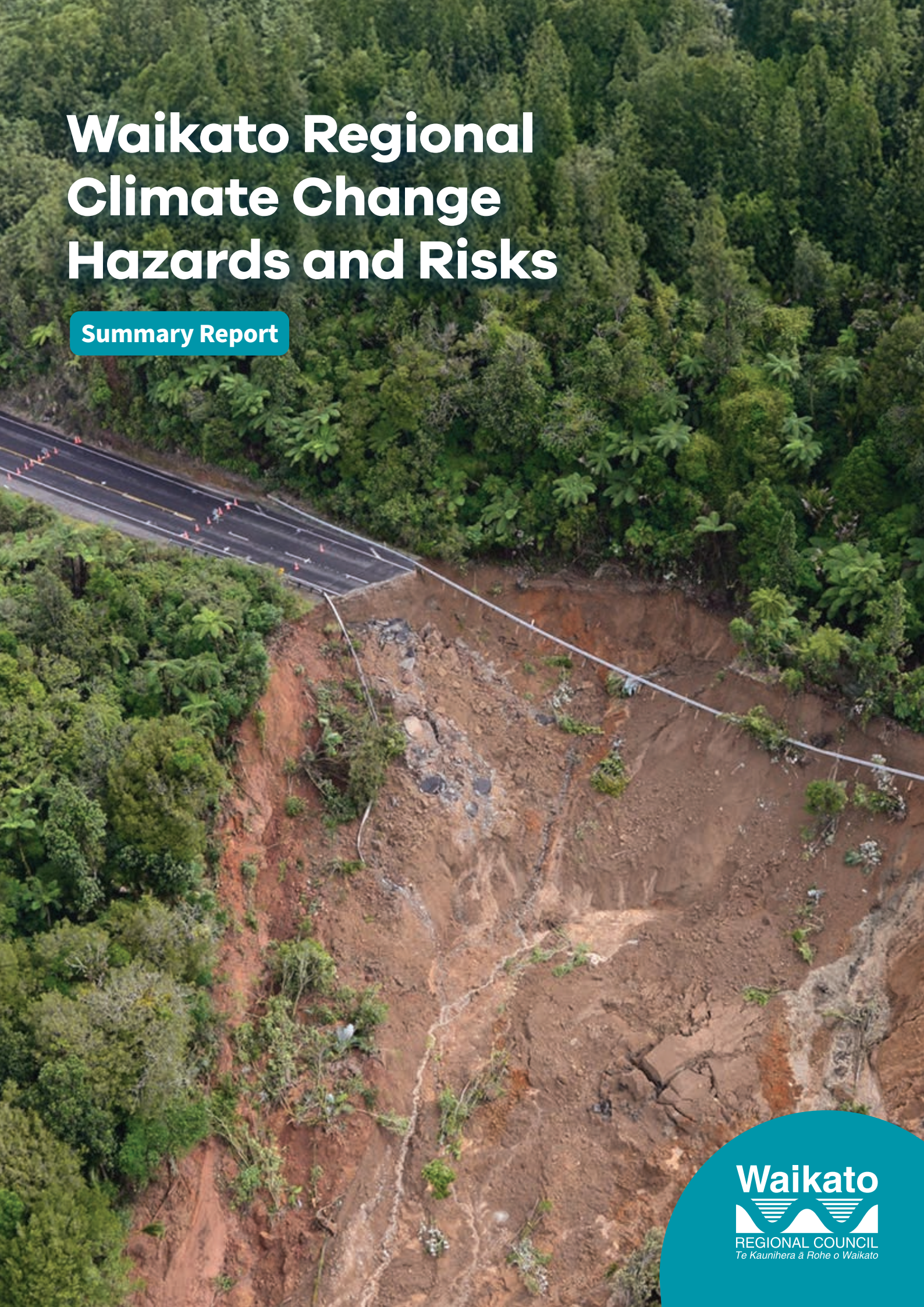
Waikato Regional Climate Change Hazards and Risks

Summary Report



Waikato
REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

Waikato residents already live with the impacts of climate change, which pose significant risks to our economy, communities, infrastructure and environment. These impacts and risks will increase over time, with some impacts already locked in. Other impacts can be influenced by our emission reduction and adaptation efforts. To identify the main climate change risks for the Waikato region, Waikato Regional Council led and funded a high-level risk screening project. The findings from that project, as well as the most recent climate projections and hazards for the region, have been compiled into a technical report which you can find **here**. High level overviews and maps of hazards and risks for the one city and 10 districts making up the Waikato region have also been developed.

This summary report highlights key hazard and risk information in the technical report.

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Cover image: State Highway 25A Cyclone Gabrielle February 2023

How can this information be used?

Every individual, organisation and sector will need to adapt and plan for climate change.

The technical report compiles a significant body of information and valuable insights into the hazards and potential risks that are likely to affect the Waikato region, providing a central reference for planning and responding to the impacts of climate change in the Waikato. Both this summary report and the technical report can be used to:

- inform future work and research programmes
- help identify where focused risk management and/or further detailed risk assessment is required for specific:
  - locations (district/community scale)
  - sectors
  - organisations
- support communication with communities and stakeholders
- prioritise adaptation responses and investment.

By understanding and addressing our main risks, the Waikato region can remain resilient and prepared for the impacts of climate change, protecting our economy, people, infrastructure and environment from the adverse effects of a changing climate.

Climate change is a complex and multifaceted phenomenon. Due to the evolving nature of climate science and potential unforeseen events, decisions on planning and investment, adaptation, and policymaking should consider a wide range of sources of information, expert advice, quantitative data and ongoing research.

We recommend users consider a broad range of sources and do not base decisions solely on the technical report.

Appendix 1 in the technical report documents the limitations and assumptions of this work.

Regional context

Our region's response to climate risk must reflect our unique local context: our geography, demographics, our strengths and opportunities in a changing climate, and our vulnerabilities.

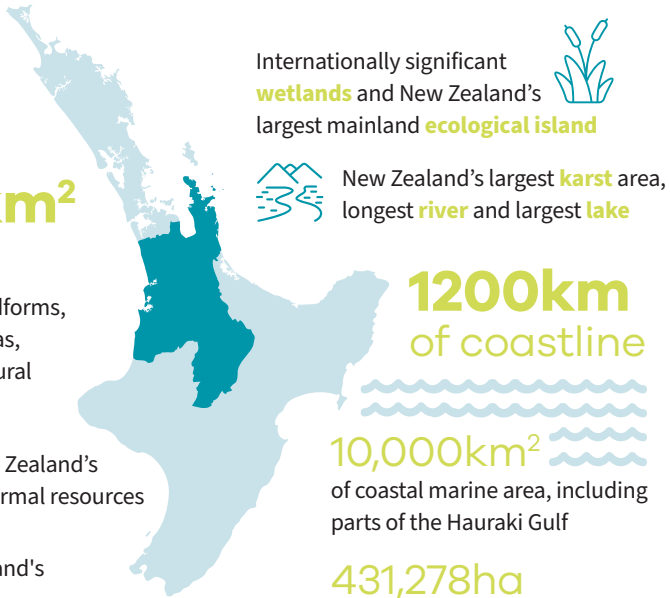
Some key statistics are summarised below, with more detail in Section 2 of the technical report.

Our natural resources

25,000km²
land area
with many distinct landforms, from mountainous areas, plains and urban and rural development

70% of New Zealand's geothermal resources

1/4 of New Zealand's best soils



Internationally significant **wetlands** and New Zealand's largest mainland **ecological island**

New Zealand's largest **karst** area, longest **river** and largest **lake**

1200km
of coastline

10,000km²
of coastal marine area, including parts of the Hauraki Gulf

431,278ha
of marine mammal sanctuaries

Prioritising risk and adaptation action

Section 9 of the technical report offers a possible framework to guide decision-making. Questions include:

- What is the severity of the risk across different time periods and under different emissions scenarios?
- How could a risk compound and cascade across our Waikato society, nature and the economy?
- What are the costs of inaction?
- Will today's decisions – or inaction - lock in future risks or lead to mal-adaptation?

Who we are

10 districts

1 city

214,609 rateable properties

6 principal iwi groups

506,000 people | 10% of NZ's population

over 1/3 of the population live in Hamilton. Nearly another 30 per cent live in the Waikato and Waipā Districts.

Population density:

- Highest in Hamilton (~1,600 people per km^2).
- Lowest in the Waitomo District (3 people per km^2).
- Southern parts of the region are much more sparsely populated, especially Ōtorohanga, Taupō and Waitomo Districts.

Deprivation and vulnerability

Many Waikato areas face high socio-economic deprivation. Communities with higher deprivation may have reduced ability to prepare for and respond to climate hazards. For a map of social deprivation across the Waikato region, see the Appendix to this report.

Age and ethnicity

Youngest population:
Hamilton (median age 32.7 years vs 37.9 nationally)

Ethnicity:
Similar to New Zealand generally but higher numbers of Waikato people identify as Māori (24% vs 17% nationally). Lower numbers of Waikato people identify as Pacific people or Asian, except for South Waikato with a large Pacific community and Hamilton with a large share of Asian people.

Oldest population:
Thames-Coromandel (54.8 years). Hauraki and Taupō Districts also have populations skewed towards older age ranges.

High Māori populations in the south of the region:

- Waitomo (45%)
- South Waikato (36%)
- Ōtorohanga and Taupō (30%)

Our regional economy

Total gross domestic product (GDP)

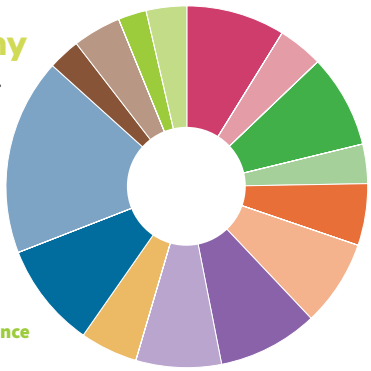
$29.2 billion in 2021 | ~9% of NZ's total

Waikato is the 4th largest regional economy in NZ.

Broad-based economy, with significant sub-regional specialisation and concentration of industries.

Structure of the Waikato economy

(value added by industry) (Statistics New Zealand, 2023).



- Agriculture
- Other primary
- Primary manufacturing
- Other manufacturing
- Utilities
- Construction
- Wholesale and retail
- Healthcare and social assistance
- Education and training
- Other services
- Property related services
- Distribution
- Information media, telecoms etc
- Financial and insurance services
- Public admin and safety

Agriculture* is just one of Waikato's industries exposed to the increasing frequency, severity and impact of natural hazards. Many Waikato towns depend on agriculture for economic sustainability, which makes them vulnerable to indirect and cascading risks from climate hazards impacting the agricultural industry.

**Includes dairy, sheep, beef and goat farming, horse breeding and horticulture*

How will the Waikato economy need to evolve to be successful in the climate of 2050 and 2100?

What adaptations and planning are needed today to ensure long-term resilience?

Key climate hazards in the Waikato

Climate change is expected to increase the frequency, severity and impact of many natural hazards in the region. Over the next century, the Waikato region can expect rising sea levels, more extreme weather, warmer summers and milder winters with seasonal rainfall shifts. Drought risk will likely increase in the north and east over spring and summer, and seasonal changes in rainfall and wind may occur in the west.

Severe weather and flooding

The Waikato region is highly vulnerable to severe weather events, which we expect to become more frequent and intense. The region's steep river catchments and low-lying flood plains, such as the Coromandel Peninsula and Hauraki Plains, are particularly prone to flooding from heavy rainfall and storms. Increased rainfall can overwhelm rivers and drainage systems, leading to widespread flooding in both urban and rural areas. Coastal inundation and elevated coastal water levels can also exacerbate river flooding in tidal areas and hinder the discharge of river systems.

The Waikato region has extensive flood management schemes and land drainage networks, all built to provide agreed levels of service. However, these may be unable to maintain historic levels of protection without considerable additional investment. Ongoing development in flood-protected areas also increases exposure to flood risk.

Landslides and erosion

Intense rainfall and river flooding increase land instability, causing landslides and erosion, particularly in steep catchments with weaker geology. Longer dry periods can worsen land instability, making dry cracked ground more susceptible to failure. The Coromandel Peninsula is highly vulnerable, as seen during Cyclone Gabrielle in 2023, where landslips caused significant road damage including the closure of State Highway 25A. Additionally, western Waikato hill country is prone to land instability. Riverbank erosion is also common on outer river bends during flood events due to high-energy flows.

Coastal inundation, erosion and sea level rise

Coastal inundation and erosion are significant climate risks for the Waikato region. Coastal areas, including Port Waikato, Mōkau, Aotea Harbour and various Coromandel communities, are highly susceptible to both short-term erosion from storms and long-term erosion driven by coastal processes like sea-level rise.

Sea-level rise is expected to increase inundation events and accelerate coastal erosion. Currently, coastal inundation risks 8,000 people, $1.46 billion worth of buildings, and 540 square kilometres of productive land. A one-metre rise in sea level could significantly increase these impacts, potentially affecting over 11,000 residents, $2.2 billion worth of buildings, and 630 square kilometres of land if no future protection measures are taken.

King tides and storm events worsen coastal erosion and inundation, removing natural buffers like sand dunes, increasing vulnerability of properties, infrastructure and eco-systems. Sea-level rise also raises groundwater levels, affecting buried infrastructure and foundations of infrastructure like roading. It increases liquefaction risk, shifts the freshwater-saltwater interface of rivers, and increases saltwater intrusion into groundwater bores.

Vertical land movement affects coastal inundation by changing local sea levels. Subsiding land increases relative sea-level rise, while uplifting land can reduce these impacts. Higher levels of subsidence in coastal and low-lying locations may increase inundation risks over time.

Droughts

While currently known for its water resources, the Waikato region faces more frequent and severe droughts. Rising temperatures and inconsistent rainfall will increase drought risk especially in northern and eastern areas, impacting agricultural and horticultural industries. Severe droughts in 2019 and 2020, and the 2007-2008 North Island drought highlight the economic impacts of drought, which can also affect water quality and eco-systems.

Temperature increase

Extreme heatwaves are becoming more common and intense as temperatures rise, affecting human health, animal welfare, the marine environment and economic productivity. Recent summers have seen record-breaking temperatures and more warm days (≥ 25°C). High temperatures and humidity cause significant heat stress, with events often lasting several days. Impacts include increased demand for water and energy, infrastructure degradation and agricultural challenges due to heat stress on livestock and reduced crop yields. Fewer frost days are expected, affecting winter recreational activities and tourism, as seen with the low snowfall in Tongariro National Park in 2022. Warmer air also holds more moisture, leading to more intense rainfall.

Increased fire weather

Climate change increases wildfire risk by raising temperatures and reducing moisture. Higher temperatures lower humidity and extend droughts, making fire fuels more available. Changing rainfall patterns cause wetter conditions in some areas and drier conditions in others. The region's highest fire danger areas are in the Matamata-Piako and Hauraki Districts, including Matamata, Morrinsville, Waihi, Thames, Te Aroha and Paeroa. The Kaimai-Mamakū forest park near Te Aroha, is particularly at risk. Fire weather risk in Waikato is projected to increase by about 3 per cent per decade until 2050, with a high-end scenario predicting a 10 per cent increase per decade from 2050 onwards, potentially doubling current fire risk.

Climate change projections for the Waikato region

Using NIWA's downscaled climate projections, the following tables summarise the range of expected changes across key climate hazards. They provide the range of projected climate change futures that can be expected across the Waikato region for two time periods - mid-century and end of century - across different Shared Socioeconomic Pathways (SSP) projections.

The climate change projection data in the following tables is the *mean* change expected across the whole region. Therefore, it is possible for a larger or smaller range to occur than what is provided below. Several sources have been used to inform this data, including Ministry for the Environment (2024), NZ Sea Rise (2024) and Yi, et al., (2021).

For more detail on the potential future climate that will impact the Waikato region and districts, see the updated 2024 **Climate Projections Map** (Ministry for the Environment, 2024). The map and dashboard include projection descriptions and detailed maps for each territorial authority.

Temperature increase and drought

Hazard	Description	Present day (baseline 1995-2014)	Mid-century (2040 - 2060)		End of century (2080 - 2100)		Spatial variation across the region
			SSP2-4.5	SSP3-7.0	SSP2-4.5	SSP3-7.0	
Average temperatures	• The average daily air temperature per year or season.	8 °C to 10 °C on average per year	+ 1.1° to 1.2° C temperature increase	+ 1.3° to 1.4° C temperature increase	+ 1.9° to 2.1°C temperature increase	+ 2.9° to 3.1° C temperature increase	• Average daily temperature is expected to increase across the whole region, however Hamilton City, Ōtorohanga, Rotorua and Taupō Districts are expected to see a significant increase in the number of hot days, particularly by end of century. • By mid-century, three out of four summers in Hamilton will include a 15-day hot spell more intense than those occurring once a decade in the recent past (1984-2015). • By mid-century, significant multi-week heatwaves with temperatures at or above 30 °C for several weeks could occur in Hamilton.
Hot days (>25deg)	• The number of days per year or season with a maximum daily air temperature over 25°C or greater and very hot as 30°C. • Significant increases are expected in summer, especially by end of century. • By mid-century, summer temperatures are projected to rise by +0.9°C – 1.8 °C and up to 3.8°C by end of century.	10 to 38 hot days on average per year	+ 12 to 30 more hot days per year	+ 17 to 39 more hot days per year	+ 25 to 54 more hot days per year	+ 48 to 82 more hot days per year	
Frost days	• The number of days per year or season with a minimum daily air temperature below 0°C. • These will significantly decrease in the southern parts of the Waikato region, particularly by end of century.	6 to 45 frost days on average per year	3 to 12 fewer frost days per year	3 to 14 fewer frost days per year	5 to 22 fewer frost days per year	5 to 29 fewer frost days per year	• Taupō District will see the largest decrease in estimated frost days followed by Rotorua District. • There is a smaller decrease in the number of frost days seen across the northern Waikato Districts.
Drought	• Dry days are days where rainfall is less than 1mm per day. • Potential evapotranspiration deficit (PED) is a drought index (expressed in mm) representing drought exposure. • An increase in PED indicates an increase in drought severity. • By the end of century, the time spent in drought ranges from minimal change through to more than double, depending on the climate model and emission scenario considered.	213 to 242 dry days on average per year 42mm to 144mm PED	-2 to +1 more dry days per year +21mm to +36mm of PED	-2 to +1 more dry days per year +2mm to +44mm of PED	+1 to +3 more dry days per year +27mm to +66mm of PED	+6 to +8 more dry days per year +48mm to +87mm of PED	• Drought risk is expected to increase across the whole region, but particularly in north-eastern districts.
Increased fire weather	• Fire weather index is dependent on temperature, precipitation, relative humidity and wind speed. • The number of days with very high and extreme fire danger could increase significantly across the country.	*No projection information available					• The highest fire danger in Waikato is projected for the Matamata-Piako and Hauraki districts, including Matamata, Morrinsville, Waihi, Thames, Te Aroha, and Paeroa. • Districts and locations identified above will experience higher temperatures could see increased fire weather. • However, the Waikato region is not expected to see a significant increase in wind, which is an exacerbator of fire risk.

Flooding, extreme rainfall and storms

Hazard	Description	Present day (baseline 1995-2014)	Mid-century (2040 - 2060)			End of century (2080 - 2100)			Spatial variation across the region
			SSP2-4.5	SSP3-7.0	SSP5-8.5	SSP2-4.5	SSP3-7.0	SSP5-8.5	
Annual rainfall	• The total amount of rainfall per year or season. • Slight increase expected overall, but potential for a 11% decrease by end of century. • Rainfall intensity is expected to increase, so while seasonality of rainfall may decrease, more intense rainfall is expected to fall over shorter periods.	1160 – 2260mm total rainfall per year on average 122 to 152 rainy days per year	-3% to +0.4% change in annual rainfall -1 to +1 very rainy days per year	-3% to -2% change in annual rainfall -1 to +1 very rainy days per year	N/A	-5% to -2% change in annual rainfall -2 to +1 very rainy days per year	-8% to -6% change in annual rainfall -4 to +1 very rainy days per year	N/A	• Overall Rainfall: Projected to decrease in many districts, especially in spring. • Significant Decreases: Notable in Waikato, Thames-Coromandel, Hamilton City, Waipā, Ōtorohanga, Rotorua, and Taupō during spring. • Hauraki and Matamata-Piako: Show significant variability in winter rainfall, with decreases up to 16% and slight increases around 3%. • Taupō District: Largest projected change in rainfall by end of century, with annual rainfall expected to change between -11 and 1%. Spring rainfall could decrease by -22% to -3%. • Flooding Risk: Varies across the region, with flood-susceptible areas in all districts. Highly susceptible districts include Waikato, Hauraki, Matamata-Piako, and Coromandel. Taupō District also has flood-susceptible communities, especially in lakeshore areas like Tūrangi.
Extreme rainfall	• 1% AEP, 24 hour duration rainfall depth (mm) • A rainfall amount that has a 1% chance of being exceeded in any given year. • Likely to become more intense, leading to more extreme flooding. Projections taken from CMIP6 report (**Yi, et al., 2021**) where projections are provided for SSP2-4.5 and SSP5-8.5	197mm (24hr, 100year)	+13% rainfall depth (24hr, 100year)	N/A	+16% rainfall depth (24hr, 100year)	+19% rainfall depth (24hr, 100year)	N/A	+39% rainfall depth (24hr, 100year)	
Extreme weather events (wind & storms)	• Increase in cyclone frequency and intensity • Extreme precipitation intensity is projected to increase. • Windy days are defined as days with >10m/s. • The reduction in windy days tends to be more significant by end of century compared to mid-century. • Frequency of extreme winds is expected to increase in winter and decrease in summer • Increase in storm intensity predicted by end of century will result in an increase in gale force westerly winds. • This may mean that longer dry spells are followed by more intense rainfall events.	1 to 82 windy days on average per year	0 to 7 fewer windy days per year	0 to 7 fewer windy days per year	N/A	0 to 12 fewer windy days per year	0 to 20 fewer windy days per year	N/A	• North and eastern parts of the region, particularly the Coromandel Peninsula, Hauraki, Matamata-Piako and Waikato Districts are likely to experience more frequency and more intense cyclones. • Most districts are projected to experience a decrease in the number of windy days by both mid-century and end of century. • Taupō District could experience 13 fewer to 1.2 more windy days, which contrasts with the overall trend of decrease across the region. • North-eastern districts such as Coromandel, Hauraki and Matamata-Piako could experience more extreme cyclone activity into the future.
Increased land instability and soil erosion	• Increasing rainfall intensity will increase the probability of landslides occurring. • Changes in rainfall intensity could also lead to a broader geographical area susceptible to landslide risk. • Increases in earthflow, gully, sheet, and bank erosion are expected with increased rainfall and temperature.	*No projection information available							• The Coromandel Peninsula is highly susceptible to land instability, as well as Northern Waikato surrounding Port Waikato, Wharekawa, Hunua Rangers, and along King Country in the west of the region. • Land instability is also likely surrounding Lake Taupō due to the weaker volcanic ash and pyroclastic flow deposits. • These locations are also susceptible to soil erosion alongside land use areas highly populated by agriculture and horticulture, such as Hauraki Plains, Lower Waikato, Matamata-Piako and Tūākau/Pukekohe.

Coastal hazards and sea level rise

Hazard	Description	Present day (baseline 1995-2014)	Mid-century (2040 - 2060)			End of century (2080 - 2100)			Spatial variation across the region
			SSP2-4.5	SSP3-7.0	SSP5-8.5 H+	SSP2-4.5	SSP3-7.0	SSP5-8.5 H+	
Coastal inundation and sea level rise	• Extreme sea levels that are expected to be reached once every 100 years (on average) at present-day MSL, will occur at least once per year or more (on average) by 2050 - 2070 and will occur earlier in areas with smaller tidal ranges. • Exposure to extreme storm tides will increase with further sea-level rise. • Vertical land movement (VLM) should be considered when understanding sea-level rise across the region. • VLM is highly influenced by the compaction of weak geological rock (e.g. peat) and larger scale tectonic processes.	SSP2-4.5: less than +0.12 m SSP3-7.0: less than +0.12 m SSP5-8.5 H+: less than +0.13 m	+0.15m to +0.30m	+0.15m to +0.32m	+0.18m to +0.43m	+0.27m to +0.55m	+0.35m to +0.66m	+0.52 to +1.41m	• Sea-level rise will have long lasting impacts and associated risks across all our coastal districts, including Coromandel, Hauraki, Waikato, Ōtorohanga and Waitomo. • Due to large scale tectonic processes, the Hauraki Plains and Thames foreshore are highly susceptible to VLM subsidence. • The Kaiaua coastline is also susceptible to VLM subsidence. • West coast communities such as Raglan, Kāwhia and Mōkau are also at risk of VLM subsidence. • The Hauraki Plains is highly exposed to the impacts of coastal inundation; however, the risk is currently mitigated through a foreshore stopbank. • Communities along the Coromandel Peninsula, Wharekawa Coastline, and low-lying West coast communities are all at risk of coastal inundation exacerbated by SLR • The extent and intensity of coastal inundation is expected to increase due to SLR, particularly in low lying estuary environment.
Coastal erosion	Coastal erosion will increase in frequency, intensity and extent because of sea-level rise and changes to extreme weather events. Exposure of coastlines to extreme storm tides will increase with further sea-level rise.								• The location and severity of coastal erosion will vary across the region depending on location, coastal process and conditions. • West Coast areas such as Port Waikato, Raglan, Mōkau and Aotea Harbour are all highly vulnerable to coastal erosion. • Additionally, all eastern coromandel communities are vulnerable to coastal erosion, eroding property, infrastructure and the natural environment, such as Whitianga and Whangamatā.
Groundwater rise and salinity	• Groundwater levels will be influenced by sea-level rise and rainfall runoff. • Changes to salinity will depend on rainfall and runoff patterns. • VLM has a significant influence on the effects of groundwater rise								• The Hauraki Plains is highly vulnerable to the impact of a rising groundwater because of both sea-level rise and more intense rainfall and ponding. • Thames is vulnerable to groundwater rise due to vertical land movement. • Increases of saltwater intrusion in aquifers within coastal areas, e.g. Hauraki Plains and Hahei.

Assessment of climate hazard exposure by district

The presence, intensity and impact of climate hazards, both now and into the future, varies across the Waikato region. Each area, and the communities, iwi Māori, organisations and businesses located within it, will be affected by climate change and its associated risks differently. Therefore, each will need to plan for climate change in a unique way.

Some districts have greater exposure to certain climate hazards than others. Consequently, the impact will vary across the region. However, a lower presence of hazards and risks in some districts does not imply the absence of risk. There may still be smaller or localised areas within those districts that can be impacted by a hazard.

The following table provides an overview of each territorial authority's climate hazard exposure across the region.

✓✓✓ Territorial authority (TA) has a large exposure to this climate hazard now and into the future with the potential to impact significant areas.

✓✓ TA has presence of hazard and exposure to this climate hazard now and into the future with the potential to impact localised areas.

✓ Limited presence and exposure of hazards and/or limited impact areas are impacted.

Table: Assessment of climate hazard exposure by district in the Waikato region (**Ministry for the Environment, 2024**) (**NZ Sea Rise, 2024**) (**Waikato Regional Council, 2025**).

Council	Flooding (Fluvial and Pluvial)*	Coastal hazards	Extreme weather	Higher temperature	Dryness and drought	Increased fire weather	Groundwater rise and salinity stress	Landslides and soil erosion	Marine heatwaves and ocean chemistry changes	Decreased frost
Thames Coromandel	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓✓	✓✓✓	✓✓✓	✓
Hauraki	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓	✓✓✓	✓
Waikato	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓	✓✓	✓✓	✓✓	✓
Hamilton City	✓✓	N/A	✓✓	✓✓✓	✓✓	✓	N/A	✓	N/A	✓
Matamata-Piako	✓✓✓	N/A	✓✓✓	✓✓✓	✓✓✓	✓✓✓	N/A	✓	N/A	✓
South Waikato	✓	N/A	✓	✓✓	✓✓	✓✓	N/A	✓	N/A	✓✓
Waipā	✓✓	N/A	✓	✓✓	✓✓	✓	N/A	✓✓	N/A	✓
Ōtorohanga	✓✓	✓✓	✓✓✓	✓✓	✓	✓	✓	✓✓✓	✓	✓✓
Waitomo	✓✓✓	✓✓	✓✓✓	✓	✓	✓	✓	✓✓✓	✓	✓✓
Taupō	✓✓	N/A	✓✓	✓	✓✓✓	✓	N/A	✓✓✓	N/A	✓✓✓
Rotorua Lakes (WRC area)	✓	N/A	✓✓	✓	✓✓	✓	N/A	✓✓	N/A	✓✓✓

**Waikato Regional Council and/or other district councils provide and manage flood protection and land drainage schemes throughout the region. Waikato Regional Council manages flood protection and land drainage in Waikato District, Hauraki District, Thames Coromandel District, Matamata-Piako District, Waipā District and Taupō District. Hauraki and Ōtorohanga District Councils manage their own flood protection and land drainage for parts of their districts.*

Climate risks in the Waikato region

During our high-level climate change risk screening project, we identified approximately 230 direct risks and 55 indirect risks to a wide range of elements such as biosecurity, water quality, taonga species and flood defences.

We have grouped these risks under five domains: human, natural environment, economy, built environment, and governance. However, it's important to recognise that climate-induced hazards and risks don't occur in isolation and often are interconnected. They can compound, leading to secondary and cascading risks with both short and long-term consequences across different domains.

Climate change is expected to significantly impact many aspects of Māori well-being: across the environment and ecosystems, Māori economy, health, spirituality, culture, and the wellbeing of future generations. Section 5 of the technical report discusses the key themes gathered in Waikato-specific engagement with iwi Māori during the project and drawn from *He huringa āhuarangi, he huringa ao: a changing climate, a changing world*.

A summary of the risks gathered during this project is available in Section 7, with the full list of risks available in Waikato Regional Climate Change Risk Identification Workbook. The high-level overview of key climate change hazards and risks for each district (see Appendix) should be read alongside risks in Section 7.

Section 7 of the technical report also includes geographic examples where risks are currently known or expected to be present.

The geographic examples are limited to specific locations that were identified during the project, such as in survey responses and workshops, and are not a conclusive and/or complete list of all "at risk" locations across the region.

If you'd like to know more

- **Technical Report - waikatoregion.govt.nz/tr202428.**
- **Waikato Regional Climate Change Risk Identification Workbook.**
- To view the current natural hazard information Waikato Regional Council holds across the Waikato region, view the **Waikato Regional Hazards Portal** and **Coastal Inundation Tool**.
- For an interactive dashboard and greater detail on the potential future climate that will impact the Waikato region and our districts, see the updated 2024 **Climate Projections Map** (Ministry for the Environment, 2024). The dashboard includes detailed projection descriptions and maps broken down for each territorial authority.
- Our **Climate Action Roadmap**, which guides how we will work with others to support the transition to a climate-resilient, low emissions society.
- Current community adaptation projects across the Waikato:
  - **Wharekawa Coast 2120 Community Plan**
  - **Thames-Coromandel Shoreline Management Pathways**
  - **Hauraki Plains Adaptation Plan project website**

Erosion at Port Waikato

What's next for Waikato Regional Council's response?

Our council staff will be able to use the Climate Change Hazards and Risks Report across all our roles and responsibilities to help inform planning, prioritisation and investment and to support discussions with stakeholders and partners on adaptation planning and responses to climate change.

Our ongoing response includes:

- our programme of work to improve the region's quantitative natural hazard and risk data to ensure informed resilient decisions
- development of a regional resilience strategy and implementation plan
- our collaborative work with territorial authorities on local community adaptation projects (managing risk to **existing** development and land use)
- work on regional spatial planning, which supports the consideration of climate risk in strategic growth management and planning for development and critical infrastructure (managing risk to **future** development and land use)
- our Water Security Strategy for the Waikato Region and work to develop a collaborative, multi-stakeholder and regional-scale Water Security Implementation Plan to address the significant water security challenges facing the region
- our Infrastructure Strategy, which provides a high-level view of infrastructure managed by the council, and how we propose managing that infrastructure over the next 50 years.

Appendix

District climate change hazard and risk maps

The following maps outline key climate hazards and risks for each territorial authority in the Waikato region.

Mill Road Pump Station, Paeroa

Hamilton City

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the city. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Increased coastal and riverine hazards may lead people to migrate within the region to areas perceived as less risky, such as Hamilton. Consequently, this influx will place additional pressure on Hamilton City's services and housing, affecting social wellbeing. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Increased temperature, seasonality changes and increased rainfall may impact industries across the city as certain ones become less or more viable, affecting commercial and private income. Impacts from severe weather events on private and public property may also create economic costs for homeowners.

Natural environment

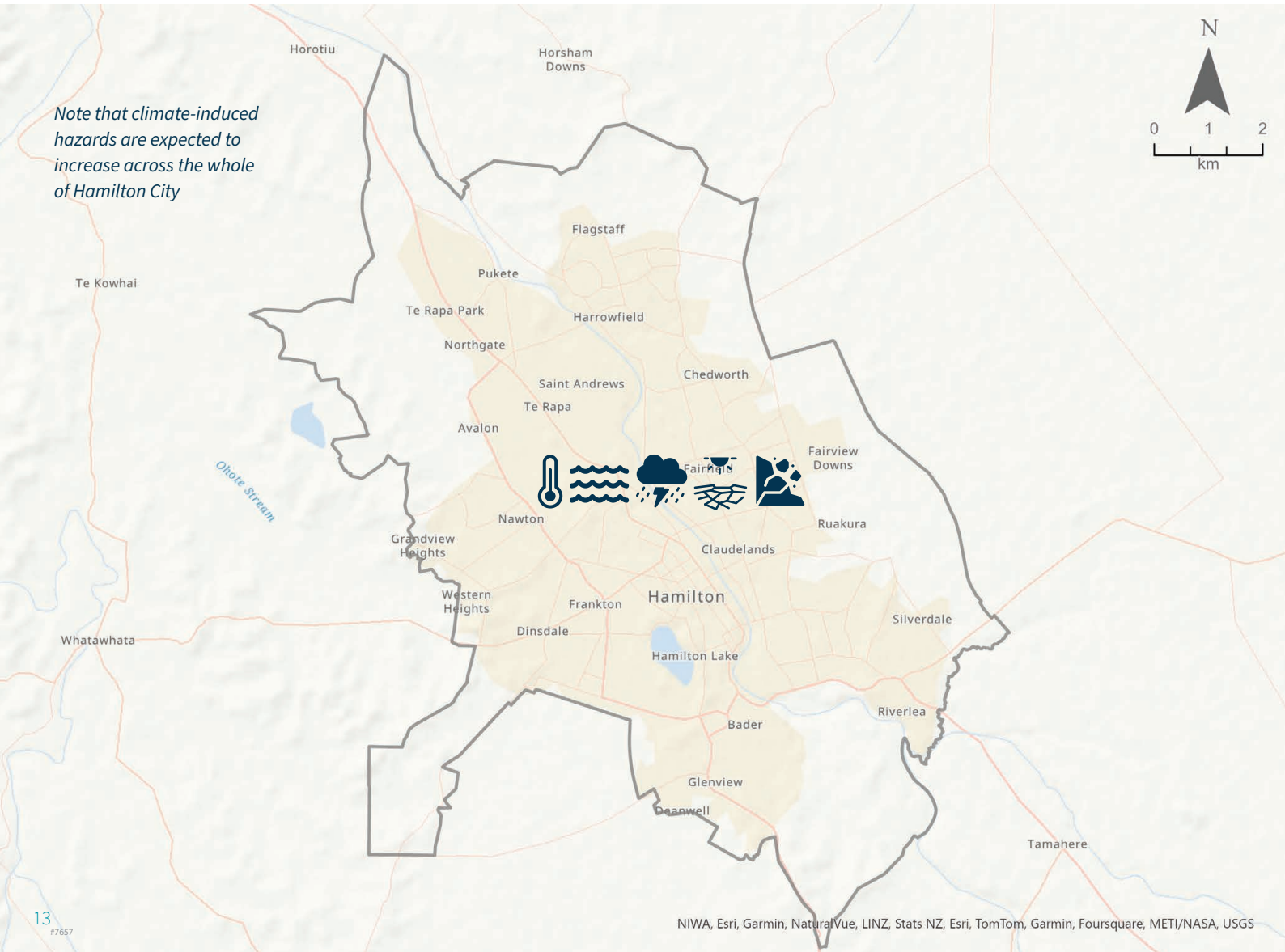
Hamilton lakes and the Waikato River are highly vulnerable to climate change, facing threats to water quality and biodiversity. Warmer temperatures can disrupt ecosystems, while increased rainfall, flooding and erosion can lead to vegetation loss and sedimentation, impacting wildlife.

Built environment

Hamilton's critical infrastructure risks being inoperable during heavy rainfall, impacting critical services across the city. Vulnerable communities face building damage from ponded water when stormwater infrastructure is overwhelmed and increased energy demand for cooling in hot days.

Hazards

- Extreme weather
- Rainfall and flooding
- Higher temperature
- Drought
- Land instability



#7657

Taupō District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

The loss of winter tourism will significantly impact Taupō communities, influencing communities' mental well-being. Vulnerable communities, such as those on the eastern and southern lakefront, face potential isolation risks driven by hazards. Land instability in Waihi Village poses a risk to iwi/Māori as demand increases on marae and community facilities with possible damage to urupā and other places of cultural significance.

Economy

Increased temperature and fewer snow days will affect winter tourism in Taupō, while increased droughts will economically impact the rural sector by reducing stock productivity and raising agricultural costs. Seasonal changes and severe weather can also harm the forestry industry through reduced rainfall, wind damage to trees and increased fire risk.

Natural environment

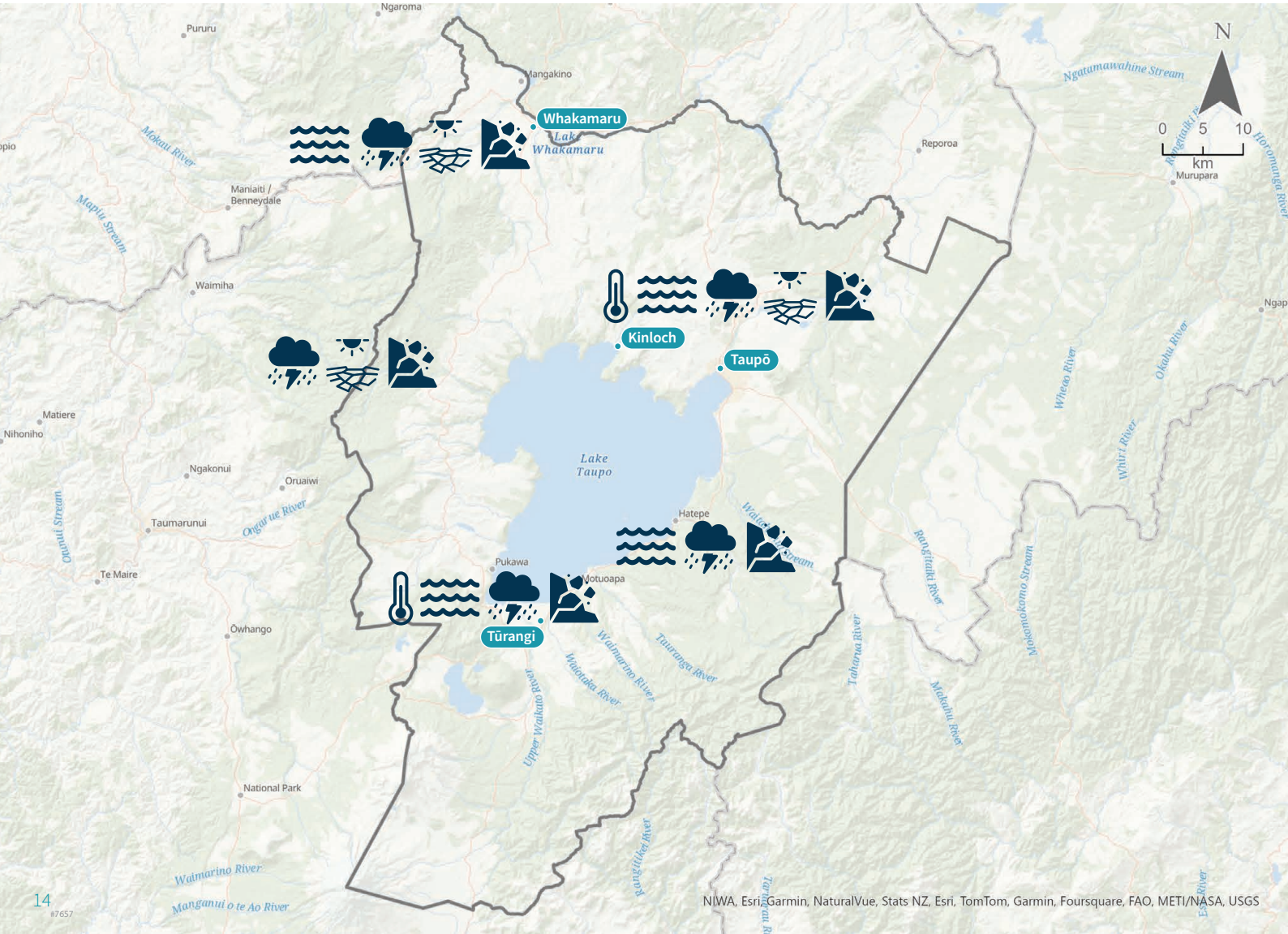
Warmer temperatures can negatively impact Lake Taupō's ecosystems, increasing algal blooms and biodiversity both in and around the lake. Increased rainfall and erosion can reduce water quality alongside increased run-off from urban centres like Taupō township and forestry areas.

Built environment

Critical infrastructure along SH1 and SH43 is vulnerable to flooding and land instability, and buildings along the eastern and southern shores of Lake Taupō are at risk of flooding, such as in Tūrangi, Tokaanu and Tauranga Taupō communites. Lake Taupō power generation is at risk during both high and low lake levels due to severe weather, drought and seasonality changes.

Hazards

- Extreme weather
- Rainfall and flooding
- Higher temperature
- Drought
- Land instability



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Ōtorohanga District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Vulnerable communities around Kāwhia and Aotea Harbours risk potential isolation driven by hazards like flooding and land instability. Flooding can also cause injury, impacting wellbeing and mental health in local communities, Ōtorohanga, Kāwhia and Aotea. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Increased temperature, droughts and increased flooding will economically impact the rural sector by reducing stock productivity, raising agricultural costs and impacting animal welfare. Severe weather events can also create significant economic costs for homeowners in vulnerable communities like Ōtorohanga and Kāwhia where flooding risk is highest.

Natural environment

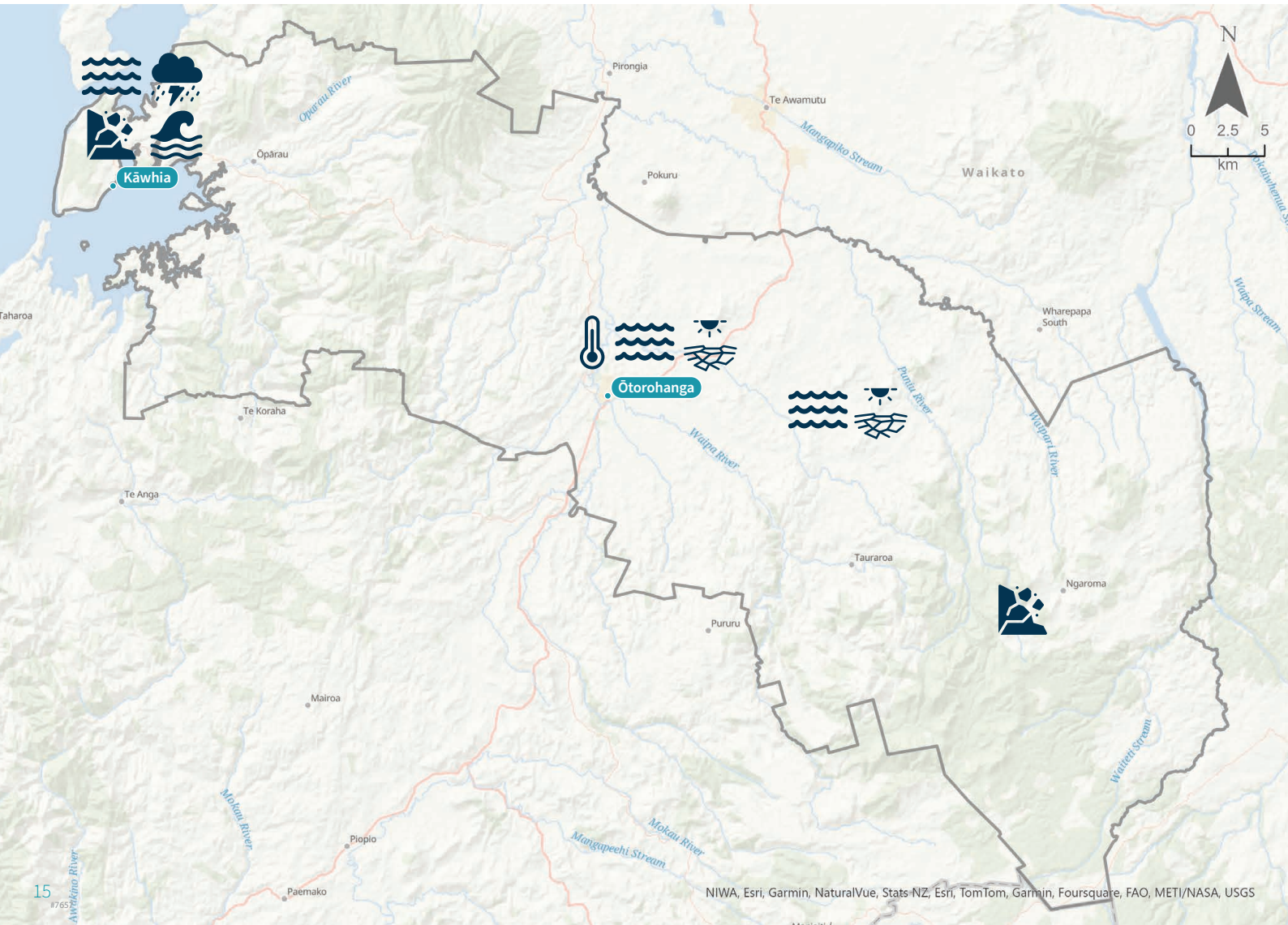
High country in Ōtorohanga is highly vulnerable to erosion and land instability, impacting native biodiversity. Kāwhia and Aotea Harbours may experience increasing sedimentation, marine heatwaves, acidification and sea-level rise impacting coastal ecosystems.

Built environment

Critical infrastructure in Ōtorohanga is at risk of damage from flooding, particularly from possible failure/overtopping of stopbanks protecting the township. Additionally, local roads and state highways across the district are vulnerable to flooding and land instability, isolating communities, particularly in the west of the district.

Hazards

- Extreme weather
- Rainfall and flooding
- Higher temperature
- Drought
- Land instability
- Coastal hazards



Waipā District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Higher temperatures in urban centres can harm vulnerable communities, increase heat-related illness, strain hospital systems and make outdoor activities less viable. Urban flooding can also cause injury loss of livelihood, impacting wellbeing and mental health. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Increased temperature, droughts and flooding will affect the rural sector by reducing stock productivity, raising agricultural costs and impacting animal welfare. Severe weather events can cause significant costs for homeowners along the Waipā, Puniu and Mangapiko Rivers. Additionally, changes in temperature, seasonality and rainfall may make gardening less viable, straining commercial production.

Natural environment

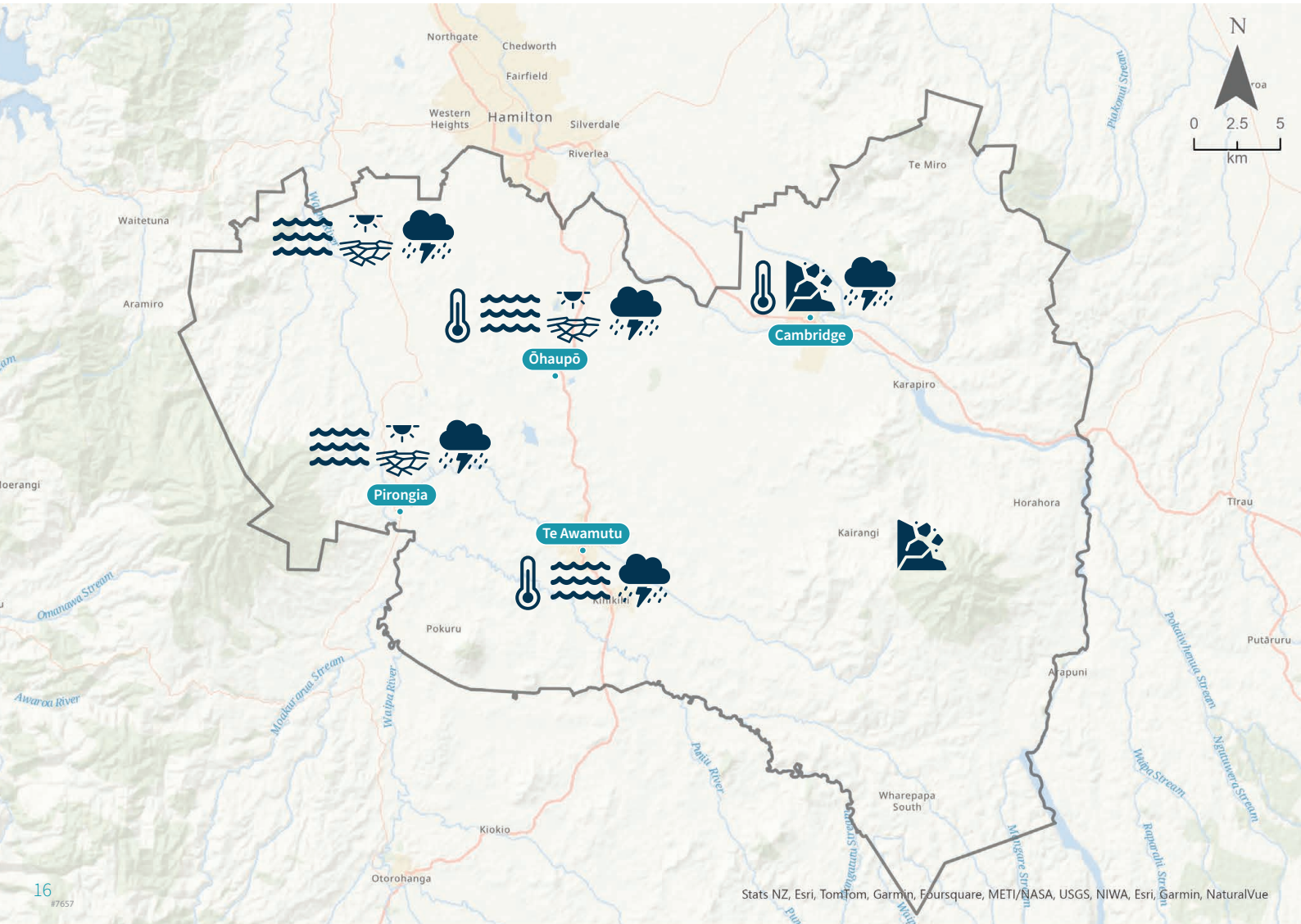
Waipā lakes and associated rivers are highly vulnerable to climate change, facing threats to water quality and biodiversity. Warmer temperatures can disrupt ecosystems, while increased rainfall and flooding can cause erosion, vegetation loss and sedimentation, impacting wildlife. Increased run-off from rural land can further decrease water quality in waterways across the district.

Built environment

Waipa's critical built infrastructure risks being inoperable during heavy rainfall, impacting critical services across key communities, like Cambridge and Te Awamutu. Vulnerable communities face building damage from ponded water when stormwater infrastructure is overwhelmed and increased energy demand for cooling on hot days. SH1 near Karāpiro is at risk of land instability, disrupting national transport.

Hazards

- Extreme weather
- Rainfall and flooding
- Higher temperature
- Drought
- Land instability



Stats NZ, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS, NIWA, Esri, Garmin, NaturalVue

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Waitomo District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Vulnerable communities like Awakino, Mōkau and Marakopa face isolation risks from flooding and land instability, making access to critical services difficult and impacting community cohesion. Coastal erosion and flooding can cause injuries, alongside economic stresses impacting wellbeing, and mental health. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Waitomo Caves is vital to the Waitomo District's economy. It provides jobs but also faces risks from heavy rainfall and land instability. Increased temperature, droughts and flooding affect the rural sector by reducing stock productivity, raising agricultural costs and impacting animal welfare. Severe weather events can also create significant costs for homeowners.

Natural environment

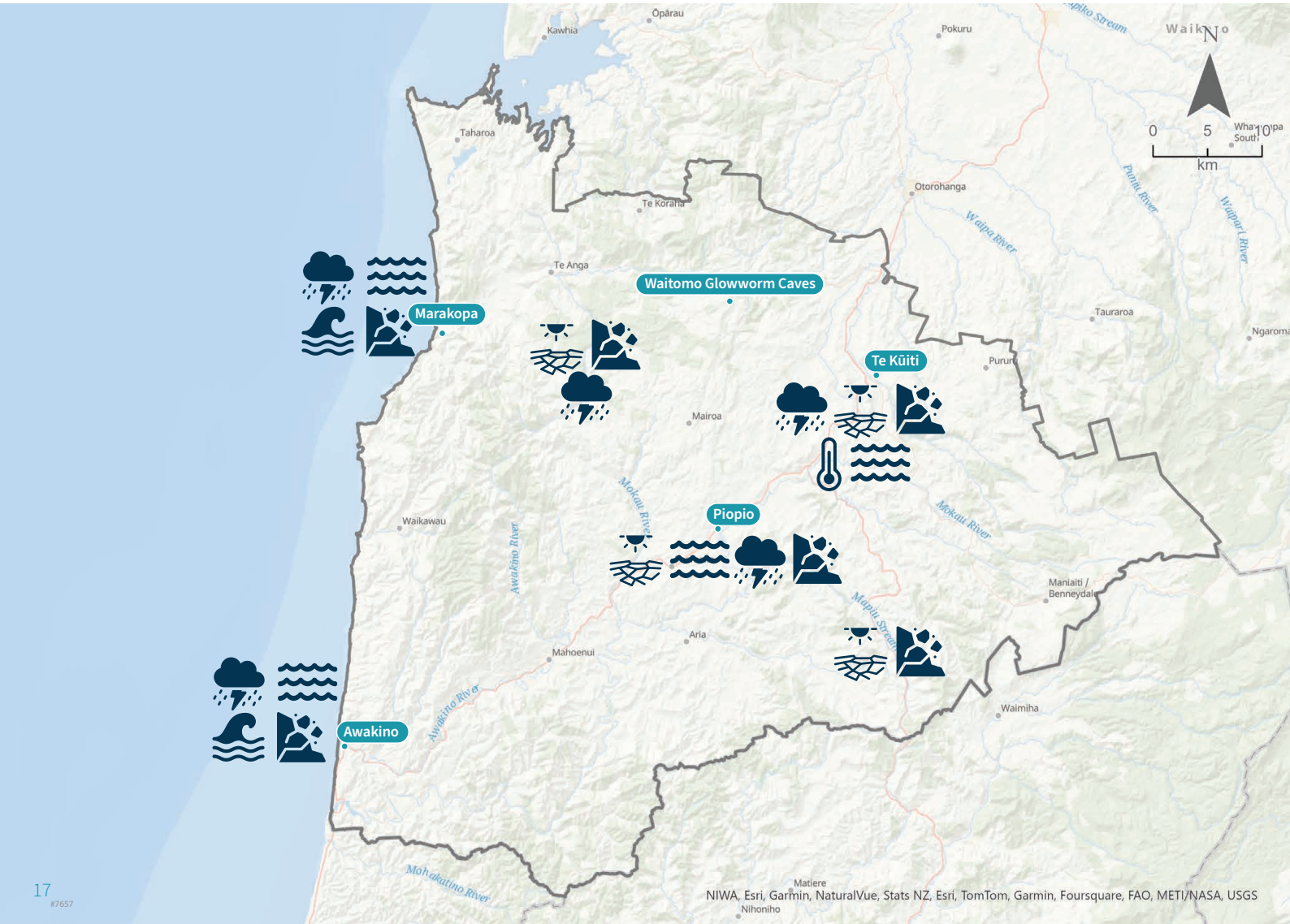
King Country is highly vulnerable to erosion and land instability, affecting native biodiversity and bush. Coastal erosion and sea-level rise at river inlets like Marakopa and Mōkau threaten coastal ecosystems, leading to coastal squeeze, increased sedimentation, marine heatwaves and acidification.

Built environment

Roading networks across the district are vulnerable to land instability, potentially isolating communities such as Awakino, Mōkau, and Marakopa. The North Island Main Trunk faces flood risk north of Te Kūiti. Te Kūiti and Piopio face building damage from ponded and river flooding when stormwater infrastructure is overwhelmed.

Hazards

- Extreme weather
- Rainfall and flooding
- Higher temperature
- Drought
- Land instability
- Coastal hazards



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Hauraki District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Increased temperature may lead to risks to human health from heat related illness and make outdoor activities less viable impacting social and mental wellbeing, alongside community isolation and economic stress from drought. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Increased temperature, drought conditions and river flooding will affect the rural sector by reducing stock productivity, raising agricultural costs and impacting animal welfare. Reduced water availability poses a significant risk as the district relies heavily on this resource.

Natural environment

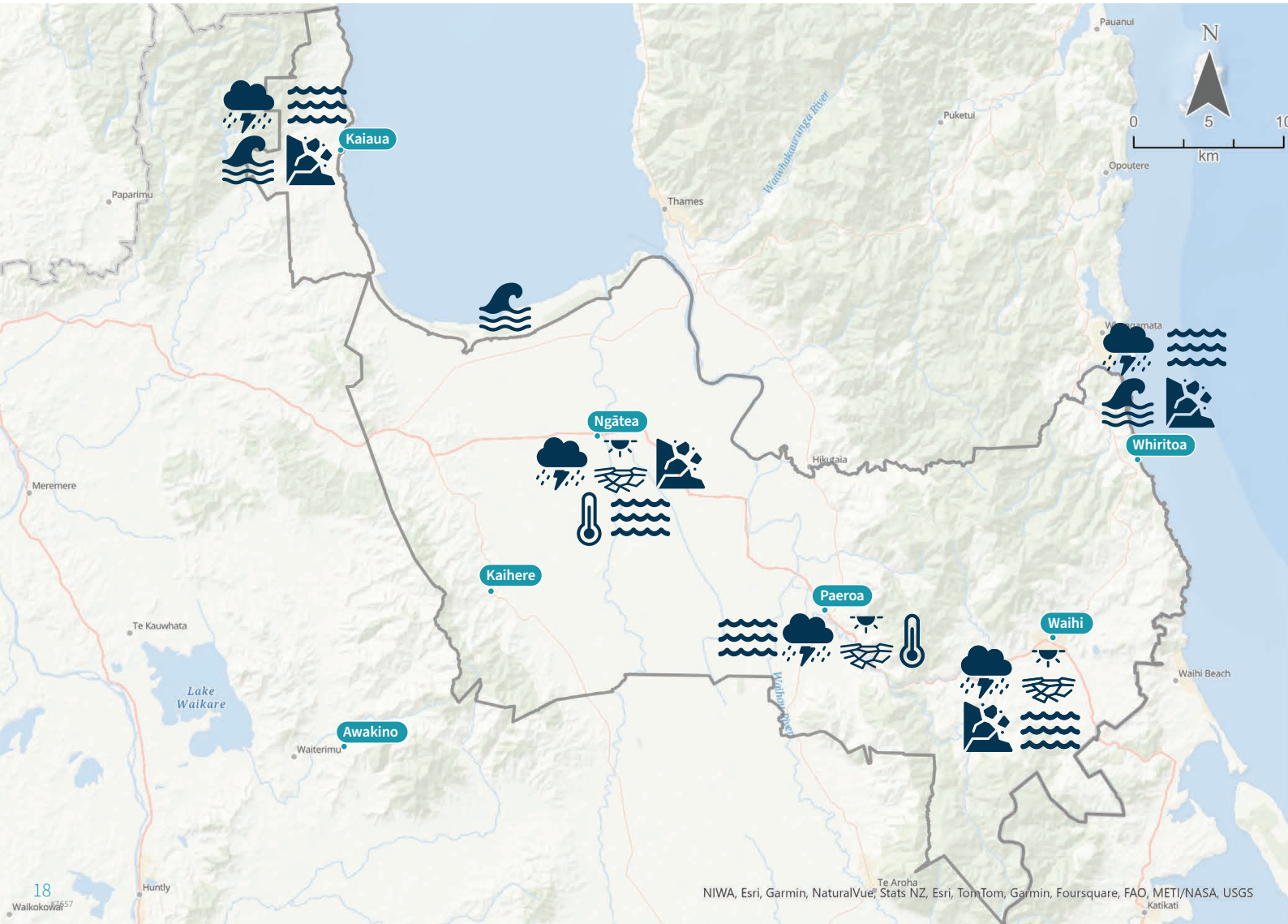
The district faces increased risks in coastal and terrestrial environments such as the Pūkorokoro-Miranda and Kopuatai Wetland Ramsar sites. Water quality across the district is also at risk from increased coastal and inland flooding, higher temperatures and drought conditions.

Built environment

SH2 is a significant transport route at risk from flooding (inland and coastal) and land instability, which would reduce the community's ability to move across the district. Flood risk management infrastructure risks being overwhelmed by extreme weather events leaving critical infrastructure and buildings vulnerable to damage.

Hazards

- Extreme weather
- Rainfall and flooding
- Higher temperature
- Drought
- Land instability
- Coastal hazards



Rotorua District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for that part of the district which is within the Waikato region. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Increased temperature may lead to risks to human health from heat-related illness and make outdoor activities less viable impacting social and mental wellbeing, alongside community isolation and economic stress from drought.

Natural environment

Increase in severe weather can lead to increased run-off from forestry and native bush, which reduces water quality. Native vegetation, biodiversity and forestry are at risk of fire from increased temperatures.

Economy

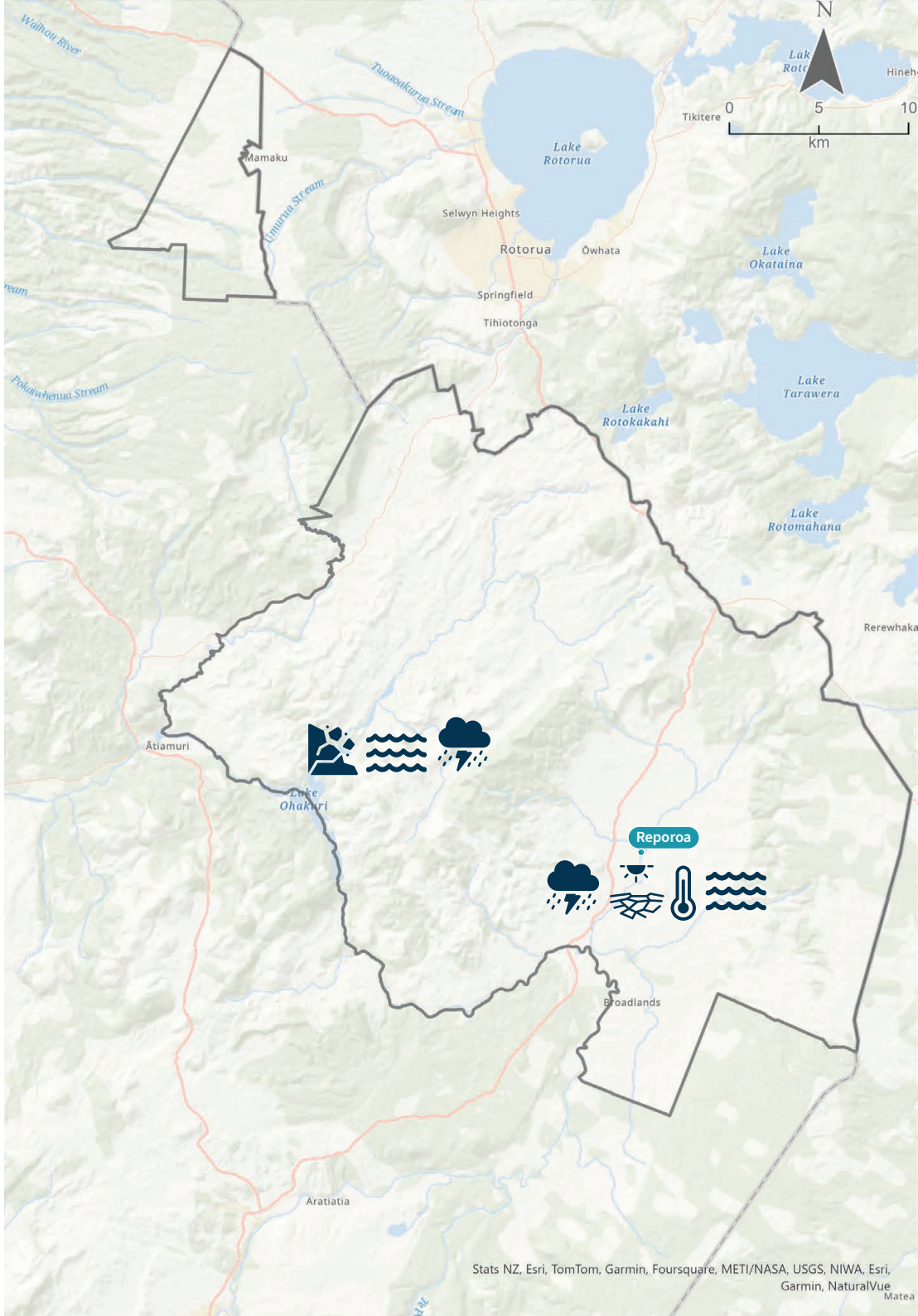
Increased temperature, droughts and increased flooding will economically impact the rural sector by reducing stock productivity, raising agricultural costs and impacting animal welfare.

Built environment

Agricultural infrastructure and buildings in and around Reporoa are at risk from flooding.

Hazards

- Extreme weather
- Drought
- Rainfall and flooding
- Land instability
- Higher temperature



South Waikato District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Impact on the forestry industry reduce wellbeing in communities that work in the industry. Urban flooding can cause injury and loss of livelihood impacting wellbeing and mental health. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Increased temperature, droughts and river flooding will economically impact the rural sector by reducing stock productivity, raising agricultural costs, and affecting animal welfare. Seasonal changes and severe weather can also impact the forestry industry through reduced rainfall, wind damage to trees, and increased fire risk.

Natural environment

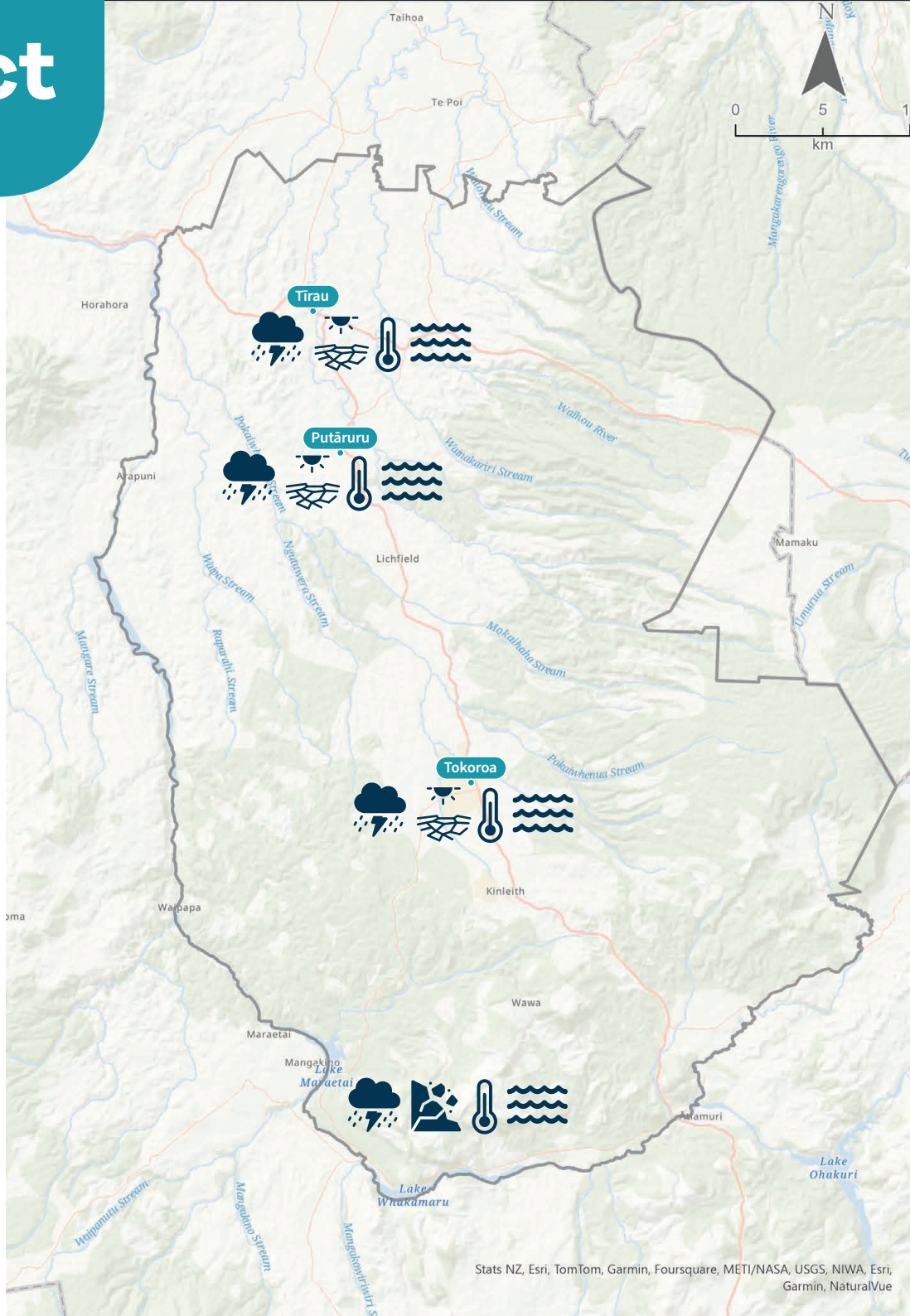
Increase in severe weather can lead to increased run-off from urban, forestry and native bush reducing water quality and impacting tourist destinations across the district, like the Blue Springs. Native vegetation, biodiversity and forestry is at risk of fire from increased temperatures.

Built environment

South Waikato's critical infrastructure may fail during heavy rainfall, affecting services in Tīrau, Putāruru and Tokoroa. Vulnerable communities risk building damage from overwhelmed stormwater systems. Waikato River power generation is at risk from severe weather, drought and seasonal changes.

Hazards

- Extreme weather
- Drought
- Rainfall and flooding
- Land instability
- Higher temperature



Thames-Coromandel District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Community isolation is a significant risk for the district, leading is access issues to community, critical services and education. Isolation and loss of community cohesion can impact community wellbeing. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Tourism, a key contributor to the district's economy, faces significant risks from various hazards. Continuous impacts on critical infrastructure can increase the economic burden on the community and lead to higher inflation for transported produce and goods. Homeowners may also face increased economic costs due to higher maintenance and insurance expenses. Additional impacts may affect the aquacultural industry.

Natural environment

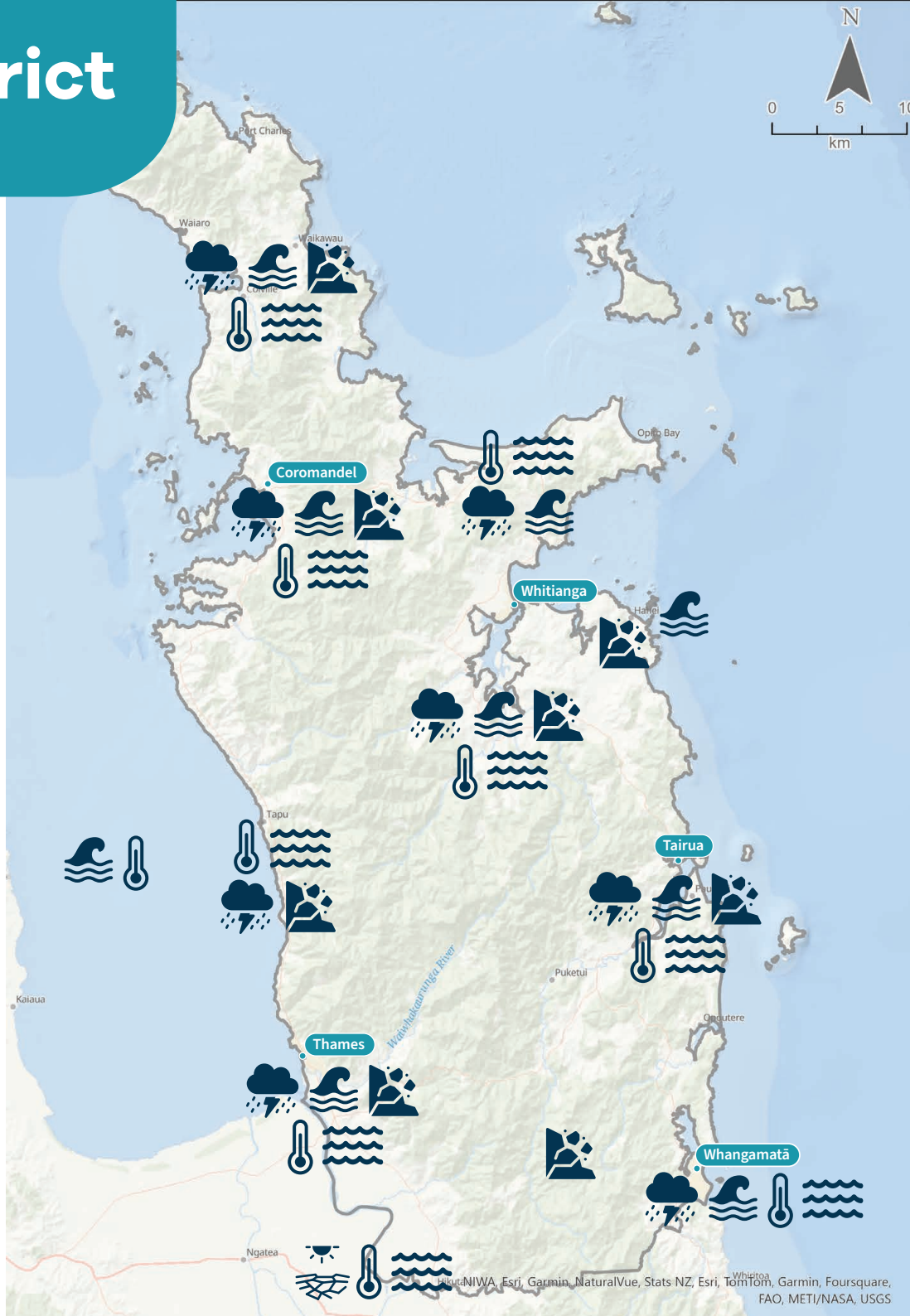
The Hauraki Gulf, a significant marine reserve for the region and New Zealand, is among the most at-risk ecosystems. Increased marine temperatures and ocean acidification have already caused sponge bleaching and disrupted marine food chains and wildlife.

Built environment

All roading networks in the district are at risk from multiple hazards, isolating communities and disrupting regional connections. Key impacts are driven by land instability, flooding and sea level rise. SH25 at Coroglen, Manaia, Kūaotunu, Tairua, Whangamatā and Thames is highly vulnerable to several hazards influencing transport across the district. Buildings and critical infrastructure across the district are also at high risk from flooding and land instability impacts.

Hazards

- Extreme weather
- Rainfall and flooding
- Higher temperature
- Drought
- Land instability
- Coastal hazards



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Waikato District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Coastal communities like Port Waikato and Raglan face isolation risks from flooding and land instability, which can cause injuries and affect well-being, alongside low-lying inland communities such as Ngaruawahia and Huntly. Many marae near the Waikato River and low-lying coastal areas are at risk of flooding. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Natural environment

Whangamarino Wetland, a key Ramsar site, faces climate hazards affecting water quality and biodiversity. Warmer temperatures disrupt ecosystems, while increased rainfall, flooding and erosion cause vegetation loss and sedimentation, impacting wildlife. Coastal erosion and sea level rise at Port Waikato and Raglan also threaten coastal ecosystems, causing coastal squeeze and increased sedimentation.

Economy

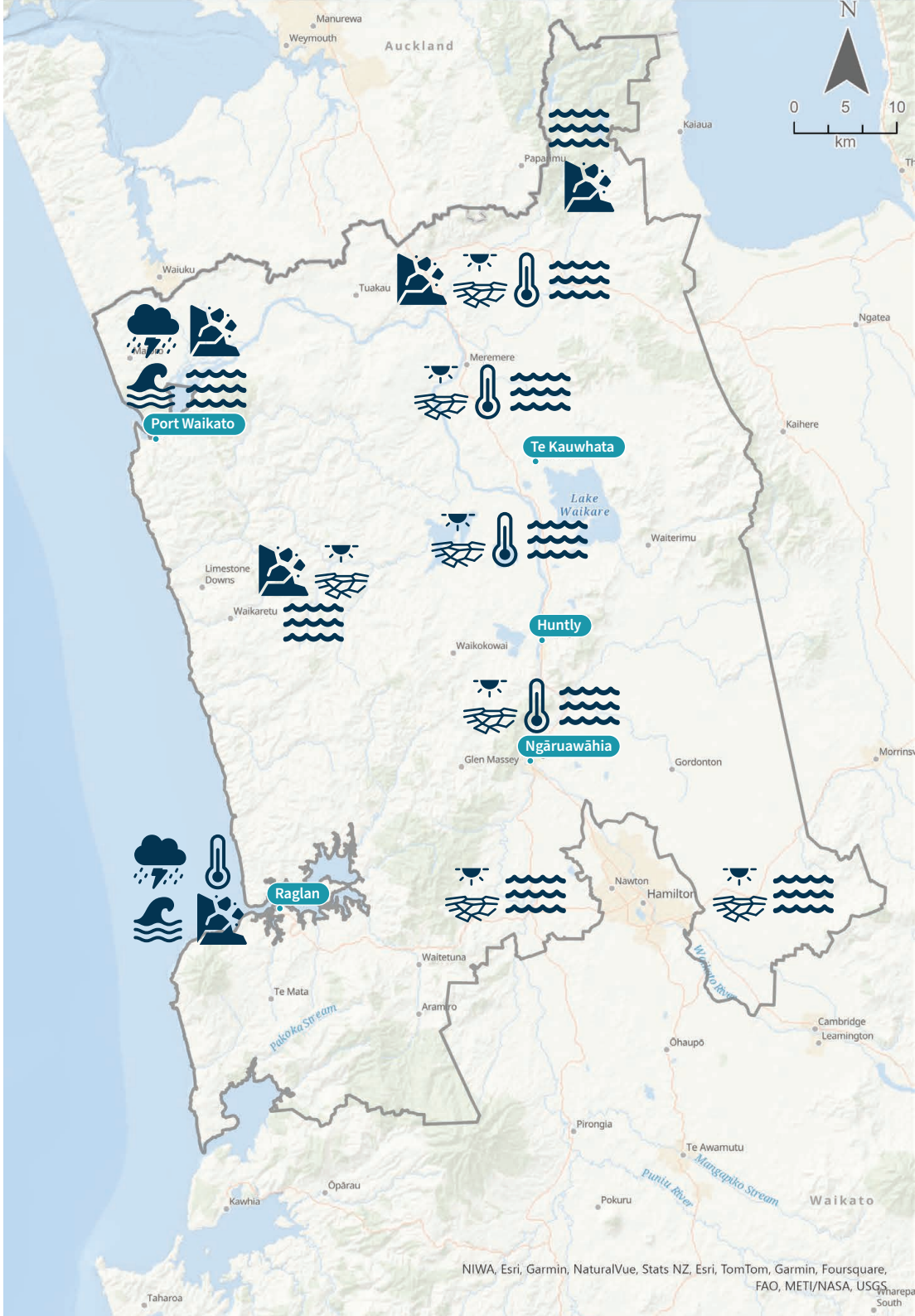
Increased temperature, drought and heavy rainfall threaten Franklin's horticultural industry, straining production. Severe weather events can cause significant economic costs for homeowners. Additionally, increased river and ponding flooding will financially strain lower Waikato farmers, affecting their economic sustainability.

Built environment

Roading networks in the district are vulnerable to land instability, potentially isolating communities like Raglan and Port Waikato. SH1 and the North Island Main Trunk are at risk of managed flooding at Rangiriri during high river flows in the Waikato River. Many communities, such as Huntly and Rangiriri, face critical infrastructure failure from possible stopbank failure or overtopping. Coastal community assets, like the Sunset Beach carpark, are at risk of coastal inundation and erosion.

Hazards

- Extreme weather
- Drought
- Rainfall and flooding
- Land instability
- Higher temperature
- Coastal hazards



Matamata-Piako District

Climate change hazards and risks

This map provides a high-level overview of key climate hazards and risks for the district. It should not be interpreted as showing all climate hazards, risks and all locations.

Human

Higher temperatures may harm vulnerable communities, increase heat-related illness and impact outdoor activities (work, recreational, walking and cycling). Extreme weather and flooding may cause injury, isolate communites, and impact physical and mental wellbeing. Demand on marae and community facilities may increase with possible damage to urupā and other places of cultural significance.

Economy

Higher temperatures, drought and flooding may reduce rural sector productivity and impact animal welfare. Extreme weather will influence the cost of properties and business owners from direct damage, loss of essential services and loss of tourism. Changes in temperature, seasonality changes, rainfall and water availability impact farming and horticulture systems, which affects the overall economic wellbeing of the district.

Natural environment

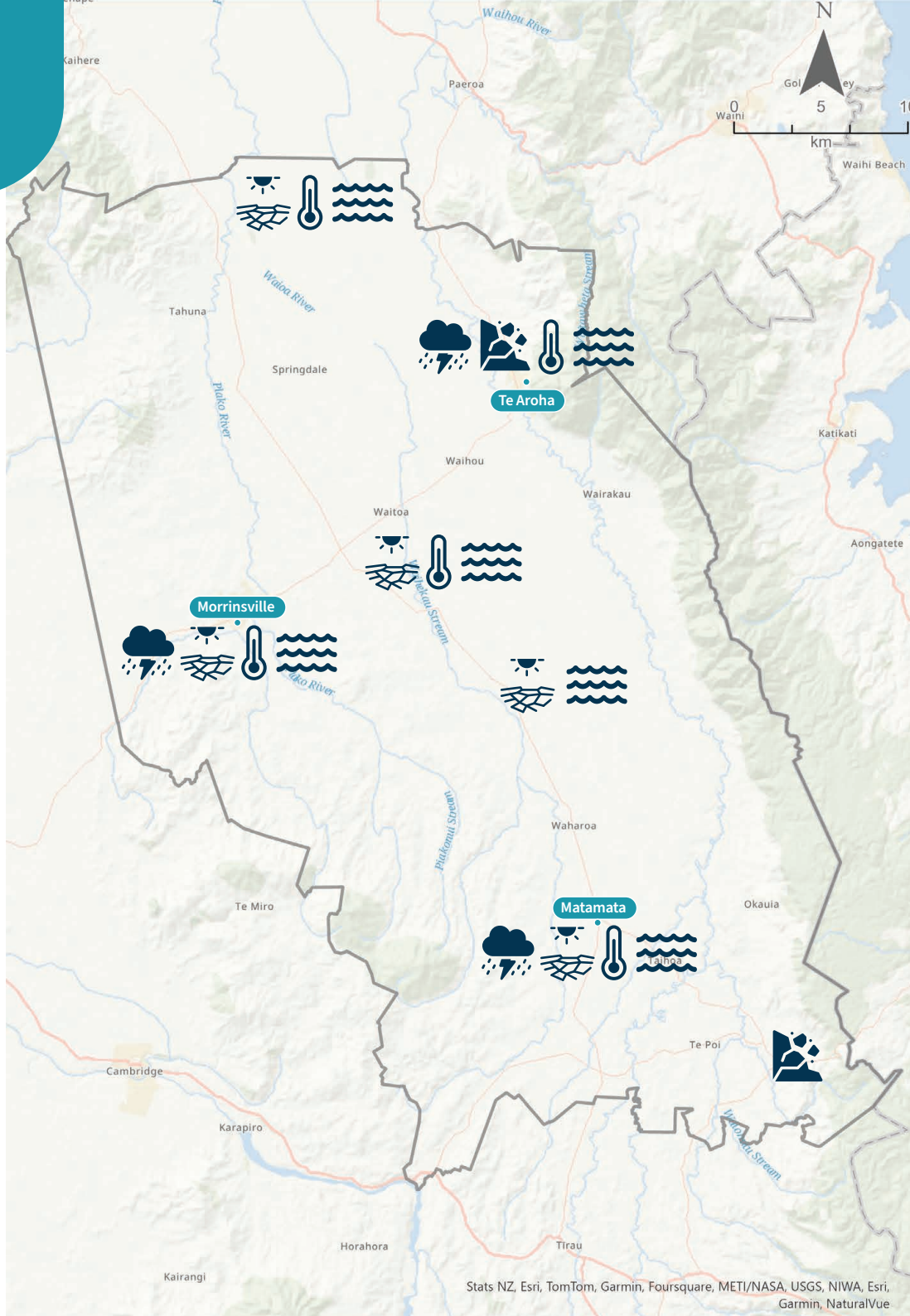
Kopuatai Dome is a significant Ramsar wetland site for the district and is at risk from multiple climate hazards including threats to water quality and biodiversity. Warmer temperatures can disrupt ecosystems, while increased rainfall, flooding and erosion can lead to vegetation loss and sedimentation, impacting wildlife.

Built environment

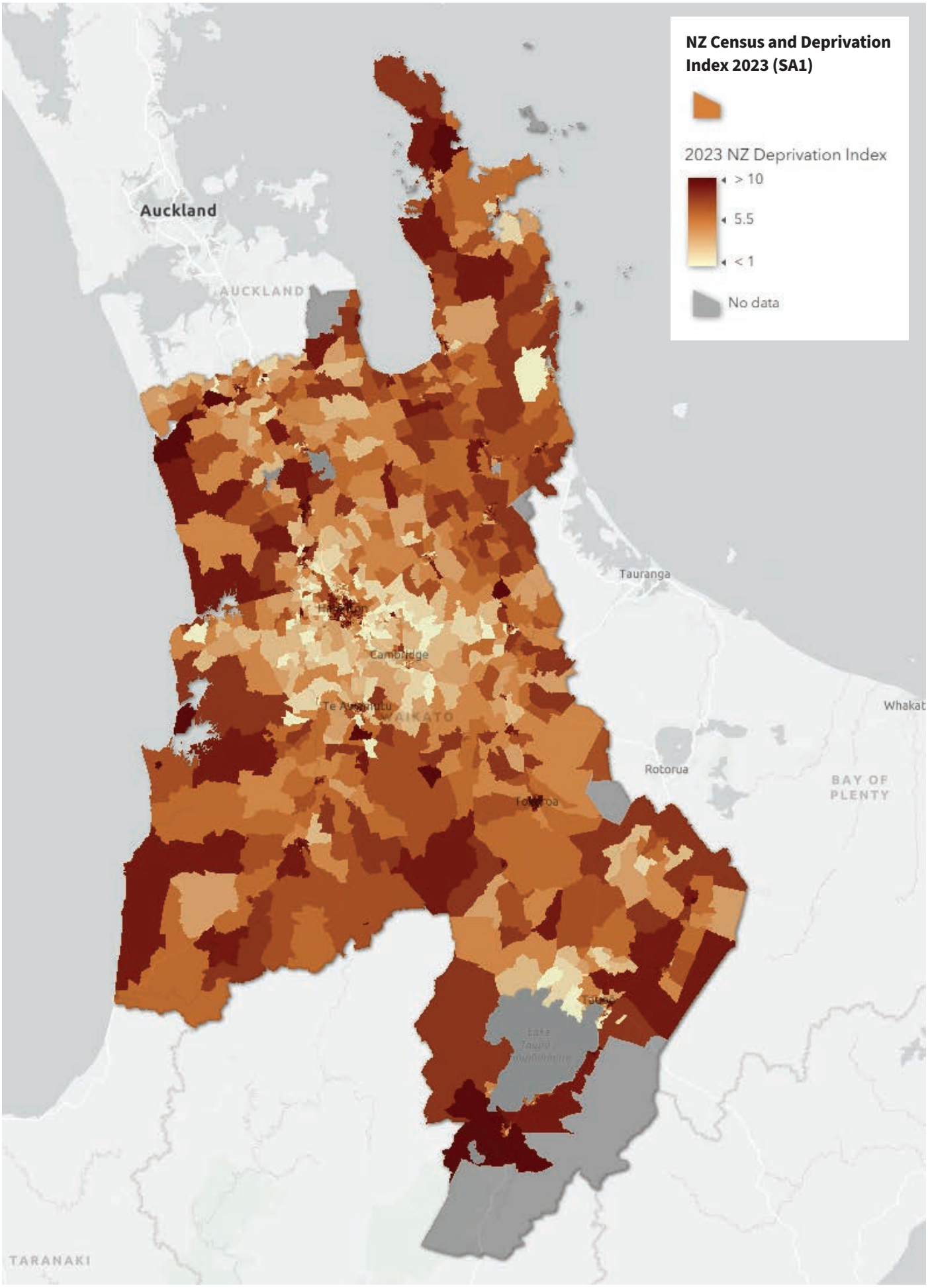
SH 29 across the Kaimai Range is vulnerable to land instability, affecting transportation to the Bay of Plenty and local roads and buildings in Te Aroha. Heavy rainfall can render critical infrastructure inoperable, leading to loss of services in vulnerable communities like Te Aroha. These communities also face building damage from ponded water when stormwater systems are overwhelmed and increased energy demand for cooling on hot days.

Hazards

- Extreme weather
- Drought
- Rainfall and flooding
- Land instability
- Higher temperature



Map of social deprivation across the Waikato region



Overview of social deprivation index for the Waikato region from the 2023 New Zealand census (Stats NZ, 2023)

Waikato
REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

He taiao mauriora **Healthy environment**

He hapori hihiri **Vibrant communities**

He ōhanga pakari **Strong economy**

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Private Bag 3038, Waikato Mail Centre,
Hamilton 3240, New Zealand
0800 800 401 waikatoregion.govt.nz