19. Climate Change and Ocean Acidification

Introduction

Society currently relies on fossil fuels as an energy source but needs to find alternatives as quickly as possible. The consumption of these fuels and livestock farming are the two major contributors to the large increase in the release of carbon dioxide and other greenhouse gases into the atmosphere over the last 150 years. The general consensus of scientific opinion is that the world is getting warmer, causing its climate to change. Global average temperature is now more than 1 degree Celsius higher than pre-industrial temperatures. To prevent dangerous and potentially irreversible impacts of climate change, the rise in global temperatures must be kept to less than 2 degrees Celsius above pre-industrial levels. There is now strong evidence that most of the warming observed is attributable to increased concentrations of greenhouse gases produced by human activities. As more gases accumulate in the atmosphere, the Earth gets warmer, resulting in rising sea temperatures and levels, the melting of glaciers and ice caps and greater extremes in weather patterns, such as more storms of greater intensity and longer droughts.

In Marlborough, it is predicted that the mean air temperature will increase by approximately 0.7-1.0 degrees by 2040 and 0.7-3.0 degrees by 2090 above 1995 levels. The climate is likely to become drier and the frequency of droughts is expected to increase. There is also a predicted increase in westerly winds, especially in winter and spring. Warming of the seas and oceans because of climate change increases stratification of the surface layers, thereby affecting light and nutrient availability and consequently decreasing phytoplankton production – the base of the entire ocean food chain.

Section 7 RMA requires the Council to have regard to the effects of these predicted climatic changes in exercising its functions under the RMA. While there is now a state of scientific certainty regarding the facts of climate change, the exact nature of these effects will always involve a degree of uncertainty, given the timeframe, the range of factors involved and the complexity of global weather systems, as well as the extent that the global community reduces greenhouse gas emissions. However, there is strong national guidance providing for an adaptive management approach that allows uncertainty to be addressed and flexibility in adapting as more information becomes available. Taking all of this into account, the provisions of this chapter focus on applying the best available information to enable people and communities to respond to the adverse effects created by climate change – and any beneficial effects that may arise. It is noted that the adverse long-term effects of global warming are likely to outweigh any regional short term benefits that may occur.

In addition to climate change, a consequence of higher carbon dioxide levels in the sea is ocean acidification. Rising carbon dioxide levels in the atmosphere results in increasing amounts being absorbed by the oceans, forming carbonic acid, thereby lowering pH and altering the ocean's chemistry, making it more difficult for marine organisms to produce carbonate structure such as shells and bones. This "ocean acidification" process has been identified as a key threat to New Zealand's marine habitats, because it is so pervasive, potentially affecting every habitat and a very wide range of marine organisms. The pH of coastal waters is inherently variable due to a complex interplay of factors, which include temperate, biological uptake and respiration, terrestrial run-off and pollution.

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Note:

The MEP Hearings Panel decision of Topic 16 - Climate Change includes a decision to restructure the order of the chapters in Volume 1 in order to give the climate change provisions more prominence. This version of the Plan incorporating the decisions does not implement the restructuring at this point in time at the direction of the Panel. The Panel has used the notified provision numbers in their decision. Restructuring the MEP in accordance with the Panel's decision on Topic 16 would have made it difficult for submitters to cross reference the decision with the restructured plan content. It is intended to restructure the Volume 1 content when the

MEP is to be made operative. To avoid any doubt, this note has no statutory weight, it is merely included to inform plan users of the Panel's intent.

Issue 19A – Climate change and ocean acidification have the potential to affect Marlborough's natural and physical resources and the ability of people and communities to use these resources.

Marlborough relies on its natural and physical resources for its social and economic wellbeing and health and safety. The nature of many natural and physical resources and the ability to use them, especially land and freshwater resources, is dependent on climate. This makes Marlborough vulnerable to any long term changes in climate and ocean pH.

Primary industry makes a significant contribution to Marlborough's economy and is vulnerable to changes in climate. Many primary industries rely on sufficient quantities of rainfall or freshwater in rivers and aquifers to supplement rainfall through irrigation. The various crops that are grown or the type of stock that is grazed reflects these climate variables. Predictions of higher temperatures, more extreme temperatures and reduced rainfall could therefore have a significant impact on rural land users through increased risk of drought and decreased water availability. Any decrease in water availability will also increase the competition for freshwater amongst existing users and between extractive and in-stream values.

Marlborough's natural ecosystems could also be vulnerable to the effects of climate change and/or ocean acidification. Indigenous terrestrial, aquatic and marine species could respond to increased temperatures and/or drier conditions by shifting to more suitable climatic zones. Any inability to move may have significant consequences for the long term viability of affected indigenous species, especially plants.

However, climate change may create new opportunities. Plant growth could improve due to longer growing seasons and rising carbon dioxide levels. Warmer temperatures and decreased frost risk may enable new crops to be established; for example, Marlborough may become more suited to growing red wine grape varieties. Changes in climate may also create the opportunity to develop new ways to produce renewable energy. However, these benefits may be limited by negative effects of climate change such as prolonged drought or greater frequency or intensity of storms.

The public health effects of climate change include warmer winters, which may alleviate cold related illnesses and death. This would have the added advantage of reducing energy consumption during the winter months. In contrast, hotter summers may cause heat stress while drier and windier conditions could create more dust and affect sufferers of respiratory disease. Windier conditions will also create additional challenges for the use of agrichemicals in the rural environment. Climate change may also lead to more stress-related mental health effects from extreme weather events such as droughts, floods or fires as these can cause disruption to individuals and business, including the primary sector.

Communities may enjoy the health benefits of warmer winters, but warmer temperatures may also have significant biosecurity implications. Sub-tropical diseases may become a problem if carrier insects become established. Rising average temperatures could lead to the wider establishment and spread of new and/or existing pest plants, increased abundance of animal pests and greater survival of a range of insect pests. Some of these insects, such as mosquitos, may be carriers of diseases which are currently not present in Marlborough, and which adversely affect human, animal or plant health.

Climate models are improving and many more global model projections were available for the Fifth Assessment Report for the Intergovernmental Panel on Climate Change (IPCC) compared to the Fourth Assessment Report. The 2016 Ministry for the Environment report 'Climate Predictions for New Zealand' has drawn on this work, and as well as a detailed New Zealand regional climate model run on the NIWA supercomputer, to give a report with 'an unprecedented level of detail and robustness in the information provided'. The report notes that climate change effects over the next

decades are predictable with some level of certainty. This situation is complicated, however, by the fact that New Zealand and Marlborough are subject to natural climate variations associated with La Nina/El Nino and the Interdecadal Pacific Oscillation. These natural variations will be superimposed on human-induced long term climate changes.

Rising carbon dioxide levels in the atmosphere results in increasing amounts being absorbed by the oceans, forming carbonic acid, thereby lowering pH and altering the ocean's chemistry, making it more difficult for marine organisms to produce carbonate structure such as shells and bones. This "ocean acidification" process has been identified as a key threat to New Zealand's marine habitats, because it is so pervasive, potentially affecting every habitat and a very wide range of marine organisms. The pH of coastal waters is inherently variable due to a complex interplay of factors, which include temperate, biological uptake and respiration, terrestrial run-off and pollution.

[RPS, R, C, D]

Objective 19.1 – Mitigation of and adaptation to the adverse effects on the environment arising from climate change or ocean acidification.

This objective focusses on actions that the community can take to reduce the potential for adverse effects on the environment caused by climate change and ocean acidification, and to respond to any effects that do occur. There is now scientific certainty regarding climate change. There remains, however, an inherent uncertainty regarding the exact nature and extent of likely local climate changes in Marlborough and their effects. While the exact nature of those adverse effects is unknown, it is still possible to plan for climate change. The planning however needs to be flexible and adaptive. Further research will assist in this regard, refining the potential impacts. In the meantime, it is prudent to promote actions that reduce and offset carbon emissions and retain sufficient flexibility in the use, development and protection of natural and physical resources to enable resource users to adapt to a changing climate and ocean acidification.

[RPS]

Policy 19.1.1 – Promote actions within Marlborough to reduce carbon emissions as the preferred option, with offsetting as a less favoured alternative.

Climate change and ocean acidification are global issues that New Zealand's central government is addressing at an international and national level. The RMA effectively excludes regional councils from the role of regulating emissions for climate change purposes (Sections 70A and 104E of the RMA). However, the Council can explore opportunities for supporting national policies and where appropriate promote methods that address climate change problems within New Zealand's national policy framework for climate change. For example, the Council will assess and then address the carbon footprint of delivering its own services to the community (including its tree planting) and encourage businesses to do likewise. This is one of many actions the Council could undertake to enable Marlborough's people and communities to play their part in responding to these global issues.

[RPS]

Policy 19.1.2 – Improve the community's understanding of the potential effects of climate change and ocean acidification on the Marlborough environment.

Although there has been considerable research to predict long term climate change and ocean acidification internationally and nationally, very few of the research findings have been applied directly to Marlborough's climate and coastal marine area. This makes it difficult to establish the likely effects of climate change and ocean acidification on natural and physical resources and the ability of people and communities to utilise these resources. It is therefore desirable to investigate local climate change and ocean acidification, especially as Marlborough contains two distinct climate zones: a wetter climate north of and including the Richmond Range and a drier climate south of the Richmond Range; as well as distinct coastal marine areas. The findings gained from research initiated through this policy can be applied to better understand the potential implications of climate change and ocean acidification in a Marlborough context.

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The Council will also use a collaborative engagement process involving the community to help define and understand coastal hazards and climate change, based on the Ministry for the Environment guidance for local government 'Coastal Hazards and Change 2017.

[R, C, D]

Policy 19.1.3 – Enable primary industries to adapt to the effects of climate change and ocean acidification.

Farmers and foresters, as well as those involved in fishing and aquaculture, are inherently adaptable resource users and it is likely this will need to continue into the future as changes in climate and ocean pH begin to affect users' ability to utilise land, freshwater and marine resources. Responses to increased temperatures and reduced water availability may require modifications to farming practices or diversification of crops or stock types. Increased temperatures and reduced frost risk may also create opportunities to produce crops not previously grown in Marlborough. Similar opportunities could exist for the aquaculture industry as a result of increasing sea water temperatures. As Marlborough's economy is based on these primary industries, it is important that such adaptations can be made. Changes to consented aquaculture activities including farming structures and crop/stock types, may need to go through a resource consent process.

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[R]

Policy 19.1.4 – Take a precautionary approach to the allocation of additional freshwater resources and taking into account the foreseeable impacts of climate change and where freshwater has already been allocated, ensure that the allocation reflects the status of the resource and the effects on both out-of-stream and instream uses and values.

Sustainable flow regimes established through previous resource management plans have been reviewed during the preparation of the MEP. This involved a review of the sustainable yield from Marlborough's rivers and aquifers to confirm appropriate levels of allocation to resource users. Historical flow and level records were utilised as part of this process, including data that has been recorded since the original plans were notified. This approach ensured that any influence of climate change on sustainable yield was taken into account.

Given the importance of freshwater to the social and economic wellbeing of Marlborough, consideration was also given to opportunities to provide additional access to freshwater resources. Appropriate caution was applied to this task as the opportunities enabled by the allocation may not be realised if climate change reduces sustainable yield in the future. Access to freshwater may become unreliable to the extent that people cannot make a return on the investments made. This risk should be considered in perspective, taking into account the variable nature of Marlborough's freshwater resources in response to natural climate oscillations.

This policy can be applied to the environmental data collected over the life of the MEP. In this way, the policy will also inform any subsequent review of the provisions contained in Chapter 5 - Allocation of Public Resources.

[R]

Policy 19.1.5 – Ensure that the freshwater that is available for out-of-stream use is allocated and used efficiently, by:

- **(a) requiring that the rate of water use authorised by water permit be no more than that required for the intended use, having regard to the local conditions;**
- **(b) enabling the transfer of water permits between users within the same Freshwater Management Unit; and**
- **(c) enabling the storage of water during periods of high river flow for subsequent use during low flow and low level periods.**

One of the significant risks of climate change locally is that Marlborough's climate may become drier, with drought periods becoming more frequent and longer in duration. If this happens, it is

essential that available freshwater resources are allocated and utilised efficiently to ensure that the social and economic benefits that can be derived from the freshwater that is available are maximised. The matters specified in (a) and (b) target efficient allocation and use of freshwater. The intent is to ensure that freshwater is not unnecessarily "locked up" in paper allocation when it could benefit existing or potential users.

If water availability declines over time due to reduced river flows or aquifer levels brought about by decreased rainfall, then storing freshwater would be an effective means of retaining reliability of supply. As set out in (c), this policy enables the taking of freshwater during periods of higher river flow. Stored water can then be used during periods of low river flow when access might otherwise be restricted.

The matters set out in (b) and (c) will result in more resilient communities as they reduce the vulnerability of resource users to decreased freshwater availability brought about by climate change. More details on the policy responses set out in (a) to (c) are contained in Chapter 5 - Allocation of Public Resources.

Commented [13]: Manawa Energy Limited (previously Trustpower)
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[R, C, D]

Policy 19.1.6 – Recognise that coastal ecosystems, habitats and species are potentially vulnerable to the effects of climate change by adopting a precautionary approach to the use and management of coastal resources to allow natural adjustments to occur.

Marlborough's coastal ecosystems, habitats and species could be vulnerable to the effects of climate change. Indigenous terrestrial, aquatic and marine species could respond to increased air and ocean temperatures, and drier conditions, by shifting to more suitable marine biogeographic and/or climatic zones or making other similar adjustments. Any inability to move or adjust may have significant consequences for the long-term viability of affected indigenous species, especially plants. This policy directs that a precautionary approach be applied to the use and management of coastal resources to ensure such natural adjustments can occur. The policy gives effect to Policy 3 of the NZCPS.

Commented [14]: Environmental Defence Society
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[R]

Policy 19.1.7 – Before granting a resource consent for discharge of greenhouse gases to air from heat devices on a site, the regional council must:

(a) consider the total discharges of greenhouse gases from all heat devices on the site the application relates to; and

(b) recognise that, cumulatively, all discharges of greenhouse gases resulting from the production of industrial process heat, regardless of volume, contribute to climate change, and any reduction in greenhouse gas emissions contributes to mitigating climate change.

Terms used in the policy and defined in the Resource Management (National Environmental Standards for Greenhouse Gas Emissions from Industrial Process Heat) Regulations 2023 have the meaning in those regulations.

This policy has been inserted into Plan as a requirement of the National Policy Statement for Greenhouse Gas Emissions from Industrial Process Heat 2023.

Commented [15]: NPS-GHG (2023)

[R]

Policy 19.1.8 – When considering an emissions plan as part of an application for a resource consent for a discretionary activity relating to discharges to air of greenhouse gases from heat devices, the consent authority must consider:

(a) the timing and content of updates of the emission plan to be made by the holder of the consent; and

(b) how those updates will reflect changes in technology and best practices.

Terms used in the policy and defined in the Resource Management (National Environmental Standards for Greenhouse Gas Emissions from Industrial Process Heat) Regulations 2023 have the meaning in those regulations.

This policy has been inserted into Plan as a requirement of the National Policy Statement for Greenhouse Gas Emissions from Industrial Process Heat 2023.

Commented [16]: NPS-GHG (2023)

Methods of implementation

The methods listed below are to be implemented by the Council unless otherwise specified.

[RPS]

19.M.1 Council carbon footprint

Investigate Council operations to establish their carbon footprint; set goals for reducing carbon emissions having regard to New Zealand's national emissions reduction targets and develop an action plan to reach those goals.

[D]

19.M.2 Marlborough Regional Land Transport Plan

Consider, in the review of the Marlborough Regional Land Transport Plan, provisions to reduce emissions of greenhouse gases taking into account the climate change provisions of the MEP.

[D]

19.M.3 Marlborough Walking and Cycling Strategy

Maintain, implement and review the Marlborough Walking and Cycling Strategy to promote modes of transport that do not rely upon fossil fuels.

[R, C, D]

19.M.4 Research

Apply the findings of international and national climate change and ocean acidification research to Marlborough's environment to the extent that is possible and support research relating to Marlborough. The findings can then be applied to determine and better understand the implications of climate change and ocean acidification.

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[R, C, D]

19.M.5 Information

Share the findings of research on climate change and ocean acidification in Marlborough and the implications of these predictions with the community. This will help to allow people to take action to prepare for those implications and therefore reduce the adverse effects of predicted climate change and ocean acidification.

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[R]

19.M.6 Regional rules

Rules will establish sustainable levels of freshwater allocation that take into account the effects of climate change on river flows, aquifer levels and the resulting sustainable yield from those freshwater resources.

Enable the taking of surface water for storage purposes through the application of a controlled activity rule to the abstraction.

Use a broad definition of "marine farming" so that marine farmers are able to modify farming practices and diversify or change crop/stock types in response to changes in climate and ocean pH. Changes to

the consented aquaculture activitv, including farminq structures and crop/stock tvpes mav need to go through a resource consent process.

[D]

19.M.7 District rules

Apply a range of permitted activity rules to farming and forestry activities. Use broad definitions of "farming" and "forestry" so that farmers and foresters are able to modify farming practices and diversify or change crop/stock types in response to changes in climate.

Enable the creation of permanent carbon sinks through the application of appropriate rules.

[R, D]

19.M.8 Carbon sequestration

Encourage tree planting of appropriate species in appropriate locations to assist with carbon sequestration.

Issue 19B – Climate change could affect natural hazards and create a coastal inundation hazard associated with sea level rise.

The predictions of climate change include predictions of more extreme weather events. For the east coast of the South Island, including Marlborough, this means drier conditions and an increase in the incidence of drought. Drier conditions will also increase the risk of fire. Climate change may also result in a change in the frequency of extreme rainfall events. Any increase in frequency in such events could lead to more frequent and severe flooding.

In rural areas, if extreme events such as droughts and floods become more severe and frequent, costs associated with dealing with stock losses, increased soil erosion and damage and disruptions to farm operations would be expected to increase. To date, there is no indication that severe Marlborough rainfall events are increasing, though average global temperatures have clearly risen over the last ten years.

Global warming is raising sea level due to thermal expansion of ocean water and melting of glacial and polar ice. Sea level is predicted to rise around 0.55 to 1.52 metres by 2130[1]. This rise increases the risk of inundation at the coast. Coastal erosion in areas will become more prevalent, increasing the demand for coastal protection measures, both of which can have adverse effects on natural values. Along the coastal margin of the Wairau Plain, the level of the Wairau River bar and river mouth efficiency has far greater influence on the potential for inundation than the projected sea level rise. Further south, the topography and lack of settlement minimises any inundation risk. However, the risks are far greater in the Marlborough Sounds where settlement and associated infrastructure (especially means of access, such as jetties and access tracks) tend to be located in the coastal environment and near the water edge. Where land is subsiding, the adverse effects of sea level rise from climate change can be accelerated.

More frequent extreme weather events would also pose a significant risk to regionally significant infrastructure such as buildings, roads, water, sewerage, electricity transmission and communication systems.

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[1] Table 10, Coastal Hazards and Climate Change: Guidance for Local Government, 3rd Edition. Ministry for the Environment, December 2017.

[RPS, R, C, D]

Objective 19.2 – Avoid and mitigate the adverse effects of natural hazards influenced by climate change.

Provisions elsewhere in the MEP seek to avoid and mitigate the adverse effects of natural hazards. This objective recognises that the severity and/or frequency of those natural hazards could potentially increase as a result of climate change. In these circumstances, any additional adverse effect should likewise be avoided or sufficiently mitigated.

While it could make existing natural hazards worse, climate change in itself creates a new hazard in sea level rise. It is appropriate that the adverse effects of sea level rise and the associated inundation of land are avoided and mitigated given that these adverse effects are permanent.

[R]

Policy 19.2.1 – Monitor flood hazard on an ongoing basis.

The magnitude and incidence of flooding may increase in response to climate change, particularly the predictions for more severe rainfall events. Policies in Chapter 11 - Natural Hazards establish a framework for reducing the risk of flooding to adversely affect communities. This is achieved by mapping the known and predicted flood risk areas and applying appropriate management to activities within those mapped areas. If climate change does result in increased magnitude or incidence of flooding, then this information will be collected and used to inform the review of the existing management framework. In response, it may be necessary to change and/or increase the boundaries of the flood hazard overlay in the MEP. Any such changes would have to pass through the First Schedule process of the RMA. Policy 11.1.16 in Chapter 11 - Natural Hazards provides more detail on this matter.

[R, C, D]

Policy 19.2.2: For planning and development in the coastal environment the following sea level rise allowances and scenarios must be used (until a dynamic adaptive pathways planning process is completed) to assess and manage potential coastal hazard risk:

(a) Coastal subdivision, greenfield developments and major new infrastructure – use a minimum 1.52 m sea level rise; and

(b) Changes in land use and redevelopment (involving intensification or use of land beyond the existing footprint of built development or structures) – use a minimum 1.52 m sea level rise; and

(c) Existing coastal development and assets within their existing footprint – use a minimum 1.0m sea level rise; and

(d) Non-habitable short-lived assets with a functional need to be at the coast, and which either have low consequences or are readily adaptable (including services) - use a minimum 0.65m sea level rise.

Dynamic adaptive pathways planning approach, and the climate change/sea level rise scenarios in clauses (a) and (b) are as defined in "Coastal Hazards and Climate Change: Guidance for Local Government, Ministry for the Environment, December 2017.

The International Panel on Climate Change has determined that it is very likely that the rate of global mean sea level rise during the twenty-first century will exceed the rate observed during 1971– 2010 due to increases in ocean warming and loss of mass from glaciers and ice sheets.

The Ministry for the Environment advises local government[2] to use a "dynamic adaptive pathways planning" approach to considering the effects of climate change, and managing and adapting to it

[2] Coastal Hazards and Climate Change: Guidance for Local Government, 3rd Edition. Ministry for the Environment, December 2017.

and the hazards risk from sea level rise and climate change. The approach provides flexibility that allows an agreed course of action to be changed if the need arises.

Until the adaptive pathways planning is undertaken, the Ministry for the Environment guidance is to use interim sea level rise allowances and scenarios, depending on the type of activity. This advice, for four categories of activity, is reflected in Policy 19.2.2. The allowances are based on Tables 10 and 12 of the guidance, which provide for minimum transitional sea level rise allowances and scenarios.

The Council has chosen to specify a single value for Category A and Category B activity of 1.52m (unlike the guidance) in order to provide certainty to resource users. 1.52m is the H+ scenario for greenfield development and new infrastructure in 2130. The minimum sea level rise allowances in (a) and (b) therefore provide a 100 year allowance for that type of activity proposed during the life of the MEP.

Although the life of the MEP is only ten years, buildings have a minimum design life of 50 years and new subdivisions and property titles have an indefinite life. Equally new infrastructure can be long-lived, and involve multi-million dollar community investment. The policy reflects the different timeframes, and increases of sea level – and the different risk involved – associated with various types of development. It also recognises that a different approach is possible with new, compared to existing development. For example, development under (a) and (b) both involve multiple (and potentially numerous) properties. In these circumstances, given the scale of development, and therefore the scale of the investments being made, it is necessary and appropriate to take a precautionary approach to planning for sea level rise. In contrast, development under (c) is more likely to involve an individual property and, as the development already exists, it is acceptable to plan for a lower level of sea level rise.

This policy will be applied to the determination of resource consent applications, plan changes and designations.

Rules elsewhere in the MEP require buildings to be set back from the coastal marine area. This in itself will act to protect buildings from the adverse effects of sea level rise and/or storm surge. However, when applications are made to establish a building within this setback, then the policy will be able to be applied.

[R, C, D]

Policy 19.2.3 – Using a collaborative community engagement model, identify and priorities areas, assets and infrastructure (e.g. roads) where the coastal environment is under threat of inundation from rising sea levels and associated storm surges. Using that process develop an implementation plan to avoid or mitigate the adverse effects of such outcomes on the community.

Policy 24(1) of the NZCPS requires the identification of areas "potentially affected" by coastal hazards and climate change and Policies 25 and 27 of the NZCPS provide guidance for the management of existing and future coastal land use and development. Interim management, until a dynamic adaptive pathways planning (DAPP) process is completed, as provided in Policy 19.2.2 above. This policy sets out the process to be applied in the DAPP process. The DAPP process and the community engagement that is integral to it, is described in "Coastal Hazards and Climate Change: Guidance for Local Government, 3rd Edition. Ministry for the Environment, December 2017. It involves a 10 step decision making process as set out below.

Figure 19.1: The 10 step decision cycle for long term strategic planning and decision making for coastal areas (Source: Ministry for the Environment, 2017)

Methods of implementation

The methods listed below are to be implemented by the Council unless otherwise specified.

[R, C, D]

19.M.9 Research

In order to plan for the effect of sea level rise, it is necessary to understand the areas along the Marlborough coast that are likely to be affected by inundation and storm surge in the long term. The Council will undertake an investigation to establish the extent and nature of the inundation hazard using the International Panel on Climate Change's most recent projections of sea level rise.

[R, C, D]

19.M.10 Community engagement and evaluation

The Council will lead a process to evaluate and identify the areas, assets and infrastructure valued by the community but also likely to be inundated by sea level rise and associated storm surges. An action plan will be developed with the affected communities using the engagement process in the Ministry for the Environment guidance. This involves using the 10 step decision cycle for long term strategic planning and decision making for coastal areas set out in Figure 6.1.

[R, C, D]

19.M.11 Monitoring

The Council will continue to monitor water levels and flows in Marlborough's rivers. This will provide information on the magnitude and frequency of flood events over time and will allow changes in flood risk to be identified and evaluated.

[D]

19.M.12 District rules

Use rules to establish buffers between buildings and infrastructure and the coastal marine area. The horizontal setback created will reduce the potential for structures and infrastructure to be inundated until the research and community engagement outlined above is completed. The research and community engagement may prompt the need for additional district rules in certain locations to ensure Policy 19.2.2 continues to be met.

Anticipated environmental results and monitoring effectiveness

The following table identifies the anticipated environmental results of the climate change and ocean acidification provisions of the MEP. Unless otherwise specified, the anticipated environmental results are ten year targets. For each anticipated environmental result, a series of indicators will be used to monitor the effectiveness of the climate change and ocean acidification provisions.

Anticipated environmental result	Monitoring effectiveness
19.AER.1 The community's understanding of the effects of climate change, sea level rise, and ocean acidification improves over time.	The results of research into the local effects of climate change and sea level rise, and ocean acidification are reported to the Council. Environmental data, including climate, flooding and ocean pH, is collected and reported to the Council to establish long term trends.
19.AER.2 Primary producers are able to adapt to the effects of climate change and ocean acidification.	Monitoring of land use and land use change establishes changes in crop type. Marine farmers have evolved farming practices, as necessary, in response to changes in ocean pH.
19.AER.2A Coastal ecosystems, habitats and species are able to adapt to the effects of climate change.	Reports of coastal ecosystems, habitats and species adapting to the effects of climate change.
19.AER.3 Buildings and infrastructure established after the notification of the MEP are not inundated by the sea.	Reports of inundation and/or damage to buildings and/or infrastructure.
19.AER.4 There is a reduction in the carbon footprint of the Council's operations.	Council report establishing carbon footprint of its operations and subsequent reports on reductions achieved.

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19.AER.5 The community is involved in planning for the consequences of inundation from sea level rise and associated storm surge.	The 10 step community engagement and evaluation process set out in Policy 19.2.3 and Method 19.M.9 is completed.