

STAGE 3 - SECTION 32

CHAPTER 5

NATURAL HAZARDS

PART 2

Supplementary Report (2) to Section 32 Report - Chapter 5 - Natural Hazards

This report provides an addendum to the "Section 32 Natural Hazards Chapter" ("the Section 32 Report") to record amendments proposed to the Section 32 Report to reflect amendments proposed to "Chapter 5 – Natural Hazards" by the Stage 3 Proposal). Headings used in this report reflect those used in the Section 32 Report. Unless otherwise stated the text of the Section 32 report is retained with the following amendments. Consequential renumbering may be required where additional text is added and/or numbered provisions are deleted.

The new provisions are introduced to the Chapter as part of the Stage 3 proposals include:

- i. new Rule 5.8.4 Rural, Specific Purpose and Open Space zones – Activities and earthworks in Floor Level and Fill Management Areas (Explanatory Note: rule cross references to the Rule 5.8.1 in the notified chapter which includes rules for Residential zones only);
- ii. new Rule 5.8.5 Repair of land used for residential purposes in Rural and Open Space Zones (Explanatory Note: rule cross references to the Rule 5.8.2 in the notified chapter Rule 5.8.2 which deals with Residential zones only);
- iii. new Rule 5.8.6 for Flood Ponding Management Areas in Rural Zones (Explanatory Note: rule implements Policy 5.3.3 in the notified chapter);
- iv. new Rule 5.8.7. All Rural zones Activities and earthworks in the Waimakariri Stopbank Floodplain Management Area (Explanatory note: reproduces existing Waimakariri Stopbank Floodplain provisions in operative district plan);
- v. new Rule 5.8.8 for High Flood Hazard Management Areas (Explanatory note: reflects new information);
- vi. new Rule 5.8.9 Te Waihora / Lake Ellesmere and Te Wairewa / Lake Forsyth Flood Management Areas (Explanatory Note: largely reproduces existing rule in operative district plan with the exception of Te Wairewa/Lake Forsyth Flood Management Areas where new information requires more restrictive approach);
- vii. new provisions within Rule 5.10 Port Hills and Banks Peninsula slope instability that replace text that states "PHASE TWO REVIEW" with cross referencing to relevant zone or district wider rules (that version of the rule used is that included as Attachment A to Ms Janice Carter's Rebuttal Evidence¹);
- viii. new policies to address the Changing climate (5.2.9) and Coastal hazards (5.6.1 and 5.6.2) to replace interim Policy 5.6.1 (Policy 5.6.1 be deleted from the notified chapter as a consequence of expert witness caucusing - see Attachment A to Ms Janice Carter's Rebuttal Evidence for amendments to the notified version);

¹Refer to Independent Hearings Panel website (www.chchplan.ihp.govt.nz); Natural Hazards proposal; Christchurch City Council Rebuttal Evidence "310 CCC - Rebuttal - Ms Janice Carter 27 - 2 - 15".

- ix. new Rule 5.11 Coastal Erosion and Coastal Inundation rules to protect areas vulnerable longer term coastal hazards in the next 100 years; and
- x. planning maps are amended to identify areas susceptible to a distance source tsunami, new Coastal Hazard Management Areas referred to in the new Rule 5.11, and additional areas where new information has enabled the extension of Floor Level and Fill Management Areas to which rules in the notified Rule 5.8.1 and Rule 5.8.3 apply.

1.1 PURPOSE AND SCOPE OF THE NATURAL HAZARDS CHAPTER

1. The purpose of the Natural Hazards chapter is to:

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- 8. ensure the Council's statutory responsibilities including those outlined within the New Zealand Coastal Policy Statement 2010 (NZCPS), the Recovery Strategy for Greater Christchurch and the Land Use Recovery Plan 2013 (LURP), and the Canterbury Regional Policy Statement 2013 (CRPS) are reflected in the objectives, policies, rules and planning maps; and recognises proposed amendments to the CRPS and Regional Coastal Environment Plan 2005 (RCEP) proposed under LURP Action 46 to transfer responsibility for coastal hazard management from ECan to territorial local authorities.

(Explanatory note: paragraph updates and replaces existing paragraph 8).

1.3 RESEARCH

- 1. The Council has commissioned technical advice and assistance from various internal and external experts and utilised this, along with internal workshops and community feedback, to assist with setting the Plan framework for the proposed Natural Hazards Chapter provisions. This advice includes the following:

Table 1: Key Technical Reports informing the Chapter

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Flood hazards			
	Title	Author	Summary of content
a	Proposed Variation 48 Assessment of the Variation and Summary of the evaluation made under section 32 of the RMA	Dec 2003	Summarises the analysis of the proposed plan variation undertaken under section 32 of the RMA.

b	Preliminary Assessment of Historical Flooding	May 2008	Assesses historical flooding information within defined settlements of Akaroa Harbour.
c	Plan Change Section 32 Assessment Waimakariri Stopbank Floodplain Land Use Controls.	July 2010	Summarises the analysis of the proposed plan change undertaken under section 32 of the RMA.
d	Operative Plan Change 32 to the Christchurch City Plan - Waimakariri River Stopbank Floodplain Land Use Controls and supporting s32 report	Christchurch City Council. Operative Date 15 April 2013	The purpose of Operative Plan Change 32 is to prevent unnecessary risk to human life and property within the Waimakariri Floodplain in the event of a primary Stopbank failure. Controls focus on prevention of habitable buildings where the hazard is greatest and as well as managing filling and
e	Christchurch City High Flood Hazard District Plan Review	DH I Water and Environment Ltd Nov 2014	Uses new flood hazard modelling of the Avon and Halswell catchments to map areas susceptible high flood hazards and an assessment of high hazard areas adjacent the estuary affected by tidal inundation not covered by the catchment models. Model status reports for each of the five models have either been produced as part of this study or updated as required.
f	Change to the Avon Surface Water Model	DHI April 2015	Updated version of the model that identifies additional areas subject to flooding in major flood events in the northwest of the city including west of the railway line.
g	Woolston Hydraulic Model and Flood Hazard Mapping Update Summary	Jacobs April 2015	Updated version of the model that identifies additional areas subject to flooding in major flood events in the Woolston and the Central city areas.

Coastal hazards			
	Title	Author	Summary of content

a	Coastal Hazards and Climate Change: A Guidance Manual for Local Government in New Zealand	Ministry for the Environment 2008	Provides best practice information and guidance with aim of strengthening the integration of coastal hazards and climate change considerations in land use planning and decision making.
b	Akaroa Harbour Basin Settlements Study – Coastal Erosion and Inundation Project	DTec Consulting, 2 nd Edition 2008	Provides information in respect of the Banks Peninsula settlements of Akaroa, Takamatua, Robinsons Bay, Duvauchelle, Barrys Bay, French Farm, Tikao Bay, and Wainui.
c	New Zealand Coastal Policy Statement	Ministry for the Environment 2010	States policies in order to achieve the RMA in relation to the coastal environment of NZ.
d	Canterbury Regional Policy Statement	Canterbury Regional Council 2013	Provides an overview of the resource management issues in the Canterbury region, and the objectives, policies and methods to achieve integrated management of natural and physical resources and including directions for district plans.
e	Effects of Sea Level Rise for Christchurch City Report for the Christchurch City Council	Tonkin & Taylor Limited November 2013.	Updates information contained in the 1999 T & T report titled: Study of the Effects of Sea Level Rise for Christchurch. Based on sea level rise projections in the report, the minimum floor level is recommended to be set at 12.3m (Council datum) allowing for sea level rise of 1m to the year 2115.
f	LURP Action 46 – Amendments to Regional Policy Statement and Regional Coastal Environment Plan in relation to coastal hazard management.	Environment Canterbury June 2015	Action 46 of the Land Use Recovery Plan (LURP) directed ECan to make changes to the Canterbury Regional Policy Statement (CRPS) and its regional plans in accordance with the LURP. Changes were made to the CRPS and the Regional Coastal Environment Plan (RCEP) in relation to coastal hazard management in Christchurch City, Waimakariri and Selwyn districts. Updated coastal hazard zone mapping was included in the changes.

g	Coastal Hazard Assessment - Stage One - Review	Tonkin & Taylor Limited, November 2014	Reviews the existing coastal hazard zones for southern Pegasus Bay and identifies areas susceptible to coastal inundation around Lyttelton Harbour.
h	Changing climate and rising seas: Understanding the science	Parliamentary Commissioner for the Environment 2014	Reviews the science behind climate change and the processes driving sea level rise.
i	Updated inundation modelling in Canterbury from a South American tsunami. Environment Canterbury report number R14/78.	NIWA Nov 2014	Report maps areas of the Canterbury coast susceptible to inundation resulting from a Mw9.485 earthquake originating off the coast of Peru across the Pacific Ocean showing the landward extent of inundation, water elevations and maximum flow speeds.
j	Coastal Hazard Assessment - Stage Two	Tonkin & Taylor Limited, July 2015	Identifies areas susceptible to coastal hazards (erosion and sea water inundation) for the open coast adjoining the Christchurch urban area and the sheltered harbours of Brooklands Lagoon, the Avon/Heathcote Estuary and Akaroa and Lyttelton Harbours.

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Updated research assessing the landward extent of areas susceptible to coastal hazards including coastal erosion (which will result in shoreline retreat in some areas) and coastal sea water inundation (producing sea water flooding during storm events and high tides) and tsunami for the Christchurch District has been used to inform the provisions for reducing the risk to people and property through the proposed Christchurch Replacement District Plan.

Other options for addressing the risk from coastal erosion and inundation will be considered by the Council in the proposed Natural Hazards Strategy and a Resilience Strategy which are both under preparation and through the Land Drainage Recovery Programme.

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2. RESOURCE MANAGEMENT ISSUES

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2.2. Reduced Risk from Natural Hazards ...

2.5 Repair of earthquake damaged land...

PROVISIONS (POLICY, RULE, METHOD) <u>MOST APPROPRIATE WAY TO ACHIEVE THE OBJECTIVES</u>

<p>5.1.1 Objective - Reduced risk</p> <p>Reduced risk to people, property, infrastructure and environment from the effects of natural hazards, including: ...</p>	
Provision(s) most appropriate	Effectiveness and Efficiency
<p>Option 2: (Strengthened policies and rules)</p> <p>...</p> <p><i>Policies and Rules for Flooding...</i></p> <p>Rules</p> <p>Flood Hazard Rules (Rule 5.8) summary (see chapter for actual rule)...</p> <p>Rule 5.8.4 Rural Zones, Specific Purpose Zones, and Open Space Zones - Activities and earth works in Floor Level and Fill Management Areas</p> <p>This rule duplicates provisions in Rule 5.8.1 Residential Zones - Activities and earthworks in Floor Level and Fill Management Areas.</p> <p>Rule 5.8.5 Repair of land used for residential purposes in Rural Zones and Open Space Zones damaged by earthquakes within a Floor Level and Fill Management Area (provisions previously introduced under section 27 Canterbury Earthquake Recovery Act to the Operative Plan).</p> <p>This rule duplicates provisions in Rule 5.8.2 Repair of land used for residential purposes damaged by earthquakes within a Floor Level and Fill Management Area (provisions previously introduced under section 27 Canterbury Earthquake Recovery Act to the Operative Plan).</p> <p>Rule 5.8.6 All zones - Activities and earthworks in Flood Ponding Management Areas</p> <p>This rule controls filling, excavation, new subdivision and new buildings in Flood Ponding Management Areas for the purpose of achieving <i>Policy 5.3.3.a Maintain the flood storage capacity and function of natural floodplains, wetlands and ponding areas, including the Hendersons Basin, Cashmere</i></p>	

Stream Floodplain, Hoon Hay Valley, Cashmere-Worsleys Ponding Area, Cranford Basin, and Lower Styx Ponding Area. These rules reproduce provisions in the operative district plan introduced by Plan Variation 48 to protect natural ponding areas. The technical information supporting these provisions remains relevant and indicates current management approach remains appropriate. It imperative that these natural ponding areas be maintained because of the benefit they provide to existing urban development. Rules controlling subdivision to create additional allotments and new buildings i.e. non-complying activities, are the same status as for High Flood Management Areas, because is it imperative that these natural ponding areas be maintained as they are relied upon by both existing and urban development to attenuate flooding hazards.

Rule 5.8.7 Waimakariri Floor Level and Fill Management Area - Activities and earthworks

This rule controls the intensification of buildings, filling and excavation within the Waimakariri Stopbank Floodplain. The rule carries over provisions in the operative Christchurch City Plan that were introduced through Operative Plan Change 32 to the Christchurch City Plan - *Waimakariri River Stopbank Floodplain Land Use Controls*. A comprehensive Section 32 Report with technical information supported this plan change.

5.8.8 High Flood Hazard Management Areas - Activities and earthworks

This rule controls subdivision and new buildings in those areas subject to flooding where the depth and/or velocity of water during a major flood event meet the "High hazard areas" definition in Chapter 11 of the CRPS. High hazard flood areas are mapped in the operative district plan for within the Waimakariri Stopbank Floodplain have been carried over into the planning maps of the proposed Replacement District Plan.

New flood hazard modelling has been undertaken for the Avon and Halswell catchments to develop mapping of areas susceptible high flood hazards. An

assessment was also made of high hazard areas adjacent the estuary affected by tidal inundation but not covered by the catchment models. Model status reports for each of the five models have either been produced as part of this study or updated as required.

5.8.9 Te Waihora / Lake Ellesmere and Te Wairewa / Lake Forsyth Floor Level and Fill Management Areas

These rules largely reproduce those in the operative district plan.

Te Waihora / Lake Ellesmere Floor Level and Fill Management Area

New information has resulted in the extension of the Floor Level and Fill Management Areas and High Flood Hazard Areas which has enabled the north western extent of the Te Waihora / Lake Ellesmere Flood Management Area to be removed.

Te Wairewa / Lake Forsyth Floor Level and Fill Management Area

New information gathered from the major flood event in 2014 which affected the catchment and settlement of Little River revealed the area affected is greater than that current managed under the operative district plan and that floor height requirements in the operative district plan were exceeded in this flood event. This means the minimum floor height requirements in the operative plan cannot be relied upon to protect new buildings from inundation. Minimum floor height will need to be assessed for all new buildings through the resource consent under the restricted discretionary activity status.

The extent of the Te Wairewa / Lake Forsyth Flood Management Areas has been extended to reflect the new information and the name amended to reflect naming protocol adopted to better reflect the primary controls over floor levels and filling of sites.

Policies and rules for slope instability areas ...

5.10.1 Activity status for Port Hills and Banks Peninsula Slope Instability Management Areas

The rules replace references to "Phase 2

<p>Review" in the notified part of the chapter. The activity status proposed is consistent with the approach taken within the "Mass Movement Hazard Management Areas 2 & 3" i.e. where earthworks, new buildings or structures or the upgrading of existing infrastructure or new infrastructure is proposed resource consent approval is required to enable any risk from geotechnical hazards to be fully assessed.</p> <p>Planning maps</p> <p>Amendments to the Natural Hazard Planning Maps identify additional areas within the Floor Level and Fill Management Areas (FLFMA) to the northwest of the notified FLFMAs including to the west of the railway line, and at Halswell and adjoining part of Te Waihora/Lake Ellesmere.</p> <p>The FLFMAs at Halswell are based on DHI modelling applying the same principles as all for all other FLFMAs around the city and a model supplied by Environment Canterbury. The FLFMA adjoining Te Waihora/Lake Ellesmere utilises the DHI modelling of the Halswell River.</p> <p>Mapping of the separate Te Waihora /Lake Ellesmere FLFMA relies on existing information while mapping of the Te Waiwera / Lake Forsyth FLFMA is based on the work of the Mayoral flooding taskforce of 2014.</p>	
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2.6 Accommodating the effects of Climate Change and associated sea level rise

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RESOURCE MANAGEMENT ISSUE 6 – Reduced risk from coastal hazards

Changes in the global climate are leading to warmer temperatures, rising sea levels and more extreme weather events. Where these natural events interact with people and property (including infrastructure) at the coast they can result in coastal hazards including coastal erosion and coastal inundation. Coastal erosion results from rising sea levels and the action of the waves bringing the shoreline further inland while coastal inundation refers to the seawater coming onto the land during a storm. Inundation can also occur in association with local, regional and distant source tsunamis originating from earthquakes.

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3. SCALE AND SIGNIFICANCE EVALUATION

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3.1 Objectives, policies and rules

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Statement of Expectations

The process for preparation of the Replacement Christchurch District Plan is prescribed by the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014 ("the Order"). The Resource Management Act 1991 (RMA) is modified by the Order to provide a streamlined process for the review of the operative Christchurch City Plan and operative Banks Peninsula District Plan and preparation of the Replacement Christchurch District Plan. The Order states that the Council must have particular regard to the Statement of Expectations (Schedule 4 of the order).

The relevant expectations for the Central City Natural Hazards section include:

- (a) *clearly articulates how decisions about resource use and values will be made, which must be in a manner consistent with an intention to reduce significantly (compared with the existing district plans) —*
 - (i) *reliance on resource consent processes; and*
 - (ii) *the number, extent, and prescriptiveness of development controls and design standards in the rules, in order to encourage innovation and choice; and*
 - (iii) *the requirements for notification and written approval:*
- (b) *contains objectives and policies that clearly state the outcomes that are intended for the Christchurch district:*
- (c) *provides for the effective functioning of the urban environment of the Christchurch district, reflecting the changes resulting from the Canterbury earthquakes, including changes to population, land suitability, infrastructure and transport:*
- (d) *facilitates and increase supply in housing, including by-*
 - ...
 - (iv) *having regard to constraints on environmental and infrastructure capacity, particularly with respect to natural hazards;*
 - ...
- (h) *sets a clear direction on the use and development of land for the purpose of avoiding or mitigating natural hazards:*
- (i) *uses clear, concise language and is easy to use.*

An evaluation of how the second part of the Natural chapter will meet these expectations is provided below.

Overall the provisions proposed in the second part of the Natural Hazards respond to the above expectations by:

- a. including provisions necessary to set a clear direction on the use and development of land for the purpose of avoiding or mitigating natural hazards (clause h above) and contains objectives outlining clear outcomes of:
 - i. Reduced risk from natural hazards;
 - ii. Increased public awareness of natural hazards;

- iii. A recovery process where repair of earthquake damaged residential land is facilitated;
- b. clearly articulating permitted activities in the Floor Level and Fill Management Areas in comparison with existing provisions in district plans (Note also the option of "certification" through a process that does not rely on the resource consent process was considered by the Independent Hearings Panel during the Hearing of submissions to the Stage 1 Natural hazard proposal (refer to discussion about certification in the Section 32 report for the Natural Hazards section of the Central City chapter);
- c. reducing requirements for notification and written approvals in terms of recession plane controls where floor levels are raised to comply with minimum floor level requirements in the Floor Level and Fill Management Areas; and
- d. by providing for the effective functioning of the District through rules and assessment matters aimed at:
 - i. mitigation of flooding impacts on buildings during major flood events and by requiring floor heights of new buildings be raised to avoid inundation and damage in Rural Zones, Specific Purpose Zones, and Open Space Zones;
 - ii. mitigation of effects of development in natural flood ponding areas;
 - iii. mitigation by ground improvement or building/layout design for land potentially subject to liquefaction in Rural Zones, Specific Purpose Zones, and Open Space Zones;
 - iv. mitigation of the effects of development within the primary and secondary stopbank setbacks within the Waimakariri Floor Level and Fill Management Area;
 - v. mitigation of coastal erosion, or sea water inundation during a storm event in the 50 - 100 year planning timeframe;
 - vi. avoiding subdivision and development in areas susceptible to high flood hazard;
 - vii. avoiding coastal erosion or sea water inundation during a storm event in the next 50 years; and
 - viii. identifying areas susceptible to a distance-source tsunami generated off the coast of Peru.

Strategic Directions

The Strategic directions chapter provides the overarching direction for the district plan, including for developing other chapters within the Plan, and for subsequent implementation and interpretation; and has primacy over the objectives and policies in the other chapters of the Plan. The objectives and policies in the other chapters (such as this Central City chapter) must be expressed and achieved in a manner consistent with the objectives of the Strategic Directions chapter.

Approach to Coastal Hazards in the District Plan Review

Coastal erosion and inundation associated with storm events

Policy 25 of the NZCPS promotes a range of options for responding to coastal hazard risk by directing that

"In areas potentially affected by coastal hazards over at least the next 100 years:

- a. avoid increasing the risk of social, environmental and economic harm from coastal hazards;
- b. avoid redevelopment, or change in land use, that would increase the risk of adverse effects from coastal hazards;
- c. encourage redevelopment, or change in land use, where that would reduce the risk of adverse effects from coastal hazards, including managed retreat by relocation or removal of existing structures or their abandonment in extreme circumstances, and designing for relocatability or recoverability from hazard events;
- d. encourage the location of infrastructure away from areas of hazard risk where practicable;
- e. discourage hard protection structures and promote the use of alternatives to them, including natural defences; and
- f. consider the potential effects of tsunamis and how to avoid or mitigate them."

Policy 11.3.1 of the CRPS provides direction on Policy 25 of the NZCPS by directing the avoidance of new subdivision, use and development in high hazard areas (which includes areas subject to coastal erosion and sea water inundation over the next 100 years). Within Policy 11.3.1 are clauses (1) to (4) provide exemptions where subdivision, use and development is not likely to: result in loss of life or serious injury, suffer severe damage or loss, require new or upgraded hazard mitigation works to mitigate or avoid the natural hazard, or exacerbate the effects of the natural hazard. Clause (6) directs the effects of the natural hazards on new subdivision, use and development in areas zoned in the district plan for urban residential, industrial or commercial use must be "avoided" or "appropriately mitigated". An exemption to maintaining or upgrading critical or significant infrastructure is provided for in clause (7).

Stage 3 Policy 5.6.1 provides two approaches to the management of coastal erosion and seawater inundation associated with storm events. Policy 5.6.1a and supporting provisions give effect to CRPS Policy 11.3.1 by identifying areas susceptible to coastal erosion and coastal storm inundation in the next 50 years as high risk areas. Activities within these areas are considered unlikely to meet criteria (1)-(4) and should be avoided to reflect criterion (6). Coastal areas identified as high risk from coastal erosion in the next 50 years and coastal storm inundation in a 2% AEP event are mapped as Coastal Erosion Hazard Management Area 1 (CEMA1) and Coastal Inundation Management Area 1 (CIMA1).

The approach taken in Stage 3 Policy 5.6.1a also implements Objective 3.3.6.a.i in the operative Strategic Directions chapter by recognising that continued intensification of subdivision, use and development where there is a high risk from coastal erosion and storm inundation is unacceptable.

Stage 3 Policy 5.6.1b and supporting provisions give effect to CRPS Policy 11.3.1 meet criteria (1)-(4), (6) and (7) by identifying those coastal areas where subdivision, use and development may continue if appropriately mitigated because of the lesser risk from coastal erosion in 50 to 100 years period between 2065 and 2015 and coastal storm inundation in a 1% AEP event. These areas are mapped as Coastal Erosion Hazard Management Area 2 (CEMA2) and Coastal Inundation Management Area 2 (CIMA2). This approach implements Objective 3.3.6.a.ii in the operative Strategic Directions chapter by recognising that subdivision, use and development may be undertaken if the risks are appropriately mitigated.

Criterion (7) in CRPS Policy 11.3.1 provides for any exemption for the maintenance and/or upgrading of critical infrastructure. In recognition of this exemption less restrictive rules apply to this activity and coastal hazard mitigation works across all coastal management areas.

Proposing a management approach for coastal erosion and coastal storm inundation based on the timeframes from 2015 to 2065 (the next 50 years) and from beyond 2065 to 2115 (50 -100 years) and the effects and increasing risk over this time is a pragmatic response to the immediacy of the risk associated with these coastal hazards and the predicted acceleration in the rate of sea level rise in approximately 50 years. This approach also anticipates that local, regional and national strategies will be developed in the future to respond to predicted effects of extreme weather events and accelerated sea level rise on coastal areas.

This approach also reflects the approach taken in the RCEP (2005) which uses the 50 and 100 year timeframes for its coastal hazard provisions. Chapter 9 in the RCEP includes policies and rules that control: new development in the coastal environment to ensure the need for coastal protection is minimised, new habitable buildings in areas susceptible to coastal hazards, minimisation of coastal hazard damage, and protection of natural features that buffer the effects of coastal hazards and provide information on avoidance of locating in hazard prone areas.

Under the RCEP controls on development susceptible to coastal erosion are divided between two hazard zones. Hazard Zone 1 includes land between Mean High Water Springs and the landward extent of the current active beach system that is at risk from coastal erosion within 50 years from the date of the RCEP being produced. Adjoining Hazard Zone 1 along its landward boundary is Hazard Zone 2 which includes land at risk from coastal erosion in the 50 to 100 year timeframe. The RCEP also identifies areas of the coast historically affected by coastal inundation however no rules apply to these areas.

The Council has been investigating the risk of coastal hazards on its community for several years. This work has continued since the 2010-2011 earthquake sequence when subsidence in some coastal areas reduced the height of land above mean sea level by up to half a metre. In one area adjacent to the Avon Heathcote Estuary land previously occupied by residential activities now forms part of the intertidal area.

Research undertaken by consultants Tonkin & Taylor for the Council since the earthquake sequence has culminated in the latest report (Coastal Hazard Assessment - Stage 2; June 2015) ("the Tonkin & Taylor 2015") which maps areas vulnerable to coastal erosion and sea water inundation in storm events over the next 100 years along the Christchurch City coast line and for the urban settlements within Akaroa and Lyttelton harbours.

The Tonkin & Taylor 2015 report applies international and national best practice guidance to the investigation taking into account the effects of a changing climate including accelerated sea level rise and the predicted exacerbation of weather conditions such as increased storm events, applies a probabilistic approach to the assessment of risk from coastal hazards along the open coast, assumes a 1 metre sea level rise by 2115 and uses beach profile data gathered by ECan over several decades to inform the modelling of coastal erosion along the open coast adjoining Christchurch City. Where Coastal Hazard Assessment does not assess a section of coastline, the coastal hazard zone in the Regional Coastal Environment Plan is relied on to inform to location of the landward extent of coastal erosion.

Within Christchurch City most of the areas vulnerable to risk from coastal hazards overlap with areas identified as Floor Level and Fill Management Areas where proposed rules in the notified part of the Natural Hazards chapter require the raising of floor heights for new buildings and additions to existing buildings and control filling and excavation of land.

Controls on the installation of coastal hazard mitigation works are proposed to ensure that any works that could worsen any existing coastal hazards or transfer or increase the risk to other people or property are appropriately managed.

The Council is preparing both a Natural Hazards Strategy and a Resilience Strategy that will consider a range of responses for existing and future development susceptible to risk from coastal hazards. Decisions made by the Council about the content of these strategies has the potential to impact on the approach taken to reducing the risk from coastal hazards in the proposed Christchurch Replacement District Plan and may result in subsequent review of the coastal hazard provisions.

Tsunami

For natural hazards such as tsunami not addressed in CRPS Policies 11.3.1, 11.3.2 and 11.3.3, Policy 11.3.5 directs that subdivision, use or development shall be avoided if the risk is unacceptable. The policy prescribes consideration be given to the likelihood and potential consequences of the natural hazard events for people, communities, property and infrastructure, the environment and emergency response organisations. Where uncertainty exists the Policy directs the Council adopt a precautionary approach. Stage 1 Natural Hazards Policy 5.2.4 reflects CRPS Policy 11.3.5 which it promotes the adoption of a precautionary approach where a high degree of uncertainty exists.

A comprehensive "consequence assessment" for any natural hazard would include an assessment of the impacts and consequences on the built environment, the economy, health and safety and the environment. Determining the nature and severity of the consequences of a natural hazard is the second stage in the well-established and widely accepted risk based approach (ISO 31000) to managing a natural hazard. The second stage is preceded by "know your hazard" (stage one) and followed by "evaluating the likelihood of an event" (stage three).

Consequence assessments can be tailored and scaled to suit a particular purpose and budget. The more detail the assessment, the more accurate the findings. To determine the consequences of a particular event, the "impact" of that event needs to be determined. For example, an impact of a tsunami may be the destruction of houses, while the consequence is that people have nowhere to live and need accommodation.

The Christchurch district lies on the western edge of the Pacific Ocean and is subject to local and distant-source tsunamis (NIWA, 2014). A tsunami can be defined as a large sea wave caused by an earthquake, landslide or other disturbance under the ocean. Tsunami waves do not resemble normal sea waves, because their wavelength is far longer. Rather than appearing as a breaking wave, a tsunami may instead initially resemble a rapidly rising tide, and for this reason they are often referred to as tidal waves.

There are three tsunami scenarios facing the Christchurch coastline - local, regional or distance source. A local source tsunami takes less than one hour to reach the coast while a regional source tsunami takes one to three hours travel time to reach the coast. The distance source tsunami is more than three hours travel time from the coast.

The most recent information on distance sourced tsunami hazard with the potential to affect the Christchurch district is contained in the report prepared by the National Institute of Water and Atmospheric Research in November 2014 entitled "Updated inundation modelling in Canterbury from a South American tsunami" (NIWA 2014).

The NIWA 2014 report describes and maps the findings of the modelling and analysis of a distance source tsunami resulting from an earthquake off the coast of Peru. This report assesses the modelled tsunami as having a high return period in the order of 2500 years however the report acknowledges that this information can help inform "evacuation planning and emergency management" and may be useful for "strategic development planning and infrastructure planning".

The high return period of 2500 years (or an Annual Exceedance Probability of 0.0004%) means this particular tsunami hazard has an extremely low likelihood of occurrence. For this reason the risk from this natural hazard has been assessed as being acceptable insofar as controls limiting development are not justified. However the landward extent of this tsunami is mapped in the Natural Hazard Planning Maps for "Information Only" as a means of achieving the Stage 1 Natural Hazards Objective 5.1.2 of increased public awareness of the range and scale of this natural hazard events. This mapping also implements Stage 1 Policy 5.2.7 by informing people about natural hazards affecting their properties.

Along with identifying and quantifying natural hazards, ECan has an interest in and responsibility for quantifying risk. To date the emphasis of their geological natural hazards research work has centred on defining the hazard (establishing the context), however they are well aware of the need to better define the risks from natural hazards.

At this time ECan have commissioned further research to assess Christchurch's exposure/vulnerability to tsunami using the NIWA 2014 "worst case scenario" hazard information and RiskScope. This work will assess impacts on residential dwellings, displacement of residents, and urban infrastructure and will form the basis for the Canterbury CDEM Group's 2016 National CDEM exercise.

The Council will continue to liaise with ECan and other parties to discuss opportunities for building on the knowledge of tsunami.

The Council provides tsunami guidelines for communities along the Christchurch and Banks Peninsula coastline

(<http://www.ccc.govt.nz/homeliving/civildefence/informationondisastershazards/tsunami.aspx>) together with a tsunami warning system along the Christchurch coastline.

Approach to Multiple Hazards in the District Plan Review

The approach taken in the Natural Hazards proposal to management of multiple natural hazards reflects the direction provided in statutory documents and the risk profile of each natural hazard for the district. This approach aims to achieve

integrated and sustainable management of people, property and infrastructure by reducing the risk from the adverse effects of natural hazards to an acceptable level.

The CRPS gives recognition to natural hazards events affecting the Canterbury region and provides direction on the approach taken to management through its objectives, policies and methods in Chapter 11 Natural Hazards. These provisions identify unique natural hazards events and give direction on the management of the effects of these hazards. The management approach varies depending on the level of risk associated with the natural hazards (i.e. the likelihood and consequences) which in turn depends on the quality of technical information available. Where information is less robust more general guidance is provided (e.g. tsunami) and a precautionary approach is required. Where the risk from natural hazards is unacceptable or intolerable i.e. potentially life threatening and/or mitigation is unsustainable, avoidance of subdivision, use and development is directed.

The Natural Hazards proposal reflects the direction in the CRPS by identifying and managing the effects of unique natural hazards events and the potential adverse effects from these natural hazards through objectives, policies and methods. The methods used primarily involve controls on subdivision, use and development with the exception of tsunami hazard where the mapping of a distance source event is provided for information purposes. Collectively the rules ensure a comprehensive assessment of the risk of natural hazards affecting people, property and infrastructure both on and off the subject site.

The option of condensing the mapping of natural hazards and rules to simplify and reduce the complexity of both was considered but discounted because this would limit the ability to manage the effects unique to each natural hazard event in a comprehensive and integrated manner. A condensed “one hazard represents all” approach could dilute the complexity of both individual natural hazards and multiple natural hazards affecting many sites across the district and could undermine the rigor needed for assessing and managing risks from multiple natural hazards.

5. EVALUATION OF PROPOSED POLICIES, RULES AND METHODS

...

A quantitative economic cost benefit analysis was not considered necessary given the directive in statutory and higher order policy documents to manage the risk posed by coastal hazards to people and property including infrastructure.

5.1 Identification of options

...

5. Coastal erosion and sea water inundation.

<p>PROVISIONS (POLICY, RULE, METHOD) <u>MOST APPROPRIATE WAY TO ACHIEVE THE OBJECTIVES</u></p>
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5.1.1 Objective - Reduced risk	
Reduced risk to people, property, infrastructure and environment from the effects of natural hazards, including: ...	
Provision(s) most appropriate	Effectiveness and Efficiency
<p>Option 2: (Strengthened policies and rules) ...</p> <p>5.2.9 Policy - Changing Climate</p> <p>a. Ensure all subdivision, use and development takes account of the effects of a changing climate when considering the risk from natural hazards and associated effects on people, property and critical infrastructure.</p> <p>...</p> <p>Policies and Rules for coastal hazards</p> <p>5.6 Policies for Coastal Hazards and Coastal Hazard Mitigation Works</p> <p>5.6.1 Reduce risk to people, property and critical infrastructure in areas affected by coastal hazards by:</p> <p>a. avoiding subdivision and development in areas of high risk affected by coastal erosion and sea water inundation over the next 50 years;</p> <p>b. controlling subdivision and development in areas affected by coastal erosion and sea water inundation in the 50 - 100 year period; and</p> <p>c. enabling the modification of existing buildings to reduce risk from coastal erosion and sea water inundation over the next 100 years.</p> <p>5.6.2 Restrict coastal hazard mitigation works involving new physical structures unless:</p>	<p>1. Benefits</p> <p>a. Policy 5.2.9 recognises the phenomenon of a changing global climate that is resulting in warmer temperatures, rising sea levels and more extreme weather events. Overarching policy recognition is needed to make sure the effects of a changing climate on the risk from natural hazards is considered as part of subdivision, use and development. This level of policy guidance is essential to reducing the risks to people, property and critical infrastructure and to achieving integrated and sustainable management of natural and physical resources.</p> <p>b. Policy 5.6 provides a framework for managing risk from the coastal hazards of erosion and sea water inundation from storm events which:</p> <p>i. reflects the directives in legislation and strategic documents including the NZCPS 2010, LURP 2013 and CRPS 2013 including the proposal by ECan to amend the CRPS 2013 and RCEP 2005 to transfer coastal hazard management from ECan to territorial local authorities;</p> <p>ii. applies a consistent policy approach to areas of the district where people and their property are concentrated; and</p> <p>iii. aims to achieve a more sustainable and integrated management of natural and physical resources to meet the economic, social and cultural wellbeing of the community;</p> <p>iv. avoids the intensification of people, their property and infrastructure in areas vulnerable to risk from coastal hazards;</p> <p>v. provides the Council and its community the opportunity to adjust practices of use and development in response to the likelihood of inundation and shoreline retreat;</p> <p>vi. recognises the statement of expectations in the <i>Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014</i> where in clause (h) it directs the Council sets a clear direction on the use and development of land.</p>

<ul style="list-style-type: none"> a. the coastal hazard risk cannot reasonably be avoided; and b. alternatives to physical works such as the relocation, removal or abandonment of existing structures are not practicable; and c. the works are effective and do not: <ul style="list-style-type: none"> i. worsen any existing coastal hazard; ii. transfer or increase the risk to other people or property including critical infrastructure; iii. adversely affect the natural environment; and iv. sites of cultural significance to Ngāi Tahu/Manawhenua. <p>(Explanatory note: The above policy replaces interim policy 5.6.1)</p> <p>2. Methods</p> <p>Rules for Coastal Hazard - see 5.11 Coastal Erosion and Coastal Inundation rules in chapter for details.</p> <p>In summary four coastal hazard management areas are proposed:</p> <ul style="list-style-type: none"> i. Coastal Erosion Management Area 1 (area affected by erosion over next 50 years); ii. Coastal Erosion Management Area 2 (area affected by erosion in the 50-100 year timeframe); iii. Coastal Inundation Management Area 1 (area affected by sea water inundation in storm events over next 50 years); and iv. Coastal Inundation Management Area 2 (area affected by sea water inundation in storm events in the 50-100 year timeframe). 	<p>2. Costs</p> <ul style="list-style-type: none"> a. Rules requiring resource consent approval create compliance costs however this must be weighed against the need to manage the adverse effects of coastal erosion and storm inundation over the next 100 years. b. The entire community, including landowners and occupiers of property and critical infrastructure in areas vulnerable to adverse effects from coastal erosion and storm inundation, will be subject to additional costs over time as measures to avoid and mitigate the effects of coastal hazards are investigated and implemented. c. There are opportunity costs associated with development aspirations that cannot be achieved where more restricted controls are proposed to the subdivision, use and development of land. <p>3. Efficiency and Effectiveness</p> <ul style="list-style-type: none"> a. The objectives and policies for coastal erosion and coastal inundation provide a clear framework for the management of new subdivision and development in areas at risk from coastal hazards over the next 100 years. b. Identifying areas subject to coastal erosion and coastal inundation over the next 50 years provides a more plausible timeframe for the Council and its community relate to and provides consistency with aspects of the Building Act with respect to the life of a building and floor height requirements to mitigate flooding. c. Coastal hazard management overlays on the planning maps provide for an efficient means of identifying areas at risk from coastal erosion and coastal inundation.
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<p>Rules applying to the Coastal Erosion and Coastal Inundation Management Areas propose controlling:</p> <ol style="list-style-type: none"> i. subdivision to create vacant allotments, ii. new buildings; iii. coastal hazard mitigation works including earthworks associated with these works; iv. the upgrading of existing infrastructure and development of new infrastructure where there is a functional need to located in the overlay) including earthworks associated with these works. <p>Permitted activities in all Coastal Erosion and Coastal Inundation Management areas include:</p> <ol style="list-style-type: none"> a. Repair and maintenance of infrastructure including earthworks associated with these works. <p>This rule acknowledges that infrastructure is present in areas susceptible to coastal erosion and inundation and will continue to be provided for some years into the future.</p> <p>Restricted discretionary activities in Coastal Erosion Management Area 1 and 2 and Coastal Inundation Management Area 1 and 2 including Rules 5.11.1:a, b and f controlling:</p> <ul style="list-style-type: none"> · subdivision to create vacant allotments, · new buildings and · the modification of existing for the purpose of reducing damage form coastal hazards <p>These rules enables applications for new subdivision, new buildings to be evaluated against the risk from coastal hazards in that period from 50 to 100 year from 2015 This approach enables buildings and structures to be developed but anticipates building and foundation designs that facilitate the relocation of buildings as these activities become more susceptible to risk from coastal erosion and inundation over time. Use of existing buildings/sites can continue as can repair and</p>	
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<p>maintenance. Gaining resource consent approval is justified because of the need to fully evaluate the environment, economic and social implications of enabling subdivision and buildings in these areas.</p> <p>Provision is made for existing buildings to be modified to reduce their exposure to the risk of coastal hazards. It is anticipated modification may range from alterations to foundations to raising of floor heights and enables the relocation of buildings including movement of buildings on a site. The Restricted Discretionary Activity status of this rule enables a rigorous assessment of any proposal while acknowledging the less restrictive approach taken to subdivision and new buildings exposed to coastal erosion and storm inundation under the 50-100 year timeframe because of the opportunity for area wider options to be considered through local, regional and national lead initiatives.</p> <p>Discretionary activities in all Coastal Erosion Management Areas and Coastal Inundation Management Areas:</p> <ul style="list-style-type: none"> a. coastal hazard mitigation works...; and b. the upgrading of existing infrastructure or development of new infrastructure.... <p>This rule implements Policy 5.6 by acknowledging the extensive network of coastal hazard mitigation works (CHMW) that will continue to require maintenance and upgrading. New CHMW are also likely to be needed to protect additional areas from coastal erosion and inundation into the future. Controlling new CHMW ensures these Works are designed and constructed to acceptable standards, with the full implications for the subject site or sites and adjoining areas considered. Repair, maintenance and monitoring of CHMW can also be required.</p> <p>The dune network along much of Christchurch City's coastline is located on</p>	
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public land under Council management (existing resource consent CRC951255 provides for the maintenance of the dunes). Controlling activities in respect of the dune system achieves *Policy 5.2.6 - Natural features providing hazard resilience*.

The rule also recognises that infrastructure is present, and will continue to be established, in areas susceptible to coastal hazards. Control over the upgrading of existing infrastructure and establishment of new infrastructure in areas susceptible to risk from coastal hazards ensures full consideration is given to all implications of such development.

The cost of gaining resource consent approval is justified because of the need to fully evaluate the environment, economic and social implications of proposed infrastructure.

As the effects of a changing climate are experienced across the district, provision for coastal hazard mitigation works including both soft and hard engineered structures will be considered for wider areas of the coast, beyond those identified in Coastal Erosion Management Areas 1 and 2 and Coastal Inundation Management Areas 1 and 2, to protect people, property and infrastructure.

Non-complying activities in Coastal Erosion Management Area 1 and Coastal Inundation Management Area 1

- a. subdivision to create vacant allotments; and
- b. new buildings.

This rule achieves objective 5.1.1 of reducing risk to people's safety, well-being and property in areas subject to coastal hazard over the next 50 years and implements policy 5.6 by avoiding further subdivision in areas at potential risk from coastal hazards over next 50 years. Use of existing buildings/sites can continue as can repair and maintenance. The rule also

has the effect of reducing the exposure of new people and buildings to the risk of coastal hazards. The rule provides a clear signal to the market of susceptibility of these areas to coastal erosion and inundation.

Coastal Hazard Mitigation Works

In many areas of the District works such as beach re-nourishment and dune replacement have been undertaken, and structures such as sand fences, seawalls, groynes, gabions and revetments have been established, to mitigate the effects of coastal erosion and sea water inundation on land and property including infrastructure. The operative District Plan for the Christchurch District makes no specific provision for works and structures designed to mitigate the effects of coastal erosion and sea water inundation.

At present proposals to undertaken works or to establish structures for the purpose of mitigating coastal erosion and sea water inundation may be considered under both the Canterbury Regional Coastal Environment Plan and the operative District Plan for the Christchurch District. With the proposed transfer of responsibility for coastal hazard management from the Canterbury Regional Council to the Christchurch City Council as part of LURP Action 46 pending, and it is appropriate at this time to make specific provision for mitigation of coastal erosion and sea water inundation in the proposed replacement District Plan.

Coastal hazard mitigation works are provided for as a discretionary activity across the District in recognition that works such as beach re-nourishment and dune replacement and the establishment of structures will continue to be maintained and repaired in many low lying parts of the District and that proposals for the establishment of physical works is likely to increase with the projected acceleration in storm events and sea level rise under a changing climate.

<p>Planning maps</p> <p>The Natural Hazards Planning Maps include Coastal Erosion Management Areas 1 and 2 and Coastal Inundation Management Areas 1 and 2 to which rules apply. Areas affected by tsunami are also mapped using the "Information only" notation.</p> <p>Non-regulatory methods</p> <p>Implement non-regulatory methods for improving public awareness of areas subject to coastal hazards (including tsunami) under the Local Government Act 2002 and Civil Defence Emergency Management Act 2002 e.g. providing warning sirens and evacuation plans with supporting public information to respond to the threat to people, their safety and well-being.</p>	
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Advice Note: Fire and Wind hazard

The risk of fire hazard is controlled by Environment Canterbury (ECan), Department of Conservation (DoC) and the Christchurch City Council (Council) through legislation other than the RMA using both regulation and by increasing public awareness through information.

The Council uses the Building Act 2004 and its regulations to address wind, snow and seismic loadings.

Advice Note: Consequential amendments

Consequential amendments will be required to Appendices 1 and 2 to reflect the provision in the second part of the chapter introduced through the Stage 3 proposal.