



# Community Adaptation Programme

## Recommendation report

Report for the Far North District Council

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# Executive summary

**This report recommends sites for Council-supported, community-led, adaptation planning projects.**

On 11th December 2023, Council endorsed the FNDC Climate Action Policy 11/12/23 as recommended by Te Koaka/Te Ao Maori committee. A core component of this policy is Council's planned work across the district to adapt to a changing climate, including supporting the development of community adaptation plans.

In late 2022, staff were instructed to identify communities where adaptation planning is most needed, and where council should support the development of adaptation plans. Specific criteria were identified by Councillors to guide staff in the selection of communities.

**Recommendations are based on detailed risk and vulnerability analyses of hazards and climate change impacts.**

An evidence-based approach using a detailed spatial risk analysis was employed to identify the level of exposure and vulnerability of communities across the Far North District. Risk was assessed across four types of hazards (coastal erosion, coastal flooding, river flooding and tidal inundation), at a range of timeframes from present-day to 2130.

The effects of climate change such as increased rainfall intensity and sea level rise were included. Impacts on a range of community values and council assets were quantified, and a weighted multi-criteria analysis used to collate results for mapped 'adaptation project areas'.

**While many people and places across the north are exposed to climate hazards, some locations are at higher risk.**

The results show that many communities across the district are impacted by hazards, that impacts will increase over time, and that impacts differ between communities according to the community values or assets considered.

Areas with the highest-ranking risk scores across a range of hazard scenarios and timeframes were Hokianga harbour, Kaeo, Herekino and Whangape harbours, and Waitangi-Paihia area.

**Recommended sites are phased to balance geographic representation, community needs and available resources.**

The recommended multi-year programme of community adaptation planning projects covers communities across the district facing the greatest risks. These are broadly grouped into geographic areas and phased in four delivery stages, aligned with LTP cycles.

Recommended adaptation planning starts with Stage one projects in Hokianga, and Herekino-Whangape harbours (2024-26), followed by Stage two projects in Kaeo and Waitangi-Paihia (2027-29). Stage three (2030-32) includes adaptation planning for communities in Awanui, Ahipara and Doubtless Bay. Stage four (2033-35) covers coastal settlements from Matauri Bay south to Rawhiti.

**Recommendations are based on robust risk analysis, but should be tested by community engagement**

The recommendations are based on desktop evaluation of risks, and require engagement and testing with those communities prior to initiation. In addition, a flexible planning approach will need to be taken, with regular revisions to account for changing circumstances such as natural hazard events, major infrastructure projects or external funding opportunities.

The first step in beginning an adaptation planning project involves a detailed scoping process to define what's included in an appropriate local adaptation planning process – this is not included in this report. Project scoping will require careful consideration of the different risks to, and needs and aspirations of, the local communities, and balancing these with the available resources to deliver a successful process.

# 1. Our recommendations

## 1.1. Key recommendations

The following recommendations are based on the evidence generated by the risk assessment and multi-criteria analysis:

### A. The programme

Communities within the following adaptation project areas should be prioritised for adaptation planning over coming years (see Section 2 for the rationale):

#### **Stage One (2024-2026)**

- Hokianga harbour
- Herekino and Whangape harbours

#### **Stage Two (2027-2029)**

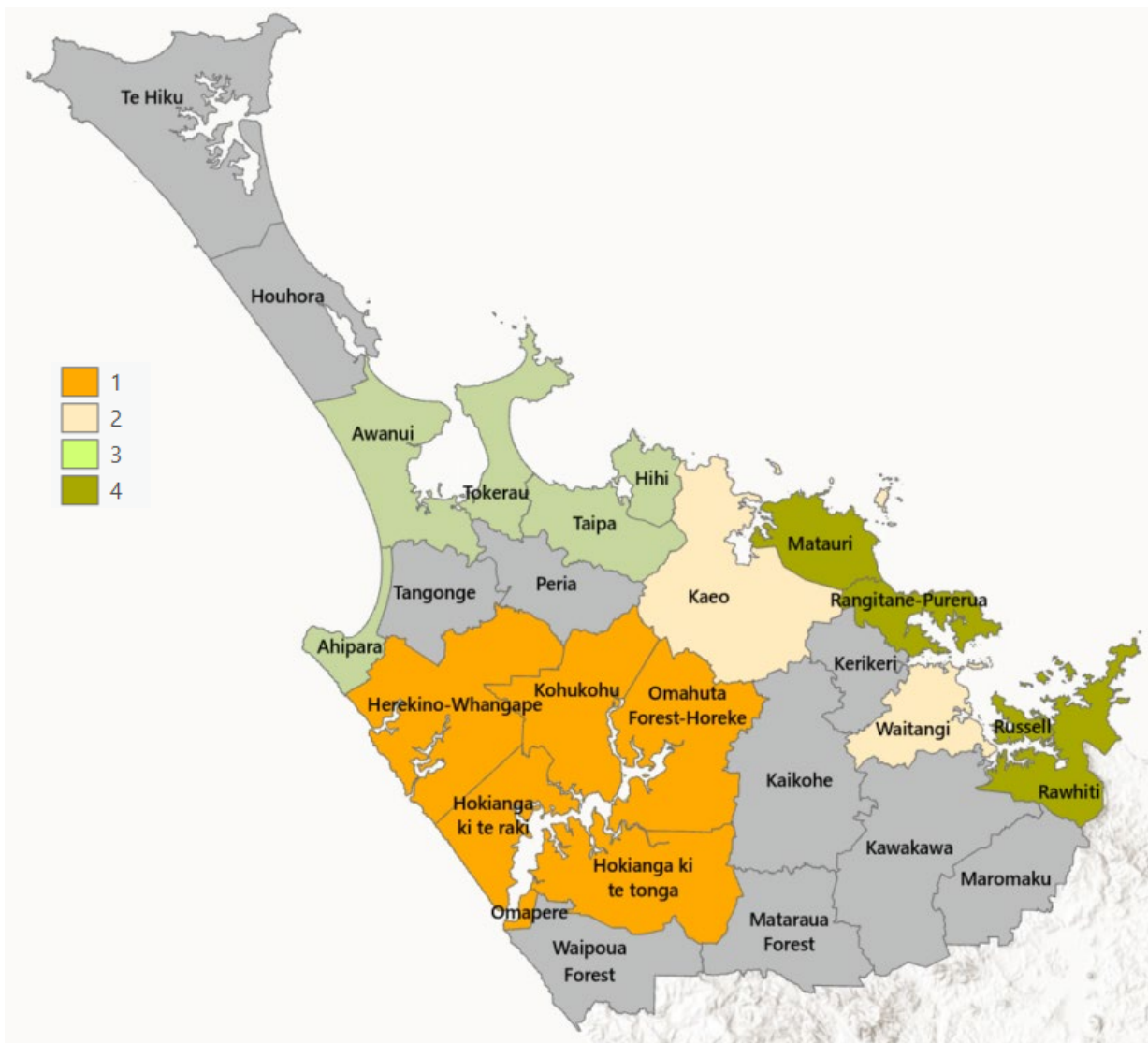
- Kaeo
- Waitangi-Paihia

#### **Stage Three (2030-32)**

- Doubtless Bay (Taipa-Hihi)
- Awanui
- Tokerau
- Ahipara

#### **Stage Four (2033-2035)**

- a. Matauri and Rangitane-Purerua
- b. Russell and Rawhiti



Stage	Indicative year	Adaptation project areas
<b>Stage one</b>	2024-26	Hokianga ki te tonga Kohukohu Hokianga ki te raki Omahuta forest- Horeke Omapere Herekino-Whangape
<b>Stage two</b>	2027-29	Kaeo Waitangi-Paihia
<b>Stage three</b>	2030-31	Awanui Ahipara Taipa Tokerau Hihi
<b>Stage four</b>	2033-35	Matauri Rangitane - Purerua Russell Rawhiti

## **B. Other considerations**

We recommend that additional considerations that were out of scope for this report should also be taken into account by Council when confirming adaptation planning site locations. These include, for example, the degree of community readiness and level of engagement, and the existence of any planned or upcoming major projects or infrastructure works.

Council will also need to consider the level of resourcing made available to support community adaptation planning projects including LTP funding, staff capacity and capability, and any external support or funding available.

The timeframes and phasing order are indicative of the level of risk based on information available. Council may wish to reassess the recommended phasing in light of other considerations or information.

## **C. Next steps**

We further recommend that engagement and consultation with the relevant iwi-hapu, and key community representatives should be undertaken as soon as possible to confirm the support and commitment of the respective communities.

Following affirmation from iwi-hapu and communities, the necessary preparations for adaptation planning should begin. Preparations should include early community engagement, project scoping, project governance and hazard and risk assessments. These should be undertaken prior to starting a structured adaptation planning process.

Appropriate adaptation planning methodologies should be developed in response to the needs of tangata whenua, and as appropriate for different communities, including addressing the desire or requirement for tangata whenua-led adaptation planning processes to address specific issues or risks to cultural assets or taonga.

## **D. Future programme flexibility**

A flexible approach should be taken by Council that allows the programme to respond to changes in external circumstances that could alter the timeframes or phasing of the programme. This could include, for example the opportunities and availability (or lack thereof) of external funding, or a major hazard event occurring.

While the above programme is based on robust available climate risk data, over time additional information, modelling or data on future climate risks (such as impacts of drought and groundwater salination, wildfire or public health impacts), are likely to become available. Such risks should be assessed and included as part of an updated and integrated risk assessment process.

The programme should be reviewed each three years as part of Council's Long-term planning cycle, with progress toward project objective and timeframes monitored and reported as appropriate.

Where there are communities that are not included in the programme that express a wish to undertake community adaptation planning, we recommend that a responsive and flexible approach be taken by Council to consider their case. Support for projects initiated and led by tangata whenua or communities should be considered on a case-by-case basis, and supported alongside the programme to the degree that funding allows.

## 1.2. About the recommended programme

The recommended programme has four Stages that are geographically aligned, covering a 12-year period (4 x LTP cycles) and includes areas that show the highest level of relative risk and vulnerability to the type of hazards included in the risk assessment.

This programme has not undertaken a detailed scoping process for each adaptation project area. A robust and comprehensive scoping process for each project area will be essential to ensure that communities, locations and assets with the highest risk and greatest needs are addressed within the project, while balancing the timeframes, costs and resourcing available. It is likely that within each project area, not all locations will require detailed adaptation pathways plans. Focusing on specific issues will enable each project to be completed successfully within the timeframes of the programme.

Given expected internal resourcing and funding (i.e. a small adaptation team with \$100-200k operational funding p.a., with ongoing increases over successive LTP cycles), we expect that the programme should be achievable with appropriate external professional support.

The recommended programme assumes that \$650,000 in external funding applied for through the Flood Resilience Fund will be available as of beginning 2024 to support Stage One, given the large geographic area and potential complexity of planning with many different communities.

## 1.3. Short summary of the risk assessment

### Overview of the process

A geospatial exposure assessment was undertaken using the most up-to-date climate hazard modelling available. Exposure of a range of community values and council assets was quantified, and an assessment of vulnerability undertaken to assess the degree of damage likely for given assets under specific hazard scenarios.

Results were combined using a weighted multi-criteria analysis process that assigned impact and importance scores, using groupings based on evaluation criteria provided by Councillors. Sensitivity testing using a range of weightings and scenarios was used to develop risk scores to test the different criteria.

Results were exported to an interactive risk viewer (the Resilience Explorer) and interrogated to develop recommendations for the planning and phasing of adaptation planning projects across the district.

### Highlights of the risk assessment results

**Herekino and Whangape harbours** show very high overall risk scores, ranking third overall for both exposure and vulnerability, and highest risk for Māori cultural assets. The assessment shows that two marae and around 10km of roads or state highways are exposed to most high tides with 1.2m of sea level rise. Four marae and 53 buildings on Māori land are projected to be within flood zones for a one-in-100yr coastal and river flooding event with 1.2m of sea level rise.

**Hokianga harbour** has very high exposure to tidal inundation of roads and state highways, with nearly 44km of roads expected to be underwater every high tide with 1.2m of sea level rise. Given the isolated nature of many these communities and the lack of alternative access, this is especially significant. Hokianga harbour has 12 marae and 235 buildings on Māori land exposed to a one-in-100yr coastal and river flooding event with 1.2m of sea level rise.

**Kaeo.** Kaeo ranks highest across the district for overall risk scores, and ranks second highest for Māori cultural assets. Kaeo also shows high risk scores to transport networks. The analysis for Kaeo shows that two marae, 28 buildings on Māori land and 140 homes are exposed to a one-in-100yr coastal and river flooding event with 1.2m of sea level rise.

Over 16km of road is projected to be inundated by most high tides with 1.2m of sea level rise, including 5.6km of state highways.

**Waitangi-Paihia**, which includes the nationally significant cultural elements of the Treaty grounds, and Te Tiriti o Waitangi marae, as well as the commercial areas of Paihia and Opuia, shows high exposure to a range of hazards across all elements. Of note are nearly 70 homes exposed to tidal inundation with 1.2m of sea level rise, and over 3km of roads and state highways exposed to coastal erosion under 1.5m of sea level rise.

**Taipa** ranks fifth highest in risk when social vulnerability is considered. The area has nearly 14km of roads expected to be inundated at high tide with 1.2m of sea level rise, and 70 houses affected by a one-in-100yr coastal flooding event with 1.5m of sea level rise.

In **Awanui**, 26 buildings on Māori land are exposed to tidal inundation under 1.2m of SLR, with 53 in the coastal flood zone. 14km of roads and state highways are projected to be underwater at high tide with 1.2m of SLR. Significant existing issues already occur with overtopping of coastal stopbanks at king tides and storm surge events.

In **Ahipara**, one marae, 288 homes, and nearly 3.3km of roads and state highways exposed to coastal erosion under 1.5m of sea level rise. 172 houses are exposed to a one-in-100yr coastal and river flooding event with 1.2m of sea level rise.

While not highly ranked for total risk, **Tokerau** shows high exposure of residential buildings to coastal flooding (276) and coastal erosion (203) under 1.5m of sea level rise, with nearly 3.5km of road exposed to coastal erosion under 1.5m of sea level rise.

Other locations of notable risk include East coast communities in the **Bay of Islands-Whangaroa** community board area, including Matauri Bay, Te Tii, Russell and Rawhiti. Matauri and Te Tii locations areas alone show nearly 160 homes exposed to coastal flooding under 1.5m of sea level rise.

## 2. Rationale for the recommendations

### 2.1. Context

#### 2.1.1. Background

Climate change is already affecting communities in the far north. The effects will be experienced differently across the district as time goes on. This is likely to mean that the way Council currently delivers services such as infrastructure and land-use planning may need to change as hazards and stressors like sea level rise, coastal erosion and flooding significantly influence environmental conditions, and in turn, community wellbeing.

Given the high level of uncertainty regarding the timing and severity of climate impacts, councils need to adopt a flexible approach to planning for adaptation. It's also important that major decisions or plans around adaptation are co-developed alongside iwi-hapu and communities. Community adaptation planning is an approach to decision-making that enables flexible plans to be made that can be robust against many future scenarios, by working with tangata whenua and communities.

However, adaptation planning takes considerable resources to deliver and implement. Therefore, while it's important to consider climate impacts and adaptation across the whole of the far north, we can't do adaptation planning in all locations at the same time.

#### 2.1.2. What this report does

This report was commissioned alongside a spatial risk assessment and multicriteria analysis process to provide evidence for a risk-informed decision-making process. The evidence informs the phasing of Council-led community adaptation planning processes across the Far North district into the recommended programme.

The report also outlines how the site selection criteria proposed by Council were used to prioritise sites, and how the results of the risk assessment and multi-criteria analysis support the recommended programme.

#### 2.1.3. Scope of the report

Recommendations in this report are based predominantly on information from the risk assessment, including the comparative level and timing of known risks and vulnerability. Other considerations such as community readiness, level of engagement and future work programmes should be considered by Council but were agreed to be outside the scope of this report.

The programme does not provide detailed methods to be used to develop adaptation plans specific to each location. For each community, an appropriate approach to developing an adaptation plan will need to be developed in collaboration with local iwi-hapu and communities, and articulated in a project scoping report.

#### 2.1.4. Tangata whenua and adaptation planning

Many of the communities in the Far North where adaptation planning is recommended have high proportions of Māori residents. Prior engagement with hapu representatives indicates that where Māori land, cultural assets and/or areas of significance are likely to be at high risk by climate-related natural hazards, the development of adaptation plans may need to be led fully or partially by the local tangata whenua.

However, we recognise that there is also the need for Council and other stakeholders to be involved in many instances, given the important role that planning rules, services, and infrastructure assets play in providing community resilience



and adaptive responses to climate change. The broader community will also need to be involved, including a wide range of stakeholder perspectives. Hence the process of adaptation planning will need to be collaborative.

Nonetheless, having tangata whenua involvement and leadership at the core of an adaptation planning process is crucial. It is not the role of this report to define what that looks like, given that how it will be applied may differ between each iwi, hapu, marae and whanau and between geographic locations.

From the very start of preparation for the development of an adaptation plan, a process to enable Māori values, science/mātauranga, and tikanga needs to be worked through with the relevant Māori levels of authority. This process must be embedded in the methodology as needed for each locality. Additional guidance for adaptation planning has been provided to staff which offers some suggestions to support this process, such as a Kaupapa Māori risk assessment, which will need to be worked through locally with hapu and iwi as relevant.

Likewise, the selection of locations and communities for a Community Adaptation Planning Programme needs to be informed by conversations with relevant iwi-hapu partners. The recommendations and risk assessment information in this report should be socialised with relevant tangata whenua groups such as Te Kahu o Taiunui, and other Council iwi-hapu liaison groups before final decisions are made.

We also recommend that Council conducts early engagement activities with the highest-risk communities to gauge the level of interest and readiness for embarking on what may be a challenging process of adaptation planning.

## **2.2. The process of prioritising locations for adaptation planning**

### **2.2.1. Councillor-defined selection criteria**

In December 2022, FNDC councillors voted on criteria that should be used to identify communities where adaptation planning would start. The results of the poll are shown below in Table 1 below. The top four criteria identified by councillors were '*Exposure to coastal hazards*', '*Honouring Tiriti*', '*Critical community lifelines*', and '*What's at stake*'. The criteria were used both as a guide to grouping datasets in the risk assessment process, and as specific questions to guide the selection process.

Criteria assessed	Criteria	Score	Normalised score
Adaptation project area prioritisation criteria	Exposure to coastal hazards	31	15
	Honouring Titiri	29	13
	Critical community lifelines	26	10
	What's at stake	26	10
Influence on programme timing	Representativeness	22	6
Not assessed			
Additional considerations for FNDC (out of scope in this report)	Active communities and stakeholders	20	4
	Existing governance structures in place	20	4
Not assessed	Data availability	20	4
	Process value	19	3
	Organisational ability and resourcing to respond	19	3
	Strategic alignment	17	1

**Table 1.** 2022 FNDC Councillor poll results: Considerations for prioritisation of adaptation planning project area locations and timing

### 2.2.2. Brief overview of the risk assessment process

Urban Intelligence were engaged to undertake a district-wide climate risk assessment that considered the exposure of a range of elements (e.g. houses or assets) to coastal and flooding hazards. The methods used a geospatial analysis including the most current spatial hazard information from Northland Regional Council. Hazards assessed included catchment-based flooding (pluvial and fluvial), coastal erosion, coastal flooding (i.e. storm surge) and tidal inundation due to sea level rise, over a range of timeframes.

Hazard layers were used to test exposure of a range of spatial data for vulnerable elements supplied by FNDC and NRC. Elements included Council infrastructure and reserves, residential and commercial buildings, Māori land and buildings, marae, roads, airports, community facilities, critical lifelines and others. Elements were grouped into 'domains' of similar types in alignment with prioritisation criteria (See Section 2.2.4).

Each element was assessed for potential exposure and damage under different hazards and the results presented in an online viewer, the Resilience Explorer.<sup>1</sup> Figure 2 below shows a screenshot from the viewer.

<sup>1</sup> [www.resilience-explorer.com](http://www.resilience-explorer.com)



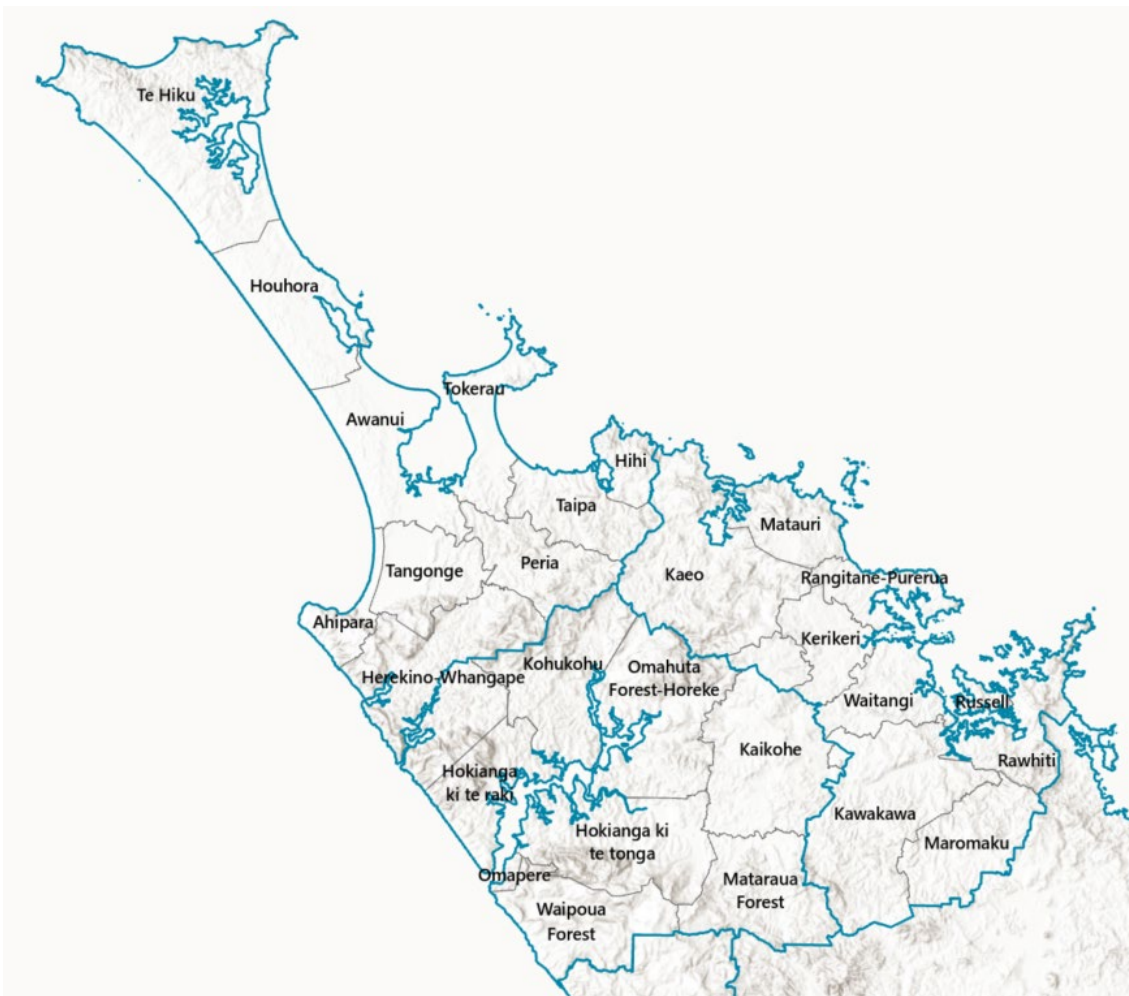
**Figure 2.** Risk assessment results as shown in the Resilience Explorer. Location near Kaeo, River flooding ARI10

Data from the risk assessment were exported for analysis and site selection by Adapterra using a multi-criteria analysis technique. The data output from the risk assessment included nearly 3.5 million data points across a range of different measurement units of exposure and damage results such as area of buildings or land, length of road, and number of facilities.

A peer-reviewed multi-criteria analysis process (MCA) was used to derive meaningful insights from this large dataset.<sup>2</sup> Multicriteria analysis is a robust technique commonly used across the public and private sectors to compare different types of data in a wide range of decision-making processes. The technique creates comparative rankings for different data, using weightings, and results in relative risk scores that show comparative differences in risk between locations. Social vulnerability data from the 2018 Census were also considered during this process.

Results from the multi-criteria analysis were ultimately mapped to 27 'adaptation project areas', which are defined geographic areas that were developed with the FNDC Climate Action team. The definition of the areas considered a range of factors including iwi rohe, the 'clumping' of hazard exposure datapoints, catchment and geographic features, community and political boundaries and Census area units.

<sup>2</sup> Hawchar et. al. (2020) A GIS-based framework for high-level climate change risk assessment of critical infrastructure



**Figure 3.** Adaptation project areas (grey lines) also showing community board areas (blue lines)

### 2.2.3. Short summary of risk assessment results

Table 2. below shows the relative risk scores for different adaptation project areas. Four hazard scenarios are shown: 'Current day all hazards', 'Near-term coastal hazards', 'Long-term all hazards', and 'Long-term all-hazards with vulnerability'. The results are ranked high-low in terms of the 'Long-term all-hazards with vulnerability' scenario.

Perhaps unsurprisingly, the results show that the spatial distribution of risks across the Far North is not uniform, and that some areas exhibit higher relative risk than others. Relative risks for locations across the Far North also differ according to the type of hazard, the types of elements exposed, and the timing of the hazard scenarios.

Adaptation area	Community board area	Current day all hazards	Near-term coastal hazards (2080)	Long-term all hazards (2130 H+)	Long-term all hazards * vulnerability
Kaeo	Bay of Islands-Whangaroa	0.62	0.52	0.94	0.52
Hokianga ki te tonga	Kaikohe-Hokianga	0.29	0.32	0.74	0.51
Herekino-Whangape	Te Hiku	0.35	0.52	0.71	0.47
Kohukohu	Kaikohe-Hokianga	0.51	0.43	0.69	0.46
Taipa	Te Hiku	0.18	0.37	0.63	0.32
Hokianga ki te raki	Kaikohe-Hokianga	0.18	0.10	0.32	0.30
Awanui	Te Hiku	0.16	0.17	0.60	0.27
Waitangi	Bay of Islands-Whangaroa	0.25	0.42	0.78	0.25
Omahuta forest- Horeke	Kaikohe-Hokianga	0.20	0.19	0.37	0.25
Tangonge	Te Hiku	0.45	0.00	0.49	0.22
Omapere	Kaikohe-Hokianga	0.19	0.24	0.26	0.16
Matauri	Bay of Islands-Whangaroa	0.15	0.12	0.30	0.13
Kawakawa	Bay of Islands-Whangaroa	0.34	0.06	0.49	0.13
Ahipara	Te Hiku	0.02	0.10	0.28	0.11
Peria	Te Hiku	0.10	0.00	0.12	0.08
Rawhiti	Bay of Islands-Whangaroa	0.05	0.10	0.13	0.07
Houhora	Te Hiku	0.06	0.07	0.11	0.06
Tokerau	Te Hiku	0.09	0.16	0.20	0.05
Waipoua Forest	Kaikohe-Hokianga	0.09	0.01	0.08	0.05
Rangitane - Purerua	Bay of Islands-Whangaroa	0.02	0.10	0.21	0.04
Te Hiku	Te Hiku	0.06	0.07	0.08	0.04
Hihi	Te Hiku	0.06	0.08	0.20	0.04
Russell	Bay of Islands-Whangaroa	0.10	0.13	0.22	0.04
Maromaku	Bay of Islands-Whangaroa	0.04	0.00	0.06	0.03
Mataraua Forest	Kaikohe-Hokianga	0.02	0.00	0.02	0.02
Kerikeri	Bay of Islands-Whangaroa	0.04	0.02	0.09	0.01
Kaikohe	Kaikohe-Hokianga	0.01	0.00	0.01	0.00

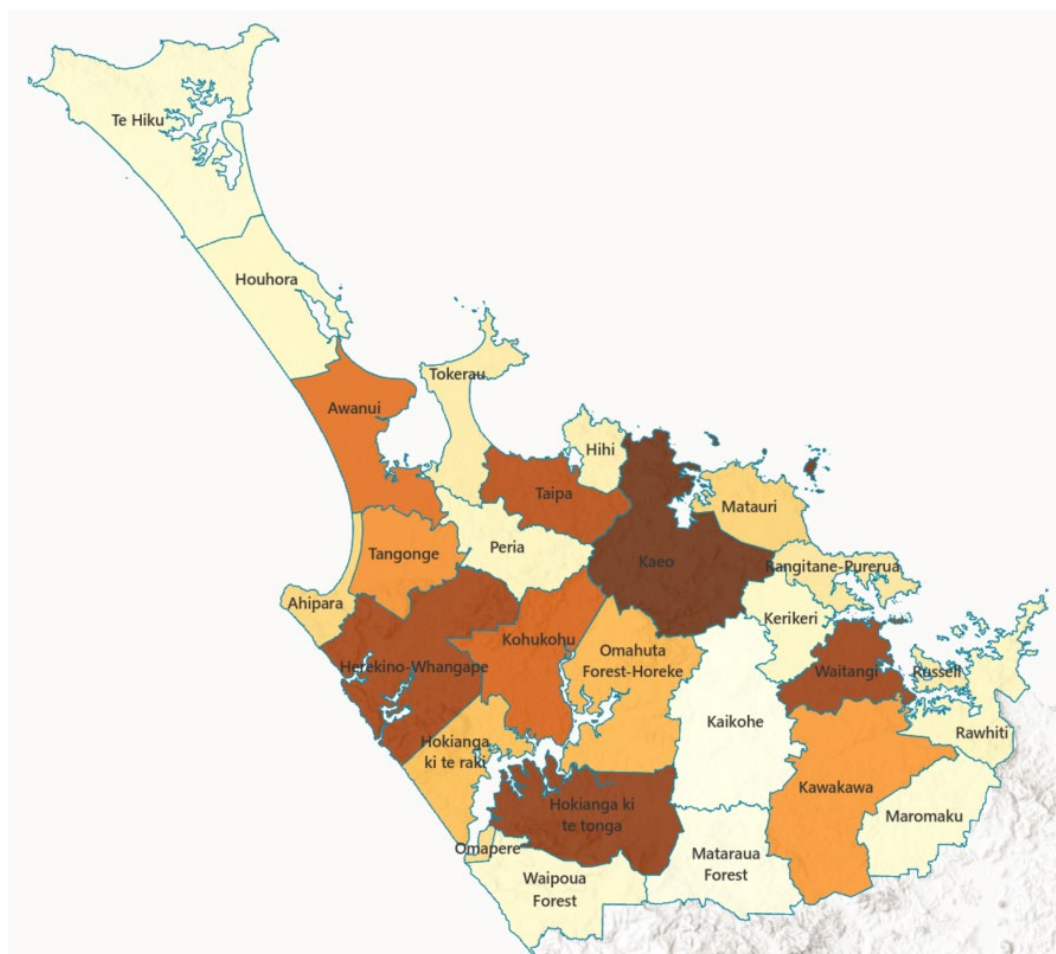
**Table 2.** Relative risk scores for adaptation project areas, ranked high-low for long-term all hazards including vulnerability

High-level observations of relative risk across the district indicate that:

- Without including vulnerability, Kaeo is ranked highest relative risk score overall and Waitangi-Paihia second.
- When relative risk scores are combined with vulnerability measures, four of the six highest ranked adaptation project areas, are in proximity of the Hokianga harbour: Hokianga ki te tonga, Herekino-Whangape, Kohukohu, and Hokianga ki te raki.
- Taipa and Awanui both show high relative risk scores with and without vulnerability applied
- In addition to the above areas, Omapere, Matauri and Ahipara also have comparatively high relative risk scores.
- Tangonge (which includes Kaitaia) and Kawakawa, and to a lesser degree Peria, exhibit high relative risk scores that are almost completely driven by river flooding risks rather than coastal hazards

Figure 4 below shows a map of the relative risk scores depicted by colour (darker colours indicate higher risk) for adaptation project areas across the district. The map shows results using a long-term, all hazards scenario (i.e. risks

due to river and coastal flooding, coastal erosion, and high-tide inundation, in 100+ years including 1.2 to 1.5m of sea level rise).



**Figure 4.** Relative risk scores reported to adaptation project areas (darker = higher relative risk score)

#### 2.2.4. How the risk assessment results relate to the prioritisation criteria

We interpreted the top three criteria in relationship to exposure data in the risk screening process. The criterion *'Exposure to coastal hazards'* relates to exposure of elements in all domains, while *'Honouring Tiriti'* relates solely to Māori cultural assets. *'Critical community lifelines'* relates to exposure of elements within the Transport and Lifelines domains but could also include regional transport connectivity.

The multicriteria analysis process allows weightings to define how the Councillor-voted criteria contribute to relative risk scores. Weightings were developed using expert judgement and tested where possible with FNDC staff. However, the process is flexible, and weightings can be easily changed to see how they influence relative risk scores.

We used a flexible approach through sensitivity testing to test a range of weightings and look for patterns in the data to help identify priority adaptation planning locations. This included running separate analyses for individual selection criteria to show key differences in relative risk scores when weightings were changed.

For example, the results of considering only the 'community' domain (which includes residential and commercial buildings and community facilities such as schools), shows different patterns of risk distribution to those seen when considering only the 'Māori cultural assets' domain (which includes marae, buildings on Māori land, Māori freehold land, archaeological sites and sites of significance).

We interpreted the criterion *'What's at stake'* as an assessment of vulnerability or adaptive capacity. Social vulnerability indices developed by Massey University were used as a measure of vulnerability or adaptive capacity and used to sensitivity test the risk results.

The criterion *'Representativeness'* was interpreted to mean the degree to which adaptation project areas cover all three community board areas across the Far North District. We used this criterion to inform the timing and phasing of adaptation planning projects, while maintaining a risk-based prioritisation process.

The remaining criteria were agreed to be largely out of scope for this assessment. The criteria *'active communities and stakeholders'* and *'existing governance structures in place'* may be used as additional considerations by council when undertaking early engagement and establishing appropriate methodologies in priority adaptation planning project locations. The remaining criteria were deemed to have low analytical value due to limited variation between sites.

## 2.2.5. Implications of the risk assessment results for site selection

### 1. Exposure to coastal hazards

The risk assessment results show that some adaptation project areas consistently exhibit high levels of risk when considering different hazard scenarios or domain weightings. Exposure to specific assets can provide an indication of the level of risk faced by different communities. Table three below shows an example of indicative exposure counts for four asset types (marae, buildings on Māori land, residential buildings and roads).

Programme	Adaptation area	Marae (count)				Buildings on Maori land (count)				Residential buildings (count)				Roads & State Highways (m)			
		River flooding 1% AEP 1.2m SLR	Coastal flooding 1.5m SLR	Coastal erosion 1.5m SLR	Tidal inundation 1.2m SLR	River flooding 1% AEP 1.2m SLR	Coastal flooding 1.5m SLR	Coastal erosion 1.5m SLR	Tidal inundation 1.2m SLR	River flooding 1% AEP 1.2m SLR	Coastal flooding 1.5m SLR	Coastal erosion 1.5m SLR	Tidal inundation 1.2m SLR	River flooding 1% AEP 1.2m SLR	Coastal flooding 1.5m SLR	Coastal erosion 1.5m SLR	Tidal inundation 1.2m SLR
Stage One	Hokianga ki te tonga	3	1	0	1	102	21	0	10	9	31	0	20	16918	13971	0	8081.1
	Herekino-Whangape	3	4	0	2	53	39	0	8	0	0	0	0	57533	17371	0	9940.1
	Kohukohu	3	1	0	0	30	5	0	1	21	17	0	7	41689	21752	0	15092.9
	Omahuta forest- Horeke	2	1	0	0	44	9	0	2	26	25	0	3	40291	17378	0	12976.1
	Hokianga ki te raki	4	0	0	0	59	26	0	15	4	1	0	0	15161	11284	0	7652.5
Stage Two	Omāpere	0	0	0	0	0	0	4	0	6	4	74	0	1815	800	3013	100.0
	Kaeo	2	1	0	0	28	2	0	0	140	63	70	14	60829	20397	928	16087.1
Stage Three	Waitangi	1	1	1	0	61	20	40	2	148	107	8	69	16796	7686	3379	3013.3
	Taipa	0	0	0	0	27	16	0	6	224	179	106	2	47459	18835	2813	7634.0
	Awanui	1	1	0	0	53	52	1	26	138	147	16	2	35424	26099	404	13979.5
Stage Four	Ahipara	0	0	1	0	1	0	7	0	172	43	288	2	7065	1824	3284	871.2
	Tokerau	0	0	0	0	9	2	2	0	169	276	203	16	26825	14796	3489	2886.4
	Hihi	0	0	0	0	12	5	0	0	58	53	42	14	9390	3907	1068	2262.9
	Matauri	2	1	0	0	84	26	33	0	120	111	47	36	16672	7814	1177	4158.1
	Russell	0	0	0	0	0	0	0	0	9	19	0	4	9095	8387	668	4399.6
	Rangitane - Purerua	1	1	0	1	33	49	0	19	24	48	0	8	2427	677	0	71.3
	Rawhiti	0	0	0	0	55	30	0	9	21	2	0	0	22058	13207	0	8484.7
	Tangonge	1	0	0	0	34	0	0	0	1464	0	0	0	49030	731	0	0.0
	Kawakawa	3	0	0	0	76	2	0	0	319	0	0	0	70019	3485	0	1678.9
	Peria	1	0	0	0	3	0	0	0	0	0	0	0	43236	0	0	0.0
Houhora	0	0	0	0	4	0	0	0	106	6	0	1	9496	1450	0	599.4	
Kerikeri	0	0	0	0	0	0	0	0	178	3	0	1	13017	584	0	481.0	
Te Hiku	0	0	0	0	37	23	0	3	14	4	0	0	7602	4215	0	500.0	
Waipoua Forest	0	0	0	0	14	0	0	0	21	0	0	0	23795	1718	0	467.9	
Maromaku	0	0	0	0	11	0	0	0	0	0	0	0	34273	0	0	0.0	
Mataraua Forest	0	0	0	0	1	0	0	0	0	0	0	0	7362	0	0	0.0	
Kaikohe	0	0	0	0	1	0	0	0	0	0	0	0	6491	0	0	0.0	

**Table 3.** Unweighted exposure scores of four asset types to four hazard scenarios across all adaptation project areas

Table 4 below shows the frequency of a site being ranked within the top third across different hazard scenarios:

Adaptation project area	Number of times in highest third
Kaeo	6
Kohukohu	6
Herekino-Whangape	6
Hokianga ki te tonga	6
Waitangi-Paihia	6
Taipa	5
Tangonge	4
Kawakawa	4
Omahuta forest- Horeke	4
Awanui	4
Omapere	2
Hokianga ki te raki	1

**Table 4.** Frequency of sites occurring in the highest third of site rankings across six hazard scenarios

**How the results influenced our recommendations**

**Stage One** includes the adaptation project areas in the vicinity of the Hokianga harbour, including the Herekino and Whangape harbours, which represent some of the highest relative risk scores.

The Herekino-Whangape adaptation project area shows 2 marae and around 10km of roads or state highways are exposed to most high tides with 1.2m of sea level rise. 4 marae and 53 buildings on Māori land are projected to be within flood zones for a 100yr flooding event with 1.2m of sea level rise.

Taken collectively, adaptation project areas across the Hokianga harbour show very high exposure to tidal inundation of roads and state highways, with nearly 44km of roads expected to be underwater every high tide with 1.2m of sea level rise. Given the isolated nature of many these communities and the lack of alternative access, this is especially significant. Hokianga adaptation areas collectively have 12 marae and 235 buildings on Māori land exposed to large (100yr ARI) flooding events with 1.2m of sea level rise.

These results prompted FNDC staff to submit a funding application of \$650,000 for adaptation planning for the Hokianga to the Central Government’s Flood Resilience Fund in response to Cyclone Gabrielle. While the results of the funding application are still unknown, the funds would allow Council to deliver adaptation planning across the entire harbour over the first 2-3 year period.

Two of the highest ranked adaptation project areas, Kaeo and Waitangi-Paihia are planned for **Stage Two**. Data for Kaeo shows that 2 marae, 28 buildings on Māori land and 140 homes are exposed to a large flood event (i.e. 100yr return period storm) with 1.2m of sea level rise. Over 16km of road is projected to be underwater at most high tides with 1.2m of sea level rise.

The Waitangi-Paihia adaptation project area, which includes the nationally significant cultural elements of the Treaty grounds, and Te Tiriti o Waitangi marae, as well as the commercial areas of Paihia and Opua, shows high exposure to a range of hazards across all elements. Of note are nearly 70 homes exposed to tidal inundation with 1.2m of sea level rise, and over 3km of roads and state highways exposed to coastal erosion under 1.5m of sea level rise.

**Stage Three** includes sites within the Te Hiku community board area, including high-risk sites Taipa, Awanui and Ahipara. While not as highly ranked in terms of relative risk, Tokerau and Hihi are included due to their specific local risks to residential properties and geographic connection to the other sites.



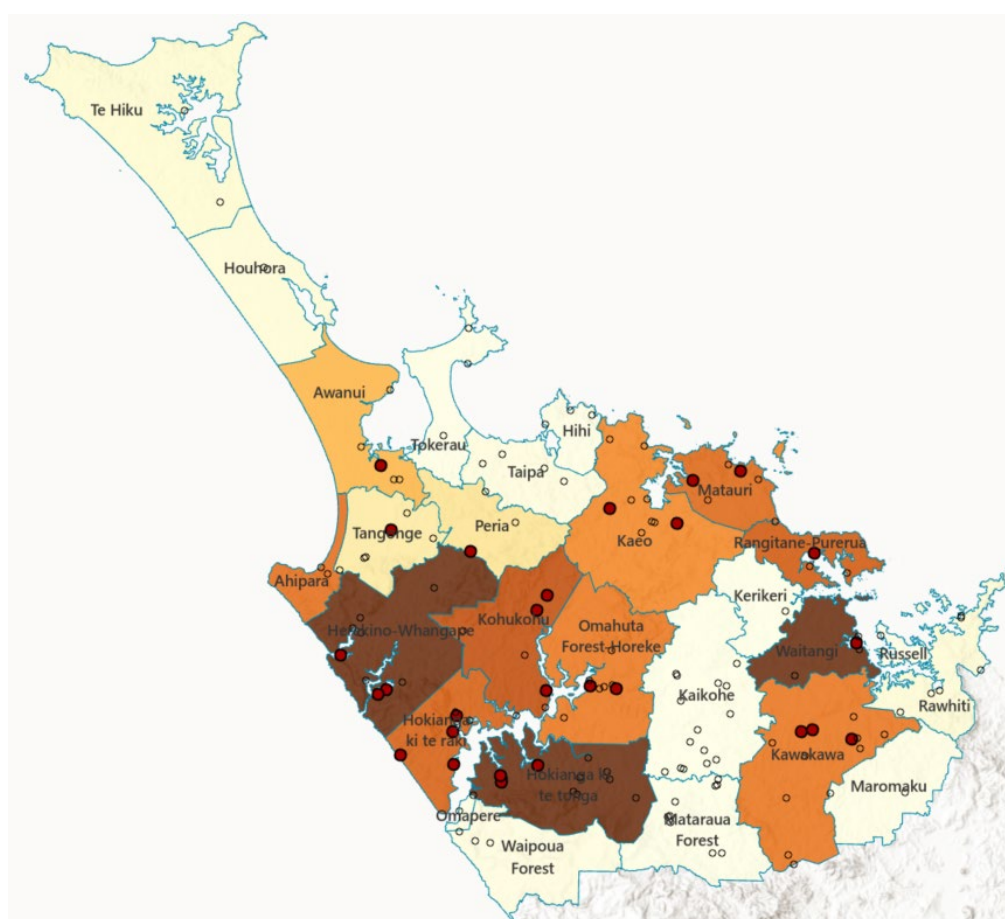
In the Awanui adaptation project area, 26 buildings on Māori land are exposed to tidal inundation under 1.2m of SLR, with 53 in the coastal flood zone. 14km of roads and state highways are projected to be underwater at high tide with 1.2m of SLR. Significant existing issues with overtopping of coastal stopbanks at king tides and storm surge events.

In Ahipara one marae, 288 homes, and nearly 3.3km of roads and state highways exposed to coastal erosion under 1.5m of sea level rise. 172 houses are exposed to a 1:100 yr flood with 1.2m of sea level rise. While not highly ranked for total risk, Tokerau shows high exposure of residential buildings to coastal flooding (276) and coastal erosion (203) under 1.5m of sea level rise, with nearly 3.5km of road exposed to coastal erosion under a 1.5m sea level rise.

**Stage Four** includes the coastal settlements along the east coast of the Bay of Islands-Whangaroa community board, including Matauri, Rangitane-Purerua, Russell and Rawhiti adaptation project areas. Matauri and Rangitane-Purerua adaptation project areas show nearly 160 homes exposed to coastal flooding under 1.5m of sea level rise. Across all Stage four areas, nearly 50 houses and 17km of roads are projected to be inundated at high tide with 1.2m of sea level rise.

## 2. Honouring Tiriti

When only Māori cultural assets are included in the relative risk scoring, Herekino-Whangape, Hokianga ki te tonga and Waitangi-Paihia show extremely high risk scores (see figure 4 below). Nonetheless, the wide geographic distribution of the 27 marae projected to be exposed to a 1:100yr river flood event with 1.2m of sea level rise illustrates the broad spread of risk across the district.



**Figure 4.** Marae across Far North District (black circle outlines), with those exposed to 100yr flood event with 1.2m of sea level rise (red circles). Adaptation project areas (blue outlines) are ranked by relative risk scores, considering Māori cultural assets only (darker = higher relative risk score).

Adaptation area	Community board area	Long-term all hazards (2130 H+)
herekino_whangape	Te Hiku	1.81
kaeo	Bay of Islands-Whangaroa	1.67
waitangi	Bay of Islands-Whangaroa	1.47
omahuta_forest_horeke	Kaikohe-Hokianga	1.31
hokianga_ki_te_tonga	Kaikohe-Hokianga	1.18
kohukohu	Kaikohe-Hokianga	1.05
matauri	Bay of Islands-Whangaroa	0.94
hokianga_ki_te_raki	Kaikohe-Hokianga	0.94
kawakawa	Bay of Islands-Whangaroa	0.92
ahipara	Te Hiku	0.92
awanui	Te Hiku	0.55
rangitane_purerua	Bay of Islands-Whangaroa	0.54
tokerau	Te Hiku	0.49
peria	Te Hiku	0.34
tangonge	Te Hiku	0.30
te_hiku	Te Hiku	0.08
rawhiti	Bay of Islands-Whangaroa	0.06
houhora	Te Hiku	0.06
Kaikohe	Kaikohe-Hokianga	0.05
waipoua_forest	Kaikohe-Hokianga	0.04
taipa	Te Hiku	0.03
kerikeri	Bay of Islands-Whangaroa	0.01
maromaku	Bay of Islands-Whangaroa	0.01
hihi	Te Hiku	0.01
omapere	Kaikohe-Hokianga	0.01
mataraua_forest	Kaikohe-Hokianga	0.00
russell	Bay of Islands-Whangaroa	0.00

**Table 4.** Relative risk scores (Long-term, all hazards scenario) considering only Māori cultural assets

### **How the results influenced our recommendations**

Of the top ten sites scoring the highest relative risk for Māori cultural assets only, 7 are included in Stage One and Two.

The prioritisation of the Hokianga and Herekino-Whangape adaptation project areas in Stage One is a direct response to the high levels of risk to Māori cultural assets in those areas, and an acknowledgement of the urgent need for forward planning to avoid increasing harm from hazards.

Waitangi-Paihia is a site of national cultural significance, being the signing place of te Tiriti o Waitangi, and is included in Stage Two. However, given the significance of the site the authors suggest that a period of building close relationships with tangata whenua prior to embarking on adaptation planning will result in more enduring outcomes.

Kaeko ranks second highest when only Māori cultural assets are included in the relative risk scores. While obviously a high priority, given the complexity of the asset systems and the large flood work programme being implemented by NRC over the next two years, adaptation planning is recommended for the second Stage.

Stages 3 and 4 cover the remainder of sites in the top 50% of the highest scoring sites in terms of relative risks due to exposure of Māori cultural assets, excluding Kawakawa and Peria where risks are due to river flooding only.

### 3. Critical lifelines

Roading asset systems across the Far North are likely to be a key consideration in adaptation planning. A full investigation into road route resilience, flood outage durations and isolation effects was outside the scope of this report. However, an inspection of road exposure data can help indicate some locations which are highly likely to be impacted by climate change into the future, for example from tidal inundation due to sea level rise.

The Kohukohu adaptation project area alone, for instance, is expected to have nearly 15km of roads under water during most high tides with 1.2m of sea level rise. When all of Stage Two adaptation areas in the Hokianga-Herekino-Whangape harbour areas are included, this figure increases to over 50km (see Figure 5 below). This will have detrimental impacts on the connectivity of local communities, and exacerbate flooding impacts during severe weather events.

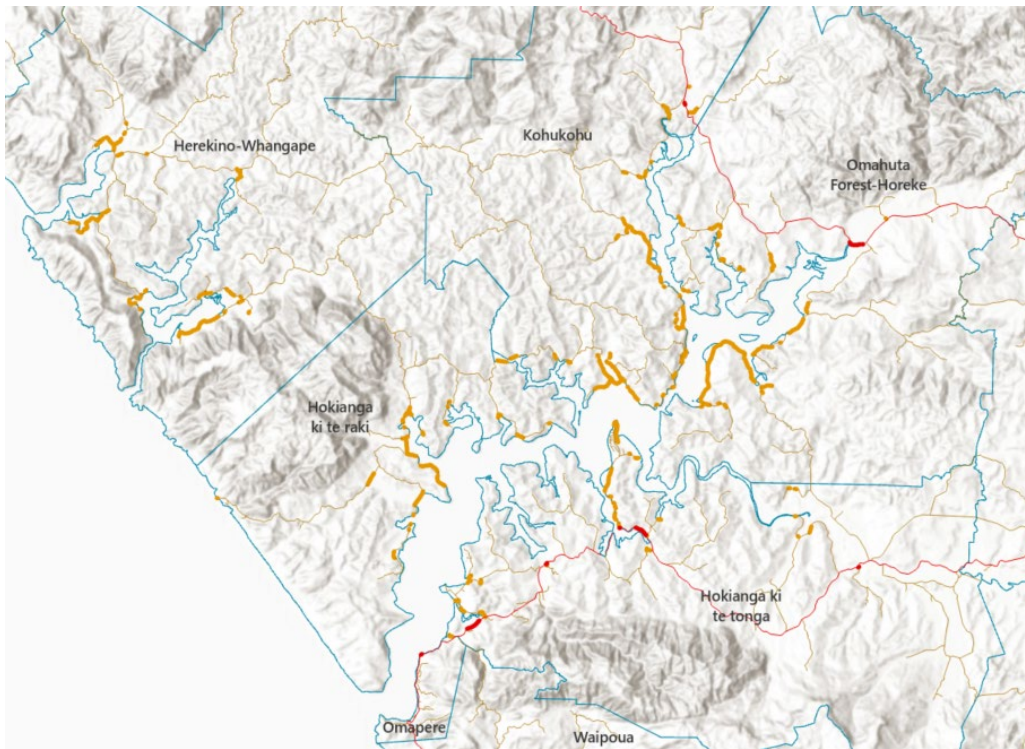
In terms of regional and national connectivity, Kaeo is projected to have over 5.5km of state highway inundated at high tide with 1.2m of sea level rise. Given the area’s importance as the only alternative northern route to the often-damaged Mangamuka gorge, this is an urgent issue to address.

#### How the results influenced our recommendations

Impacts on critical lifelines played a key role in our recommendations to prioritise the Hokianga-Herekino-Whangape adaptation project areas in Stage One, and Kaeo in Stage Two. In addition, projected impacts on roading in Awanui and Taipa (Stage Three) and Russell and Rawhiti (Stage Four) influenced our recommendations for phasing of those sites.

Tidal inundation 1.2m SL Roads	State highways
kohukohu	14993   100
awanui	12819   1161
omahuta_forest_horeke	12289   688
kaeo	10437   5650
herekino_takahue	9940   0
rawhiti	8485   0
hokianga_ki_te_raki	7653   0
taipa	6934   700
hokianga_ki_te_tonga	6381   1700
russell	4400   0
matauri	4158   0
tokerau	2836   50
hihi	2263   0
waitangi	1876   1137
ahipara	871   0
kerikeri	481   0
waipoua_forest	468   0
kawakawa	453   1226
houhora	399   200
te_hiku	100   400
rangitane_purerua	71   0
omapere	50   50
kaikohe	0   0
maromaku	0   0
mataraua_forest	0   0
peria	0   0
tangonge	0   0

**Table 5.** Length of roads and state highways (m) exposed at high tide per adaptation project area, with 1.2m of sea level rise



**Figure 5.** Roads (orange) and State highways (red) inundated (thick lines) in high tide flooding with 1.2m of sea level rise – Hokianga harbour area

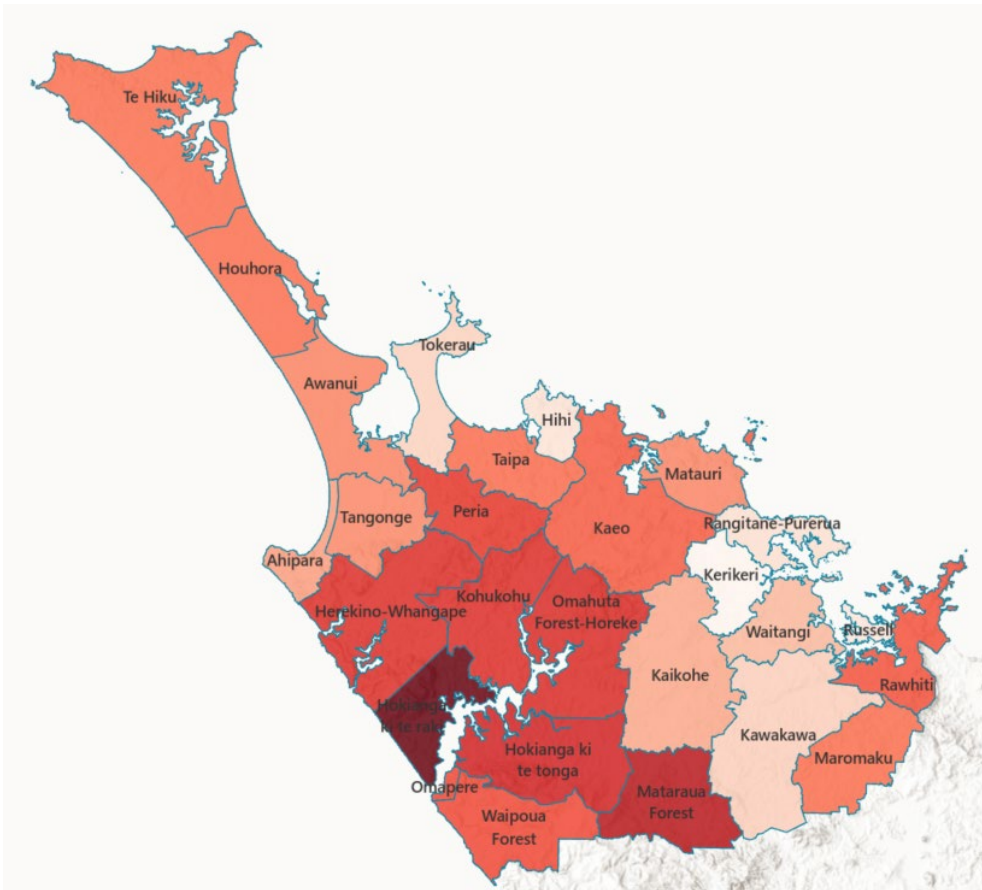
#### **4. What's at stake – vulnerability**

While there remain concerns and questions over the use of the term vulnerability, and the use of census data in risk assessment, some measures of vulnerability can be useful indicators of differences across the district. Vulnerability data was sourced from the 2018 Census and based on the Social Vulnerability Index developed by Massey University.<sup>3</sup> The datasets used covered four themes: Having enough money to cope with crises and losses; Awareness, knowledge and skills to cope with hazards and emergencies; Safe, secure and healthy housing and Enough food and water to cope with shortage. A map of combined vulnerability indices is shown below in Figure 6.

#### ***How the results influenced our recommendations***

The results especially reinforced the need for working with communities in the Hokianga area, and to a lesser extent, Kaeo and Rawhiti. When applied to the risk assessment results, vulnerability scores can highlight potential differences in the ability of communities to respond, recover and adapt to climate risks.

<sup>3</sup> <https://www.ehinz.ac.nz/projects/social-vulnerability-indicators/>



**Figure 6.** Social Vulnerability Index scores reported to adaptation project areas (darker = higher social vulnerability score)

### 2.2.6. Alignment of the programme with relative risk scores

Table 6 below shows relative risk scores of the adaptation project areas grouped according to Programme Stages. The column to the far right shows the sum risk scores across all adaptation project areas for a given Stage.

Programme	Adaptation area	Community board area	Current day all hazards	Near-term coastal hazards (2080)	Long-term all hazards (2130 H+)	Long-term all hazards * vulnerability
Stage One	Hokianga ki te tonga	Kaikohe-Hokianga	0.29	0.32	0.74	0.51
	Herekino-Whangape	Te Hiku	0.35	0.52	0.71	0.47
	Kohukohu	Kaikohe-Hokianga	0.51	0.43	0.69	0.46
	Omahuta forest- Horeke	Kaikohe-Hokianga	0.20	0.19	0.37	0.25
	Hokianga ki te raki	Kaikohe-Hokianga	0.18	0.10	0.32	0.30
Mapere	Kaikohe-Hokianga	0.19	0.24	0.26	0.16	
Stage Two	Kaero	Bay of Islands-Whangaroa	0.62	0.52	0.94	0.52
	Waitangi	Bay of Islands-Whangaroa	0.25	0.42	0.78	0.25
Stage Three	Taipa	Te Hiku	0.18	0.37	0.63	0.32
	Awanui	Te Hiku	0.16	0.17	0.60	0.27
	Ahipara	Te Hiku	0.02	0.10	0.28	0.11
	Tokerau	Te Hiku	0.09	0.16	0.20	0.05
	Hihi	Te Hiku	0.06	0.08	0.20	0.04
Stage Four	Matauri	Bay of Islands-Whangaroa	0.15	0.12	0.30	0.13
	Russell	Bay of Islands-Whangaroa	0.10	0.13	0.22	0.04
	Rangitane - Purerua	Bay of Islands-Whangaroa	0.02	0.10	0.21	0.04
	Rawhiti	Bay of Islands-Whangaroa	0.05	0.10	0.13	0.07
Tangonge	Te Hiku	0.45	0.00	0.49	0.22	
Kawakawa	Bay of Islands-Whangaroa	0.34	0.06	0.49	0.13	
Peria	Te Hiku	0.10	0.00	0.12	0.08	
Houhora	Te Hiku	0.06	0.07	0.11	0.06	
Kerikeri	Bay of Islands-Whangaroa	0.04	0.02	0.09	0.01	
Te Hiku	Te Hiku	0.06	0.07	0.08	0.04	
Waipoua Forest	Kaikohe-Hokianga	0.09	0.01	0.08	0.05	
Maromaku	Bay of Islands-Whangaroa	0.04	0.00	0.06	0.03	
Mataraua Forest	Kaikohe-Hokianga	0.02	0.00	0.02	0.02	
Kaikohe	Kaikohe-Hokianga	0.01	0.00	0.01	0.00	

**Table 6.** Relative risk scores for adaptation project areas, grouped according to recommended Programme Stages.

## 2.3. Additional considerations for programme planning

### Local knowledge, engagement and consultation

Community-wide and iwi-hapu engagement was not within the scope of this report. However, the report's authors believe that the recommendations should be tested with local knowledge-holders and tangata whenua to ensure that the programme reflects the needs and aspirations of local iwi, hapu and communities.

Early engagement as part of the adaptation planning scoping process will also help inform if and how communities wish to be engaged in adaptation planning. A Kaupapa Māori risk screening process should be undertaken to assess if there are significant risks to important cultural assets or taonga and to determine the level and type of engagement with iwi, hapu, marae and whanau.

### Internal capability, capacity and resourcing

The Climate Action and Resilience team has three full-time staff members and a small operating budget. The report's authors were advised that the team planned to undertake one major Council-led adaptation planning project per year, which largely guided our recommendations. While ambitious, with sufficient support this may be achievable. For each Stage, a scoping process will be needed to identify key locations or asset systems requiring adaptation planning across the recommended adaptation project areas, keeping in mind the availability of staff time and operational funding to support the necessary processes.

Sufficient operational funding will be necessary to achieve the timeframes recommended in this report, given that significant portions of the work will need to be outsourced.

For Stage One, we have assumed that recently applied for funding of \$650,000 from the Flood Resilience Fund will become available from December 2023, to be spent before July 2025. This funding will enable the procurement of professional services to support the delivery of Stage One adaptation planning projects in the Hokianga.

However, factors such the complexities of local community dynamics, the need for iwi-hapu-led processes and rising external costs may affect the rate at which projects are able to be completed. Experience shows that adaptation planning projects must remain flexible to factors that can result in delays and extended timeframes.

### **Phasing over time**

Given the restrictions on internal staffing and funding, we propose that the phasing of adaptation planning projects be done over time with efficiencies sought by coordinating communications, materials and procurement of professional services between projects. We also propose that adaptation areas be grouped together in Stages to optimise the delivery of common phases of the projects such as early engagement, governance groups and hazard modelling or assessment.

Resourcing of the implementation of the adaptation plans has not been a consideration in this report. Council will need to consider the appropriate model for planning and coordinating the implementation of an increasing number of community adaptation plans, and how this fits into the Long-term plan process and other funding and planning mechanisms.

### **Prioritisation within adaptation areas**

During the scoping phase for each adaptation planning project, adaptation areas and sub-areas will need to be defined for specific consideration (or omission) to focus the efforts of the adaptation planning process to places most in need. The number, size and types of areas will depend on the project budget and resourcing. For example, across the whole of the Hokianga, specific asset systems (e.g. roads, wastewater treatment plants etc) as well as community areas will need to be identified and prioritised for the development of adaptive pathways, based on the level and timing of risk.

### **Reviewing the programme**

The programme will need to retain a degree of flexibility over time to respond to extrinsic factors and events. We recommend that over time this risk assessment is revisited, and additional hazards included for assessment, such as drinking water supply, drought, groundwater salination, windstorm, wildfire, public health impacts etc. This could alter the phasing or prioritisation of locations for adaptation planning.

External funding opportunities such as funding for Three Waters infrastructure, roading or major infrastructure projects could act as a trigger for an adaptation planning process. Additional regulatory requirements or internal funding may also act as enablers or barriers to the delivery of adaptation planning which may result in the need for a reassessment of the programme. A severe weather event such as a cyclone impacting the district or a specific community may also result in a higher or lower degree of community readiness in engagement in adaptation planning.