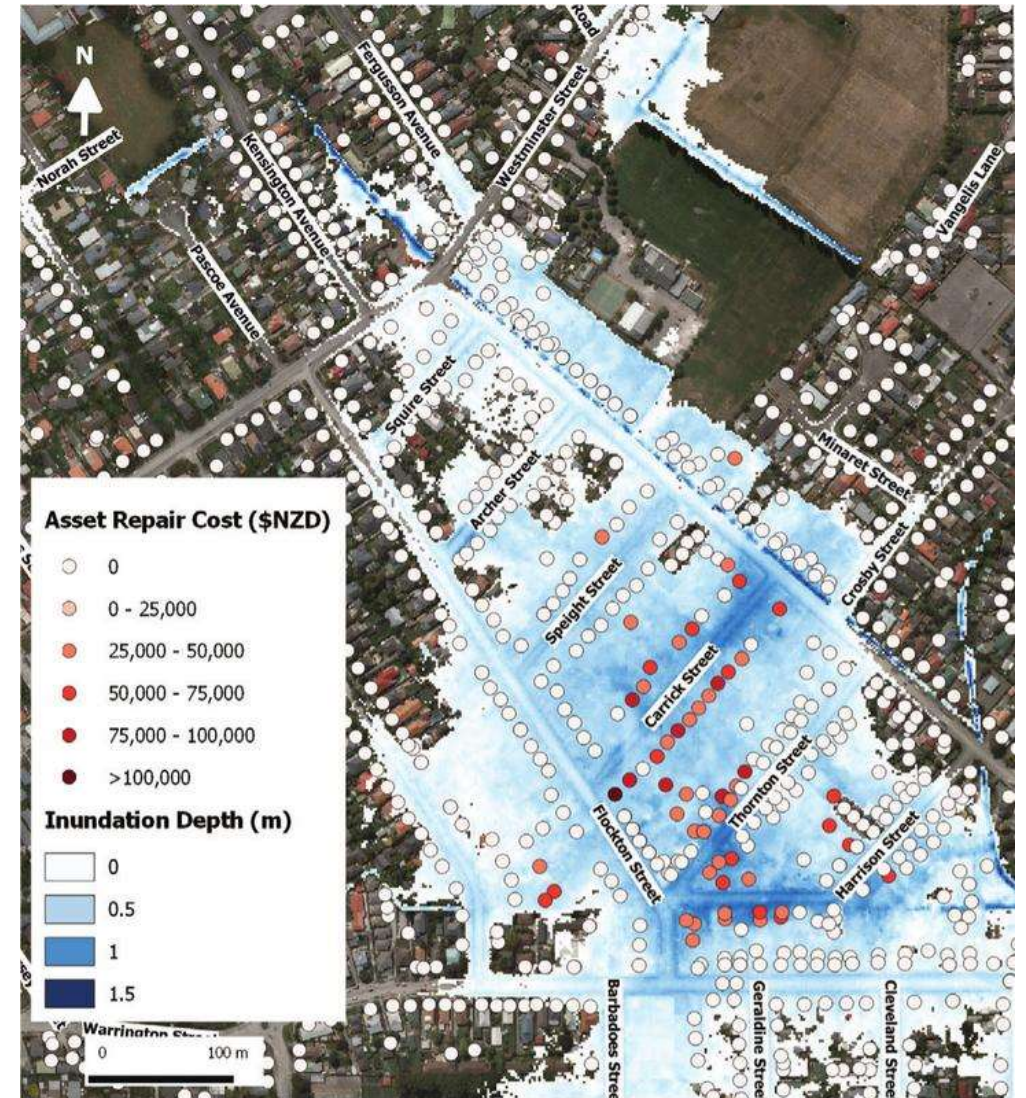
# Increasing Residential Building Exposure to Flooding



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# CS2.2/2.3 Model Data: Residential Building Vulnerability

- Micro-scale damage assessment requires detailed knowledge of factors driving building damage

- Empirical damage database collected from six flood events.

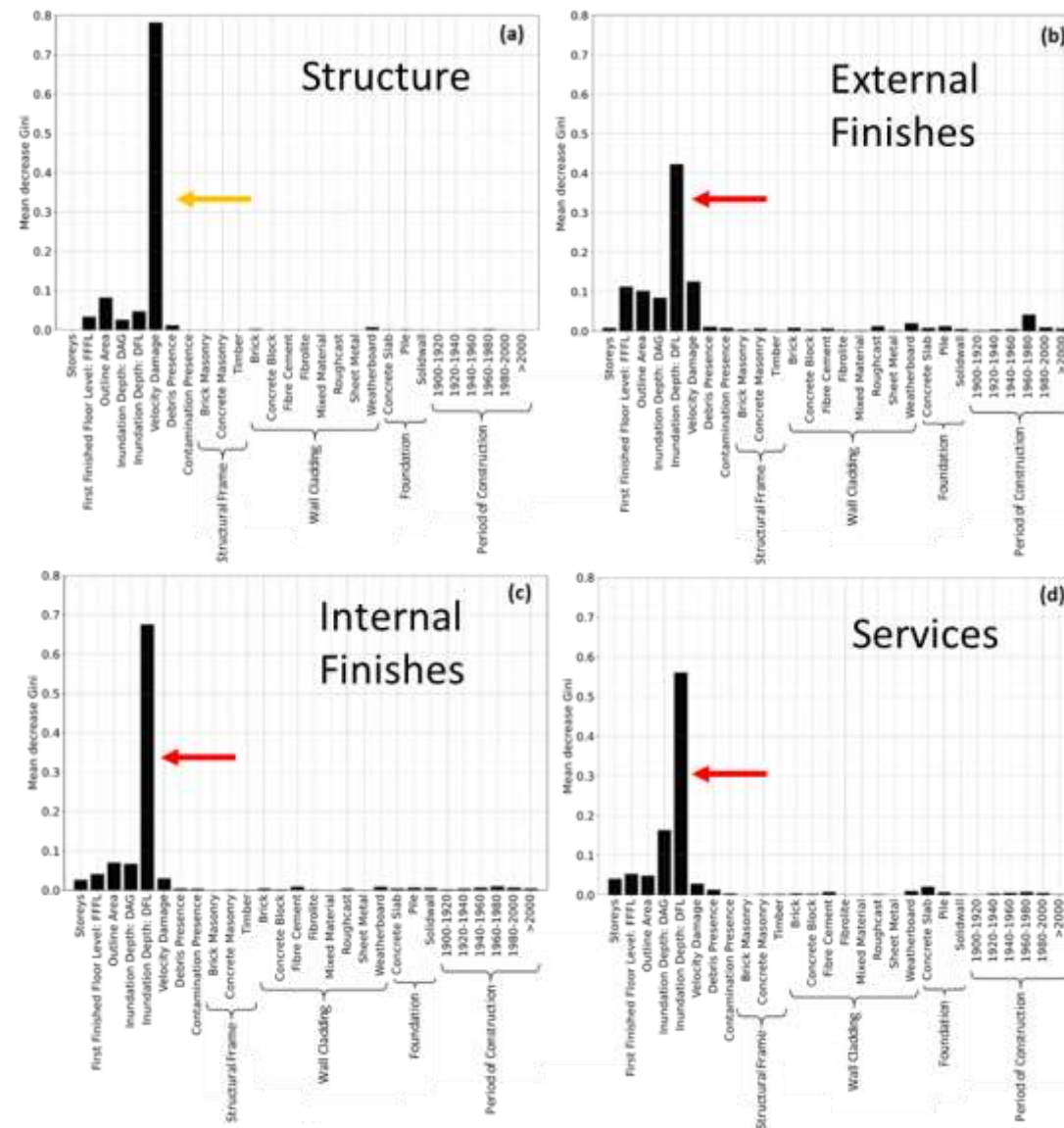- Damage influencing variables analysed for feature importance and relationships



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# Flood Risk Model Data: Residential Building Vulnerability

- **Inundation Depth** above first finished floor level is highly important for building and component damage.

- Other hazard and exposure variables are still important for physical damage and loss.

- Non-residential buildings could exhibit different damage drivers.

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# The Year Ahead (Oct 2022 – Sep 2023)

## CS2.1|2.7 A dynamic flood risk model and tool

- Network and dependency model development

- CBA/MCA methods review and model prototyping

## CS2.2|2.3 Model data

- Exposure modelling and databases

- Object-specific damage models

  - Buildings

  - Infrastructure Components

  - Primary Production

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# Questions/Pātai

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