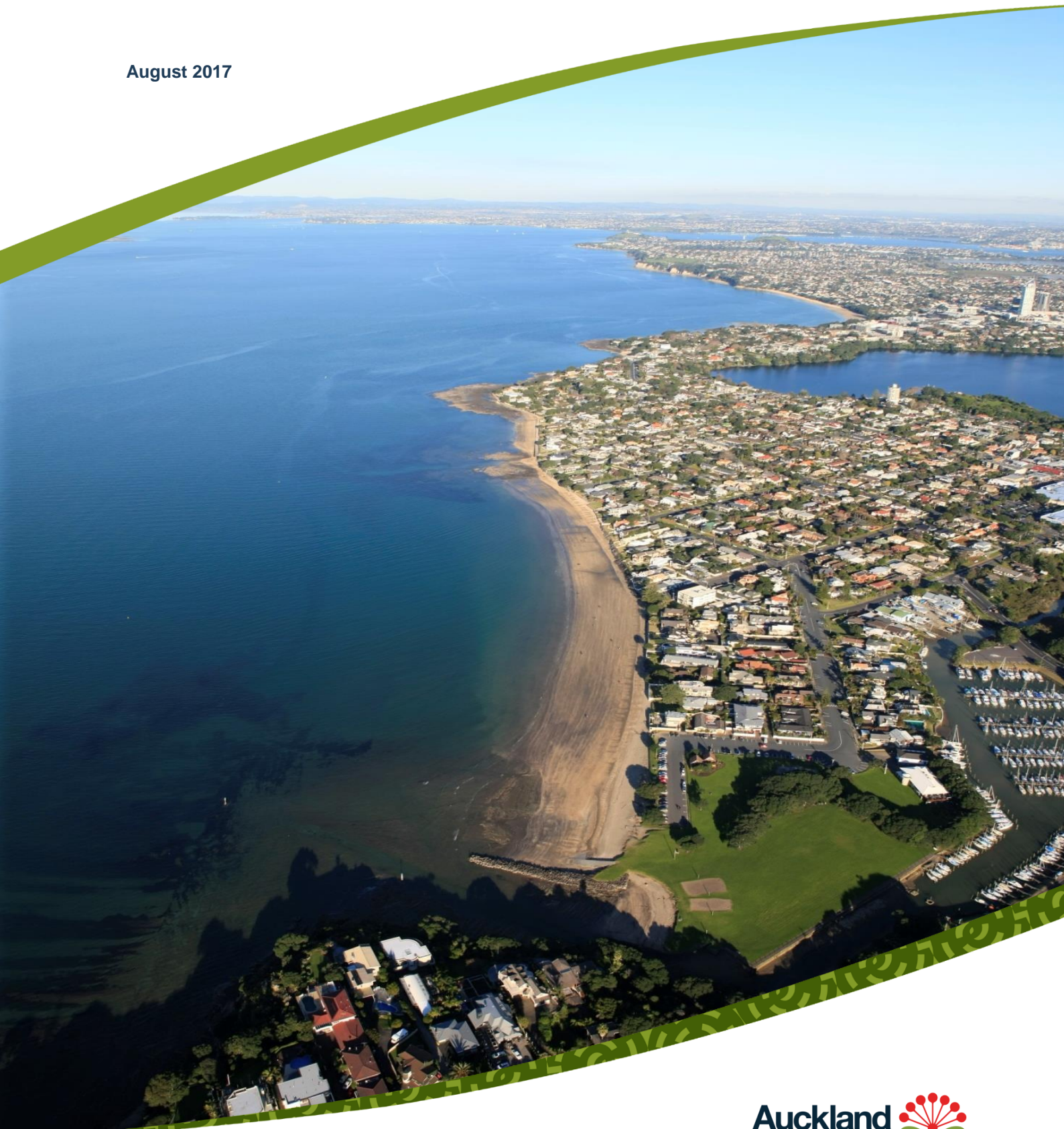


# Coastal Management Framework for the Auckland Region

August 2017





# Coastal Management Framework for the Auckland Region

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## Executive Summary

Auckland is characterised by 3,200 km of coast of high environmental, social, cultural and economic value. However, the complexity of coastal processes, combined with the future pressures associated with climate change and future growth, pose significant future management challenges. Considering Auckland Council's key roles with regard to coastal management (including regulatory, asset and emergency management) an enduring responsibility to address these issues is acknowledged. Therefore, the adoption of a definitive coastal management decision-making framework is essential to ensure sustainable economic and environmental development of our coasts in the long term.

The aim of this document is to develop a best practice, holistic, operational coastal management framework for the region, which aligns with our regional planning tools. To achieve this, a series of objectives and overarching principles have been articulated. Recognising the need for a consistent and coherent approach going forward, a tiered approach to decision making from a regional to site-specific scale has also been developed. This includes a multi-criteria analysis tool, within which a key element is embedding mana whenua and cultural values.

To enable the effective implementation of the framework, a range of tools has been identified and described. Coastal Compartment Management Plans (CCMPs) will facilitate the development of sub-regional, high-level management approaches (e.g. from 'protect' through to 'managed realignment') for sections of coastline. Selection of these approaches will be driven by an integrated assessment of the coastal system and will be considered over at least a 100-year timeframe (as required by the New Zealand Coastal Policy Statement and the Auckland Unitary Plan) to encapsulate the key principles of the coastal management framework. CCMPs will drive asset management prioritisation and budgeting, within the context of regional and local governance. The CCMPs will be founded on a series of standard requirements identified in the framework. This includes but is not limited to; acquisition of comprehensive asset data, development of Auckland Council operational policy, robust technical guidance and associated design standards, and continued regional research in relation to coastal hazards and climate change.

The framework also includes project-scale assessment and implementation tools, to deliver projects defined and derived through the framework process. In addition to the above, the framework recognises that effective engagement and consultation with a broad range of internal and external stakeholders is integral to the successful implementation of the framework.

Implementing a framework approach will take time to develop and deliver. Therefore, a short-term approach to hot-spots and urgent works has also been developed.



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## 1.0 The need to adopt a coastal management framework

This section introduces the Auckland coast and its development history. This is followed by an outline of the problem definition with respect to coastal management which subsequently highlights the need to adopt a coastal management framework for Auckland.

### 1.1 The Auckland coast

Auckland has the largest population density to coastline ratio in New Zealand. It is characterised by 3,200 km of dynamic coastline, 21,000 km of rivers and streams and 26 coastal regional parks.

Auckland's coast is bounded by the South Pacific Ocean and the Tasman Sea. It encompasses the Kaipara, Manukau and Waitemata Harbours which support a diversity of estuaries, islands, reefs, rocky shoreline, sandspits and dunes. In addition, Auckland's offshore region includes the nationally significant Hauraki Gulf Marine Park and New Zealand's first marine reserve (Goat Island), along with four additional marine reserves.



Figure 1: Auckland city waterfront and the Hauraki Gulf

Over the past decade, a significant proportion of Auckland's development and supporting infrastructure has been concentrated towards the coast; with much of the urban part of the region sited on a narrow isthmus of land between the Manukau and Waitemata Harbours. Intensive coastal development exists along the east coast almost continuously from Maraetai Beach (in the south) to Hatfield's Beach (in the north). Increased development has also occurred on the south eastern coastline of the Manukau Harbour.

Coastal residential property is highly sought after. As a result, developments have been undertaken in a range of coastal environments including immediately landward of eroding soft sedimentary cliffs and on accreted lowlands behind beach systems. The development of the Auckland Unitary Plan is one mechanism that seeks to balance future development and natural hazard risks.

## 1.2 Problem definition

The above section highlights the unique character of the Auckland coast and the sensitive balance between preserving its environmental character whilst also enabling sustainable growth to achieve the Auckland Plan vision of becoming 'the world's most liveable city'. This section introduces the key challenges associated with the above. With respect to coastal management in Auckland Council, these can be broken down into three key areas:

- 1) Auckland's coastal hazards
- 2) The changing coastline
- 3) Auckland Council's (Auckland Council and CCO) roles and coastal management practices.

Each of these aspects is discussed further in the sub-sections below.

### 1.2.1 Auckland's coastal hazards

Coastal processes are a key element of the natural character of the dynamic coastal environment. As with any system, the coastal environment oscillates through a range of conditions and occasionally experiences natural extremes. Natural hazards arise from the interactions of such processes with things we value including existing and historical development, human use or proximity of infrastructure to the coast. As a result, coastal erosion (including coastal cliff instability) and coastal inundation are two of the most commonly occurring natural hazards in the Auckland region. These specific hazards, along with the lower frequency but higher magnitude risk presented by tsunamis, are briefly discussed in turn below. Further supporting technical information can be found in Appendix A.

The magnitude of impact on the Auckland coastal margin will differ from coast to coast, within estuaries and harbours and also within localised coastal cells. Such impacts will depend on the physical drivers which shape the coast, the natural characteristics and geology of the coast, the influence and level of human modification and the future impacts of climate change.

### 1.2.1.1 Coastal erosion

Coastal erosion is the process of the removal of material at the shoreline, leading to loss of land as the coastline retreats. A distinction can be made between soft shoreline and hard cliff coastal erosion which are controlled by different processes.

Soft shorelines refer to sandy beaches and dunes comprised of unconsolidated or very weakly consolidated materials. Based on our best available information on soft coast erosion at a regional scale, predictions of erosion over the next 100 years range from 6 m (on perceived stable beaches with low/limited dune systems) to 55 m (at known more variable beaches with highly developed dune systems). However, when also considering the influence of sea-level rise on this process, predictions increase to over 200 m in some areas (Reinen-Hamill et al, 2006).



**Figure 2: Orewa Beach storm damage 2014<sup>1</sup>**

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<sup>1</sup> Evidence of historical structures attempting to manage the effects of erosion and the limited width of remaining Esplanade Reserve (approximately 2 m)

Coastal cliffs are essentially erosive landforms affected by a complex range of environmental and anthropogenic factors. Based on our best available information for cliff erosion currently available for the Auckland region (Reinen-Hamill et al, 2006), predictions over the next 100 years range from 5 m (for low, competent volcanic cliffs) to 347 m (for high, weakly consolidated cliffs). However, with sea-level rise these predictions extended to 9 m to 524 m, respectively. The sea-level rise scenarios incorporated in the above predictions allow for a 0.5 m rise. However, greater sea-level rise of approximately 1 m over the next 100 years is predicted which will likely increase these erosion predictions.

## 1.2.2 Coastal inundation

Coastal inundation is a significant hazard within the Auckland region. There are a number of meteorological and astronomical phenomena involved in the development of a combined extreme storm-tide and wave event, which can combine to cause inundation of low-lying coastal margins, particularly on the open coast.

Our best current information for the Auckland region is based on the joint extreme sea level and wave inundation mapping included in the Auckland Council Technical Report 2016-17 '*Coastal Inundation by Storm Tides and Waves in the Auckland Region*' (Stephens et al, 2016). The results demonstrate that the 1% Annual Exceedance Probability (AEP) coastal-storm event exposes approximately 4% of Auckland's total land area to coastal flooding. This exposure and associated risk significantly increases with the impact of sea-level rise.

### 1.2.2.1 Tsunami

A tsunami is a series of waves, typically created by sudden movement or rupturing of the ocean floor from earthquakes, underwater landslides or underwater volcanic eruption. Tsunami may be generated locally, regionally or from a distant source. However, it is distant source tsunami (e.g. generated off the west coast of South America) that present the greatest risk to the Auckland region.

Tsunami risk in the Auckland region is currently best reflected by Auckland Council's Civil Defence Emergency Management (CDEM) evacuation mapping<sup>2</sup>. The mapping utilised the 2,500-year Average Recurrence Interval tsunami event which predicts a maximum water elevation of over 14 m for mainland Auckland. Such an event exposes approximately 9% of Auckland total land area to tsunami inundation.

## 1.2.3 The changing coastline

Given the dynamic nature of the Auckland coast from a coastal processes and climate change perspective, described above, a key consideration for effective, long-term coastal management is the issue of changing risk over time. This highlights the need to consider two additional factors; climate change and future growth, which are further discussed below.

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<sup>2</sup> <http://www.aucklandcivildefence.org.nz/community/tsunami-evacuation-maps>



### 1.2.3.1 Climate change

Predicted climate change will exacerbate the above coastal hazards by changing some of the physical drivers. Climate effects and the associated impacts on Auckland's coastal margin are likely to include:

- Sea-level rise:
  - Increased coastal erosion and coastal cliff instability
  - Higher storm surge flooding and more extensive coastal inundation
  - Increased frequency and magnitude of events over time.
- Changes in rainfall patterns and intensity:
  - Increased pore-water pressures and subsequent slope instability
  - Increased drainage problems in adjacent low-lying areas.
- Increased storminess:
  - Reduced performance and failure of infrastructure directly affected by events
  - Increased maintenance costs of coastal structures.

Additional supporting information in relation to climate change predictions can also be found in Appendix A.

With respect to coastal management, one of the most crucial impacts of climate change to be accounted for is sea-level rise. The historic rate of sea-level rise for Auckland is recorded as 1.6 mm/yr (1899-2014). For future sea-level rise, the Ministry for the Environment's current guidance (MfE, 2008) promotes a base value of 0.5 m but consideration of at least 0.8 m over the next 100 years. However, the guidelines are currently being updated and are likely to reflect the most recent predictions from the Intergovernmental Panel on Climate Change (IPCC). Considering the 'at least a 100-year timeline', the IPCC projections can be updated to yield a base level of 0.7 m and at least 1 m by 2115 (Bell, 2015). As discussed in Appendix B, the Auckland Unitary Plan considers 1 m sea-level rise over the next 100 years in line with these projections and adopting a precautionary approach.

Sea-level rise will have important implications for coastal hazards by altering the driving mechanisms. For example, with respect to coastal erosion, it is generally accepted that a rise in sea level will result in an upward and landward movement of the coastline. In addition, an increase in water depth will increase wave heights and in turn, exposure of the coast. These factors will likely increase future rates of coastal erosion. With respect to coastal inundation, the frequency of future inundation events will increase considering the relationship between water height and extreme events.



**Figure 3: Inundation of State Highway 16**<sup>3</sup>

A key issue associated with the above is that there is a lack of clear national guidance for determining coastal hazards and the future impacts of climate change. There are currently no universally accepted approaches or international consensus on what is appropriate for future planning. There is also less than complete information on the methods used by various experts, the ways and locations in which they have been tested, the results achieved, and their applicability to sites in the Auckland region. Therefore, an approach has been adopted for coastal management which is adaptive and based on consensus at a regional level.

### 1.2.3.2 Human modification

In addition to the climatic factors described above, the Auckland coast has changed, and is continuing to change, as a result of modification of the coastal fringe, often undertaken with the intention of mitigating the above issues. As a result, a significant proportion of the coast (including extensive areas of Auckland Council landholdings) has been reclaimed, modified (including changing river and flow paths) or armoured.

The scale and extent of modification of the Auckland coast presents a series of key management challenges for Auckland Council. Historic coastal protection structures have typically been provided in an ad-hoc manner and are now not necessarily appropriate when taking a more holistic and integrated perspective. For example, some coastal protection responses create localised or wider downdrift erosion issues. In addition, a significant number of historic structures are reaching the end of their 'design life', subsequently requiring significant potential repair and renewal commitments going forward.

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<sup>3</sup> **Note:** Occurred during a King Tide event in 2014 highlighting the future issues of sea-level rise on our coastal margins (<http://auckland.kingtides.org.nz>)



Sustainable future coastal management requires a comprehensive understanding of our coastal structures and associated assets. However, considering the extent of the Auckland coast and associated modification, existing information is disparate and incomplete. These limitations have been identified and improved information is beginning to be compiled. To date, it has been difficult for asset owners and stakeholders to find information about coastal structure conditions, hazardous coastal areas and related drivers.

### 1.2.3.3 Summary

Auckland is exposed to a range of coastal hazards. Treatment of the risk they present is highly complex owing to the varying drivers associated with each hazard. Coastal erosion is a finite, ongoing hazard which, when it impacts, results in the actual loss of properties, infrastructure and assets as well as a risk to the safety of people. Coastal inundation may happen on a recurrent basis with attendant damage and risk to safety of people – historically, developments have recovered and continued to be used, although the impacts of sea-level rise may change this risk profile over time.

Coastal erosion and inundation are natural processes which only become a hazard when they affect things we value. Both processes are driven by a range of natural and anthropogenic factors. While hard protection structures such as seawalls and stopbanks have been commonly used in the past to treat the risk, these measures cannot stop the process.

These issues emphasise the importance of holistic and regional-scale hazard management and planning activities. This is particularly pertinent when addressing the complexities of cumulative hazards (e.g. at locations susceptible to both coastal erosion and inundation).

### 1.2.4 Auckland Council's coastal management roles

The above sections highlight the diversity of the Auckland coast and introduce some of the challenges associated with coastal hazards and climate change risk management. The first stage of response is consideration of Auckland Council's coastal management roles and associated responsibilities. These can be broken down into three key components:

- 1) Regulatory
- 2) Asset management
- 3) Emergency management.

These are briefly outlined below to highlight our varying but interrelated responsibilities for coastal management.

#### 1.2.4.1 Regulatory role

Auckland Council's response to coastal management, hazards and climate change is governed by a hierarchy of key statutory documents as set out under the regulatory framework. The purpose of each of these documents is set-out in Appendix B.

To summarise, the Resource Management Act 1991 (RMA) promotes the sustainable management of natural resources. Auckland Council must give effect to the RMA by addressing the actual or potential effects of any land use, development or protection of land including for the avoidance or mitigation of natural (including coastal) hazards. Supporting the RMA, the New Zealand Coastal Policy Statement 2010 encourages the preservation of the natural character of the coast and discourages the provision of hard engineering structures.

Auckland Council has developed the Auckland Unitary Plan to capture RMA requirements and other statutory documents into a regional scale plan for land and coastal management in Auckland. Given the strong focus on sustainability and natural processes, the plan includes a series of objectives, policies and controls which introduce potential constraints and requirements for development and the provision of hard engineering structures going forward.

The current regulatory framework highlights the importance of demonstrating sound consideration of a broad range of factors including coastal hazards, climate change, preserving the natural character of the coast, public access and sustainable development. To achieve this, and improve consenting outcomes, Auckland Council requires a comprehensive, long-term understanding of coastal change and coastal values which can best be captured through the development of a region-wide approach to coastal management.

#### 1.2.4.2 Asset management role

A distinct but somewhat complementary role of Auckland Council is our responsibility as an asset manager, which encompasses both governance and operational management. Auckland Council's coastal assets generally include structural defences, esplanade strips, reserves, coastal infrastructure (including transport infrastructure and stormwater outfalls).

##### **Asset governance**

Auckland is comprised of 21 local boards. Considering their distinct funding, these boards make the overarching decisions on asset management for their respective areas and are guided by a complex range of considerations, which are briefly described below:

- 1) The regulatory framework
- 2) Mana whenua values
- 3) Community, stakeholder values
- 4) Funding availability
- 5) Legal health and safety obligations
- 6) Technical feasibility.

Table 1 describes these in more detail.

**Table 1: Auckland Council's asset governance considerations**

The regulatory framework	The key statutory documents with respect to Auckland Council's regulatory role are outlined above and detailed in Appendix B.
Community, stakeholder and mana whenua values	<p>Under Auckland Council's role as an asset manager and landowner, to best represent community and stakeholder values, the Local Government Act 2002 (LGA) and Reserves Act 1977 must also be adhered to. The LGA has a purpose to provide for a democratic and effective local government. With respect to coastal management, Auckland Council must have particular regard to the contribution that core services make to its communities including; reserves, recreational facilities, community amenities, network infrastructure, and the avoidance or mitigation of natural hazards. Any management decisions Auckland Council makes should:</p> <ul style="list-style-type: none"> <li>• Take into account the diversity of the community, their present and future best interests</li> <li>• Consider the potential impact of any decision on the above.</li> </ul> <p>The Reserves Act provides for the preservation and management of the environment, landscape and recreational value of New Zealand for the benefit and enjoyment of the public. This includes ensuring, as far as possible, the preservation of access for the public to and along the coast and promoting the preservation of its natural character. In satisfying the above, capturing the values of mana whenua, the community and stakeholders requires extensive consultation and engagement.</p>
Mana whenua values	<p>Te Tiri o Waitangi provides clear guidance on the relationship between Māori and Auckland Council in the management of Auckland. Te Tiri principles associated with partnership, co-governance and Tino Rangatiratanga (self-determination) are paramount, of which Auckland Council is striving to enact. In addition to Te Tiri o Waitangi is the Takutai Moana Act which provides for the recognition of the customary rights of iwi, hapū and whānau in the common marine and coastal area. Furthermore, mana whenua have specific values in relation to their mana of the land and coastal environments which include but not limited to:</p> <ul style="list-style-type: none"> <li>• Te Ao Māori</li> <li>• Mātauranga</li> <li>• Kaitiakitanga.</li> </ul>
Funding availability	At present funding and prioritisation for coastal asset management is allocated locally. This can introduce limitations when selecting the most appropriate management response for a given area.
Legal health and safety obligations	Auckland Council has a responsibility as an employer and as a utility owner. Our activities including maintenance, inspections and construction must be able to be performed safely, which must be considered in option decision-making. Auckland Council also has a general obligation that the assets provided are safe for the public to use as intended.
Technical feasibility	This is a critical element to ensure that in achieving each of the above criteria, the final management option is technically sound (including consideration of coastal processes and climate change) and will have no adverse impacts on the coastal environment. Assessing the technical feasibility involves collaboration between a range of technical experts across the Auckland Council family. In addition, external consultants may be required to provide further assurance.

### Operational asset management

Operational asset management includes planning for, and implementing, any activities to manage existing assets. This may include renewal of hard protection structures (where deemed necessary) to protect other Auckland Council assets, such as reserves.

Current operational asset management practices in Auckland have tended to be reactive, with a focus on remedial measures post-hazard events, e.g. where structural failure or beach damage requires an urgent response. Coastal infrastructure is commonly perceived by the community as 'permanent'; therefore, reactive management post-failure presents an expectation for like-for-like renewal. This expectation can impose limitations on asset governance considerations. For example, while alternative options such as managed retreat may satisfy the other decision-making criteria listed above, public pressure to maintain the status-quo presents a significant challenge to promoting more appropriate responses.

Renewal or provision of new coastal defences maintains a perception that the long-term management approach for the coast is effectively to 'hold the line'. However, in reality, structural interventions can only be seen as a temporary measure with a finite inherent design life. Within this lifetime, coastal defences will only manage the effects and not the underlying cause of the issue (e.g. erosion, inundation). This limitation invites continuous repair and maintenance costs that are likely to increase with the pressures of climate change.

Across the Auckland Council family (Auckland Transport, Panuku, Watercare, ATEED), there are slight variances in how assets are described, in terms of expected life, condition and value. This also affects how we achieve an holistic approach to renewal and maintenance planning.

Current reactive management does not enable a long-term sustainable management approach for the Auckland coast to be determined. It does not fully capture the regional risks associated with the assets that the Auckland Council family owns, the associated lifelong management costs or the issues of changing risk over time in a way that can assist prioritisation of responses. In addition, there is a need for future decision making to be supported by robust, defensible operational policy that clearly articulates Auckland Council's coastal asset management obligations. Therefore, the coastal management framework is intended to support both governance and operational level asset management.

#### 1.2.4.3 Emergency management role

Auckland Council has a role under the CDEM Act 2002. The Act has the purpose to improve and promote the sustainable management of hazards to encourage and enable communities to achieve an acceptable level of risk and to provide for an emergency. Comprehensive emergency management revolves around the four areas of activity, known as the '4Rs': Reduction, Readiness, Response and Recovery. Auckland Council also considers a fifth 'R' to embed, Resilience.

All government departments, local government agencies, emergency services, lifeline utilities and other organisations and agencies have a role to play in planning and preparing for emergencies and for response and recovery in the event of its occurrence.

The coastal hazards introduced previously may result in an emergency if not adequately mitigated or if deemed untenable to mitigate. Auckland Council's CDEM department provides leadership in the delivery of coordinated and collaborative arrangements among organisations, agencies and communities.

Activities include:

- Contributing to the development of research, policy, regulation, frameworks and guidance that facilitates the understanding of coastal hazards
- Identifying the risks from coastal hazards that may result in an emergency
- Promoting, advocating and where practicable, undertaking actions to reduce hazards
- Planning for response and recovery
- Providing public education, timely warnings and technical information about hazards
- Ensuring effective operational capability to respond to, and recover from, an emergency.

CDEM therefore has synergies with strategic coastal management, both in terms of communicating hazards and in ensuring an effective operational response and resilience.

### 1.3 The need for a coastal management framework

Coastal management is highly complex, considering the range of interrelating processes, drivers and controls on the system. The importance of effective coastal management in Auckland is emphasised by the region's exposure to a range of coastal hazards. The potential impacts of climate change will exacerbate such hazards and place increasing risk on our coastal population, infrastructure and other assets.

The technical limitations and costs associated with reactive coastal management techniques highlight the need for careful consideration for the provision, replacement or continual maintenance of coastal infrastructure (hard or soft), intended to manage coastal hazards. It is imperative to consider carefully the location, design life and purpose of new assets based on an appreciation of the entire coastal system.

Coastal management is an emotive topic given the sometimes conflicting social, economic and environmental values that the coast can provide. Determining an appropriate risk-management response requires interactions with a range of stakeholders. This introduces further complexity to the decision-making process. With coastal and climatic issues presenting a significant future risk and management cost to Auckland, all stakeholder needs must continue to be included in the decision-making process to ensure a durable solution.

The above challenges highlight that a sensitive balance of coastal management approaches and options are required for Auckland, covering a range of management policies from 'hold the line' through to 'adapt' and 'managed realignment'. However, determining the appropriate location and design for implementation of such a range of approaches requires the development of a comprehensive framework. This must be developed based on a sound technical understanding of the scale and impact of coastal hazards as discussed and outlined through the remainder of this document.

Considering the Auckland Unitary Plan's policy to 'avoid increasing risk', a prioritised, strategic approach to future coastal management is also indicated to ensure long-term sustainability both economically and environmentally. This needs to be driven by a comprehensive, holistic understanding of Auckland's coastal hazards and their interactions with climate change to drive robust and informed planning decisions.

Therefore, the implementation of a coastal management framework for the Auckland region and the Auckland Council family is recommended.

## 2.0 Coastal management framework

Having established that a more strategic approach to managing our coastline is required, this section is focussed on what a regional framework for managing the coastline entails.

The context of coastal hazards, climate change and Auckland Council's key role in addressing coastal management challenges has been highlighted. Objectives for an approach which would address these issues are outlined below. These objectives have been developed into a framework, capturing the key principles to manage the coastline, and defining the need for robust and transparent decision-making. This section also discusses the development of a multi-criteria analysis, through consultation and collaboration, to enable the framework to be implemented at a range of scales.

### 2.1 Aims and objectives

The aim of the framework process is to develop a best practice, operational coastal management framework for Auckland. As a starting point, based on the problem definition, a series of high-level objectives have been identified for the framework. For it to be considered successful it must:

- 1) Provide guidance on the process required to develop a framework approach to coastal management
- 2) Develop a multi-criteria analysis to assess coastal management responses that is clear, transparent, and takes account of diverse Auckland Council drivers including mana whenua values
- 3) Enable a long-term, balanced perspective of coastal management and climate change issues to facilitate an environmentally and financially sustainable approach
- 4) Promote a sound understanding of coastal hazards, climate change and coastal assets in Auckland and provide and plan for sound technical information to facilitate robust and defensible decisions
- 5) Promote public understanding of coastal hazards and climate change.

It is understood that undertaking a regional approach to coastal management requires an ongoing and significant element of engagement to ensure that decision-making is transparent.

The following process was adopted in developing this framework (Objective 1):

- 1) Development of a set of strategic principles in consultation with the Governing Body (2015) to articulate Auckland Council's criteria
- 2) Engagement across the Auckland Council family to develop a broader understanding of shared asset management approaches and opportunities
- 3) Identification of key stakeholders (internal and external) for future decision making, both in framework development and implementation, to assist with development of an engagement plan
- 4) A need to develop key messages and a wider communication plan to promote public awareness of coastal hazards and our proposed management approaches.

The project team believes that items 3 and 4 should be subject to further discussion with the local boards, mana whenua and key Auckland Council family stakeholders to develop an engagement plan to garner public support of the implementation of the management framework itself. Consideration is needed of how to consult on the management plans that are developed— public engagement is vital to achieving acceptable outcomes.

The development of the framework identified that the aims and objectives identified on commencement do not address urgent issues. Therefore, the framework has been developed to also include and articulate urgent/hotspot management approaches.

## 2.2 Hierarchy of scale of the coastal management framework

The framework comprises of a four-tier hierarchy based on the scale of decision making and is underpinned by a range of additional tools as described below and in Figure 4:

- **Regional philosophy for coastal management:** Describes the overarching principles and policies
- **Systems approach to coastal management:** Breaks down the Auckland coast into sub-regional areas based on coastal processes and sediment cells
- **Coastal compartment planning:** Describes the systems-based approach to developing long-term coastal management policies. Includes sufficient flexibility to incorporate generic local requirements and considerations, which retain the regional philosophy
- **Asset management planning and project approaches:** Describes the approach to developing project-level options and approaches to enact the recommendations from the compartment plans
- **Short-term localised hotspot management:** Development of an urgent and hot-spot approach which incorporates the regional philosophy and the understanding of a tiered analysis, with the need for urgent response to ensure good short-term decision making
- **Tools to support the coastal management framework:** Identifies the need for new Auckland Council policy, coastal hazard assessment guidelines, coastal design standards and a communications plan to support the implementation of the framework.



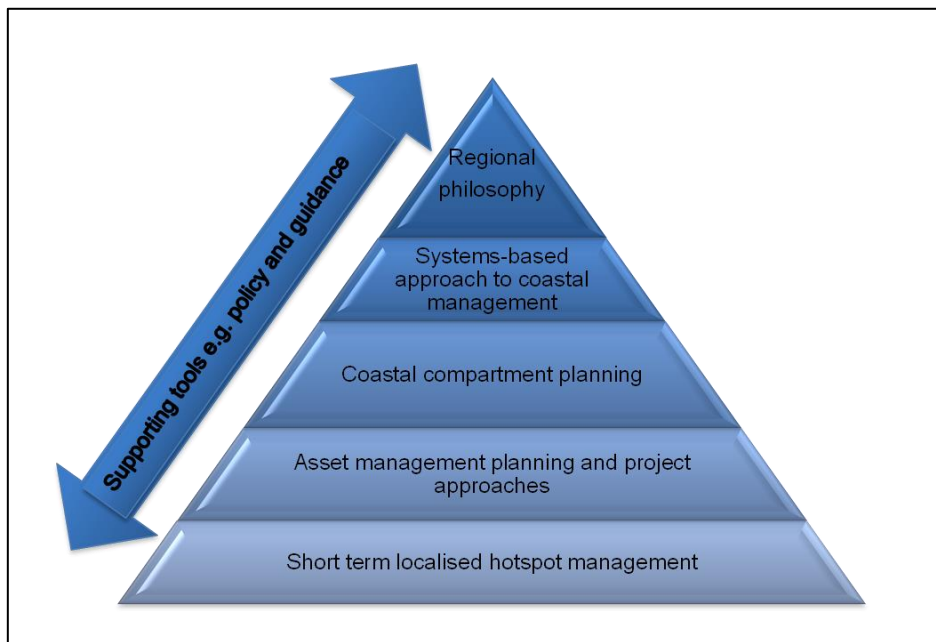


Figure 4: Hierarchy of the coastal management framework

## 2.3 Consultation and collaboration

The Auckland Council family is diverse and can bring a number of important contributions to the implementation of the above objectives. The project team for the initial draft framework captured the major coastal asset-owning entities within Auckland Council and the wider family – Community Facilities, Community Services, Panuku Development Auckland and Auckland Transport. The team also included the specialist advisory areas – Engineering and Technical Services (including Coastal and Geotechnical Services), Chief Sustainability Office, CDEM, Business Development and Improvement, and Legal and Risk. The team was led by the Chief Engineer under the guidance of the Chief Operating Officer. A collaborative approach across the Auckland Council family helps ensure that coastal hazards are coherently and strategically managed.

Māori values, and engaging and partnering with mana whenua, play a key part in the development of this coastal management framework. The Infrastructure and Environmental Services Directorate and Auckland Council as a whole are striving to increase meaningful engagement with mana whenua and are developing and implementing Māori responsiveness plans. The implementation of the coastal management framework will align with the vision and principles of the Infrastructure and Environmental Services Māori Responsiveness Plan. To give effect to Māori responsiveness plans, the coastal management framework enables important consideration of Te Ao Māori including mātauranga, mauri and kaitiaki in option assessment and decision making.

One of our commitments, as part of this framework, is to recognise and embed mana whenua values within the framework and to include Māori in decision making. To include mana whenua perspectives in the implementation of the framework, Auckland Council will:

- Include mana whenua in the decision-making and planning processes to represent their values and aspirations as kaitiaki (guardian)



- Provide opportunities to develop increased levels of meaningful engagement and dialogue around management of our Coastal resources and landscape responses.

As the framework starts to be implemented, community engagement will also be a fundamental component. Citizen science initiatives such as the Witness King Tides are already underway. Such projects have demonstrated that a collaborative and open approach is achievable, and that communities are interested in coastal management and how the environment is changing. Auckland Council will develop a communications plan to determine what needs to be consulted on, and how widely, to ensure that the implementation of the framework is successful.

Table 2 presents an overview of key internal and external stakeholders to implement the framework.

**Table 2: Key internal and external stakeholders for the Coastal Management Framework**

Internal	External
<ul style="list-style-type: none"> <li>• Auckland Council and our Insurers</li> <li>• Asset owners (various) and open space planners</li> <li>• AC CCOs (Auckland Transport, Watercare, Panuku Development Auckland, ATEED)</li> <li>• Regulatory and compliance</li> <li>• CDEM</li> <li>• Strategy &amp; planning (including natural hazards / resilience)</li> <li>• Local boards</li> <li>• Governing body (and various committees)</li> </ul>	<ul style="list-style-type: none"> <li>• Ratepayers and landowners</li> <li>• Insurers</li> <li>• Affected parties: <ul style="list-style-type: none"> <li>○ People who live in flood prone areas</li> <li>○ People who live on eroding coastlines</li> <li>○ People who want safe access to beaches</li> </ul> </li> <li>• Iwi</li> <li>• Department of Conservation</li> <li>• Research institutes (various)</li> <li>• Government: <ul style="list-style-type: none"> <li>○ Parliamentary Commissioner for the Environment</li> <li>○ Ministry for Civil Defence Emergency Management</li> <li>○ Ministry of Business, Innovation and Employment</li> <li>○ Ministry for the Environment</li> <li>○ Treasury/National Infrastructure Unit</li> </ul> </li> <li>• Other asset owners (including lifelines and NZ Transport Agency)</li> <li>• Media</li> <li>• Tourists</li> <li>• Developers</li> <li>• Commercial interests</li> <li>• Lawyers</li> <li>• Community bodies</li> <li>• Infrastructure industry</li> </ul>

## 2.5 Report structure

Following the hierarchy of the Coastal Management Framework, the remainder of the report is structured as follows:

<b>Section A3</b>	Describes the regional philosophy to the Coastal Management Framework including overarching principles.
<b>Section A4</b>	Outlines the approach to coastal compartment planning for the Auckland region.
<b>Section A5</b>	Describes the approach to asset management planning to implement the key policies identified through compartment planning.
<b>Section A6</b>	Identifies localised coastal management hotspots for prioritised works.
<b>Section A7</b>	Describes the tools needed to support the Coastal Management Framework.
<b>Section A8</b>	The next steps to implementing the Coastal Management Framework.

### 3.0 Regional philosophy

The regional philosophy to the Coastal Management Framework is dictated by a series of overarching, principles for the coastline. Any plans, policies or projects around coastal management must be cognisant of these principles. The principles were developed with the Regional Strategy and Policy Committee in December 2015 and are outlined in Table 3 below.

Additional principles for health and safety and regulatory compliance have been included as identified and added through development. After consultation on the draft Coastal Management Framework, these principles have been adopted across the Auckland Council family.

The principles have been developed into a sequential approach to coastal management; from regional coastal compartment management plans and asset management plans to localised project approaches, as previously described in Figure 4.

**Table 3: Key principles of Auckland Council’s Coastal Management Framework**

<p>Health and safety is integral to decision making: To ensure all management options are safe.</p>	<ul style="list-style-type: none"> <li>• Satisfies legislative requirements</li> <li>• Satisfies national and local guidance requirements</li> <li>• Any preferred design is safe to build and safe during operation.</li> </ul>
<p>Aligns with regulatory documents: Considers all statutory objectives and policies for an appropriate and balanced outcome.</p>	<p>Including (but not limited to):</p> <ul style="list-style-type: none"> <li>• The Resource Management Act</li> <li>• New Zealand Coastal Policy Statement</li> <li>• Auckland Unitary Plan</li> <li>• Civil Defence Emergency Management Act.</li> </ul>
<p>A systems approach: The awareness that the whole system needs to be considered for a strategic outcome.</p>	<ul style="list-style-type: none"> <li>• Coastal system (including environment, open spaces and amenity, cultural and coastal processes)</li> <li>• Whole of Auckland Council system</li> <li>• Community and governance system</li> <li>• Regulatory system</li> <li>• Framework for decision-making</li> <li>• Development system, including insurance</li> <li>• Infrastructure systems</li> <li>• Regional and local approach.</li> </ul>
<p>100-year timeframe: The use of a longer time horizon to enable sustainable, strategic decision making.</p>	<ul style="list-style-type: none"> <li>• For whole-of-life decision making</li> <li>• Sustainable thinking</li> <li>• Balance existing value with future value and cost.</li> </ul>

Time or event dependent options: The acknowledgement that the future vision for the coast may not be achieved in one step, and that interim measures are acceptable.	<ul style="list-style-type: none"> <li>• Allow for short term use of at risk areas</li> <li>• Option can change over time.</li> </ul>
Climate change impacts embedded into approach: To ensure sustainability and resilience.	<ul style="list-style-type: none"> <li>• Aligns with the Auckland Unitary Plan and existing and proposed technical design guidelines.</li> </ul>
Appropriate technical solutions: Consider a range of effective solutions and communicate why they are or are not effective.	<ul style="list-style-type: none"> <li>• Not all technical solutions are suitable for all areas</li> <li>• Allow for innovation</li> <li>• Enable community-led responses.</li> </ul>
Principles need to be developed outside specific project issues.	<ul style="list-style-type: none"> <li>• Confirms the need for a strategic, regionally-based approach to implement on a project basis.</li> </ul>
Applies the coastal management framework.	<ul style="list-style-type: none"> <li>• Clarity around prioritisation</li> <li>• Finds the right balance.</li> </ul>

## 4.0 Systems-based approach to coastal management

Fully encompassing the principle to take a systems-based approach, the next tier of the Coastal Management Framework hierarchy is to take a sub-regional or compartment planning approach to the region.

### 4.1.1 Compartmentalising the Auckland coast

Following the approach of the UK's Shoreline Management Planning, Auckland's coastline has been broken down into a series of large-scale coastal cells. Coastal cells are defined areas of the coast where sediment movement is expected to be contained or restricted to by key geomorphic features of the coast, e.g. between large headlands or within harbours. These cells provide a defined area of coast for discrete, systems-based integrated coastal management where effects of adjacent cells will be limited.

It should be noted that the definition of the coastal cells has not been restricted by local board area, considering that coastal processes are not typically confined to these boundaries. However, these boundaries should be considered when prioritising works considering the relationship to local board engagement and funding.

Table 4 and Figure 5 outline the identified coastal cells across the Auckland region. In total, 12 coastal cells have been identified for the Auckland region, including independent coastal cells for Waiheke and Great Barrier.

**Table 4: Overview of coastal cells in the Auckland region**

Coastal cell	Geographical boundaries	Local boards encompassed
A	Mangawhai – Leigh	Rodney
B	Leigh to Whangaparaoa (including Kawau Island)	Rodney Hibiscus and Bays
C	Whangaparaoa – North Head	Hibiscus and Bays Devonport-Takapuna
D	Waitemata Harbour (North Head – Mission Bay)	Devonport-Takapuna Kaipatiki Upper Harbour Henderson-Massey Whau Albert- Eden Waitemata Orākei
E	Mission Bay to Musick Point	Orākei/ Maungakiekie-Tamaki Howick Mangere-Otahuhu Otara-Papatoetoe
F	Musick Point – Matingarahi	Howick Franklin
G	Kariotahi to Awhitu	Franklin
H	Manukau Harbour (Awhitu to Whatipu)	Franklin Papakura Manurewa Otara-Papatoetoe Mangere-Otahuhu Maungakiekie-Tamaki Puketapapa Whau Waitakere Ranges
I	Whatipu to South Head	Waitakere Ranges Rodney
J	Kaipara Harbour (South Head to Tabora)	Rodney
K	Great Barrier	Great Barrier
L	Waiheke	Waiheke

**Note:** See Figure 5 for supporting map

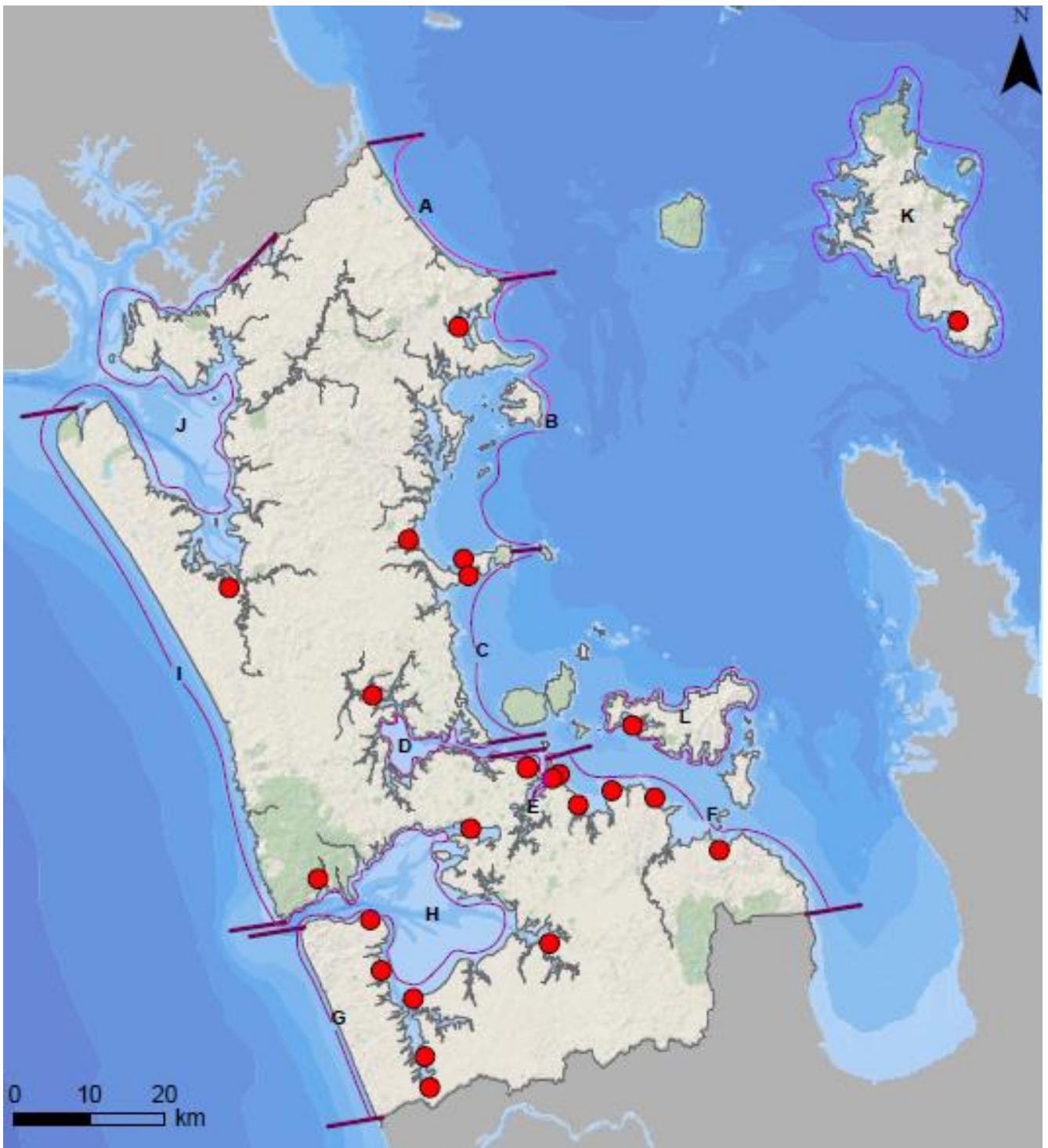


Figure 5: Regional map of Auckland outlining large-scale coastal cells

## 5.0 Coastal compartment planning

### 5.1 Approach

Using the above delineation of the Auckland Coast, Coastal Compartment Management Plans (CCMPs) will enable decision making to be focussed on the holistic natural coastal system and will include considerations to be made over at least a 100-year timeframe to ensure sustainable outcomes. CCMPs will ultimately function as a key comprehensive, long-term planning tool.

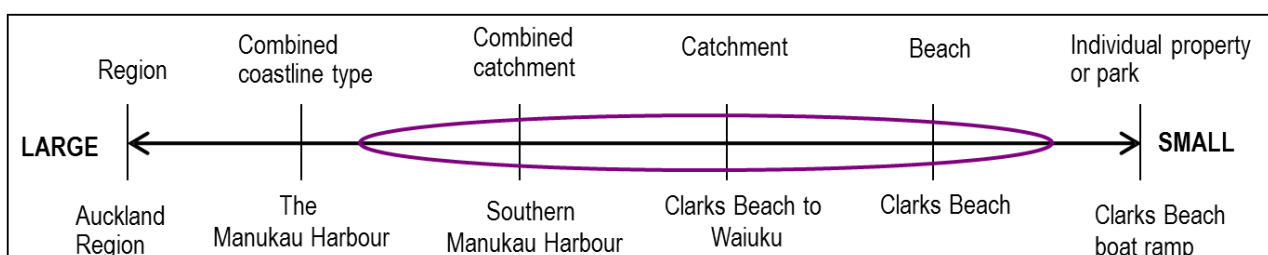
CCMPs will have a similar strategic aim to other non-statutory plans in Auckland such as area plans and catchment management plans. It is anticipated that CCMPs will assist with the implementation, monitoring and subsequent reviews of national and regional policy documents and will inform long-term approaches to asset management planning.

CCMPs are intended to develop practical operational implementation plans for coastal management. It is envisaged that they will:

- 1) Explore the natural coastal system and its interactions with wider natural and other systems within the defined compartment
- 2) Define any issues or opportunity areas
- 3) Develop and assess high-level management response options in line with the decision-making framework (Note: Management responses are defined below as 'do nothing', 'protect', 'adapt' and 'managed realignment'.)
- 4) Enable cost estimates to be prepared and timeframes for high-level implementation
- 5) Provide a platform for informed consultation at key stages of development.

The proposed actions can then be taken forward to a regional prioritisation process to confirm and secure funding to develop designs and deliver projects.

The spatial scale of each CCMP can be determined based on the range issues and input from stakeholders at each area. However, each CCMP will need to adhere to the general approach as defined by the Coastal Management Framework. The plan boundaries may be defined by administrative boundaries, geographical features or the extent of related issues (as outlined in Figure 6).



**Figure 6: Spatial scale consideration for coastal compartment management plans**



Although CCMPs are non-statutory, they are intended to articulate a shared (Auckland Council and its family, mana whenua, community and stakeholders) and supported management plan for a defined area, based on local application of the guiding principles and CCMP philosophy.

Development and implementation is achieved across the relevant departments of Auckland Council, other agencies, mana whenua, stakeholders and the community via an agreed process for engagement and consultation. It is recommended that all utility and amenity asset owners are involved in the development of CCMPs.

The use of CCMPs to translate regional objectives and principles into more localised and specific plans will ensure that management of future use, development and protection of an area will avoid the cumulative adverse effects that can result from ad-hoc, reactionary decision making.

## 5.2 Hazard management philosophies

Natural hazards arise when natural extreme events present a risk to people or things with intrinsic value. As a result, their consideration forms an integral part of the development of CCMPs. The following section outlines the philosophy all CCMPs should adopt to ensure a consistent definition and consideration of coastal hazards.

### Coastal inundation philosophies

Appendix B describes the approach to coastal inundation risk in the Auckland Unitary Plan (operative in part). In general, the 1% AEP coastal storm inundation scenario and the effects of a 1 m sea-level rise are considered, and their application is supported by regional inundation mapping as a 'control' layer in the Unitary Plan Viewer.

For greenfield developments, a conservative and precautionary approach was adopted within the notified proposed version of the Auckland Unitary Plan, considering a 2 m sea-level rise. Within the CCMP philosophy, it is proposed that this definition continues to be considered to reflect a long-term, sustainable approach to future coastal management, and that non-urban (i.e. greenfield and future urban areas) are mapped to this scenario in CCMPs.

The coastal management framework is predicated on enabling short-term approaches to be a stepping stone to different longer-term approaches. It has been considered how this approach might apply to the determination of assets at risk from future climate change. When resource management planning (Auckland Unitary Plan) rules are not triggered, the Building Act 2004 generally requires a consideration of a 50-year building life. Many buildings located in coastal inundation areas may reasonably be anticipated to be redeveloped or the buildings refurbished or replaced over the next 50 years. Therefore, our philosophy is to take a risk-based approach which considers the asset or development and the duration of the use as well as options available to manage or mitigate risk.

### Coastal erosion philosophy

Appendix B also describes the Auckland Unitary Plan approach to coastal beach and cliff erosion and its identification. Overall, where land is identified as exposed to the coastal erosion hazard, restricted discretionary resource consent is required.

In alignment with the previously outlined principles of the coastal management framework, the assessment of coastal erosion potential within the CCMPs will consider at least a 100-year timeframe. As a distinction can be made between beach, dune, soft cliff and hard cliff coastal erosion, contrasting methodologies are required to consider the baseline erosion scenario as further outlined below in Appendix A.

To accommodate the principle of 'time-dependent options', the assessment will also consider erosion extents over discrete time horizons (or epochs), this will in turn facilitate the consideration of transformative options and climate change adaptation pathways.

### **Coastal defence philosophy**

Coastal defences such as seawalls, rock revetments and groynes can mitigate the impacts of coastal erosion but predominantly cannot address the cause (e.g. the driving coastal processes such as a shortage in beach sediment supply). Considering this limitation, coastal defences can only be considered as a temporary measure, requiring continuous maintenance and renewal if to be considered a long-term solution.

As a result of the above, the CCMP philosophy must consider a baseline scenario without the presence of coastal defences. This is important considering:

- 1) The varying design standards of existing defences
- 2) Effects on current coastal processes
- 3) The limited design life of coastal structures and the subsequent potential for non-renewal in the future
- 4) To understand the potential consequences if the structure fails
- 5) Effects that could result if an event larger than that which the structure is designed for occurs (e.g. an event greater than the 1% AEP event)
- 6) Ensure that adequate consideration is given to the benefits of protecting land from coastal processes and hazards versus the costs of providing for or maintaining such structures.

The above approach will provide a baseline to consider all infrastructure and asset decision making. This will include ensuring that seawall maintenance and renewals are articulated as management options and assessed appropriately within a cost-benefit analysis including environmental, social and cultural as well as economic costs and benefits. Maintenance of sea walls may be considered a viable short-term option, but this will be dependent on the condition and associated assessment of the remaining useful life of the structure in question.

For specific circumstances, it may be justified to test the sensitivity of the decision making using 'with structure' scenarios.

Finally, while some rural areas have coastal 'stop' banks, at present very little of Auckland's existing urban area is currently protected by these structures. In the event of such structures being built, consideration must always be given in long-term planning to the consequences of failure and the remaining residual risk (e.g. what happens if an event larger than the structure is designed for occurs).

### **Tsunami inundation philosophy**

Auckland Council's approach to tsunami inundation risk for CCMPs will be in alignment with that proposed in the Auckland Unitary Plan. Applying a risk-based approach to natural hazard management, this acknowledges that tsunami risk is most appropriately managed through CDEM arrangements, as opposed to policy and planning activities considering the low frequency of such events. Therefore, CCMPs, should take into account tsunami warning and evacuation infrastructure and opportunities to build community resilience but will not specifically plan for tsunami in terms of coastal protection.

### **Climate change philosophy**

As previously discussed, the impacts of climate change will have crucial coastal management implications. Climate change effects to be accounted for include; sea-level rise, changes in rainfall patterns and the potential for increased storminess.

### **Sea-level rise**

Past and current predictions of sea-level rise were outlined in Section 1 and our approach to coastal inundation philosophies above. The science of sea-level rise is further described in Appendix A.

In alignment with the coastal management principles (to consider at least a 100-year timeframe), the Auckland Unitary Plan and the above coastal inundation philosophy; CCMPs should consider at least a 1 m sea-level rise by 2115 when assessing coastal inundation and erosion risk on existing developments. When considering the impacts of climate change on greenfield sites, the sea-level rise allowance should be extended to 2 m (as originally recommended in the notified, proposed Auckland Unitary Plan) in order to continue to promote a precautionary and conservative approach to property assets at risk, based on potential lifespans of existing assets.

The effects of sea-level rise on soft shore erosion will be to push shoreline migration inland faster. To facilitate the assessment of baseline erosion under shorter time timeframes/epochs (as recommended to promote consideration of time dependent options), 20-year and 50-year timeframes should also be assessed for consistency with the above recommendations.

### **Changes in intensity and frequency of rainfall and storm events**

Climate change is also expected to alter the intensity and frequency of significant rainfall and storm events.

Changes in rainfall events have the potential to increase flows and exceed stormwater storage capacity. With respect to CCMPs, this is important considering the potential for a joint rainfall and coastal storm or king tide events, resulting in increased inundation risk. '*Stormwater Code of Practice*' provides Auckland Council's guidance regarding the percentage increase in 24-hour design rainfall depth and intensity due to future climate change for a range of rainfall scenarios. Therefore, within CCMP development for areas prone to catchment flooding, CCMPs should adhere to the above guidance and to consider the potential for cumulative hazards.

Finally, increased storminess has the potential to reduce the performance and increase the maintenance costs associated with hard coastal defences. Therefore, future promotion of 'protect' or 'hold the line' approaches must be justified through robust cost benefit analyses.

## 5.3 Management policies

At a high level, four key policies to coastal management will be considered. Each is briefly described in turn below:

- Do nothing
- Protect
- Adapt
- Managed realignment or retreat.

### **Do nothing**

Under the 'No Active Intervention' or 'Do Nothing' approach, no formal measures are put in place in terms of protection measures to control observed processes. This approach (in conjunction with monitoring) may be adopted when there is reduced risk to the public, limited to no infrastructure, insufficient budget to undertake an alternative approach or when there is currently limited understanding to identify an appropriate management response at the present time (e.g. if understanding of coastal processes influencing the site is unclear).

The approach should also be considered as a baseline scenario when considering any of the alternative approaches described below to fully appreciate the costs and benefits associated with the options (e.g. what is at risk if nothing is done). Doing nothing can also be an option in the context of reviewing existing Auckland Council assets.

A 'Do Minimum' approach could also be considered as a subset of 'Do Nothing', to reflect either works to extend existing asset life, or to make assets safe.

### **Protect**

The exposure to coastal hazards may be mitigated through a range of engineering solutions including hard (e.g. seawalls, rock revetments, offshore breakwaters, groynes, drainage, tidal gates, stopbanks etc.) and soft (e.g. beach re-nourishment and sand transfer, dune planting, slope revegetation, drainage etc.) measures. However, there are a range of factors that must be taken into consideration with the provision of such structures.

The potential for coastal structures to negatively impact on the coast through obstruction of access, constraining recreational opportunities, reduced visual aesthetics and introducing adverse environmental effects (e.g. accelerating down-drift coastal erosion) are all potential limitations that must be adequately assessed.

Design and consent life, and level of service of structures should also be considered. Hard protection structures have a limited design life and maximum consent duration of 35 years. Level of service relates to the size of any extreme event (and sea-level rise scenario) that the structure is expected to withstand. For flooding, a range of levels of service may be considered.

## **Adapt**

Adaptation involves acquiring an increased understanding of the coastal cell and influencing processes and providing for natural changes and variations over time. Techniques may include raising the level of assets to allow for sea-level rise, dune stabilisation and replanting and land-use planning instruments such as rolling easements. Adaptation provides an appropriate management response for present day conditions but accepts that the management response chosen will have to be modified over time in response to changing conditions (projected climate change).

In mitigating coastal-storm inundation risk, a method that is becoming more commonly proposed is the provision of elevated ground levels. This technique may be used to achieve a suitable habitable floor level or to reduce water depths to a perceived safe level in the event of inundation occurring. However, there are several limitations of this approach that require strong guidance including:

- 1) Ensuring connectivity between property, infrastructure and lifeline networks for future resilience
- 2) The potential for higher rates of sea-level rise than currently predicted/accounted for
- 3) The impact of substantial earthworks on other systems, amenity values or the natural functioning of the floodplain (the latter if the low-lying land is also prone to freshwater/catchment flooding).

## **Managed realignment**

The final high level, operational coastal management approach that may be considered is 'managed realignment' or 'retreat'. This approach involves the removal of coastal protection structures and the setback or relocation of buildings, services and/or infrastructure a suitable distance inland.

There may be numerous advantages of this approach including;

- 1) Enabling Auckland Council to abandon legacy structures that may have been inappropriately designed or costly to maintain or replace; and
- 2) Providing opportunities to naturalise the coastline and encourage more sustainable practices of working with coastal processes.

The latter increases the coastline's ability to respond to coastal events and sea-level rise, and as a result, can have cost advantages over structural responses that require ongoing maintenance.

Despite the potential merits of managed realignment, the approach is inherently difficult to implement. A key issue is community perception and acceptance. Experience within Auckland Council to date has highlighted that intensive community engagement is essential if future managed realignment schemes are to be adopted. This must be supported by an in-depth understanding of coastal evolution under the managed realignment and future climate change scenario. At present, key limitations to acceptance of managed realignment schemes are the lack of applied examples that can be referred to and, in some cases, limited inland space for relocation. In contrast, there are numerous examples of hard protection schemes around the Auckland coast which, despite their varying levels of success, the community perceive as a more successful and reliable coastal management approach.

## 5.4 Management epochs

To align with the coastal management principles, key regulatory documents and best practice it is fundamental that at least a 100-year timeframe is considered within CCMPs to enable long-term, sustainable decision making. However, it is recognised that making policy assessments over this timeframe is challenging and that the overall management of any given section of coast may be made up of a series of adaptive interventions over time. To assist with this process, discrete management epochs should be assessed as follows:

- Epoch 1: 0 – 10 years
- Epoch 2: 10 – 25 years
- Epoch 3: 25 – 50 years
- Epoch 4: 50 – 100 years.

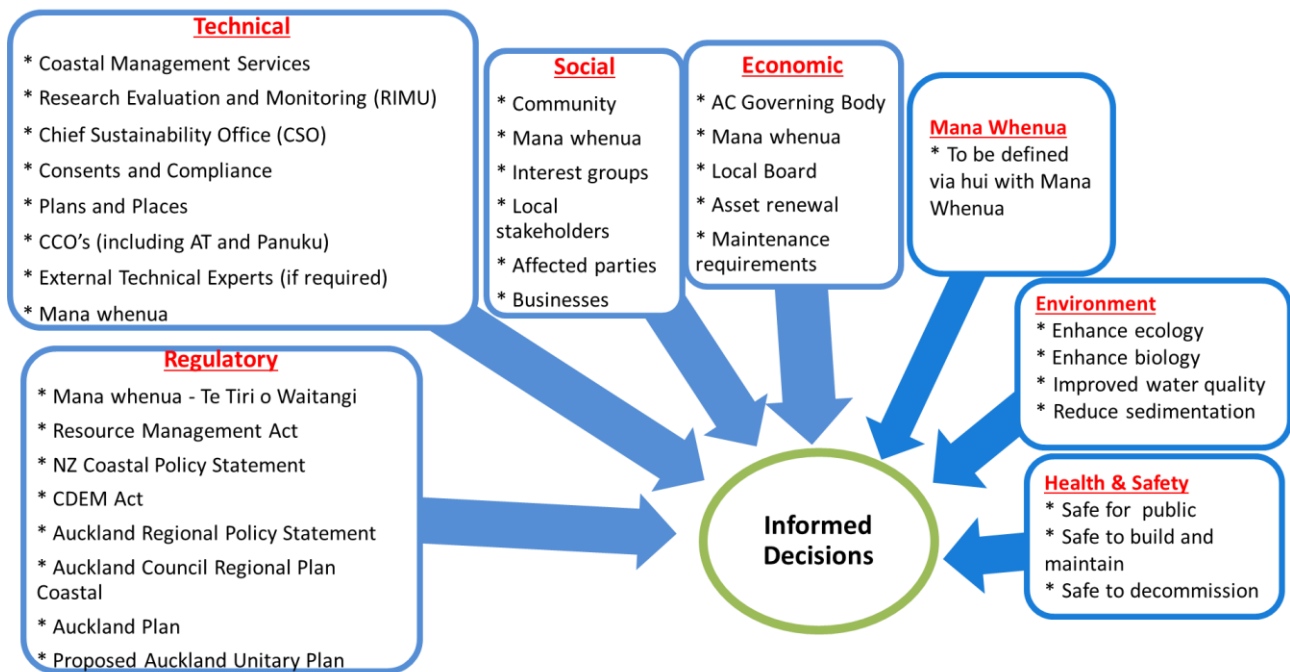
The sequencing of the epochs allows for more detail in the near future to be considered and also encourages the development of time-dependent options – recognising that management responses appropriate over the next 0-10 years (e.g. hold the line) may need to be adapted in the future.

## 5.5 System for policy appraisal and decision-making

Identification of appropriate management policies to apply over time within the life of the CCMP requires a consistent approach. To identify the most appropriate policies to be applied within discrete management areas of the CCMP, its effect on core considerations (or values) of the coast need to be assessed. Core considerations and the appraisal approach to develop time dependent management policies are described below.

### 5.5.1 Core considerations

Figure 7 provides a summary of the identified core values which align with the principles of the coastal management framework.



**Figure 7: Core considerations to inform decision making**

The core considerations are further described below, in no particular order. However, it is imperative that these aspects are further understood at a site-specific level through engagement with the relevant local board, community and iwi. For example, social considerations at one site may relate to local businesses but may relate to recreational space or a unique feature at another site. In addition, the potential impacts of management policies on mana whenua should be developed collaboratively with reference to a specific area.

**Regulatory considerations - Does the policy align with national and regional statutory documents?**

As previously discussed under Auckland Council’s regulatory role (Section 1), its response to coastal management is governed by a hierarchy of key statutory documents as set out under the regulatory framework. It is therefore fundamental that any management policies adopted comply with these documents including the Treaty of Waitangi, Resource Management Act, New Zealand Coastal Policy Statement and any regionally specific documents (such as but not limited to the Waitakere Ranges Heritage Act and Hauraki Gulf Marine Park Act).

**Technical considerations - Is the policy feasible?**

Any management policy must be technically viable and appropriate to comply with the guiding principles. Taking a systems approach means first understanding the physical drivers and controls which affect the outcomes in order to then define appropriate solutions.

Technical criteria should also consider what operational and maintenance activities the policy might need over at least a 100-year timeframe, including climate change effects, any monitoring, renewals, routine maintenance or post-storm maintenance, in order to achieve the required outcome.



**Environmental considerations - How will the policy affect the environmental values of the site?**

Whilst linked to technical considerations, it is important that management policies are appropriate for the given coastal environment. This includes consideration of how the policy may affect any environmental designations of the site (e.g. significant ecological areas), natural character and landscape values, or environmental issues (e.g. water quality).

Policies should also seek to protect, improve or enhance ecological and biodiversity values wherever possible.

**Economic considerations - What are the economic implications of the policy?**

As an aspiration, decision making should evaluate the costs and benefits of options, to provide robust guidance on the best return on investment. However, it is recognised that quantifying all the benefits of coastal assets is often difficult.

As an example of sound decision making, the UK government utilises a framework where a theoretical baseline of 'No Active Intervention' (or 'Do Nothing') is used to weigh up the costs and benefits of intervention. Auckland Council's coastal management framework necessitates the development of a reasonable basis for economic comparison, and possibly economic justification of investment. This may then drive wider Auckland Council discussions regarding prioritisation and levels of investment.

The use and occupation of land next to the coast can have a significant effect on economic decision-making, particularly for Auckland Council assets. For example, many coastal roads run alongside the sea with underground utilities following the road network. These are typically located on or protected by sea wall structures and are important lifelines to remote communities. Another example is coastal reserves, which are often valuable land and include facility assets such as toilets, car parks and even sports fields. The 100-year timeframe and the systems approach should enable consideration of enduring use and requirements for such assets and utilities over time.

**Social considerations - How will the policy affect the local community, key stakeholders and other users of the area?**

There is a growing understanding of the economic importance of recreation and amenity. For Auckland, the accessible coastal environment, with its range of amenity uses, and its intrinsic value, are part of what makes Auckland one of the world's most liveable cities.

Whilst coastal amenity can be measured in terms of replacement land value for reserves, and our green assets can be economically valued and managed alongside 'hard' assets, it has proved difficult to place an economic value on many of these intangible aspects. It is recognised within Auckland Council that the coastal environment is a large factor in the growth of Auckland, and in being a global attractor of international skills and enterprise.

This does not mean that the status quo must be protected at all costs - with the current hazards and the increasing risk from sea-level rise, this would be unsustainable. However, it does mean that the natural and stakeholder environmental values need to be incorporated into decision making that ensures these values are fundamental to the economic and social discussion, as well as the technical consideration.

The impact of communities on sustainability and resilience of a city is also a factor - community organisations can centre around sports such as swimming or sailing, which rely on beachside facilities and access.



Community groups frequently use reserves for social gatherings. Therefore, the intrinsic social value of the assets also needs to be considered in decision-making.

When assessing options, key considerations would be the effect on:

- Existing uses of the area
- Intrinsic value of the area
- Community use and appreciation.

### **Health and safety considerations – Is the policy safe to implement?**

Health and Safety is a key overarching principle to ensure all management responses considered are safe to implement and align with legislation. For example, 'Do Nothing' policies for coastal assets in a poor condition may not always be feasible if they pose a health and safety risk.

### **Mana whenua considerations - How will the policy align with mana whenua values?**

Local, regional and unitary authorities are a significant part of delivering Treaty-based co-management of the natural environment. Auckland Council has requirements to consider mana whenua needs and aspirations in environmental management. Māori have an ancestral connection with the natural environment which is fundamental to identity and underpins their role as kaitiaki. Kaitiakitanga is acknowledged in legislation and is defined as the guardianship of natural and physical resources by tangata whenua, in accordance with tikanga (Section 2 RMA).

The Coastal Management Framework looks to facilitate kaitiakitanga through partnering with mana whenua to embed Māori values into decision making and management of the coastal environment. This will be achieved via hui with mana whenua to define the meaning of kaitiakitangi, as well as other Māori concepts (such as, but limited to, manaakitanga, wāhi tapu and whakapapa) when applied to coastal management and understand how to bring these concepts into decision-making. Three hui have been held since July 2016. At least another three hui with mana whenua will be held to develop a deeper appreciation of mana whenua values, to apply the values to the management of the coastline and to ensure they are in keeping with Māori tikanga. It is envisaged hui will develop strong foundations for an enduring partnership with mana whenua and will help guide the development of new engagement systems. The values included in the table below are place-holders to demonstrate how mana whenua values may fit within the multi-criteria analysis tool and will be confirmed via the planned hui as mentioned above.

## **5.5.2 Appraisal methodology**

To identify the appropriate coastal management response for any given area within the CCMP, the following approach must be taken:

- a) Assess the 'Do Nothing' policy over the next 100 years to provide a baseline for assessment
- b) Assess the appropriate alternative management policies over the range of discrete management epochs within the 100-year timeframe
- c) Identify the preferred combination of time-dependent management policies.

Applying the above process, Table 5 outlines the appraisal matrix to be applied to each management policy with a hypothetical example provided in red.

**Table 5: Policy appraisal matrix and hypothetical example for social completed for ‘do nothing’ at a coastal park prone to inundation**

Policy <u>Do Nothing</u>	Management epoch			
Value	0 – 10 years	10 – 25 years	25 – 50 years	50 – 100 years
Environment				
Technical				
Social	<b>Example:</b> Values of coastal park retained.	<b>Example:</b> Park prone to increasing levels of coastal inundation over time with coastal storm surge events and sea level rise.	<b>Example:</b> Approximately 20% of the park permanently inundated with 0.3 m sea-level rise. Loss of toilet blocks and BBQ facilities on coastal edge.	<b>Example:</b> Approximately 50% of the park permanently inundated with 0.7 m sea-level rise. Coastal access road cut off, marine access only.
Regulatory				
Economic				
Mana whenua				

## 5.6 Implementation of coastal compartment management plans

The general process for developing a CCMP will include:

- Consultation with local community, mana whenua and stakeholders on issues and aspirations regarding the relevant coastal area
- A review of existing asset monitoring and environmental data including known 'hotspots' where the coastline reacts sensitively to events such as storms
- Assessment of coastal processes and natural hazard implications, in line with hazard management philosophies articulated in the framework
- Identification of site-specific opportunities, risks and constraints
- Completion of any necessary technical research or studies
- Development of appropriate management options (and related assessment including economic considerations) in line with asset management philosophies articulated in the framework
- Application of decision-making criteria to establish preferred management options for the compartment being assessed
- Preparation of a draft CCMP and prioritisation of approach
- Consultation on the draft CCMP with relevant stakeholders, mana whenua and the community
- Feedback from consultation to the draft CCMP.

Approval and implementation of the CCMP.

### 5.6.1 Content of the CCMP

The emphasis and level of detail provided in a CCMP will depend on the particular matters that are addressed with an agreed baseline of:

- Coastal hazards
- Public access and open space amenity values
- Environmental protection and enhancement, cultural and natural heritage, landscape and natural character values
- Infrastructure condition assessment, development and commercial uses
- Economic considerations.

Typical contents for a CCMP and a pilot example for Orewa Beach are included in Appendix C.

### 5.6.2 Prioritisation and delivery

Following the breakdown of the Auckland coast into discrete management cells, Section A7 describes the process applied for identifying 'hotspot' areas where coastal improved management is a high priority for a range of reasons including: coastal asset condition, proximity of high value infrastructure, exposure to coastal hazards, high amenity, ecological or cultural heritage values. These areas would benefit from having early CCMPs completed to develop long-term asset management approaches.

Having a regional understanding of hotspots also enables a more holistic view to be taken of planning for post-storm management, enabling a prioritised, post-storm activities programme across the region to be developed. This will also enable potential 'risk' expenditure that may be needed after significant storm events to be evaluated.

## 5.7 Assessment of CCMP approach

CCMPs will identify high-level management philosophies for any given section of coast and will subsequently feed data on options to be included in Asset Management Plans. As a result, CCMPs are long-term vehicles for budgeting future work and operational maintenance.

It is acknowledged that CCMPs may not necessarily address urgent short-term work that may be required to respond to severe storm events but will develop the overarching vision and criteria for longer term prioritised development and adaption.

As a general principle, it is suggested that CCMPs will clearly promote the temporary nature of coastal structures and the need to consider whether protection or defence structures are a long term and affordable management option or whether erosion of public land may be an acceptable option. In this respect, CCMPs will assist with defining such areas subject to hazards over time and will include set criteria used to determine the appropriateness of any defences.

## 6.0 Asset management planning

Effective asset management planning will identify how the CCMP policies for any given section of coast should be implemented (e.g. optioneering) over time.

In general, the philosophy to coastal asset management planning recommended by this framework is as follows:

- 1) Use the best available data on existing assets to inform current risk profile and current investment planning
- 2) Assess the regional risk profile to plan prioritisation and funding of management interventions including asset renewals or new capital investment, operational activities etc.
- 3) Consider a range of asset management options, in line with the strategic principles and decision-making tool (described in Section 4.3).

This section describes how the outputs of the CCMP will be taken into the budgeting and prioritisation process for future works

### 6.1 Improving data on coastal assets in the Auckland region

Work on developing a deeper understanding of the coastal asset base from seven city and district councils has been ongoing alongside development of the framework. Asset and coastal condition assessments support Auckland Council's wider shoreline monitoring programmes. Specifically, the information that is gathered informs the management of:

- Existing coastal structures
- Compliance with existing coastal permits and related consent condition requirements
- Budget prioritisation and requirements for consultation in respect of coastal erosion management (as required)
- Budget prioritisation for renewal programming.

Auckland Council currently holds isolated sets of disparate asset information, highlighting a need to more accurately define the extent, type and current condition status of some coastal assets to improve operational planning and budget forecasting. In response, a comprehensive review of Community Facilities coastal asset data is underway.

The Coastal Asset Data Review Project (CADRP) aims to provide an improved understanding of the quantum of coastal assets under Auckland Council control, current condition and resource consent status, subsequent requirements for renewal, upgrade or replacement and projected costs.

A northern pilot for the CADRP has been completed to verify the scale, type and condition of coastal protection and access structures (seawalls, stairs, ramps and boat ramps). In total, the northern pilot has reviewed 336 seawalls on 120 coastal sites (north of the harbour bridge) which equates to 27 km in total length and has identified:

- 23 seawalls owned by Community Facilities which had previously been omitted from the asset data (approximately 2.3 km in length)
- 70 seawalls previously managed by Community Facilities confirmed to be either in private ownership or owned by CCOs
- A change in condition grade of approximately 104 seawalls with revised inspection data captured in GIS and SAP applications.

The above findings and improved data accuracy demonstrate the potential for improved efficiencies related to budget forecasting and renewal programming.

Following completion of the northern pilot, CADRP has also completed a preliminary review of southern assets and is currently being extended to the central and western areas, including offshore islands. The completed CADRP will provide a complete dataset of coastal structures (and their condition) located within the coastal marine area. This data is essential to the development of a regional coastal asset management plan to prioritise future asset management works and refine future forecasting.

Although the CADRP is currently focused on a review of Community Facilities assets, the intent is to consider application across other Auckland Council departments and CCOs enabling a region-wide assessment of coastal assets which uses an agreed process and constant asset condition rating criteria. This will have the added advantage of refining regional variations and improving the accuracy of data used to inform asset renewals or replacement.

## 6.2 Prioritisation of asset management

A more detailed understanding of coastal structure lifespan and cost, utilising a consistent approach across Auckland, will enable Auckland Council to review its asset risk profile across the entire Auckland region.

The knowledge of asset life, in combination with proposed CCMPs and understanding hazards, will be used to prioritise future asset management works. In general, areas will be identified where there is an underperforming or failing asset which needs to be assessed in a systems context. Areas where there are costly hotspots would also be prioritised for long-term planning, to address the hotspot issue through longer term management approaches.

In addition to condition prioritisation, there is a need for economic decision making. Economic decision making has several layers; from regional through to option-specific. At a regional level, economic considerations and the range of potential benefits for any management intervention will need careful consideration and assessment.

As noted above, historically there has been an ad-hoc approach, particularly focussed on site-specific decision making, which has resulted in a number of Auckland Council assets likely to need management intervention within the next 10 years or so. Utilising the guiding principles, the local and regional governance systems need to adopt an integrated approach to decision-making and economic prioritisation of future works regionally

For example, the Orewa seawall project, which is part of a wider strategy for Orewa Beach, is estimated to cost approximately \$5M. The overall budget for seawall renewals across Auckland is approximately \$45M over the next 10 years, whilst the replacement value for coastal assets located within or adjacent to park or esplanade reserve (public) land is approximately \$221M (see Table 6 below). While this sum reflects almost 50 years of asset replacement (assuming a 50-year asset life), work is needed to confirm that there is funding at the right time in the asset cycle, and how to prioritise any works where there is a funding shortfall, or where consideration of climate change or other factors is likely to lead to increased investment requirements. Included is a need to consider the future requirement for structures which may require renewal or replacement, noting that their intended purpose or requirements may have changed, i.e. relocation of infrastructure which was initially located immediately landward. In this situation, a review of alternative management options would need to be considered. This could include structure removal, managed realignment, or an alternative soft engineering approach at substantially reduced costs when compared to that of renewal or replacement.

**Table 6: Estimated replacement values for coastal structures managed by Community Facilities (2015)**

**Note:** Currently being updated through CADRP

Coastal assets	Asset count	Area (m <sup>2</sup> )	Replacement value
Boat ramps	284	38,309.5	\$8,045,997
Jetties	3	351.4	\$983,976
Pontoons	22	853.9	\$1,844,510
Seawalls	796	122,067.2	\$183,378,249
Wharfs	95	13,455.8	\$27,494,696
Total	1200	175,037.9	\$211,746,428

In planning for a regional prioritisation process, there needs to be a two-stage approach:

- 1) Establish the likely asset replacement value for all Auckland Council assets and a timeframe for investment
- 2) Develop a prioritisation process which will work across Auckland to determine investment priorities for projects coming out of the CCMPs and other urgent works.

The above components will provide a substantial information basis for the development of asset management plans for coastal structures across Auckland Council.



Inherent in this is the need to have a regional response to asset funding, which will arise from the overall consideration of renewals, new investments, maintenance and response requirements, and any changes in current asset provision. The Coastal Asset Management Plan will be the vehicle for this; over time it will enable wider consideration of coastal management budgets and funds. It is envisaged it will also inform higher level asset management plans for open spaces and can be extended to CCO's Auckland Transport.

CCMPs and the asset management plan process will deliver a prioritised list of problem areas where renewal or other options need to be considered at a project level. The following section addresses how the regional and sub-regional philosophies can be taken into detailed project-level consideration.

## 7.0 Project-level decision-making

### 7.1.1 Basis for decision-making

Auckland Council-funded projects require a robust decision-making process to be followed. In this context, the sub-regional assessment will identify one or more suitable management concepts for a stretch of coastline, and the Asset Management Plan will enable budgets to be made available for implementation. All projects (including operational programmes of work) will then follow the Investment Delivery Framework used by Auckland Council, to define project objectives, constraints, confirm the problem and identify option solutions, assess risks and detailed costs, and determine benefits.

The CCMP approach ensures a high-level assessment has already taken place, similar to a conceptual problem definition and design solution, with associated high-level costs, benefits and risks. For decision making at project stage, it is important that the same coastal management framework and principles are adopted. This section details how the principles have been developed further into a matrix which aligns with the Investment Delivery Framework.

### 7.1.2 Project level approaches

At project level, it will be crucial to involve stakeholders in developing the detail of the localised application of the framework decision-making tool. In addition, stakeholders are likely to add value to the development of options to assess, within the context of prior decision making at the CCMP level. The approach to detailed engagement is not yet developed in detail, as noted in Section 2.

### 7.1.3 Identifying a range of management options

Once the CCMP has identified a concept-level solution, this can be expanded into a range of technical options which will meet the conceptual design requirements in a way that is suitable for the local conditions. A range of design tools are likely to be needed. A range of options must be considered, to satisfy the requirements of the RMA, and to ensure best whole-of-life outcomes. The assessment criteria are discussed below.

### 7.1.4 Assessing a range of management options

To enable the assessment of a range of asset management options and selection of the preferred, most appropriate option, a multi-criteria analysis tool has been developed. The tool is based upon development of measures and evaluation criteria as described below.

#### Measures

A range of measures has been identified and is intended to provide a consistent evaluation process. As a first step, these measures embed and/or directly reference the coastal management principles. The principal measures have been shaded in red text in the proposed multi-criteria analysis tool below to emphasise these are fundamental. Therefore, any option that does not satisfy these fundamental requirements, should not progress.

Additional measures have been developed in consultation with mana whenua, local boards and our key stakeholders. They expand on the core values previously identified for CCMP policy appraisal but include further detail to enable quantitative assessment.

Mana whenua measures are currently included as a placeholder throughout the tool. These will be embedded throughout the analysis, recognising how values are intrinsically linked. Hui with mana whenua are pending to identify and incorporate the range of relevant mana whenua values.

#### Evaluation

The multi-criteria analysis includes four tiers of evaluation of each measure:

- 1) Red – Unacceptable/ Reduces/ Discourages
- 2) Orange – Mainly unacceptable
- 3) Yellow – Acceptable with mitigation
- 4) Green – Acceptable/Promotes/Encourages.

Each option should be scored using the measures and evaluation criteria. The sum of the scores for each criterion should be averaged to enable an even weighting of each analysis area. The final total scores will then enable ranking of the option/s for the site in question.

In completing the exercise, the following points should be emphasised. Firstly, while the tool is intended to be sufficiently high level to facilitate ease of application, it is essential that the analysis is undertaken by appropriate technical experts and in direct collaboration with relevant iwi. Secondly, it is intended that this analysis can be refined on a case-by-case basis considering the key components relevant to the given site. For example, reduced sedimentation may not form a key component of the multi-criteria analysis for an open coast area.

#### Analysis tool

Table 7 outlines the proposed multi-criteria analysis components and the measures to be applied.

Table 7: Proposed multi-criteria analysis

Criteria	Measure	Descriptor	Evaluation			
			RED Unacceptable / reduces / discourages 1	ORANGE Mainly unacceptable 2	YELLOW Acceptable (with mitigation) 3	GREEN Acceptable / promotes / encourages 4
Health and Safety	Legislative requirements	Relative to the requirements of the Health and Safety at work Act 2017 and the Local Government Act 2002.				
	National and local guidance requirements	Auckland Council Safety in Design Standards.				
Manu Whenua	Kaitiakitanga	Option aligns with kaitiakitanga and enables iwi as kaitiaki.				
	Mauri	Options allows for the enhancement of the mauri of the area being considered.				
	Protects wāhi tapu	Option provides protection of wāhi tapu in the area being considered.				
	Protects marae	Option provides protection of marae in the area being considered.				
Environmental	Suitable for existing environment	Option is in keeping with the natural coastal environment, e.g. open coast, estuarine, harbour etc.				
	Improved or enhanced ecological and biodiversity values	Replanting or additional planting with appropriate, eco-sourced plants. Other factors include benthic ecology and avifauna.				

TO BE ASSESSED IN PROJECT

Criteria		Measure	Descriptor	Evaluation			
		Aligns with environmental designations of the area	Considers environmental designations (e.g. SEAs) at the site or adjacent to in an environmentally sensitive manner.				
		Improved water quality	Treatment of poor water quality (e.g. leachate or stormwater outfalls).				
		Positive effect on sedimentation	Where high sedimentation rates have a negative impact, the proposed solution does not further increase in an adverse manner.				
		Mana whenua values to be defined					
Technical		Takes a systems-based approach	The option takes a holistic, systems-based approach to understanding the issue and identifying appropriate solutions considering coastal processes and through assessment of sufficient data.				
		Appropriately considers at least a 100-year timeframe and is time/event dependent and/or adaptable over time	The option has an appropriate design life to consider at least a 100-year timeframe or forms part of a longer-term adaptation plan for the site. Acknowledges that the future vision for the coast may not be achieved in one step, and that interim measures are acceptable.				
		Unlikely to exacerbate other issues or create adverse effects	The option has been sensitively designed considering the coastal environment and any present-day management issues, e.g. potential for end effects, increased sedimentation.				
		Appropriately considers and designs for the effects of climate change and sea-level rise	RCP 8.5 scenario is considered in assessment - at least 1 m of sea-level rise over the next 100 years.				

TO BE ASSESSED IN PROJECT

Criteria	Measure	Descriptor	Evaluation			
	Feasible to construct	Practicality of the construction methodology has been considered, e.g. access for material to site, availability of materials.				
	Option limits ongoing management and maintenance costs	The option is appropriate for the coastal environment and therefore requires minimal maintenance and renewal works.				
	Mana whenua values to be defined					
Regulatory	Is the option consistent with the objectives of the New Zealand Coastal Policy Statement and other key statutory documents including the Auckland Unitary Plan?					
	Mana whenua values to be defined					
Economic	Funding availability	Funding is available for the detailed design and construction of the option.				
	Option is within budget	If funding is available, the option is within the available budget.				
	Effects on local economy during construction or implementation are limited	The option will not have a negative impact (e.g. on local businesses and tourism) during construction.				

TO BE ASSESSED IN PROJECT

Criteria	Measure	Descriptor	Evaluation			
	Positive effect on local economy post completion of the project	The option will have positive effects (e.g. on local businesses and tourism) after completion.				
	Value of land lost/gained					
	Mitigation costs	Are there high costs associated with mitigation to compensate for the loss of or adverse effects to any assets?				
	Mana whenua values to be defined					
Social	Values of local community	Core values of the site should be determined through community engagement to guide scoping of the options. Values may include: preservation of greenspace, protection of coastal trees, adaptable over time etc.				
	Mana whenua values to be defined					

TO BE ASSESSED IN PROJECT



## 8.0 Short-term approach for hotspots

The preceding sections have established a framework for timely consideration of coastal management responses from a regional to local level. Work on the Coastal Management Framework, and on asset data, as well as previous experience on the Auckland coastline has identified some coastal management ‘hotspots’ around the region. Hotspots can be considered sites with some degree of urgent management for a number of reasons, such as the pressures of coastal hazards or the condition of coastal structures.

This section addresses the need for a short-term approach to urgent issues, which is sympathetic to the principles and decision-making criteria developed for the region. This comprises:

- Ensuring a consistent approach to identifying hotspots or urgent issues
- Listing our current understanding of Auckland hotspots
- Proposing a short-term approach.

### 8.1 Hotspot criteria

To identify Auckland coastal management hotspots, a consistent criterion has been developed for their identification as outlined in Table 8. The criteria are influenced in part by considering Auckland Council’s responsibilities as a council.

**Table 8: Criteria for identifying coastal hotspots**

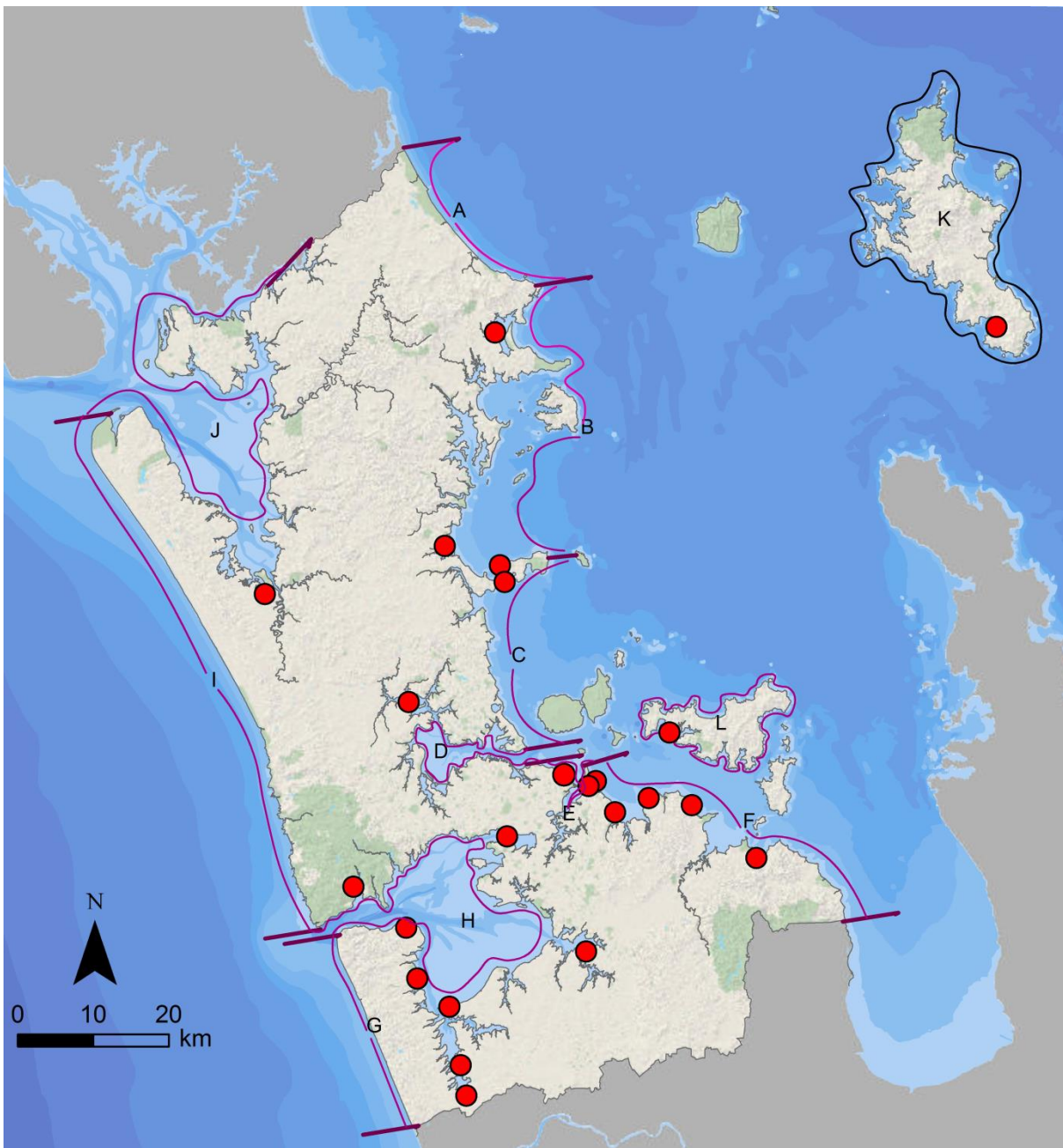
Criteria	Description
1. Coastal structures	Unsafe coastal structures that do not comply with legislation OR non-compliant and unconsented structures OR cluster of poor to moderate condition coastal assets identified within the sub-cell through Auckland Council’s Coastal Asset Data Review Project.
2. Risk of coastal hazard/s	Coastal hazard/s affecting the area (including coastal erosion, coastal inundation, land instability and sea-level rise) identified through Auckland Council’s best available information (shoreline monitoring, beach surveying and hazard mapping).
3. Coastal development	Area of future development pressure as identified by through the Special Housing Areas and Auckland Unitary Plan zoning.
4. Project integration	Where existing coastal projects are already underway and an integrated coastal management approach within the sub-cell is required for future management.
5. Coastal recreation	Where Auckland Council owns a high proportion of coastal greenspace (esplanade reserves and strips) that require a long-term management approach.
6. Cross-Council asset ownership	Where multiple coastal assets (including infrastructure) are owned by Auckland Council and CCOs (including Panuku, AT and Watercare).
7. Coastal values	Sites of high coastal value, e.g. high ecological value or high amenity value.
8. Mana whenua values	In addition to the above criteria, hui with mana whenua will be used to identify additional hotspots based on cultural values and concerns.

## 8.2 Identification

Based on the criteria, a list of initial hotspots has been identified using the best available understanding of Auckland Council's coastal protection structures and their associated condition, coastal hazards, the Auckland Unitary Plan, existing and planned coastal projects, Auckland Council asset ownership and preliminary local board feedback. Table 9 and Figure 8 outline the hotspots identified to date.

**Table 9: List of initial hotspots in the Auckland region by coastal cell**

Coastal cell	Geographic boundaries	Identified hotspots	Hotspot criteria triggered
A	Mangawhai – Leigh		
B	Leigh to Whangaparaoa (including Kawau Island)	<ul style="list-style-type: none"> <li>• Algies Bay</li> <li>• Point Wells</li> <li>• Orewa</li> <li>• Whangaparaoa North</li> </ul>	<ul style="list-style-type: none"> <li>• 1, 2, 3</li> <li>• 1, 2, 3, 5, 7</li> <li>• 1, 2, 4, 5, 6</li> <li>• 1, 2, 4, 5, 6</li> </ul>
C	Whangaparaoa – North Head	<ul style="list-style-type: none"> <li>• Whangaparaoa South</li> </ul>	<ul style="list-style-type: none"> <li>• 1, 2, 4, 5, 6</li> </ul>
D	Waitemata Harbour (North Head – Mission Bay)	<ul style="list-style-type: none"> <li>• Whenuapai</li> </ul>	<ul style="list-style-type: none"> <li>• 3, 4</li> </ul>
E	Mission Bay to Musick Point	<ul style="list-style-type: none"> <li>• Glendowie</li> <li>• Bucklands Beach / Little Buckland's</li> </ul>	<ul style="list-style-type: none"> <li>• 1, 4, 5, 6</li> <li>• 1, 2, 4, 5, 6</li> </ul>
F	Musick Point – Matingarahi	<ul style="list-style-type: none"> <li>• Eastern Beach</li> <li>• Cockle Bay</li> <li>• Sunkist Bay</li> <li>• Maraetai</li> <li>• Kawakawa Bay</li> <li>• Orere Point</li> </ul>	<ul style="list-style-type: none"> <li>• 2, 4, 5, 6</li> <li>• 1, 2, 5</li> <li>• 1, 2, 5</li> <li>• 2, 4, 5, 6</li> <li>• 1, 2, 5, 6, 8</li> <li>• 2, 4, 5, 6</li> </ul>
G	Kariotahi to Awhitu		
H	Manukau Harbour (Awhitu to Whatipu)	<ul style="list-style-type: none"> <li>• Big Bay</li> <li>• Sergeants Beach</li> <li>• Waiuku</li> <li>• Glenbrook</li> <li>• Clarks Beach</li> <li>• Hingaia</li> <li>• Onehunga</li> <li>• Huia Bay Cell</li> </ul>	<ul style="list-style-type: none"> <li>• 1, 2, 4, 5, 6</li> <li>• 1, 5, 4</li> <li>• 1, 5, 4</li> <li>• 1, 2, 3, 4, 5, 6</li> <li>• 1, 3, 5</li> <li>• 2, 3, 4, 5, 6</li> <li>• 1, 4, 5, 6</li> <li>• 1, 2, 4, 5, 6</li> </ul>
I	Whatipu to South Head	<ul style="list-style-type: none"> <li>• Muriwai</li> <li>• Piha</li> </ul>	<ul style="list-style-type: none"> <li>• 4, 5, 6</li> <li>• 2, 5, 6</li> </ul>
J	Kaipara Harbour (South Head to Tapora)	<ul style="list-style-type: none"> <li>• Kaipara River (Parakai and Helensville)</li> </ul>	<ul style="list-style-type: none"> <li>• 1, 2, 3, 5</li> </ul>
K	Great Barrier	<ul style="list-style-type: none"> <li>• Mulberry Grove</li> </ul>	<ul style="list-style-type: none"> <li>• 1, 2, 4, 5, 6, 8</li> </ul>
L	Waiheke	<ul style="list-style-type: none"> <li>• Picnic Bay</li> </ul>	<ul style="list-style-type: none"> <li>• 1, 2, 5</li> </ul>



**Figure 8: Regional map of Auckland outlining coastal cells and coastal management hotspots**

As part of implementation of this document, the identified hotspots will be used for future engagement with local boards and mana whenua to verify and expand the list.

### 8.3 Short-term management response

It is proposed that the hotspots are prioritised, in consultation with the local boards and iwi, to inform planning and implementation of the framework. Clusters of hotspots are likely to identify the need for an urgent sub-regional approach to be developed, such that a cluster area might be an early priority for a CCMP, possibly in conjunction with the urgent singular response below.

Single hotspots, or failing assets, are likely to require a 'triage' assessment of a suitable conceptual approach to determine the priority of a response, again in collaboration with stakeholders. If the response is deemed to be 'hold the line', early budgeting in the asset management plan for ongoing operational management or renewal will be triggered.

Most hotspots are storm dependent. Having more clarity of the number and scale of hotspots will also encourage broader consideration of the need for an urgent response fund, or similar.

## 9.0 Tools to support the Coastal Management Framework

To support each element of the coastal management framework hierarchy, a range of tools has also been identified which support effective implementation of the Framework. The following categories of tools have been identified:

- Auckland Council operational policy
- Guidelines and standards to enable sustainable growth
- Comprehensive information and knowledge
- Communication of the issues.

Each tool is briefly described below and further outlined in Appendix D.

### 9.1 Developing regional level tools to support a coastal management framework

To achieve the overarching aim to develop an integrated and holistic operational management framework for the Auckland region, a series of tools are required to assist the following key areas:

- Auckland Council operational policy
- Enabling sustainable growth
- Information and knowledge
- Communicating the issues.

The figure below summarises each of the key tools identified by this Framework within each management areas.

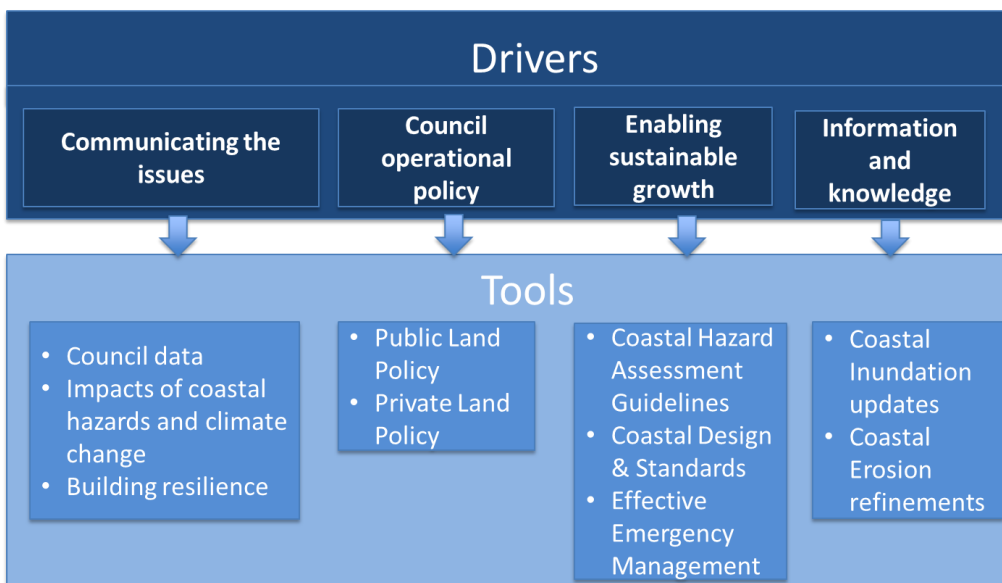


Figure 9: Summary of tools promoted to support the coastal management framework

## 9.2 Auckland Council operational policy

In terms of hazard management, there are also some policy approaches that sit outside the CCMP framework, but which will need to be determined, so that decision making operates within a consistent set of policies.

The key policies that require development are firstly, Auckland Council policy for the management of public land. This is needed to support key decision making within the framework including:

- When should Auckland Council renew assets?
- How should Auckland Council determine an adequate width of reserve is taken with development?
- How should Auckland Council ensure that adequate setbacks are used for development of new assets that will eventually come into its ownership?
- When is repair of coastal structures not cost effective in the longer-term context of climate change and sea-level rise?
- What constitutes adaptive management when there are limited options for retreat or when public pressure is not aligned with high level policy guidance?

Internal guidance on the vesting of esplanade reserves and private coastal structures on or abutting Auckland Council land have been developed and are currently being trialled internally.

Secondly, a policy for the management of private land is required. In particular, this needs to concentrate on how Auckland Council should integrate management of its assets and land when adjacent to private land.

Finally, a policy for the appropriateness of private development on public land, i.e. provision of coastal structures (by residents) on esplanade reserves to protect adjacent private land holdings is needed. Key to this consideration is the potential risk and liabilities that may be presented to Auckland Council related to enduring ownership and maintenance of structures.

The above reaffirms the need for Auckland Council to develop robust policy. In lieu of any supporting guidance, it is proposed this should be developed and that the principles should guide the development of the CCMPs. Once the principles are established, the policy would be drafted by Auckland Council subject matter experts and legal advisors. Both policy and decision-making framework could be consulted on together for adoption and implementation at a more detailed level.



### 9.3 Guidelines and standards to enable sustainable growth

In alignment with the vision to make Auckland the 'world's most liveable city', Auckland Council aspires to enable growth in Auckland. Therefore, part of our framework is directed at the need to balance growth and the desire to live and work by the coast with long-term sustainable management of coastal hazards and assets. Auckland Council wants to make it simple for development within an acceptable risk framework. Therefore, Auckland Council has considered how to enable others to understand coastal hazard risks in relation to development, and how to ensure that design approaches are suitable for sustainable coastal management.

Key tools to facilitate the above include:

- **Coastal hazard assessment guidelines:** To support the implementation of the Auckland Unitary Plan policies and controls for coastal inundation, erosion and sea-level rise
- **Coastal design standards:** To ensure coastal engineering works are appropriate and designed suitably, utilising national and international good practice where appropriate
- **Effective emergency management:** To develop local plans, guidelines and standard operating procedures to ensure emergencies can be effectively responded to and recover from.

### 9.4 Information and knowledge

As emphasised throughout this document, coastal processes are highly complex, and our understanding is continually evolving. Therefore, continued improvement and availability of Auckland Council data to continue to help drive informed and pragmatic decision-making is required. Auckland Council already has coastal inundation data publicly available across the region through Geomaps. To continue to improve this, ongoing improvements to our data and tools to assist community interpretation are needed.

It is also noted that many other studies are underway across Auckland Council and New Zealand which will contribute to informed decision-making for the coast.

### 9.5 Communicating the Issues and aligning the coastal management framework with current Auckland Council initiatives

The current challenge facing local government across New Zealand is how to shift attitudes and behaviours towards accepting adaptive coastal management solutions. The steps to implement an adaptive management approach may take time to build greater resilience to the changing risk presented by coastal hazards and climate change. Recent local government attempts to proactively manage coastal hazard risks in areas with existing or new coastal development, recreational and lifeline infrastructure have been strongly contested by affected residents and the local community. This opposition can exist when robust mapping of coastal hazard data and opportunities to engage with the local communities have been provided.

A range of issues and challenges that highlight the importance of effective communication, education and engagement with communities include:

- 1) Contesting climate change science
- 2) Challenging technical research and the associated sourcing of data
- 3) Questioning the process of how information is placed into the public arena
- 4) The extent of community engagement and consultation
- 5) The implications of the information for those affected.

Therefore, the final objective of the coastal management framework is to promote understanding of coastal hazards and climate change. To satisfy this objective, effective, ongoing communication with communities is essential. It is recommended that a communications plan centred on community awareness is developed to disseminate:

- 1) Auckland Council data (including hazard data and climate change interactions)
- 2) Auckland Council operational policy on how we manage the coastline
- 3) The implications of coastal hazards and climate change impacts in relation to the coast (and to changes already experienced)
- 4) Tactics for communities to become more resilient.

The above are separate to engagement and consultation with communities around the overall framework approach. However, raising public awareness of the above elements is vital to support the development of CCMPs and ultimately ensure community understanding.

## 10.0 The next steps

This report has articulated the environmental, social, cultural and economic value of the Auckland coast along with the commitment to partner with mana whenua to develop and incorporate mana whenua values further into the framework. The dynamic nature of Auckland's coastline, combined with the complexity of coastal processes and the future uncertainties associated with climate change and future growth impacts, highlight the need to maintain these intrinsic values in a sustainable and equitable manner.

In implementing the framework, the current steps are recommended:

- The identified CCMP compartments are prioritised through engagement with local boards, mana whenua and stakeholders
- Urgent hotspots for immediate work are confirmed and reviewed over a 3-year time scale, to tie in with Auckland Council's rolling Asset Management Planning (AMP) cycle
- A communications plan to support CCMPs and the dissemination of new information and knowledge is developed to align with existing Auckland Council communications projects
- New Auckland Council policy, guidelines for coastal hazard assessments and coastal design standards are developed and published as stand-alone documents to support the framework
- Best practice guidance on the development of a CCMP, AMPs and the project appraisal process is produced as a technical publication.

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## Appendices

## Appendix A1.0 Coastal hazards and climate change in the Auckland region

Considering Auckland's coastal location, our region is susceptible to a range of coastal processes and occasional natural extremes including coastal erosion, coastal inundation and tsunamis. These events become hazards when they adversely affect human life, property, the economy or other aspects we value. Key information with respect to each of Auckland's coastal hazards is discussed below.

### Appendix A1.1 Coastal hazards

#### Appendix A1.1.1 Coastal erosion

Coastal erosion is the process of the removal of material at the shoreline, leading to loss of land as the coast retreats. A distinction can be made between soft erosion (e.g. beach, dune) and hard erosion (e.g. coastal cliff), which are driven by different processes and consequently discussed individually below.

##### Soft coastal erosion

Soft shorelines refer to sandy beaches and dunes comprised of unconsolidated or very weakly consolidated materials. They are dynamic environments that are susceptible to both erosion and accretion as dictated by the prevailing coastal processes.

With respect to our current understanding of soft coastal erosion in Auckland, knowledge at a regional scale is reflected by the "*Regional Assessment of Areas Susceptible to Coastal Erosion*" report (Reinen-Hamill et al, 2006). The methodology applied a series of equations to calculate the width of land susceptible to erosion considering key parameters believed to influence erosion including the effect of sea-level rise.

The assessment predicted a range of erosion rates with respect to the 2006 seaward vegetation line. Under the most "likely" scenario, areas susceptible to erosion over the next 100 years ranged from 6 m on perceived stable beaches with low/limited dune systems to 55 m at known more variable beaches with highly developed dune systems. However, predictions extended to over 200 m when the effects of longer term sea level rise were considered.

The dynamic nature of Auckland's beaches is further demonstrated by Auckland Council's coastal monitoring programme, which has been surveying 16 beaches over the past 10 to 30 years. The most recent "*Beach Profile Analysis Report*" (Kench, 2008) highlighted how beach response varies with exposure to wave climate. For example, the high energy west coast (e.g. Piha and Muriwai beaches) was found to exhibit the largest fluctuations in beach width. This was followed by the exposed north-east coast (e.g. Pakiri), the East Coast Bays, and finally the sheltered beaches of Kawakawa Bay and Maraetai.

In addition to the above regional datasets, a range of site-specific coastal erosion studies are available. To further appreciate the complexity of the Auckland coast, a selection of these are summarised in Table 10 below.



**Table 10: Summary of observed and predicted beach erosion in the Auckland region (selected sites)**

Location	Erosion extent	Observed vs. predicted	Sea-level rise
Manukau Barrier (Gibb, 1981)	Up to 19 m/year	Observed in 1981	N/A
Muriwai Beach (Gibb, 1981)	Up to 12.5 m/year	Observed in 1981	N/A
Karioitahi Beach (Tonkin and Taylor, 2014)	145 m/100 years	Predicted in 2014	1.0 m
Omaha (Schofield, 1985)	Up to 24 m/year erosion	Observed in 1985	N/A
Orewa (Tonkin and Taylor, 2012)	Up to 77 m/100 years	Predicted in 2012	0.8 m
Glenbrook (Tonkin and Taylor, 2015)	26 m/100 years landward of predicted natural coastal edge	Predicted in 2015	1.0 m

The above results highlight the variability in erosion rates across the Auckland region which can be attributed to a further range of factors including, but not limited to, the underlying geology and exposure. Overall, the complexity of the Auckland coastline emphasises the need for a sound understanding of historic and future trends in coastal erosion to inform effective future management decisions.

### Hard coastal erosion

Coastal cliffs are essentially erosive landforms. A number of environmental and anthropogenic factors can contribute to their erosion and instability including; geology, geomorphology, marine processes, weathering, climate and drainage.

The “*Regional Assessment of Areas Susceptible to Erosion*” report detailed above similarly considers the potential erosion extents for Auckland’s coastal cliffs. Predictions ranged from 5 m in low, competent volcanic cliffs to 347 m in high, weakly consolidated cliffs. However, with 0.5 m sea-level rise, these predictions extended to 9 m to 524 m over the next 100 years.

A number of additional studies have attempted to estimate long-term recession rates of coastal cliffs comprised of soft to moderately hard sedimentary rock. The results of a selection of known studies are highlighted in Table 11 below.

**Table 11: Summary of observed and predicted cliff erosion in the Auckland region (selected sites)**

Location	Predicted erosion	Observed vs. predicted	Sea level rise
Waitemata cliffs (Moon and de Lange, 2003)	0.4 to 2 m/100 years	Observed	Historic
Waitemata cliffs (Bell, 2007)	0.12 to 5.3 m/100 years	Observed	Historic
North Shore (Jongens et al, 2007)	13 to 34 m/100 years	Predicted	N/A

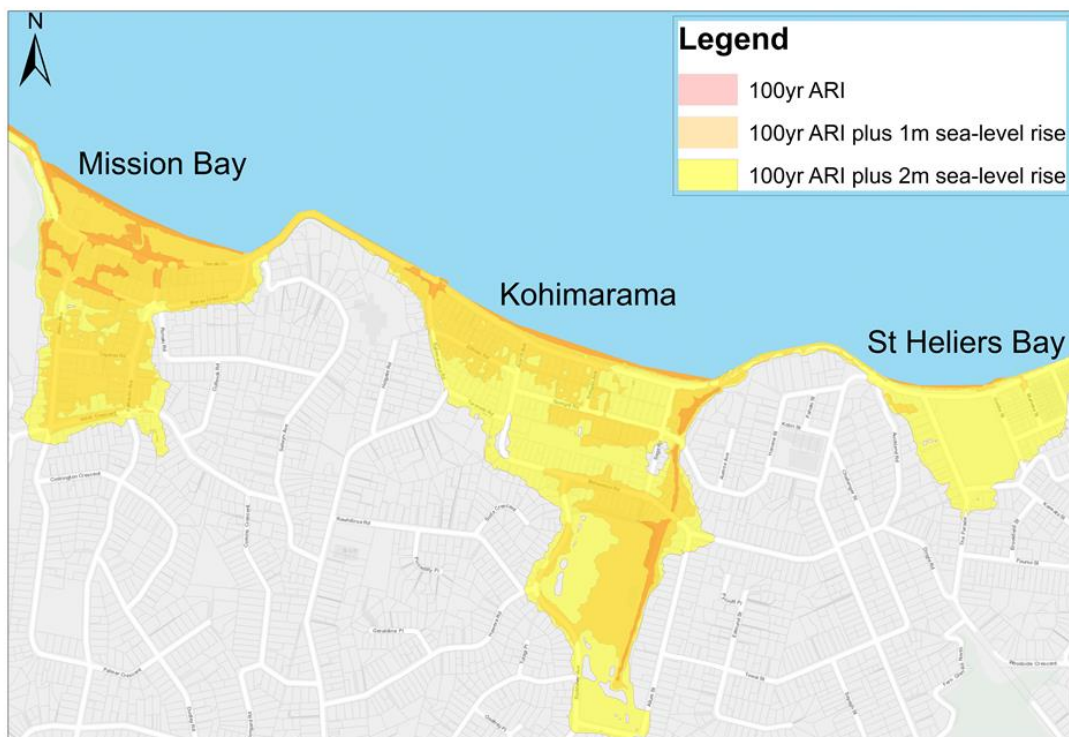
### Appendix A1.1.2 Coastal inundation

Coastal inundation is a significant hazard within the Auckland region. There are a number of meteorological and astronomical phenomena involved in the development of an extreme storm-tide and wave event, which can combine in a number of ways to cause inundation of low-lying coastal margins, particularly on the open coast.

Our best available information with respect to coastal inundation in the Auckland region is currently reflected by the modelling undertaken by NIWA (2013). Coastal extreme sea-level elevations resulting from storm-tides and wave set-up were calculated for a broad range of scenarios. These elevations were calculated at intervals along the entire Auckland coastline including the open east and open west coast, major harbours and inside small east-coast estuaries. The output extreme water elevations were combined with knowledge of land elevations to create inundation area maps. Inundation areas were mapped for the 5, 20, 50 and 100-year events. In addition, further inundation maps were produced for the +1 m and +2 m sea-level rise scenario and added to the 100-year and 50-year extreme water level.

At a regional scale, the results show that the 100-year (1% AEP) coastal-storm inundation event exposes approximately 4% of Auckland's total land area and approximately 4,000 properties to inundation. This exposure and associated risk significantly increases with sea-level rise.

The figure below shows the results of the coastal inundation mapping project for the Eastern Bays area between Mission Bay and St Heliers Bay for the 100-year (1% AEP) event and the 100-year (1% AEP) event with an additional 1 m and 2 m sea-level rise. The results demonstrate that, owing to the areas low-lying nature, a significant extent is at risk of coastal inundation if unprotected.



**Figure 10: Mapping of potential coastal inundation area for the Eastern Bays**

(based on Stephens et al, 2013)

The above methodology utilised the static mapping technique; in which all land lying below the coastal-storm inundation elevation with a flow path to the coast is assumed to be flooded in its entirety. There are some noted limitations of this approach, however, it is consistent with providing a conservative and precautionary understanding of coastal inundation.

### Appendix A1.1.3 Tsunami

Consideration must also be given to tsunami hazards. A tsunami is a series of waves, typically created by sudden movement or rupturing of the ocean floor from earthquakes, underwater landslides or underwater volcanic eruption. Tsunami may be generated from three different sources:

- 1) **Local:** Arrive from source < 1 hour, e.g. submarine volcanism or earthquake in the immediate Auckland region
- 2) **Regional:** Arrive from source between 1 to 3 hours, e.g. subduction and upper plate earthquakes
- 3) **Distant:** Arrive from source > 3 hours, e.g. west coast of South America.

Tsunami risk across the Auckland region is currently best understood based on the tsunami inundation modelling undertaken by Barberopoulou et al (2013) which informed the development of associated CDEM tsunami evacuation maps. The modelling applied the 2,500-year tsunami which was previously determined by the 'Review of Tsunami Hazard in New Zealand' report of Power (2013). This predicts a maximum water elevation of over 14 m for mainland Auckland. The inundation modelling utilised a GIS-based approach that considered how tsunami height varies with distance inland for the open coast, harbour and rivers to determine inundation levels. This approach is designed to be conservative but is deemed appropriate to inform the development of tsunami evacuation zones.

The results demonstrate that tsunami waves can surge considerable distances across inland, low lying areas. At a regional scale, the results show that the 2,500-year tsunami exposes approximately 9% of Auckland.

Figure 11 below shows the tsunami evacuation map for Orewa. The figure shows that a significant proportion of the township is at risk of tsunami inundation owing to its low-lying nature in the event of a tsunami occurring, with the yellow area corresponding to the maximum credible tsunami event.

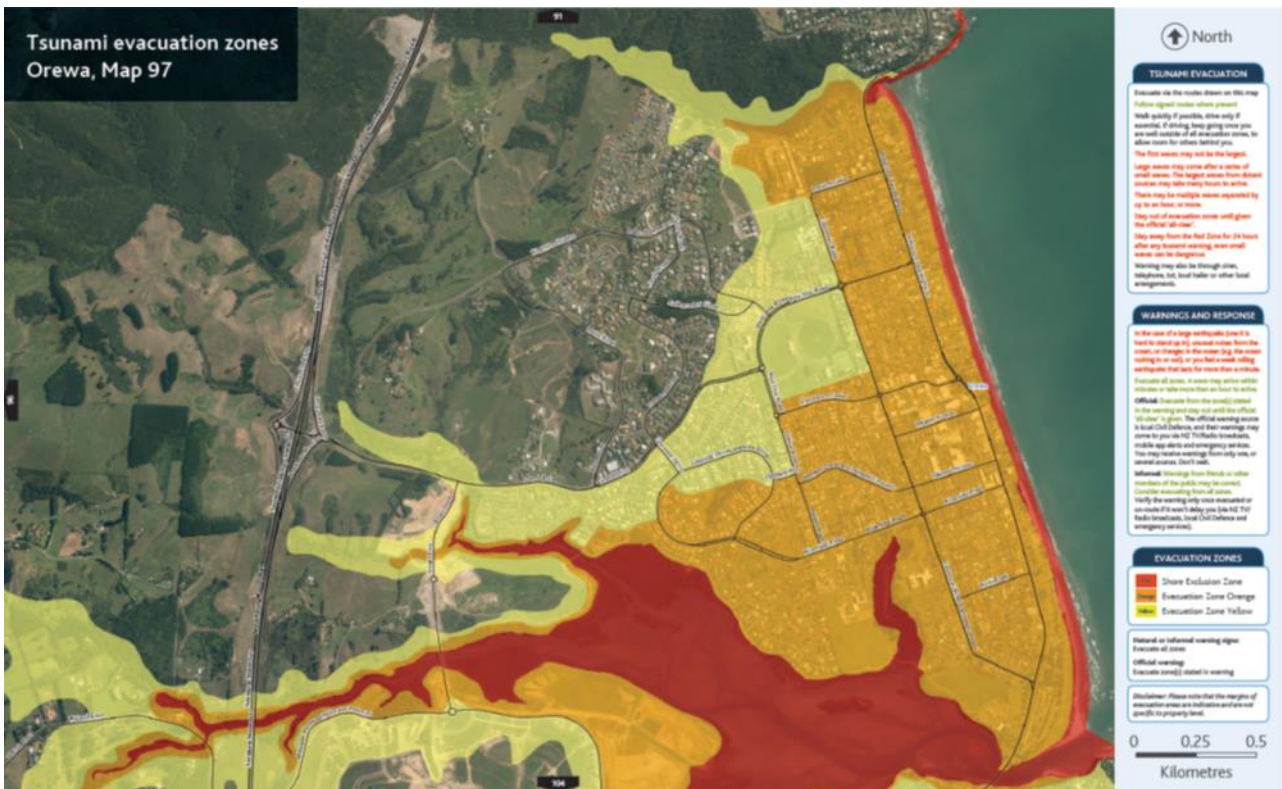


Figure 11: Tsunami evacuation map for Orewa

(<http://www.aucklandcivildefence.org.nz/community/tsunami-evacuation-maps/>)

## Appendix A1.2 Climate change

All of the above coastal hazards have the potential to be exacerbated by the impacts of climate change. This introduces the need to not only understand the present-day risk presented by such events (as described above) but also the potential for the risk changing over time.

As previously outlined in the main report, climate effects and the associated impacts on Auckland’s coastal margin may include:

- Sea-level rise:
  - Increased coastal erosion and coastal cliff instability
  - Higher storm surge flooding and more extensive coastal inundation
  - Increased frequency of events over time.
- Changes in rainfall patterns and intensity:
  - Increased pore water pressures and subsequent slope instability
  - Increased drainage problems in adjacent low-lying areas.
- Increased storminess:
  - Reduced performance and failure of infrastructure directly affected by events
  - Increased maintenance costs of coastal structures.

### Appendix A1.2.1 Sea-level rise

A key impact that has the potential to increase the risk (likelihood and/or consequence) associated with coastal hazards is sea-level rise. This process and its potential implications are described below to emphasize the issues of changes in risk over time which must be addressed through a strategic approach to coastal management.

The historic rate of sea-level rise for Auckland has been determined from the Ports of Auckland (Waitemata Harbour) tide gauge for 1899 – 2014. This yields a rate 1.6 mm/yr.

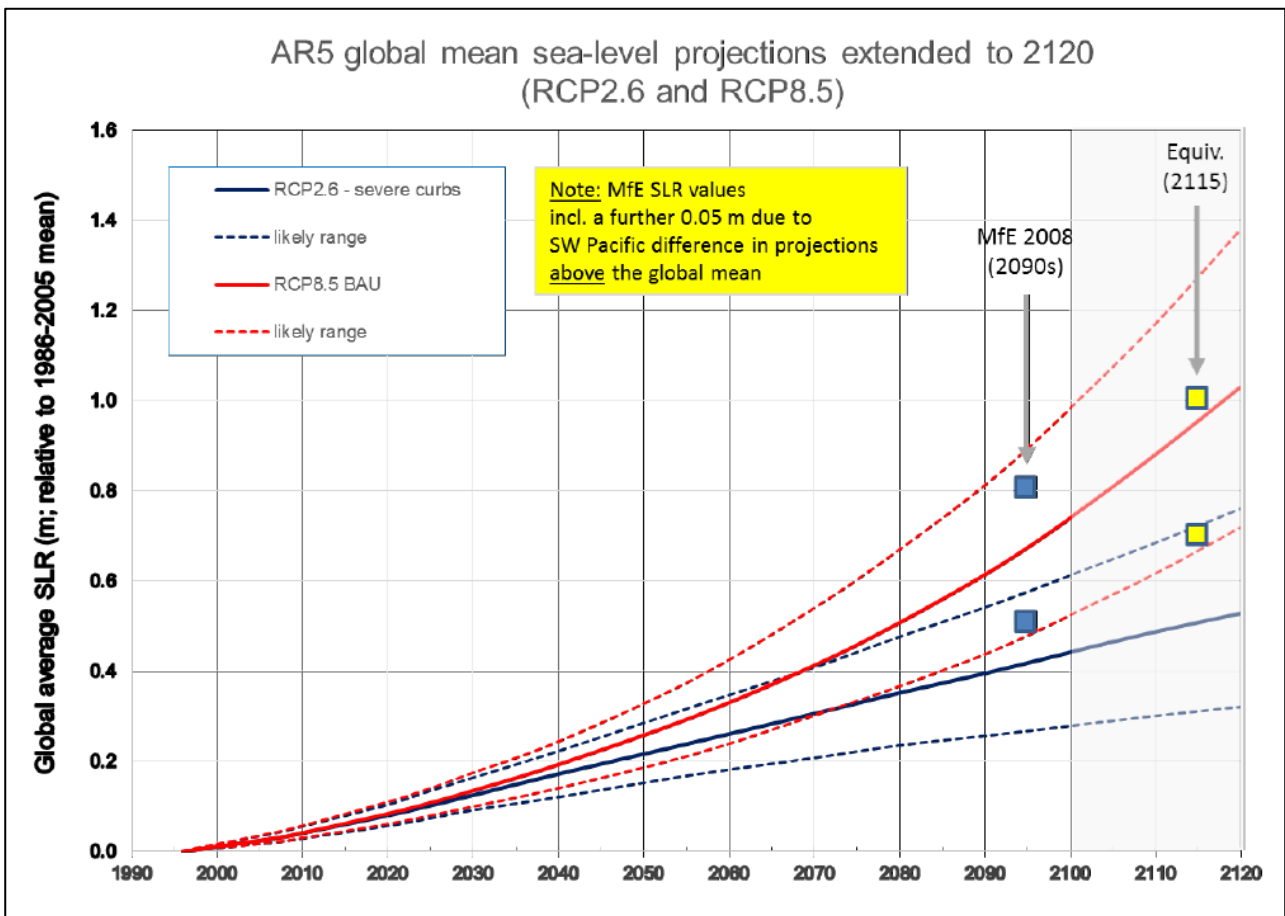
The Ministry for the Environment (MfE) “*Coastal Hazards and Climate Change*” manual is the current national guidance on accommodating sea-level rise into coastal management practices (MfE, 2008). The MfE guidelines are currently under review, however, the current guidance states that:

*“A base value sea-level rise of 0.5 m....should be used, along with an assessment of the potential consequences from a range of possible higher sea-level rises (particularly where impacts are likely to have high consequence or where additional future adaptation options are limited). At the very least, all assessments should consider the consequence of a mean sea-level of at least 0.8 m relative to the 1980 – 1999 average.”*

In addition to the above guidelines, new information that is currently available must be considered under Policy 24 of the New Zealand Coastal Policy Statement 2010. Working Group 1 of the Inter-Governmental Panel on Climate Change (IPCC) released its 5<sup>th</sup> Assessment Report (AR5) in 2015. The rise in global mean sea level by 2100 for the emission scenario will likely be 0.28 to 0.61 m (0.4 m median). For the highest emission scenario, the rise will likely be 0.52 to 0.98 m (median 0.74 m), with a likely rate of rise during the last two decades (2081 – 2100) of 8 to 16 mm/yr. The latter is up to 10 times the average over the past 100 years. It should also be noted that higher sea-level rises by 2100 cannot be ruled out considering potential ice-sheet response to climate change which is not considered in the above projections.

The IPCC projections are limited to 2100. However, the Policy Statement requires the effects of climate change out to “at least 100 years” to be considered. Recent guidance from NIWA (Stephens et al, 2013) has extended the IPCC projections to 2115 and the current MfE guidelines relative to this, as outlined in Figure 12 below. Based upon this, the above IPCC projections can be revised and yield a base level of 0.7 m and at least 1 m by 2115 (Bell, 2015).



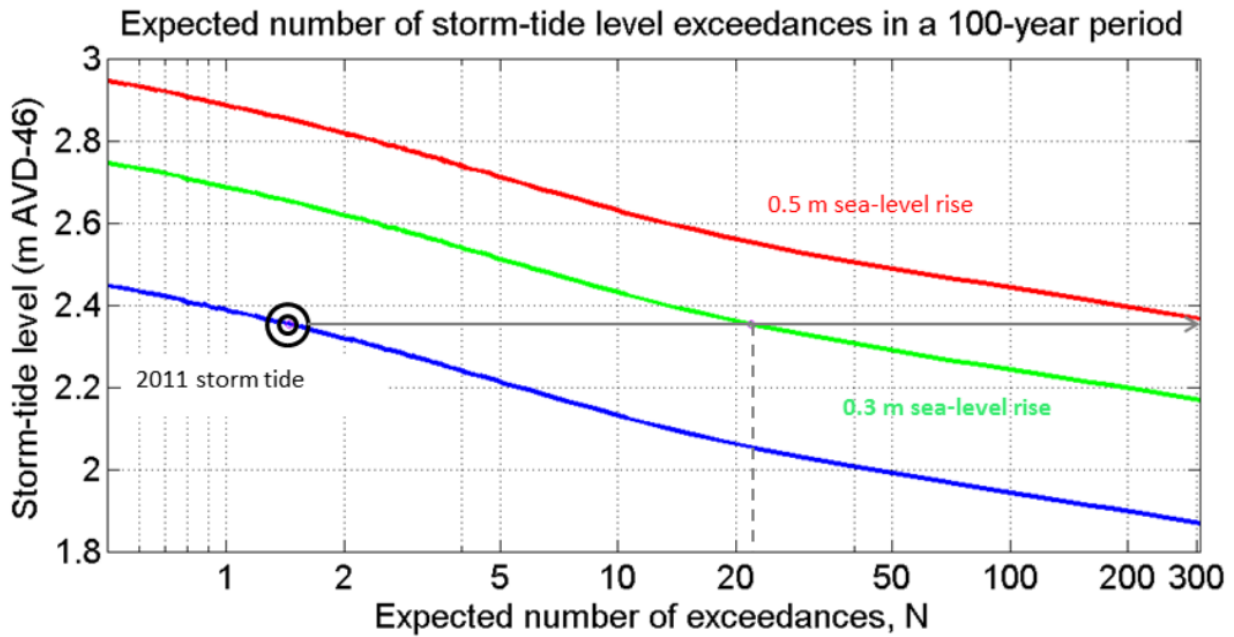


**Figure 12: IPCC-Ar5 projections of global mean sea-level rise over the 21st century relative to the 1986-2005 baseline**

**Note:** This is from ensembles of climate-ocean models including the business as usual scenario (RCP8.5) in red. The projections have been extended out to 2120 to increase the timeframe to 100+ years. Blue squares represent MfE current sea-level rise guidance and yellow squares represent recommended extensions through to 2115 (Bell, 2015).

The impacts of sea-level rise have important implications for the future impacts of Auckland’s coastal hazards, in particular coastal erosion and inundation. It is generally accepted that a rise in sea level will result in a corresponding upwards and landwards movement of the coast. Therefore, with respect to coastal erosion, it is likely that increased rates will be experienced. In addition, sea-level rise influence some of the key drivers of coastal erosion. For example, as waves are depth limited, wave heights will likely increase, increasing erosion pressures at the open coast and propagating further inland through harbours and estuaries. Where the coastal edge is protected (e.g. seawalls), these structures will be placed under increasing pressure by such changes in wave dynamics.

When considering the impacts of sea-level rise on coastal inundation, the frequency of events being experienced in Auckland will dramatically increase as summarised in Figure 13 below. For example, the present day 1% AEP coastal-storm inundation event is likely to occur approximately 20 times per century with 0.3 m sea-level rise and 300 times per century with 0.5 m sea-level rise. In addition to this increase frequency, the hazard will have much greater consequences as the rising sea level sets a higher base elevation on which storm times and waves are superimposed. This will have a similar impact on potential future tsunami inundation level.



**Figure 13: Change in the expected number of exceedances of coastal inundation events over a 100-year period with sea-level rise**  
 (Stephens, 2015)

Increased sea levels will also affect rivers and streams, surface and stormwater drainage, and sewer systems in low-lying coastal areas. The performance of these systems may be compromised by a back-up of flow due to increased downstream sea levels.

**Changes in rainfall patterns and intensity**

Climate change is expected to alter the intensity and frequency of significant rainfall events. The MfE has provided guidance on climate change effects which includes an increase to the 25-hour rainfall depth and changes to temporal rainfall intensity with 2.1° temperature increase by 2090. For example, the results show that with the 100-year rainfall event, there is a predicted 16.8% increase in the 24-hour design rainfall depth due to the future impacts of climate change.

Increased rainfall has the potential to exacerbate issues of coastal inundation. Increased peak flow and subsequent reduced stormwater capacity may combine with coastal storm inundation events, king tides or long-term sea-level rise resulting in drainage and inundation issues of low lying coastal areas.

Changes in rainfall intensity will also influence coastal erosion processes. With respect to soft shorelines, increases in rainfall intensity may increase upper catchment erosion and subsequently increase sediment availability at the coast. In contrast, with respect to cliffed shorelines, increases in rainfall intensity may increase weathering and episodic landslide events through reduced drainage capacity.

### Increased storminess

Finally, with respect to future climatic pressures on the coast, increased storminess including increased frequency of heavy swells is predicted. However, at present there is sparse available specific information for New Zealand.

Changes in storminess and swell conditions may have a significant impact on wave set-up and run-up during storms. This has the potential to:

- Increase inundation through wave overtopping
- Increase coastal erosion through increased exposure
- Reduce the performance and increase the maintenance costs associated with hard coastal defences through wave overtopping (and associated damage), exposure to higher wave energy and increase reflection (leading to increased beach lowering).

## Appendix B1.0 Overview of the regulatory framework

### Appendix B1.1 Resource Management Act

The Resource Management Act 1991 (RMA) has the stated purpose of promoting sustainable management of natural resources (Section 5). Sections 30 and 31 of the RMA set out the functions of regional councils and territorial authorities. One of which, identified for the purpose of giving effect to the RMA, is that the region/district must address in their statutory plans:

*“...the control of any actual or potential effects of the use, development or protection of land, including for the purpose of... the avoidance of mitigation of natural hazards....”.*

### Appendix B1.2 New Zealand Coastal Policy Statement

Under the RMA, Auckland Council is required to give effect to the New Zealand Coastal Policy Statement 2010. This includes Objective 5 which aims to ensure that coastal hazard risks, taking into account climate change, are managed through a range of responses. The objective is supported by a range of Policies (including 3, 24, 25, 26 and 27), the key requirements of which are:

- Adopt a precautionary approach
- Identify hazard risks over at least a 100-year timeframe and avoid increasing the risk when considering new development
- Discourage hard protection structures and promote the use of alternatives to them, including natural defences
- Promoting and identifying long-term sustainable risk reduction approaches including the relocation or removal of existing development or structures at risk
- Identify and plan for transition mechanisms and timeframes for moving to more sustainable approaches.



The Coastal Policy Statement includes specific policies that emphasise the value of preserving, restoring and protecting the natural coastal character, taking into account the principles of mana whenua values, protecting biodiversity and the coastal environment and recognising the need for public open space and walking access along the coast.

### **Appendix B1.3 Civil Defence Emergency Management Act**

The Civil Defence Emergency Amendment Act 2002 has the purpose to improve and promote sustainable management of hazards to encourage and enable communities to achieve an acceptable level of risk and to provide for an emergency. Comprehensive emergency management revolves around the four areas of activity known as the 4Rs; reduction, readiness, response and recovery, all of which require sound planning.

### **Appendix B1.4 Takutai Moana Act**

The Marine and Coastal Area (Takutai Moana) Act 2011 guarantees free public access in, on or over the common marine and coastal area with the exception of specific cases such as ports, naval bases and marinas.

### **Appendix B1.5 Hauraki Gulf Marine Park Act**

The Hauraki Gulf Marine Park Act 2000 has the purpose to integrate the management of the natural, historic and physical resources of the Hauraki Gulf, its islands and catchments.

### **Appendix B1.6 Auckland Plan**

Considering the clear link between climate change and coastal management issues, Auckland's response to climate change as set in the Auckland Plan must also be accounted for. The Plan requires Auckland Council to address three key priorities to:

- 1) Mitigate climate change
- 2) Improve energy efficiency, security and resilience
- 3) Adapt to climate change.

This includes Directive 8.5 to '*Identify the opportunities and risks associated with climate change. Increase the resilience of Auckland's communities, natural resources and built environments and their ability to adapt to the impacts of climate change.*'.

### **Appendix B1.7 Auckland Unitary Plan (Operative in Part)**

The strategic direction set out in the Auckland Plan is supported by the Auckland Unitary Plan (Operative in Part) that has brought together the superseded Regional Policy Statement and 13 legacy district and

regional plans. It provides key objectives, policies, rules and methods. With respect to coastal hazards and climate change, the plan considers at least a 100-year timeframe in line with the New Zealand Coastal Policy Statement, particularly recognizing that sea-level rise and coastal erosion are continuous processes resulting in changes in risk over time.

The Auckland Unitary Plan primarily seeks to manage the risks natural hazards present to people, property and the environment. Risk can be changed, reduced or increased through the alteration of either the likelihood or consequences of an event occurring. We are unable to alter the likelihood of a natural event occurring, but we can reduce or manage the consequences and the likelihood that it will affect something we value.

### **Appendix B1.7.1 Auckland Unitary Plan approach to coastal erosion**

The Auckland Unitary Plan (operative in part) manages the effects of coastal erosion through the 'Natural Hazards and Flooding' provisions (Chapter E.36) and 'Subdivision' provisions (Chapter E.38). The provisions require land that may be subject to natural hazards (including coastal erosion) to be identified. The Plan includes a definition of 'land potential exposed to coastal erosion' which has been defined based on the best available existing information for coastal erosion in the Auckland region:

#### **Coastal erosion hazard area**

Any land which is:

- (a) *Within a horizontal distance of 20 m landward from the top of any coastal cliff with a slope angle steeper than 1 in 3 (18 degrees); or*
- (b) *At an elevation less than 7 m above mean high water springs if the activity is within:*
  - (i) *Inner Harbours and Inner Hauraki Gulf: 40 m of mean high-water springs; or (ii) Open west, outer and Mid Hauraki Gulf: 50 m of mean high water springs; or*
- (c) *Within a lesser distance from the top of any coastal cliff, or mean high water springs, than that stated in (a) and (b), where identified in a site-specific coastal hazard assessment technical report prepared by a suitably qualified and experienced professional to establish the extent of land which may be subject to coastal erosion over at least a 100-year time frame.*

The Auckland Unitary Plan introduces two key management responses: one which applies to undeveloped, 'greenfield' land and one which applies to existing urban or developed areas. Auckland Council's approach to greenfield areas is to avoid risks through not locating development in areas affected by natural hazards. When planning for new developments there is an assumption that the land will continue to be used in this manner for the next 100 years or longer. Therefore, it is important to consider the long-term risk presented by natural hazards and the potential for such risks to be affected by climate change in order to avoid the risk for future generations

In areas which are already developed, the approach to managing risks differs. This reflects the investment present in these areas and the need to make sensible decisions about how to manage risks while providing for economic and social well-being. The Plan establishes activity controls that allow for adaptive

management. The controls aim to ensure that only appropriate development occurs within these areas and that vulnerable activities are regulated or well managed.

The Plan considers the activity status of a range of coastal protection strategies which seeks to consider the need, construction and use of hard protection structures. It provides, as a priority, a directive to enhance, maintain and protect existing natural coastal defences such as sand dunes and beaches, providing for beach nourishment and dune stabilisation as permitted activities to enable communities and individuals to improve natural defences.

### **Auckland Unitary Plan approach to coastal inundation**

Land identified as potentially subject to coastal inundation is identified as *'being subject to 1% AEP coastal inundation event'* (otherwise known as the '100-year' event) and is subject to development controls as introduced above.

For coastal inundation risk with existing development, the Auckland Unitary Plan considers both the present-day hazard resulting from our current sea level and the consideration of a 1 m rise in sea level (which is likely to occur within a 100-year time period). In areas subject to coastal inundation with present-day sea levels, a restricted discretionary consent is required for increases above 25 m<sup>2</sup> to existing buildings and new buildings.

Areas located immediately landward of the present-day mapped inundation event are likely to be subject to inundation over the coming century. Buildings in these areas are required to consider the impact of coastal-storm inundation through a permitted activity control. This control requires that habitable areas are to be located above the 1% AEP inundation area taking in to account a 1 m sea-level rise, with the addition of 500 mm freeboard to account for any potential uncertainties. The control ensures that new development over the life of the plan has an increased resilience to the hazard over the coming century, while recognising that a longer-term solution will likely need to be developed for such areas. If this development control is not able to be complied with, the activity becomes 'discretionary' and an assessment of the proposal based on the objectives and policies is required where a range of possible adaptation or mitigation measures may be considered, and other influencing factors taken into account.

For greenfield undeveloped areas, a conservative and precautionary approach was adopted based on the objective to avoid risk of adverse effects outside urban areas. This is particularly pertinent considering the issues associated with climate change, the 'permanence' of future development and the risk that mitigation may not be possible or effective in addressing risks. The notified version of the Proposed Auckland Unitary Plan required the consideration of a 2 m rise in sea level, applying a conservative and precautionary approach. Through the Hearings process, this has been replaced by reference to 'longer term sea-level rise' to allow for potential future changes in predictions. This approach aims to ensure that risks are avoided, and new communities do not face the adverse effects of hazards and risk in the future.

To support the above, coastal inundation has already been modelled, and maps produced highlighting the 1% AEP coastal inundation event plus sea-level rise. These maps were consulted on as part of the Auckland Unitary Plan hearings process and the coastal inundation 1% plus 1 m sea-level rise is included as a 'control' layer in the Unitary Plan viewer.

## Appendix C1.0 Contents of coastal compartment plans

CCMPs will be developed through a comprehensive assessment of the environment, coastal processes and a robust consultation process. They provide objectives for the future use, development and management of an area and aim to avoid the adverse cumulative effects that can result from ad-hoc decision making. Table 12 outlines the proposed standard contents list of a CCMP.

**Table 12: Example Table of Contents for CCMPs**

<b>Executive Summary</b>	
<b>1.</b>	<b>Introduction</b>
1.1	Background
1.2	Management plan objectives
1.3	Management plan scope
1.4	Statutory framework and relevant document alignment
<b>2.</b>	<b>Coastal compartment description</b>
2.1	Location and extent of compartment
2.3	Geology and geomorphology
2.4	Coastal processes
2.5	Ecological values
2.6	Natural and landscape values
2.7	Cultural and heritage values
2.7	Current use and future demand (projected growth)
<b>3.</b>	<b>Current state assessment</b>
3.1	Existing infrastructure and assets
3.2.	Coastal structure condition assessment
<b>4.</b>	<b>Coastal management issues</b>
4.1	Coastal erosion
4.2	Coastal inundation
4.3	Sea level rise and climate change
4.4	Risk and constraints assessment
<b>5.</b>	<b>Coastal management options</b>
5.1	Draft options development
5.2	Multi criteria analysis
5.3	Community, stakeholder and mana whenua consultation
<b>6.</b>	<b>Recommendations</b>
6.1	Criteria for prioritised actions
6.2	Funding
6.2	Timeframes for implementation
6.3	Local Board and Governing Body approvals

Expanding on the above proposed table of contents, Table 13, below, provides additional context for proposed content under overarching sections of the CCMP.

**Table 13: Proposed content**

Matters to be addressed	Matters to be considered
An assessment of the coastal environment (including land and coastal marine area)	<ul style="list-style-type: none"> <li>• A description of the current natural and physical environment, features, processes and values, such as ecology, natural character, water quality, coastal hazards, sedimentation rates and processes, and landscape values.</li> <li>• A description of any changes to the environment that have had a significant influence on the present characteristics, including descriptions and/or historical records from the local community and/or iwi on the changes that have occurred over time, and conditions such as new structures, sedimentation, changes in catchment use, or changes in mangrove extent.</li> <li>• Identification and description of the social, cultural, economic, heritage and amenity values and uses. Consideration should include access and navigation, identification of public roads, reserves, boat ramps, recreation areas and any significant adjoining land use or water activities (e.g. industrial or urbanised areas or mooring areas).</li> <li>• Identification of areas of high use, including a description of the activity and the geographical extent.</li> <li>• Identification and description of areas of significant environmental, social, cultural, or economic values.</li> <li>• Identification of particular areas for enhancement or protection.</li> </ul>
Issues identification	<ul style="list-style-type: none"> <li>• A description of the key issues, hazards and who is affected.</li> <li>• Identification of site specific risks and constraints.</li> <li>• Summary of existing reports, monitoring and data.</li> <li>• Confirmation of required technical studies.</li> </ul>
Options assessment	<ul style="list-style-type: none"> <li>• The vision and goals for the area, and a description of how these were determined.</li> <li>• Analysis of the degree to which the vision and goals take into account the characteristics and values identified, and the consultation undertaken.</li> <li>• A description of the proposed actions and an explanation of how these will achieve the vision.</li> <li>• The reasons and process for identifying the preferred management options and responses.</li> <li>• Identification and description of any areas of particular use and value that are proposed for protection or enhancement.</li> <li>• Identification of the location and timing of proposed actions, taking into account the need to ensure an achievable programme of actions.</li> <li>• Identification of the persons and departments who will be responsible for the proposed actions.</li> <li>• The measures proposed to: <ul style="list-style-type: none"> <li>○ Mitigate or remedy any adverse effects from the proposed actions</li> <li>○ Protect or enhance areas identified as having significant values</li> <li>○ Monitor effects and performance of management responses.</li> </ul> </li> </ul>

Matters to be addressed	Matters to be considered
Consultation	<ul style="list-style-type: none"> <li>• Comprehensive and inclusive consultation should be undertaken with affected property owners, the local community (organisations/groups), iwi, stakeholders and user groups, and where significant works are proposed Local Boards and the Governing Body.</li> <li>• Identification of the parties consulted.</li> <li>• Identification of the response and views of those consulted and a description of the decision-making process used.</li> </ul>

## Appendix C1.1 Example Pilot Coastal Compartment Management Plan: Orewa

In 2014, Auckland Council completed a review of the Orewa Beach Esplanade Enhancement Project. The results of the project can be considered similar to a reduced scale CCMP and is subsequently discussed below.

### Appendix C1.1.1 Approach

The project was developed to determine the appropriate management of the entire beachfront and was driven by the substantial amount of beachfront assets owned by Auckland Council. The project enabled time-dependent shoreline management considerations to be developed (as outlined in Figure 14, on the following page) and enabled simultaneous community consultation when developing refined preferred designs for each discrete prioritised management unit identified.

### Appendix C1.1.2 Outcome

The above approach to Orewa Beach has enabled Auckland Council to prioritise those sections of the beach presenting the greatest risk to both public users and the asset owners. The basis of this planning has assisted with targeted engagement and consultation with not only affected individuals, but the wider public, stakeholders and iwi who have a holistic interest in how the wider beach system, in respect of the Auckland region, is being managed. Consents for priority sites 3, 3a and 4 are now being progressed as a result of this work.



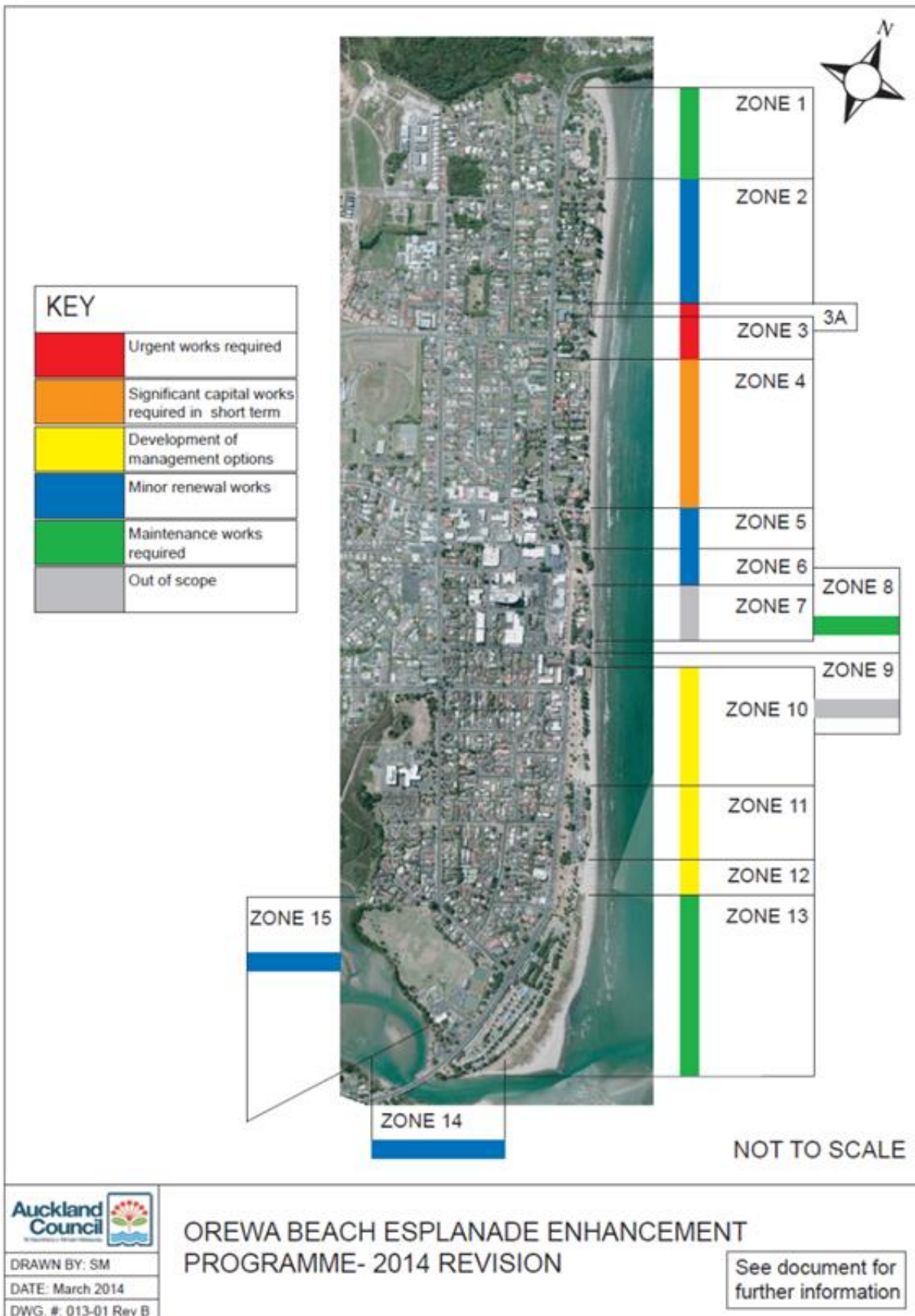


Figure 14: Orewa Beach Esplanade Enhancement Plan

## Appendix D1.0 Supporting tools

### Appendix D1.1 Auckland Council policy for the management of public land

Our prime coastal location offers significant public amenity, which is at the heart of what makes Auckland such a liveable city. However, providing for amenity on eroding coastlines raises challenges for future management responses – ultimately whether to work with or against natural processes. Where coastal erosion and failures of public amenity land occurs, and maintenance responses are required, how should Auckland Council bring current and future use, assets at risk and consequential implications into investment decision-making, to ensure equitable outcomes for Aucklanders?

Part of our refined decision-making criteria relates to what Auckland Council is able to do, legal requirements and constraints, noting that while it is reasonable and appropriate for it to consider developing a general policy approach to the management of coastal processes and in particular, to coastal erosion, that will not obviate the need to consider individual situations on a case-by-case basis as they arise. However, as noted above, there will be situations, such as areas where public amenity exists but with very little other development assets, where it may not be high priority to develop a CCMP, where having a general policy would be useful.

Legal advice received by Auckland Council confirms that any policy change in its approach to the management of coastal land it owns will need to be developed in accordance with relevant Local Government Act processes, and if implemented through the RMA, through RMA processes. Failure to follow correct process in the development of any such policy, which includes consultation, would leave Auckland Council susceptible to legal challenge, accepting that often the most effective legal attack on a policy is through identification of procedural flaws in its development.

If the appropriate processes are followed, and there is solid expert advice underlying the policy, then it is unlikely that an approach which is based around letting natural processes prevail will expose Auckland Council to significant legal liability with respect to its own land holdings.

Where there are developed lifelines or significant infrastructure on Auckland Council land that is of high value to the community, then a policy that does not seek to protect such assets may not be able to be justified. Prudent stewardship that demonstrates a sustainable development approach is necessary and there is some risk that judicial review proceedings challenging the policy could be successful. If however, Auckland Council is able to show that it has expressly considered the implications of the implementation of its policy on its relevant assets and infrastructure and has based its decision on expert advice, then the policy is likely to be legally defensible.

Central Government recently indicated that the issue of hazards associated with sea-level rise (which includes coastal erosion) are matters that will be addressed through both legislative change and national policy guidance as part of the Government's ongoing RMA reform programme. Ideally, such guidance will be provided sooner rather than later, and will assist Auckland Council in progressing the development of its policy position on the issue.



## **Appendix D1.2 Auckland Council's policy for management of private land**

In light of the above comments, the preparation of policy which sets out Auckland Council's position in respect of managing private land should presumably maintain a stance that (unless there are clear countervailing facts to the contrary), Auckland Council is not legally liable to provide support to another landowner's land where the support is removed as the result of natural erosion or slipping on Auckland Council's land.

In all cases, Auckland Council should act realistically and responsibly on a case-by-case basis, and it may be able to offer without-liability assistance.

### **Appendix D1.2.1 Coastal hazards assessment guidelines**

As outlined in Appendix B, the Auckland Unitary Plan identifies 'land that may be subject to coastal hazards'. When development is proposed within this boundary, a coastal hazards assessment is required to demonstrate that the land in question is not at risk from coastal hazards or, where the land is confirmed to be at risk, to identify appropriate mitigation measures.

### **Appendix D1.2.2 Coastal erosion**

A range of supporting methodologies to assess risk are available, the varying application of which may result in differing or incorrect predictions. Furthermore, the broad range of methodologies and associated parameters can make Auckland Council's internal assessment of such hazard assessment approaches challenging.

The above potential issues highlight the need to develop clear and consistent coastal erosion hazard assessment guidelines for both soft shoreline and coastal cliff erosion. Auckland Council technical experts have developed a memo to outline general requirements of a coastal hazard assessment. However, this needs to be formalised into a recognised practice note. Such guidance will:

- 1) Externally support planners and developers in proposing appropriate and sustainable designs
- 2) Internally assist Auckland Council's development engineers and consents team when reviewing such applications.

### **Appendix D1.2.3 Coastal inundation**

Auckland Council has regional coastal inundation mapping. To support the interpretation of this data, an online tool to determine associated inundation levels is being developed, along with the production of internal guidance documents and training. These measures will assist our engineers and planners in identifying and determining potential inundation risks across the region.

## Appendix D1.3 Coastal design standards

A legacy coastal management issue for Auckland is the inadequate or inappropriate design of some historic coastal structures leading to continued maintenance pressures for the immediate structure and/or introducing adjacent management issues. An additional issue is the need for renewal of such structures or the provision of new structures without appropriate design considerations, in particular embedding the potential impacts of climate change in the design.

To avoid such issues going forward, Auckland Council will need to provide guidelines for the appropriate design of future structures addressing a range of issues including:

- Processes to ensure coastal intervention works follow the coastal management framework and are in accordance with an appropriate high-level asset management approach (e.g. No Active Intervention, Protect, Adapt and Managed Realignment)
- Design guidance to ensure consideration is given to determining a suitable location of any proposed works (both with respect to mean high water springs and along the coastal frontage)
- Works are designed to an adequate standard, utilising national and international good practice, where appropriate
- Contracts include suitable performance and quality requirements for construction and operational management of assets.

Engineering and Technical Services has a work programme which includes developing guidance to address these technical requirements including updating the TP130 Coastal Erosion Management Manual.

### Appendix D1.3.1 Effective emergency management

The Civil Defence Emergency Management Act 2002 is the overarching element in the CDEM framework. The National CDEM Strategy, the National CDEM Plan, the Guide to the National Plan and CDEM Group Plans also form part of the framework and these are developed with the support and participation of central and local government, emergency services, lifeline utilities, other general infrastructure providers, businesses and volunteer agencies who are implementing emergency management arrangements.

The Ministry of Civil Defence and Emergency Management has issued guidelines and technical standards that aim to assist organisations and agencies with undertaking their responsibilities under the Act. This includes a wide range of CDEM related issues. Auckland CDEM has also developed local plans, guidelines and standard operating procedures to ensure emergencies can be effectively responded to and recover from.

Both the Auckland Unitary Plan and ongoing emergency management provisions enable a practical approach to mitigating natural hazard risk, through appropriate development controls, lifeline planning and warning systems, as well as through increasing community awareness and preparedness. This aspect of resilience is discussed more in the next chapter.

## **Appendix D1.4 Information and knowledge**

### **Appendix D1.4.1 Additional studies to improve our regional understanding of coastal hazards and climate change**

A comprehensive understanding of existing and future risk presented by coastal hazards and their interactions with climate change in the Auckland region is required to support future planning, policy and operational activities. Key tools to support improved information and knowledge are outlined below.

### **Appendix D1.4.2 Coastal inundation information**

As previously discussed, our coastal inundation data is available regionally. Recognising the importance of this data, Auckland Council is continuing to update and improve our understanding of coastal inundation. Additional studies of the coastal inundation extent for our small east-coast estuaries and the Kaipara River have been recently completed. Our collated, best available information is now available in Auckland Council Technical Report 17 (Stephens et al, 2016).

Going forward, Auckland Council is committed to ongoing of our understanding of coastal inundation processes and the effects of sea-level rise. Inundation data is being continuously reviewed and new, additional studies will be undertaken as required.

### **Appendix D1.4.3 Coastal erosion information**

As outlined in Appendix B, the Auckland Unitary Plan approach to coastal erosion currently provides high-level criteria to define areas that are potentially prone to coastal erosion over the next 100 years. However, considering the diversity of the Auckland coast, there is a future need to refine these criteria and advocate for a plan change within the Plan to further facilitate future sustainable development and avoid increasing risk in areas potentially prone to coastal erosion.

Refinement of the above criteria needs to be based on a robust methodology and supporting data for the Auckland coast. Therefore, a future additional study assessing the regional coastal erosion risk that takes into account our most recent sea-level rise guidance is required.

## Appendix D1.5 Communicating the issues and aligning the coastal management framework with current Auckland Council approaches

### Appendix D1.5.1 Auckland Council data

Effective risk assessment, planning and management decisions for Auckland's extensive coastline is underpinned by regional data sets derived from Auckland Council's coastal monitoring programme in addition to a range of site specific coastal hazard assessments.

CCMPs will, in time, provide additional data sets and information on long-term coastal hazards for the whole of the Auckland coast. Data is already published on Auckland Council's long-term plans and asset management plans; including the range of works they anticipate (although the level of detail is very low).

Coastal-storm inundation and catchment flood inundation mapping were consulted on as part of the Auckland Unitary Plan development and hearings process. These maps are available on Auckland Council's Unitary Plan GeoMap viewer. In addition, tsunami evacuation mapping for the Auckland region is also available on the GeoMap Viewer (under the Emergency Management Layer).

Despite the above information sources, there are areas in which Auckland Council can facilitate and improve public awareness of coastal hazards and climate change impacts in Auckland. This presents an opportunity for the Engineering and Technical Services Unit, Auckland Council and Auckland Council family asset owners, the Chief Sustainability Office and Civil Defence and Emergency Management (CDEM) to work together to develop an agreed approach for communicating hazards and Auckland Council's responses - both at an individual level through property and consent data through to a regional basis.

There has been some national experience with communicating coastal hazards information by means of including data on Land Information Memorandums (LIM) and Project Information Memorandums (PIM). Challenges were encountered in relation to community acceptance and the suitability of using probability versus certainty was challenged. Auckland Council is currently assessing the placement of natural coastal hazard data on PIMs and LIMs as part of a wider approach to natural hazard data considerations.

### Appendix D1.5.2 Auckland Council policy

Section 14 of the Local Government Act 2002 requires Auckland Council to *"conduct its business in an open, transparent and democratically accountable manner"*. This *"should have regard to the views of all of its communities"*, and when making a decision it *"should take account of the diversity of the community and the community's interests, the interests of future as well as current communities and the impact of any decision on these interests."*

Balancing this is the requirement to ensure prudent stewardship and the efficient and effective use of resources in the interests of each district or region, including by planning effectively for the future management of its assets.

It is fundamental that the public is consulted on the development of Auckland Council policies but, as noted above, this needs to be within the broader understanding of the dynamic coastline, the changing hazards and the challenges associated with managing the coastline in a way that provides value to Aucklanders for the short and long term.

### Appendix D1.5.3 Implications of climate change

The impacts of climate change impacts are accounted for in Auckland Council's current, regional coastal-storm inundation and catchment flooding modelling and supporting mapping. This data has informed future planning considerations, e.g. through the Auckland Unitary Plan coastal hazards definitions and associated policies.

The Auckland Plan, Strategy and Research unit has produced a Climate Change Adaptation Guide for Auckland Council, and the Chief Sustainability Officer leads discourse on climate change predictions and effects. Further work is planned, in conjunction with technical advice units such as Engineering and Technical Services, to establish and communicate expected climate change effects in Auckland, and develop an awareness raising programme for Auckland.

A communications plan, developed alongside this Operational Coastal Management Framework, would contribute into the national discussion on climate change adaptation and resilience building.

The above work will be complementary to existing initiatives including the global king-tides movement that Auckland Council sponsors. This citizen science initiative encourages the Auckland community to visit and photograph the highest tide events (known as king tides) that naturally occur along the coastline to effectively 'realise' the effects of sea-level rise.



**Figure 15: Community participation in a witness King Tide 'citizen science' event at Takapuna Beach in 2014**

(<http://auckland.kingtides.org.nz>)

#### **Appendix D1.5.4 Resilience to natural hazards**

Actively building resilience to coastal hazard impacts requires enhancing the capacity of the coastal edge and local communities to absorb and recover quickly from individual hazard events or adapt to continual change (like those created from climate change). A key part of this is building resilient communities and informing people how they can take active measures to become more resilient at a personal and community level. Auckland Council's "Know your Local Hazards" Local Board reports and associated letterbox flyers have helped to build awareness about local coastal hazards. A regional 'Know Your Hazards Report' is currently being developed.

#### **Appendix D1.5.5 Communication plans for public awareness**

A communications plan is required to set the road map of how Auckland Council will raise community awareness in each of the above areas. The communications plan will develop consistent messages and narratives, delivered through multiple media platforms to socialise knowledge that describes the dynamic nature of coastal hazards and how to build resilience to these natural events. CDEM's nationally consistent messaging on flooding, tsunami and earthquakes are successful examples of such an approach.

The communications plan will focus on how to increase community understanding of natural coastal processes. How these natural processes are exacerbated by climate change and the impacts and hazard risks associated with these processes. Understanding the historical context of coastal modification is important as this describes where responsibility and liability for managing these risks lie - providing the public with an understating of how Auckland Council will manage the coastal environment using a range of options to mitigate coastal hazards.

Positive examples of community engagement, consultation and implementation of technical adaptive responses can be communicated to highlight a range issues. This will move towards educating affected communities, so expectations are realistic and balanced. This will facilitate informed discussions and consultation with communities and achieve a shared and successful outcome.

An initial meeting of Auckland Council, Wellington City, Regional Councils, Christchurch City Council and the Ministry for the Environment in July 2015 informally agreed to work together and share experiences, build positive case studies and narratives which may help form a consistent approach to communicating, engaging and showcasing positive management responses to coastal hazard risks.

All communications will need to be placed within the wider national discussion occurring through other districts and local councils. Existing national policy guidelines (The New Zealand Coastal Policy Statement and the Coastal Hazards and Climate Change Guideline) or any future national policy guidelines will also need reference to ensure national consistency.

Essential to the communication plan is articulating the coastal management framework that Auckland Council has developed as this describes the principles, policies and decision-making framework. This would allow an exploration and definition of a shared scope, grow a shared understanding of the range of coastal management options and their adaptive (operational, environmental and aesthetic) limitations. This will enable and allow for consistent messaging regarding how Auckland Council intends to use CCMPs to deliver a regionally coherent best practice approach.



The communications plan would also be used to define how the process of consultation should be undertaken on a CCMP level, i.e. setting key considerations and parameters to ensure communities know they will be involved. This in turn allows communities to positively contribute to any consultation process so that well-informed decisions are made on the long-term sustainable and viable adaptive responses to coastal hazards. The process and experience Auckland Council has with the Auckland Unitary Plan may offer insights.

Leads on the key communication topics have been identified through consultation as follows:

- Auckland Council coastal hazard data – Engineering and Technical Services
- Climate change – Chief Sustainability Office
- Resilience – Civil Defence Emergency Management.