



Coastal adaptation programme

Coastal community adaptation profiles

Te Taitokerau Climate Adaptation Strategy

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Authors: Matt de Boer, Jan van der Vliet

Contents

Coastal community adaptation profiles.....	1
Executive summary	Error! Bookmark not defined.
Introduction	3
Te Taitokerau Climate Adaptation strategy and the regional context	3
What are coastal adaptation profiles?.....	3
Part One. First pass exposure assessment.....	3
What did we do?	4
Hazard layers.....	5
Exposure indicators.....	8
What did we find?	9
Part two. Choosing an adaptation engagement process.....	1
Adaptation engagement approaches	1
The <i>Adaptation engagement framework</i> report describes four different engagement approaches, summarised below:.....	1
Community-led adaptation planning project	2
Small-scale adaptation planning project.....	2
Combined adaptation planning project	2
Large-scale adaptation planning project	2
Assessing adaptation engagement approaches using community attributes	2
Appropriate timeframes for adaptation engagement.....	3
Adaptation needs assessment	3
First pass exposure assessment data.....	5
Community attribute data	6
Community attributes - place	6
Community attributes -people	7
Attachments (NRC sharepoint files).....	8
Consultant GIS methodology reports:	8
Site exposure assessment data:.....	8

Introduction

Te Taitokerau Climate Adaptation strategy and the regional context

This report is the third in a series of technical chapters contributing to the Te Taitokerau Climate Adaptation Strategy (the Strategy). In the previous chapter 'Climate risk overview', the risks posed by coastal hazards were identified as a key gap in council responses to date, presenting an opportunity to develop community adaptation responses to the projected impacts of climate change.

A priority action recommended in the Strategy is the *Coastal adaptation programme*, a 10-year programme of adaptation planning with coastal communities across the region. The *Coastal adaptation profiles* technical report help develop this future adaptation planning work program by describing the range of coastal risks, and community needs and opportunities in different coastal community across the region. The intent of the report is to provide data on the different levels of risk projected for different communities, guidance on appropriate adaptation planning approaches that might be appropriate for different communities, and community attributes to consider when planning adaptation engagement.

What are coastal adaptation profiles?

The aim of the profiles is to assist councils in deciding who, how, and when:

- Who – which are the communities with the highest risks from coastal hazards?
- How - what kind of adaptation engagement approach is appropriate for different coastal communities?
- When - what is the most appropriate timeframe for adaptation engagement?

Part one of the report presents a GIS analysis of coastal hazard assessments and other spatial data to describe the potential for coastal risks at a selected number of coastal sites under different climate change scenarios.

Part two of the report suggests a process that councils can use to define appropriate engagement approaches and timeframes using information drawn from existing documents and local knowledge.

Part One. First pass exposure assessment

A 'first-pass risk assessment' approach¹ is used to develop an overview of the coastal risks likely to affect discrete communities over a 100-year timeframe. It draws on data made up of several spatial hazard layers and a limited number of 'exposure indicators'. Exposure indicators include elements like building footprints, marae, roads and community buildings. This provides a preliminary quantitative dataset to understand at a high level the kind of exposure faced by each community. It

¹ MfE (2017) Coastal Hazards and Climate Change: a guide for local government

is not intended to be a comprehensive analysis or risk assessment – this will happen at a detailed local level during the adaptive pathways planning process. We acknowledge that some values (like ecological significance) will not be captured here; this is because the existing datasets were not sufficient to provide meaningful analysis.

What did we do?

Northland Regional Council staff undertook a visual assessment of the entire Northland coastline, using recently developed coastal hazard maps, and identified a preliminary list of 58 sites. A spatial analysis of exposure to hazards was undertaken by consultants, with the results delivered as GIS spatial data and tables. The sites are shown in figures 1-3 below.

This information was used to help guide workshops with district council staff, where community attributes and processes to choose adaptation planning sites were discussed.

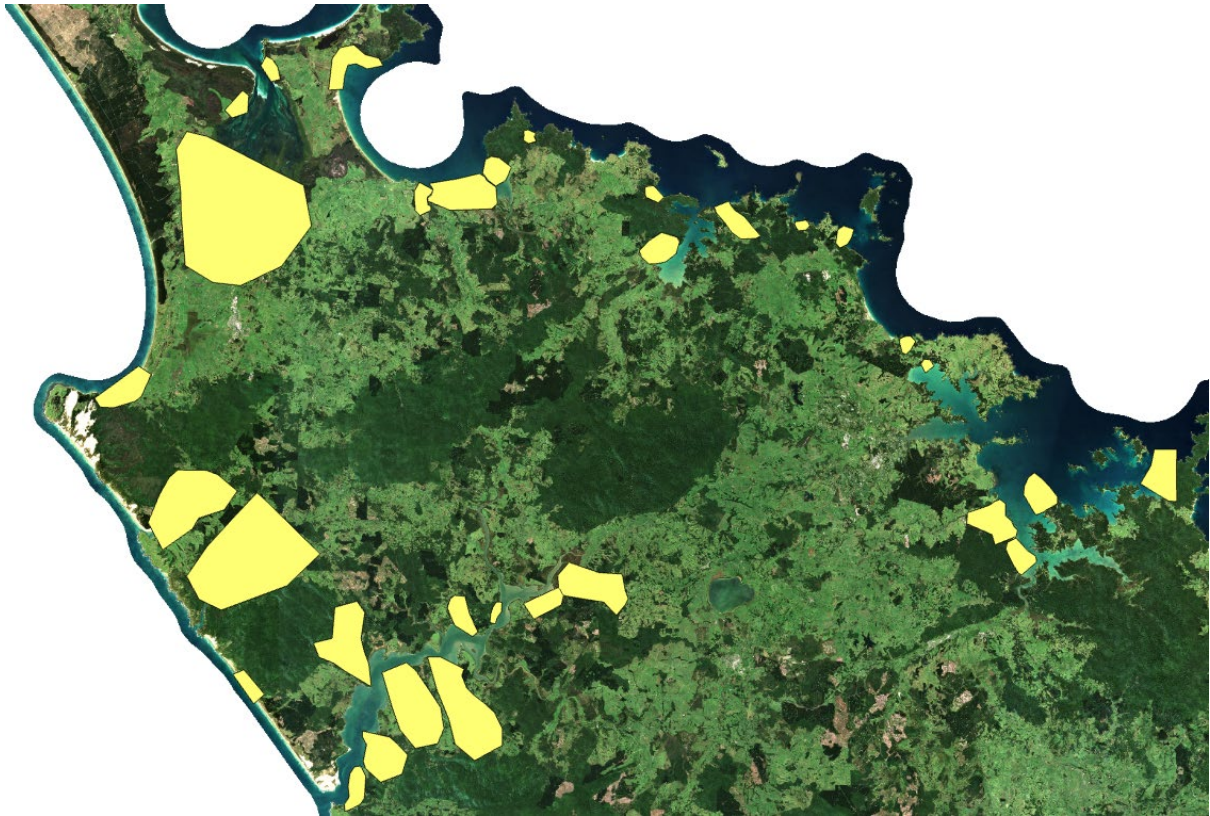


Figure 1. Far North District Council sites

Whangaruru North/Tuparehuia	Rangiputa
Russell/Long Beach	Kaimaumu
Opuā	Awanui
Paihia/Waitangi/Haruru	Ahipara
Te Tii	Owhata/Herekino
Taronui Bay	Mitimiti
Matauri Bay	Whangape harbour
Te Ngairē	Panguru
Tauranga Bay	Motukaraka
Totara North	Kohukohu
Taupo Bay	Whirinaki
Taemaro	Omanaia
Hihi	Horeke/Maraeroa
Coopers beach/Cable bay	Pakanae
Taipa	Opononi/Omapere
Tokerau/Whatuwhiwhi	Rawhiti



Figure 2. Whangarei district sites

Whangarei
Takahiwai
Marsden
Ruakaka
Waipu
Waipu cove
Langs Beach
Waikaraka/Tamaterau
Taiharuru

Pataua
Outer Whangarei harbour
Ngunguru
Tutukaka
Matapouri
Wooleys/Sandy Bay
Whananaki
Helena Bay
Whangaruru South/Oakura

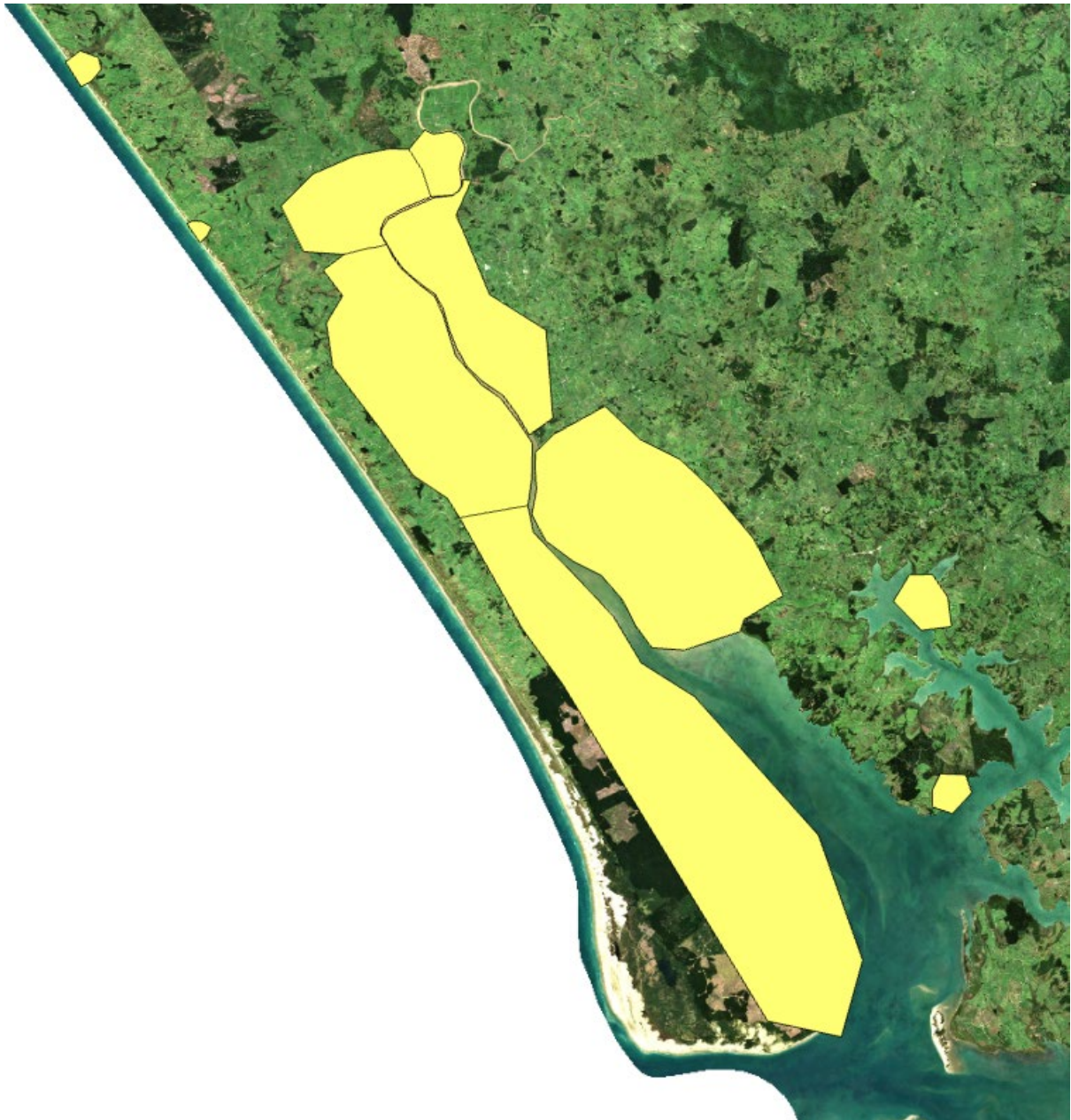


Figure 3. Kaipara District Sites

Raupo/Ruawai
Dargaville
Bayly's beach
Awakino Pt

Turiwiri/Mititai
Wairoa west bank
Mangawhai
Omamari

Methodology

Hazard Layers

We used a subset of existing spatial hazard layers, developed in recent years by consultants for NRC. The data represents the best coastal hazard information currently available for Northland, and is publicly available via NRC’s website.

We grouped the hazards into two types: periodic inundation events (coastal flooding) and permanent loss of land (coastal erosion and permanent tidal inundation).

Different scenarios were used to illustrate changing risk over time. For periodic inundation events, present day, 60-year (2080) and 110-year (2130) timeframes were used. For permanent loss of land, 60- and 110-year timeframes were used.

The sources of hazard data are shown below in table 1.

Hazard type	Hazard name	Data layer name	Hazard definition
Periodic inundation events	Coastal flooding present day	CFHZ0	Coastal flooding 1% AEP event, no SLR
	Coastal flooding 2080	CFHZ1	Coastal flooding 2% AEP event, +0.6m SLR
	Coastal flooding 2130	CFHZ2	Coastal flooding 1% AEP event, +1.2m SLR
Permanent loss of land	Coastal erosion 2080	CEHZ1	Coastal erosion 66% probability in 2080, includes 0.6m SLR
	Coastal erosion 2130	CEHZ2	Coastal erosion 5% probability in 2130, includes 1.2m SLR
	Permanent tidal inundation 2080	MHWS2080	Mean high water springs 10, +0.6m SLR
	Permanent tidal inundation 2130	MHWS2130	Mean high water springs 10, +1.2m SLR

Table 1. Hazard data

Exposure indicators

Seven GIS spatial data layers representing community values potentially affected by hazards were selected from a range of 52 available layers recently gathered from councils. These were selected to give a high-level indication of the extent of exposure to different hazard scenarios, to be used for comparative purposes only. The exposure analysis is not designed to be used as an indication of risk for individual sites - more detailed analysis will be required at the local level to inform local risks and vulnerabilities. The sources of GIS data used are listed below, with more detail on specific layers used in Appendix A.

Value domain name	Exposure indicator name
Property	Building footprint
	Land area
Council assets	Road
	3 waters network
Community	Community facilities
	Māori freehold land
Māori	Marae and surrounds

Table 2. Value domains and exposure indicators

What did we find?

The assessment provided a large amount of data that will help councils understand the spread of risks due to coastal hazards under climate change scenarios, and assist in developing a programme of targeted adaptation planning.

Examples of the data outputs are shown below for one site and district (for brevity we do not include the complete dataset in this report). The data includes tables of exposure counts for each individual site (see Table 3), as well as graphs showing the relative distribution of risks for each district across different hazard scenarios (see Figure 4).

Note that this assessment is an exposure count only and does not provide an indication of potential consequences, loss or damage. It is intended to be used as a first-pass screening to assist with the selection of sites for more detailed risk assessment.

A preliminary ranking of sites was undertaken by identifying the three sites with highest exposure counts for each value domain per hazard scenario. A summary per district of how many times each site was represented in the top three is presented in table 4. Note that this is presented as an indicative summary only, and further analysis is required.

The complete results of the spatial analysis are presented in three excel file attachments (also presented in Appendix C as NRC SharePoint file links):

- Coastal exposure assessment _FNDC_20210624
- Coastal exposure assessment _WDC_20210624
- Coastal exposure assessment _KDC_20210624

Dargaville, Kaipara district

Periodic inundation

Coastal flooding	depth	Community facilities (no.)	Maori land (m2)	Marae 100m buffer (m2)	Buildings (no.)	3 waters pipes (m)	Roads (m)
Present day	0.15 - 0.3m	0	1032	920	48	8925	1789
	0.3 - 1.0m	0	644	4331	22	7749	790
	1.0 +	0	0	717	2	1924	161
	Total	0	1675	5969	72	18597	2740
2080	0.15 - 0.3m	0	8043	1111	92	8828	2602
	0.3 - 1.0m	0	2361	3243	86	12802	2480
	1.0 +	0	681	2515	5	9027	569
	Total	0	11085	6869	183	30658	5651
2130	0.15 - 0.3m	0	4176	6731	105	6025	3321
	0.3 - 1.0m	0	19595	4401	643	45561	11038
	1.0 +	0	2121	5249	91	19510	2525
	Total	0	25891	16380	839	71096	16884

Permanent loss of land

Costal erosion	probability	Community facilities (no.)	Maori land (m2)	Marae (no.)	Buildings (no.)	3 waters pipes (m)	Roads (m)
2080	66%	N/A	N/A	N/A	N/A	N/A	N/A
2130	5%	N/A	N/A	N/A	N/A	N/A	N/A
Permanent tidal inundation	sea level rise (above mean high water)	Community facilities (no.)	Maori land (m2)	Marae (no.)	Buildings (no.)	3 waters pipes (m)	Roads (m)
2080	0.6m	0	1418	5241	39	11302	1168
2130	1.2m	0	13197	6183	198	31748	5142

Table 3. Example exposure data table for Dargaville, Kaipara.

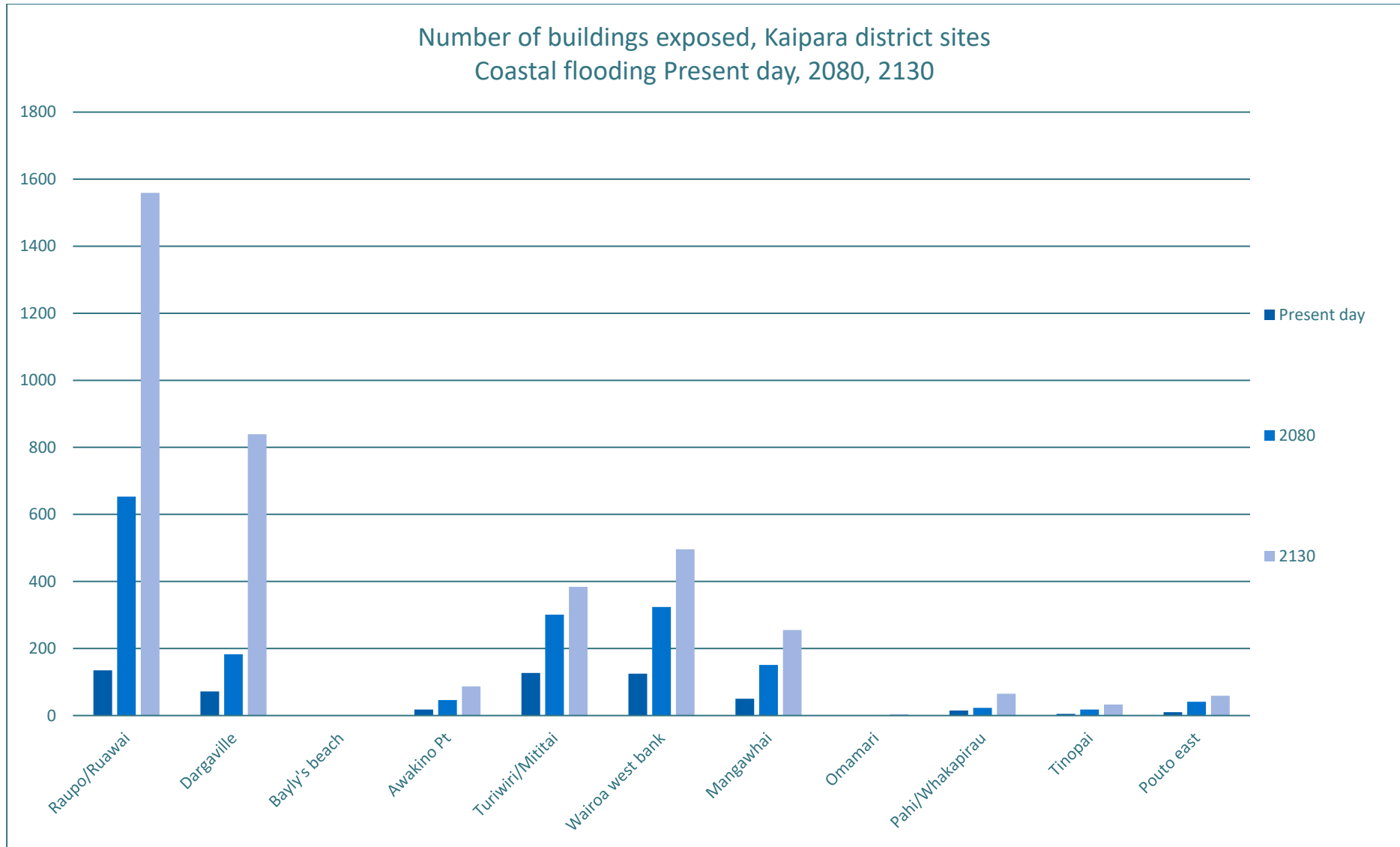


Figure 4. Example exposure comparison graph: Number of buildings exposed in Kaipara district sites to coastal flooding (Present day, 2080, 2130)

Kaipara district		Far North District		Whangarei District	
Site name	count	Site name	count	Site name	count
Raupo	12	Awanui	10	Whangarei	8
Wairoa west	5	Paihia	7	Pataua	8
Turiwiri	5	Tokerau	5	Ngunguru	7
Dargaville	5	Panguru	4	Marsden	6
Mangawhai	5	Whangape	4	Whangaruru	6
Pahi	5	Ahipara	4	Takahiwai	4
Baylys	3	Horeke	2	Outer Whangarei harbour	3
Pouto east	2	Whangaruru	2	Whananaki	2
Wairoa west	1	Russell	1	Waipu	2
Tinopai	1	Motukaraka	1	Wooleys	1
		Omanaia	1	Langs	1
		Whangape	1	Langs	1
		Opononi	1	Taiharuru	1
		Kaimaumu	1	Tutukaka	1
		Matauri	1		
		Paihia	1		
		Taipa	1		
		Kohokohu	1		

Table 4. Count of sites registered in the highest three exposure counts for all value domains and all hazard scenarios.

Part two. Choosing an adaptation engagement process

Different communities will have different needs for adaptation planning. When developing adaptation planning programs, councils will need to identify appropriate engagement approaches that work best for their communities. The *Adaptation engagement framework* report helps outline the governance structures and project management requirements of different scales of adaptation engagement.

Data representing different community attributes can help indicate which appropriate approaches to adaptation planning for communities. Alongside the exposure indicator data explored in the previous section, community attribute data can also help identify appropriate timeframes for engagement.

Community attribute data is largely qualitative and can be drawn from a wide range of sources including council staff workshops, hapū representatives, census statistics and civil defence. Details of possible data sources are presented in Appendix B. This report does not collate or report on community attribute data. Following feedback from workshops with district councils in early 2021, the report suggests a process that could be used. The following presents a possible process for council staff to follow when considering locations and timeframes for adaptation planning.

Adaptation engagement approaches

The *Adaptation engagement framework* report describes four different engagement approaches, summarised below:

Engagement approach	Description	Cost	Management	Timeframe
Community-led	Community-directed adaptation planning. Support from councils (e.g. hazards data, facilitation, funding opportunities etc), but process is led by community and documented via IHEMPs, CDEM plans etc.	\$	minimal	flexible
Small-scale/low complexity	Council-led process using facilitated community panels (1 or 2) and adaptive pathways decision-making framework. Limited requirement for complex engineering investigations or feasibility studies etc. Plan adopted by council.	\$\$	low	2-3 years
Combined locations	As for small-scale/low complexity, but combining multiple adjacent sites into one larger project with multiple community panels.	\$\$\$\$*	Moderate*	2-3 years*
Large-scale/high complexity	Council-led process using multiple facilitated community panels and adaptive pathways decision-making framework. Requirement for complex engineering investigations and feasibility studies etc. Plan adopted by council.	\$\$\$\$\$	high	3-6 years

*depends on scale of project

Characteristics of different communities can help determine which of these approaches is appropriate for different locations. These may include:

Community-led adaptation planning project

- Small population
- Relatively low number of interested parties
- Strong desire for self-determination
- Tangata whenua or community groups may have strong ownership over planning process
- Evidence of existing adaptation planning and/or community resilience plans
- Relatively few council assets exposed to hazards

Small-scale adaptation planning project

- Small population
- Relatively low complexity of interested parties
- Small number of council assets exposed
- Some exposure of private and public assets
- Little interaction with other sites

Combined adaptation planning project

- As per small-scale needs, but with enough connectivity to join into a larger combined project

Large-scale adaptation planning project

- Large population
- Many different groups within (and outside) the location affected
- High potential for conflicting views within the community
- High complexity with many different values affected (e.g. natural values, amenity, property, infrastructure)
- Significant exposure of private and public assets including lifelines infrastructure
- Large potential impact on local economy

Assessing adaptation engagement approaches using community attributes

We have identified community attributes that may be useful when defining an appropriate adaptation response for different communities. Attributes may include:

Scale

- Size, type of settlement (urban vs rural)
- Natural heritage values at risk
- Population
- Number of dwellings
- Public assets and infrastructure
- Importance to local economy (e.g. food production)

Connectivity

- Proximity to other communities, especially where part of contiguous coastal geomorphology

Cultural

- Presence of strong cultural sense of autonomy, or cultural heritage values
- Strong desire for rangitiratanga, or community self-determination

Complexity

- Number of interested or affected parties
- Diversity of risks/impacts
- Diversity of values affected
- Regionally significant infrastructure or economic values affected
- Exposure of planning zones allowing development
- Treaty claims
- Obvious conflicting values

Appendix B contains a list of potential data sources to use for defining community attributes.

Appropriate timeframes for adaptation engagement

Regardless of the engagement approach used, some communities are likely to require, or be ready for, adaptation planning sooner than others. While ultimately all at-risk coastal communities will need to plan for climate change adaptation at some point, councils need to schedule adaptation planning programmes in line with available budgets and community expectations.

Consideration of projected hazard exposure and community readiness will help councils understand the urgency for adaptation planning for different communities. We also acknowledge that there are existing interactions with communities, such as ongoing conflict or legal issues that need to be taken into account that may also influence timing.

Considerations for setting engagement timeframes may include:

Exposure

- Overall risk severity (at multiple timescales)
- High immediate and/or short-term risk
- Impacts on long-lived infrastructure
- High potential for ad-hoc responses resulting in lock-in
- High potential impact on development/redevelopment

Community readiness

- Evidence of community readiness and engagement with issues
- Evidence of dissatisfaction - opportunity to defuse issue?
- Existing or future spatial plans
- Existing plans for infrastructure investment that may require adaptation planning input

Relationship building required

- Existing tension between community and council
- Existing issues with community engagement processes that may complicate adaptation planning

Adaptation needs assessment

The data from the hazard exposure assessment and community attributes can be combined using expert judgement using the following processes to give direction to site selection and timing for adaptation engagement.

Adaptation needs	Community attributes
Engagement approach	Scale
	Connectivity
	Cultural
	Complexity
Engagement timeframe	Exposure (now, 50, 100yrs)
	Community readiness
	Community conflict

Rankings for exposure and community attributes help point to appropriate engagement approaches and timeframes for adaptation planning. The below tables summarise the recommended approach to choosing engagement approaches and timeframes.

Engagement approach

Engagement approach	Scale	Complexity	Connectivity	Cultural
Community-led	Small	Low		High
Small community	Small	High	Low	
Combined locations	Small	High	High	
Large community	Large	High		

Timeframe

Timeframe	Exposure current day	Exposure 50yr	Exposure 100yr	Community readiness	Prioritise relationship building
Immediate	Extreme/high	Extreme/high	Extreme	High	
Short term	high	Extreme/high	Extreme	High	
Medium term		high	Extreme/high		
Long-term			high		
On hold				Very low	High

Appendix A

First pass exposure assessment data

Exposure indicators

Value domain name	Exposure indicator name	Unit	Contributing data layer names	Changes to layers
Property	Building footprint	count	NRC LINZ BUILDING FOOTPRINT CENTROIDS (Freq)	N/A
	Land area	m2	N/A	N/A
Council assets	Road	m	NTA KDC ROADS (m)	grouped into one layer
			NTA WDC ROADS (m)	grouped into one layer
			STATE HIGHWAYS (m)	grouped into one layer
			NTA FNDC ROADS (m)	grouped into one layer
	3 waters network	m	KDC WASTEWATER LINES (m)	grouped into one layer
			FNDC WATER SERVICES (m)	grouped into one layer
			WDC STORMWATER LINES (m)	grouped into one layer
			WDC WATER LINES (m)	grouped into one layer
			WDC WATER SERVICES (m)	grouped into one layer
			KDC STORMWATER LINES (m)	grouped into one layer
Community	Community facilities	count	NORTHLAND SCHOOLS (Freq)	grouped into one layer
			WDC LIBRARIES (Freq)	grouped into one layer
			WDC MUSEUMS (Freq)	grouped into one layer
			FNDC CEMETERIES (Freq)	grouped into one layer
			NORTHLAND HOSPITALS (Freq)	grouped into one layer
			CIVIL DEFENCE COMMUNITY CENTRES (Freq)	grouped into one layer
			WDC CEMETERIES (Freq)	grouped into one layer
			NORTHLAND MEDICAL CENTRES (Freq)	grouped into one layer
WDC COUNCIL OFFICES (Freq)	grouped into one layer			
Māori	Māori freehold land	m2	MAORI FREEHOLD LAND (m2)	N/A
	Marae and surrounds	count	MARAE LOCATIONS (Freq)	buffer of 100m applied

Appendix B

Community attribute data

During workshops with district council staff we discussed sources of information to help describe community characteristics that would assist staff to develop adaptation engagement programmes. We grouped information into two main groups: place and people. These sources of data are not prescriptive but can be used by council staff to start conversations about ‘how and when’, develop adaptation needs descriptions in community profiles or simply inform site ranking.

Community attributes - place

Attribute type	Attribute name	Details	Data source	Data type	Measures affected
Hazards	Access	Road access outside community area	GIS data	Visual assessment, description	Exposure
	Historic event evidence	Any evidence of coastal or river hazards; other stressors (e.g. water supply)	NIWA, council reports, local knowledge	Reports, media, description	Exposure
Location/ Township	Size	Area, Population, total building count	Stats NZ, LINZ	Counts	Scale
	Urban/rural/other	Type of settlement	GIS data, Council staff knowledge	Description	Scale
	Connectivity	Proximity to other settlements/ potential to combine with other sites	GIS data, Council staff knowledge	Description	Connectivity
Cultural	Maori cultural heritage	Marae, urupa, waitapu, Māori freehold or other land ownership	GIS data, hapū knowledge	Count, description	Cultural
Environmental	Significant natural character	Natural values, aesthetics and amenity, and its meaning to locals and visitors	local knowledge	Description	Scale Complexity
	Natural heritage	Significant ecological, habitat or biodiversity values	GIS data, Council staff knowledge	Count, description	Scale Complexity
Council assets and planning	District infrastructure	Existing council assets - e.g. Roads, 3 waters, reserves, boat ramps etc	GIS data, Council staff knowledge	Count Description	Complexity
	Infrastructure plans and budgets	Long term plan, Infrastructure strategy details	Council staff knowledge	Description	Complexity
	Community plans	Structure plans, spatial plans, community engagement (existing or planned)	Council staff knowledge	Description	Community readiness
	Development	Future development, undeveloped land potential	District plans, growth strategies; council staff knowledge	Description	Complexity

Table 3. ‘Place’ Community attributes data types and sources

Community attributes -people

Attribute type	Attribute name	Details	Data source	Data type	Measures affected
Sensitivity	Social statistics	Age, health, population trends	StatsNZ	Description, statistics	Complexity
	Permanent vs transient residents	Evidence of holiday home population dynamics	StatsNZ	Description, statistics	Complexity
	Interested parties	Number of key interested parties, hapu/iwi, stakeholder groups, businesses etc	Local knowledge	Description	Complexity
Adaptive capacity	Community readiness	Existing adaptation momentum, willingness to engage; Engagemnt fatigue	local knowledge	Description	Community readiness
	Conflict	Community dissatisfaction or activism, history of conflict with councils	local knowledge	Description	Conflict
Resilience	CDEM planning and engagement	Existence of formal CDEM plans, previous engagement with CDEM	CDEM team	Description, reports	Community readiness
	Maori community	Strong community networks, sense of autonomy and resilience. May be informal, expressed through coordinated civil defence response actions or IHEMPs	local knowledge	Description	Cultural
	Local economy	Potential impact on local economy of food production; QV land use database, local knowledge	local knowledge	Description, statistics	Complexity

Table 4. 'People' Community attributes data types and sources

Appendix C

Attachments (NRC file links)

Consultant GIS methodology reports:

Climate change risk assessment Python Toolbox overview

https://northlandregionalcouncil.sharepoint.com/:b:/s/dmHazardManagement/ETI3XsTwKT5Bpa4-F0MHLSEB4_IT0V3z_SBKBD2g-yraqw?e=ImuKlr

Community Area Climate Change Risk Assessment

<https://northlandregionalcouncil.sharepoint.com/:b:/s/dmHazardManagement/EfeZQZS1QlIkufg5BqzAfveBnRj6WrKa6aYrNU7Gdgsnvw?e=BtXPTH>

Site exposure assessment data:

KDC

<https://northlandregionalcouncil.sharepoint.com/:x:/s/dmHazardManagement/EcmOlqBABlxGgCiyynheZsBrCko2V2EPt8NdweM6ZjRkg?e=ab56dz>

FNDC

https://northlandregionalcouncil.sharepoint.com/:x:/s/dmHazardManagement/EYKTzQejR0VGnXBIMo_7mNMB0I32HfRcEhJJLeBTnDUHXg?e=aan93d

WDC

<https://northlandregionalcouncil.sharepoint.com/:x:/s/dmHazardManagement/EXMRbazR2m1Gi5s-z5CRDYkBOG421rcjvwo7OsvLVMmsGA?e=dTSeP6>

GIS model files

W:\ArcGIS Pro\Environmental Services\Rivers and Natural Hazards\Natural Hazards\Data\Climate risk analysis

Northland Regional Council

P 0800 002 004

E info@nrc.govt.nz

W www.nrc.govt.nz