Independent Hearings Panel

Christchurch Replacement District Plan

Te paepae motuhake o te mahere whakahou a rohe o Ōtautahi

IN THE MATTER OF section 71 of the Canterbury Earthquake Recovery Act 2011 and the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014

AND

IN THE MATTER OF proposals notified for incorporation into a Christchurch Replacement District Plan

Date of hearing: 2-6, 11-13, 17-18 March 2015

Date of decision: 17 July 2015

Hearing Panel: Hon Sir John Hansen (Chair), Environment Judge John Hassan (Deputy Chair), Dr Philip Mitchell, Ms Sarah Dawson, Ms Jane Huria

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DECISION 6

NATURAL HAZARDS (PART)
(AND RELEVANT DEFINITIONS AND ASSOCIATED PLANNING MAPS)

Outcomes: **Proposals changed as per Schedules 1 and 7**

COUNSEL APPEARANCES AND REPRESENTATIONS

Mr J Winchester, Mr B Pizzey and Ms S Scott	Christchurch City Council
Mr P Radich QC, Mr C Carranceja, Ms J Silcock, Ms E Moore, Mr D Allen	The Crown
Mr P Smyth	Ian Connor and Ruth Woodley Roland Logan and Sharon Ng Richard and Sally Tripp Simon Gurnsey and Sara Crane David Mason Richard and Heather Larson
Ms S Watson	Port Hills Property Group
Ms J Appleyard	Christchurch International Airport Limited Waterloo Park Limited Lyttelton Port Company Limited Orion New Zealand Limited
Ms J Walsh	Ngāi Tahu Property Limited Te Rūnanga o Ngāi Tahu Mahaanui Kurataiao Limited on behalf of Te Ngāi Tūāhuriri Rūnanga, Te Hapū o Ngāti Wheke (Rāpaki), Te Rūnanga O Koukourārata, Ōnuku Rūnanga, Wairewa Rūnanga and Te Taumutu Rūnanga Progressive Enterprises Limited
Mr E Chapman and Ms J Robinson	IAG New Zealand Limited
Mr C Fowler	Southern Response Earthquake Services Limited
Mr P Maw and Ms M Mehlhopt	Canterbury Regional Council
Mr J Gardner-Hopkins	Mobil Oil New Zealand Limited Z Energy Limited BP Oil New Zealand Limited (The Oil Companies)
Mr D Pedley	KI Commercial Limited
Mr A Hughes-Johnson QC	Gavin Case, Margaret Case and Michael Case

Ms L Semple and Ms H Marks	Carter Group Limited Maurice Carter Charitable Trust Oakvale Farm Limited Marriner Investments Marriner Investments No 1 Limited Maurice R Carter Limited Avonhead Mall Limited AMP Capital Palms Pty Limited TEL Property Nominees Limited
Ms P Steven QC	Grants Road Holdings Limited
Mr A Beatson and Ms N Garvan	Transpower New Zealand Limited

SUBMITTER APPEARANCES

See Schedule 2

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INTRODUCTION

Preliminary matters as to effect of decision

[1] This decision[1] ('decision') concerns the Christchurch City Council's notified part chapter on Natural Hazards (we refer to the notified proposal as the 'Notified Version'). This is intended to form part of a comprehensive framework of controls on the use, development and subdivision of land under the proposed Christchurch Replacement District Plan ('pCRDP') to address natural hazard risks.

[2] Following our hearing of submissions and evidence, we[2] have decided[3] to make changes to the Proposal, as set out in Schedule 1.

[3] We are required to serve this decision on the Christchurch City Council ('the Council'/'CCC') as soon as practicable. No later than five working days after the Council receives the decision, it must give public notice of it (and of the matters specified in the Order) and serve that public notice on all submitters on the Natural Hazards Proposal.[4]

[4] The following persons may appeal our decision to the High Court (within the 20 working day time limit specified in the Order), but only on questions of law:

(a) all persons who have made submissions (and/or further submissions) on the Notified Version;

(b) the Minister for Canterbury Earthquake Recovery and the Minister for the Environment, acting jointly;

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1 It is the sixth in a series by the Independent Hearings Panel ('Hearings Panel'/'Panel') concerning the formulation of a replacement district plan for Christchurch City (including Banks Peninsula) ('CRDP'). Further background on the review process, pursuant to the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014 ('the Order'/'OIC') is set out in the introduction to Decision 1, concerning Strategic Directions and Strategic Outcomes (and relevant definitions) ('Strategic Directions decision').

2 Members of the Hearings Panel who heard and determined this proposal are set out on the cover sheet. For the record, we posted notice of any potential conflicts of interest on the Independent Hearings Panel website, www.chchplan.ihp.govt.nz, on 17 December 2014. No submitter raised any issue in relation to this. Panel member John Sax recused himself from participating in the Natural Hazards Proposal, and took no part. That was in view of his business association with one of the submitters on the Proposal, Waterloo Park Limited (920, FS1277). In the course of the hearing, it was identified on various occasions that submitters were known to members of the Panel. In some cases, that was through previous business associations. In other cases, it was through current or former personal associations. Those matters were recorded in the transcript, which was again available daily on the Hearings Panel's website. No issue was taken by any submitter.

3 Order, cl 12(1)(b).

4 The Order also specifies other obligations on the Council in terms of making copies of the decision available.

(c) the Council.

[5] The Natural Hazards Proposal (as changed by this decision) will be deemed to be approved by the CCC on and from:

(a) the date the appeal period expires (if there are no appeals); or

(b) the date on which all appeals relating to the Proposal are determined.

[6] As soon as reasonably practicable after that deemed approval, the Council must make the Proposal (as changed by this decision) operative as part of the CRDP.[5] That is done by giving public notice in the manner directed by the Order.

Identification of parts of existing district plans to be replaced

[7] The Order also requires us to identify the parts of the existing district plans that are to be replaced by the Proposal. We do so in Schedule 3.

The natural hazards of the Christchurch environment and their relevance to the proposal

[8] As is the case for many other New Zealand cities and towns, natural hazards are inherent to the environment of Christchurch. The various natural hazards affecting the city are inter-related and the risks they pose can be cumulative. These have been exacerbated and brought into sharp focus by the Canterbury Earthquake Sequence. The steep basalt cliffs and boulders of the city's Port Hills and Banks Peninsula present further risks of mass movement, rock fall and cliff collapse during, and in the aftermath of, significant earthquakes.[6] Much of the city is on the flood plains of rivers flowing from the Southern Alps, a landform of the competing Australian and Pacific tectonic plates. The flood plains and coastal setting of the city mean large parts of it have fine sandy and silty soils prone to liquefaction when saturated through earthquake-induced shaking.[7] The Pacific Ocean, along the city's eastern flank, exposes the

5 Order, cl 16.

6 In this decision we have used the correct spelling of 'rock fall' from the Shorter Oxford Dictionary. However, because the scientific experts used the term as one word, and have done so in a number of the scientific documents we have referred to, in our changes to the Proposal (Schedule 1) we have used one word.

7 Statement of evidence of Peter Allan Kingsbury on behalf of CCC, 4.1.

city to risks associated with earthquake-induced tsunami and climate change-induced sea level rise (projected to be 1.0m by 2115).[8]

[9] The earthquakes of 2010 and 2011 were a sharp reminder of the importance of effectively dealing with natural hazard risk within the CRDP. One hundred and eighty-five lives were lost and many suffered injuries. There was widespread destruction of essential community infrastructure. Many heritage and other buildings that gave Christchurch its "sense of place" (such as Christ Church Cathedral and other landmark buildings) were destroyed, or so severely damaged that their future remains uncertain. The scale of destruction and irreparable damage to commercial and other buildings in the central city means that it now presents as a desolate, albeit recovering, heart to the city.

[10] Many thousands of homes were destroyed or severely damaged. Many homeowners had a sequel of flood damage, aggravated by changes to ground levels and water tables. More than four years on, many households continue to live in their damaged homes as they work to resolve insurance and related issues. Their lives have yet to return to "normal". Entire suburbs have had to be abandoned, demonstrating the ineffectiveness of district planning to date for the management of natural hazard risks.[9]

[11] As part of being satisfied that the CRDP will promote the sustainable management purpose of the RMA,[10] we must be satisfied that it takes proper account of natural hazards in the environment. In the Christchurch setting, accounting for natural hazards in the environment is part of "managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for… their health and safety".[11] In addition, the CRDP must be fit to serve the CCC's natural hazard management functions.[12]

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8 Adopted by CCC as a suitable mid-range projection based on the latest national (MfE, 2008) and international (IPCC, 2014) guidance documents, and not disputed in the evidence. Refer Statement of Evidence of Mark Christopher Ivamy on behalf of Christchurch City Council, 4.2, 5.12.

9 For liquefaction, we were informed that the City Plan relied primarily on s 106 of the RMA for control and the Banks Peninsula Plan did not include any relevant controls. For slope instability, we were informed that both the City and Banks Peninsula Plans had relatively benign rules targeting only subdivision. We were not informed as to the Plan's regimes for flood hazard.

10 Resource Management Act 1991.

11 RMA, s 5(2).

12 As described by RMA, ss 72, 31(1)(b)(i).

[12] Properly accounting for natural hazards in the CRDP is highly challenging. Inevitably, to best enable people and communities (of the present and future generations) to provide for their health and safety and wellbeing, the CRDP needs to limit choices as to the use and development of land. That is made more challenging in a context where previous planning regimes, which have influenced and shaped land use patterns and associated expectations, were not well-informed by natural hazard risks.

[13] An effective regulatory framework for natural hazards' management needs to be comprehensive and proportionate. It needs to be based on the best available information and sound scientific analysis. Hence, it needs to be regularly updated. It also needs to properly reflect, and maintain currency with, community risk-tolerance values. As Mr Taig, the Council's risk management expert, aptly put it:[13]

> I think as New Zealanders you can't be too picky. Of course we would all like the risk as low as we can possibly get it, but we have to accept in return for living in this lovely place, we live with a lot of geological hazard. And that brings some risk with it which is not always going to be easy to deal with or manage.

[14] The Canterbury Regional Policy Statement 2013 ('CRPS'), updated through the Land Use Recovery Plan ('LURP') following the earthquakes, provides significant policy direction on these matters. So does our Strategic Directions decision,[14] which has incorporated into the CRDP a specific natural hazards' objective as to strategic infrastructure (Objective 3.3.6).[15]

The Proposal

[15] The Notified Version is the first part[16] of an overall regime intended for natural hazards' management under the pCRDP, and is part of the Council's developing "Natural Hazards

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13 Anthony Richard Taig, transcript, page 63, lines 1–6.

14 Strategic Directions and Strategic Outcomes (and relevant definitions), 26 February 2015.

15 As to the avoidance of new subdivision use and development in areas where natural hazard risks to people, property and infrastructure are assessed as "unacceptable". The decision records this objective is included subject to the qualification that the requirement for further or alternative strategic direction being re-considered as part of considering this proposal. The objective stated an exception for new strategic infrastructure where (i) there is no reasonable alternative and (ii) the strategic infrastructure has been designed to maintain, as far as practicable, its integrity and form during natural hazard events.

16 A further natural hazards' proposal is expected to be notified as part of Stage 3 of the pCRDP process. This would see the natural hazards regime extended to other natural hazard issues (particularly coastal hazards and high hazard flooding areas), and expanded to other parts of Banks Peninsula and the Port Hills.

Strategy".[17] It applies a central philosophy of regulating according to benchmarks of "acceptable" risk for the various natural hazards.[18]

[16] That reflects Objective 6.2.1 of the CRPS that "recovery, rebuilding and development are enabled… through a land use and infrastructure framework that… protects people from unacceptable risk from natural hazards and the effects of sea-level rise".[19]

[17] That philosophy is applied to three identified classes of natural hazard in different ways:

(a) For "slope instability" hazards (encompassing mass movement, rock fall and cliff collapse), the primary focus is on life-hazard risk (although recognition is also given to property and infrastructure risks);

(b) For flooding hazard (as well as land filling, excavation, recovery and repair), the primary focus is on property risk and improving the resilience of the building stock (although recognition is given to life-safety risks in high hazard areas);[20] and

(c) For liquefaction and geotechnical hazard, the focus is also on property risk.

Slope instability hazard provisions

[18] As we later discuss, the Notified Version's risk-based approach to slope instability hazards uses the metric Annual Individual Fatality Risk ('AIFR'),[21] applied at an area-wide scale. According to this approach, areas for control are mapped as:[22]

(a) Cliff Hazard Management Areas 1 and 2 ('CCMA1', 'CCMA2'), which are generally assigned to steep cliffs and immediate surrounds;

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17 Evidence in chief of Helen Mary Beaumont for the Christchurch City Council, paras 4.1-4.4.

18 Opening submissions on behalf of Christchurch City Council, at 2.2 and 5.2; as we later discuss in the Expert Evidence section.

19 CRPS, Objective 6.2.1(8).

20 In addition, the general natural hazard policies (e.g. 5.2.1) on unacceptable risk of loss of life or serious injury are applicable. However, life-hazard risk in flooding areas is more directly applicable to "high hazard" areas which are to be addressed as part of Stage 2.

21 An exception is for what the pCRDP refers to as Mass Movement Areas 2 and 3, which are mapped based on potential effect on property, rather than AIFR.

22 The acronyms here reflect changes we have made to the names of these areas, as we later discuss.

(b) Rock Fall Hazard Management Areas 1 and 2 ('RFMA1', 'RFMA2'), which are generally assigned to potential rock fall sources and their downslopes; and

(c) Mass Movement Management Areas 1, 2 and 3 ('MMA1', 'MMA2', 'MMA3'), which are generally assigned to sloping areas potentially prone to mass movement risk.[23]

[19] Within each of these hazard areas, and using AIFR, the Proposal defines specified thresholds of "intolerable" life-safety risk.[24] This is for the purpose of triggering prohibitions and restrictions on the subdivision, use and development of land within the mapped areas. Under the Notified Version, the stringency of these prohibitions and restrictions varies according to the particular areas:

(a) In CCMA1, generally where properties had been "red-zoned" by the Crown,[25] subdivision, earthworks, and some buildings and structures are classified as prohibited activities (with other specified activities and structures classified as non-complying, discretionary activities and, in some cases, restricted discretionary activities).

(b) In CCMA2, RFMA1, MMA1, subdivision and earthworks and some buildings and structures are classified as non-complying, discretionary and, in some cases, restricted discretionary activities.

[20] Inherently, the determination of thresholds of intolerable or unacceptable risk requires informed value judgment for and on behalf of the community. These matters are discussed later in this decision.

[21] As we later discuss, an acknowledged limitation of the slope instability regime of the Notified Version was that it was based predominantly on area-wide modelling. We have found the Notified Version deficient insofar as it has failed to adequately acknowledge that limitation.

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23 Activity categorisations are also stated for "Remainder of Port Hills and Banks Peninsula Slope Instability Management Area". This is an interim measure, pending modelling and notification of further provisions to be addressed in Stage 2.

24 Later in this decision we explain why we have changed the term "intolerable" to "unacceptable".

25 Statement of evidence of Emma Jacka, for the Crown, 20 February 2015, sections 6 and 7.

Flooding hazard provisions

[22] Flooding hazard is a matter on which the CRPS gives specific direction. Ms Mehlhopt, counsel for the Canterbury Regional Council ('Regional Council'), helpfully summarised this as follows:[26]

> 21 … It provides specific directions for defined hazards such as flooding in high hazard areas and then sets out a more general risk-based approach for other hazards.
>
> 22 … strong directions are provided… which require … objectives and policies, and may include methods… to:
>
> (a) Avoid new subdivision, use and development that does not meet the criteria set out in Policy 11.3.1 clauses (1) to (5)[27] for known high hazard areas…
>
> (b) Avoid new subdivision, use and development of land in known areas subject to inundation by a 0.5% AEP[28] (1 in 200 year) flood event, unless the subdivision, use and development (excluding critical infrastructure):[29]
>
> (i) is of a type that is not likely to suffer material damage in an inundation event; or
>
> (ii) is ancillary or incidental to the main development; or
>
> (iii) new buildings have an appropriate floor level above the 0.5% AEP design flood level and hazardous substances will not be inundated during a 0.5% AEP flood event.
>
> When determining areas subject to inundation, [taking] climate change projections including sea level rise into account.[30]

[23] Except to the extent of a general policy, the flood hazard provisions of the Notified Version do not address "high hazard areas", as these are to be addressed at a later stage of our inquiry. Outside such areas, the Notified Version seeks to give effect to the CRPS, primarily through the imposition of controls on minimum floor levels for new buildings[31] and additions, filling and excavations. These controls would apply for all residential, commercial and industrial zones.

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26 Closing legal submissions of counsel for the Canterbury Regional Council, 17 March 2015.
27 The Regional Council subsequently provided us with a copy of the updated CRPS, which adds further provisions, but does not alter the substantive effect of Ms Mehlhopt's submission.
28 Annual Exceedance Probability – see Chapter 5: Introduction of the Proposal as set out in Schedule 1 of this decision.
29 CRPS, Policy 11.3.2.
30 CRPS, Policy 11.3.2.
31 This is defined to include rebuilds.

[24] The geographic extent of these controls is defined by mapping, with the maps being based on modelling and other available data. The quality and extent of modelling and other data influenced the nature of imposed controls. Those parts of the city[32] where the Council was satisfied that its flood modelling data and tide level statistics were sufficiently reliable to fix floor levels[33] were included within a Fixed Minimum Floor Overlay ('FMFO'), within the wider Floor Level and Fill Management Area ('FLFMA').[34]

[25] Within the FMFO, new buildings (and additions that increase the ground floor area of existing buildings) would be permitted activities,[35] subject to an "activity specific standard". That standard would specify that the minimum floor level would be the highest of the following:

(a) Flooding predicted to occur in a 1 in 200-year rainfall event concurrent with a 1 in 20-year tidal event, including 1m sea level rise plus 400mm freeboard as predicted by the relevant CCC model and version identified in Table 5.8.1.1a; or

(b) Flooding predicted to occur in a 1 in 200-year tidal event concurrent with a 1 in 20-year rainfall event, including 1m sea level rise plus 400mm freeboard as predicted by the relevant CCC model and version identified in Table 5.8.1.1a; or

(c) 12.3m above CCC Datum.[36]

[26] Those parts of the city where the Council did not consider it had sufficient modelling data and information were excluded from the FMFO, and were subject to significantly more onerous controls. New buildings and additions that increase the ground floor area of existing buildings[37] were classed as restricted discretionary activities. Assessment criteria for consent

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32 Ms Brookland explained that results were from the following flood models – Styx River Hydrological and Hydraulic Model, Dudley Creek Hydrological and Hydraulic Model, Avon River Hydrological and Hydraulic Model, Heathcote River Hydrological and Hydraulic Model, Bells Creek Hydrological and Hydraulic Model, Heathcote and Avoca Valley Hydrological and Hydraulic Model, Sumner Valley Hydrological and Hydraulic Model, and Halswell Hydrological and Hydraulic Model (Statement of evidence of Iris Brookland on behalf of CCC, 4.2). However Mr Whyte on behalf of CCC qualified the position, noting that the Sumner model had not yet been the subject of formal peer review: Transcript, page 586, lines 1-4.

33 Statement of evidence of Iris Brookland on behalf of CCC, 4.2

34 Which Mr Chapman, for IAG New Zealand Limited (FS1483), aptly described as the "yolk" within the "egg white".

35 A range of smaller scale buildings, additions, and activities are also specified as permitted activities without being subject to those activity specific standards.

36 Within the FLFMA, new buildings and additions that increase the ground floor area of existing buildings that do not meet those activity specific standards are classed as restricted discretionary activities.

37 Other than the listed smaller scale buildings and additions and activities, as noted.

applications were wide-ranging. Rather than simply focussing on the setting of floor levels, they encompassed consideration of the environmental impact of "proposed mitigation measures", as well as consideration of privacy and other immediate neighbour impacts. Despite that, the Notified Version specified that consent applications would be non-notified.

[27] The irony in this approach is that those parts of the city that were excluded from the FMFO, and hence the subject of more stringent controls, generally corresponded to areas where flood-prone properties were subject to less flooding risk than those in the FMFO.

[28] We have found that aspect of the Notified Version inappropriate in the sense that it would impose unnecessarily onerous consequences for impacted landowners, and is not enabling of the recovery. We return to discuss this in our evaluation under ss 32 and 32AA later in this decision.

Land repair, filling and excavation of land

[29] The Notified Version also included controls in relation to the repair of residential land damaged by earthquakes, and land filling and excavation. These specify permitted activities (within specified limits, such as in regard to heights and volumes) and restricted discretionary activities (with a range of matters specified for the Council's discretion).

Liquefaction (and geotechnical) hazard provisions

[30] Policy 11.3.3 of the CRPS is:

> New subdivision, use and development of land on or close to an active earthquake fault trace, or in areas susceptible to liquefaction and lateral spreading, shall be managed in order to avoid or mitigate the adverse effects of fault rupture, liquefaction and lateral spreading.

[31] As to the matter of liquefaction risks, the Notified Version sought to include most of the flat land of Christchurch within one of two areas — Liquefaction Assessment Area 1 ('LAA1') or Liquefaction Assessment Area 2 ('LAA2').

[32] In both areas, the Notified Version classifies subdivision to create an additional vacant lot or lots as a restricted discretionary activity. In consent applications, specified matters for assessment are broad-ranging. They encompass the nature and extent of the liquefaction hazard and mitigation techniques proposed, and their effects on neighbours, subdivision layout,

services, the suitability of the site for anticipated uses, the overall effects on the reasonable use of the site, and all other matters reserved for discretion over restricted discretionary subdivisions in Chapter 8. Associated rules would require consent applicants to provide related information. That is despite also providing that any application would be non-notified.

[33] The differences in management approach between these two areas are relatively subtle, despite the much lower level of liquefaction risk in the LAA2 area. Within the LAA1 area, additional assessment criteria would apply where an activity would take place on a site with an area of 1500m^2 or more and that activity is a restricted discretionary activity under any relevant residential zones. Those additional criteria are focussed on liquefaction hazards and mitigation.

[34] As we discuss in our evaluation under ss 32 and 32AA later in this decision, we find the Notified Version unduly onerous, particularly in the fact that it imposes such controls over a wide swathe of the city. As we shortly discuss, we found no sensible justification for this on the evidence.

STATUTORY FRAMEWORK

Order in Council and the Resource Management Act 1991

[35] The Order directs that we hold a hearing on submissions on a proposal and make a decision on that proposal.[38]

[36] It sets out what we must and may consider in making that decision.[39] It qualifies how the RMA is to apply and modifies some of the RMA's provisions, both as to our decision-making criteria and processes.[40] It directs us to comply with s 23 of the Canterbury Earthquake Recovery Act 2011 ('CER Act').[41] The Order also specifies additional matters for our consideration.

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38 Order, cl 12(1).
39 Order, cl 14(1) .
40 Order, cl 5.
41 Our decision does not set out the text of various statutory provisions it refers to, as this would significantly lengthen it. However, the electronic version of our decision includes hyperlinks to the New Zealand Legislation website. By clicking the hyperlink, you will be taken to the section referred to on that website. The Independent Hearings Panel's website is www.chchplan.ihp.govt.nz/.

[37] Our Strategic Directions decision, which was not appealed, summarised the statutory framework for that decision. As it is materially the same for this decision, we apply the analysis we gave of that framework in that decision.[42]

Statutory documents and our obligations in regard to them

[38] There was no material dispute as to the relevant RMA and CER Act statutory documents that are relevant for our consideration. Those relevant documents, and our obligations in regard to them, are as follows (and, as these are not matters in dispute, we refer to our Strategic Directions decision as setting out the meaning of those obligations):[43]

Statutory document	Statutory direction
New Zealand Coastal Policy Statement	give effect to
National Policy Statement on Electricity Transmission	give effect to
Canterbury Regional Policy Statement 2013 (CRPS)	give effect to
Mahaanui Iwi Management Plan 2013	take into account
OIC Statement of Expectations[44]	have particular regard
Recovery Strategy Mahere Haumanutanga	not be inconsistent with
Land Use Recovery Plan (LURP)	not be inconsistent with
Christchurch Central Recovery Plan	not be inconsistent with
Natural Resources Regional Plan; Regional Coastal Environment Plan; Land and Vegetation Management Regional Plan (Part II)	not be inconsistent with
Proposed Land and Water Regional Plan	have regard to
Selwyn and Waimakariri District Plans	have regard to the extent to which the pCRDP needs to be consistent with the plans of adjacent territorial authorities
National Civil Defence Strategy; Canterbury Regional Civil Defence Emergency Management Group Plan	have regard to, to the extent the content has a bearing on resource management issues for the district

42 At [25]-[28].
43 At [40]-[62].
44 Order, Schedule 4.

[39] Our discussion below focuses on those aspects of these documents where matters of interpretation or application were in contention. For completeness, we record that we have complied with the statutory directions for these documents in making this decision.

Relevance of Strategic Directions decision

[40] In addition, our Strategic Directions decision is relevant in that it contains objectives "for the district"[45] which are now operative as part of the provisions of the CRDP.[46] Under the RMA, the policies and rules of the CRDP are to implement related objectives.[47] Again, that was not a matter which any party disputed, and we refer to and apply the analysis we give in our Strategic Directions decision for our findings on that.[48]

Applicable provisions of the CRPS

[41] The CRPS, in its chapters 6 and 11, espouses a risk-based approach to natural hazards' management (the first sentence of its Introduction to Chapter 11 stating, "This chapter provides a framework for managing natural hazard risk…"). It includes the following:

(a) Objective 6.2.1, which directs that the framework for enabling recovery, rebuilding and development of Greater Christchurch, protects people from "unacceptable risks from natural hazards and the effect of sea level rise".

(b) Objective 11.2.1, that new subdivision, use and development of land "which increases the risk of natural hazards to people, property and infrastructure is avoided or, where avoidance is not possible, mitigation measures minimise such risks".

(c) Specific policy directions we have earlier described in regard to flooding hazards.[49]

45 'Christchurch District' defined in OIC, cl 3(1).
46 In terms of cl 16 of the Order.
47 RMA, s 75.
48 Section 32AA RMA further evaluation at [97]-[130], Interpretation at [148]-[149], and also in relation to Objective 3.3.6 Natural Hazards.
49 Including amendments under ss 24(1)(c) and 24(3) of the CER Act arising from Action 46 of the LURP, outlined in the Joint Memorandum of Counsel for the Canterbury Regional Council and Christchurch City Council in relation to the Natural Hazards Proposal, 25 June 2015.

(d) Policy 11.3.3, which we have described earlier in relation to land on or close to an earthquake fault trace or area susceptible to liquefaction or lateral spreading.

(e) Policy 11.3.4, which directs that critical infrastructure be designed to maintain, as far as practicable, its integrity and function during natural hazard events.[50]

(f) Policy 11.3.5, which directs a risk management approach based on likelihood and consequence arising from natural hazard events for matters not covered under previous Policies 11.3.1 to 11.3.3, and avoidance if risk is unacceptable.

(g) Policy 11.3.6, which states the role of natural topographic (or geographic) and vegetation features which assist in avoiding or mitigating natural hazards should be recognised and the features maintained, protected and restored, where appropriate.

(h) Policies 11.3.7 — Physical mitigation works, and Policy 11.3.8 — Climate change are also relevant considerations for us.

[42] Mr Smyth,[51] acting for several landowners directly impacted by the rock fall risk management aspects of the Notified Version, submitted that the provisions of the Notified Version would contradict Policy 11.3.6. This was on the basis of his interpretation that this policy directs us to take natural features and vegetation into account for the purpose of mapping hazard lines.

[43] We disagree. On its face, we acknowledge the policy allows for an approach where the potential benefits of vegetation and other natural features, for the avoidance or mitigation of

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50 This policy also specifies that new critical infrastructure will be located outside high hazard areas unless there is no reasonable alternative. "High hazard areas" are defined in the CRPS as:

1. flood hazard areas subject to inundation events where the water depth (metres) x velocity (metres per second) is greater than or equal to 1, or where depths are greater than 1 metre, in a 0.2% AEP flood event;
2. land outside of greater Christchurch subject to coastal erosion over the next 100 years; and
3. land within greater Christchurch likely to be subject to coastal erosion including the cumulative effects of sea level rise over the next 100 years. This includes (but is not limited to) the land located within Hazard Zones 1 and 2 shown on Maps in Appendix 5 of this Regional Policy Statement that have been determined in accordance with Appendix 6; and
4. land subject to sea water inundation (excluding tsunami) over the next 100 years.

This includes (but is not limited to) the land located within the sea water inundation zone boundary shown on Maps in Appendix 5 of this Regional Policy Statement.).

When determining high hazard areas, projections on the effects of climate change will be taken into account.

51 Closing submissions on behalf of Gurnsey and Crane (694), Tripp (679), Mason (486), Larson (680), Connor and Woodley (289, 1097), Logan and Ng (594).

natural hazards, are considered in the context of determining resource consent applications. We accept that the expert evidence demonstrates that natural features could render land free of rock fall hazards. However, contrary to Mr Smyth's submission, the expert evidence addressed shortly overwhelmingly persuades us that it would be imprudent to assume vegetation could render land sufficiently free of rock fall hazard for the purpose of mapping hazard lines.

[44] However, we agree with Mr Smyth to some extent. That is, we find that the Notified Version in regard to slope instability hazards was deficient in failing to account for the limitations of the area-wide modelling on which its rock fall hazards provisions were based. As we note later, the expert witnesses clearly recognised these limitations. We return to this issue in our ss 32 and 32AA evaluation later in this decision.

Our findings as to the statutory documents

[45] No other submitters argued, in closing, that the Proposal would not give effect to the CRPS. Subject to the modifications we have made to the Proposal, we agree with the closing submissions for the Regional Council,[52] the Crown[53] and CCC[54] that the Proposal will give effect to the CRPS.

[46] A number of submitters challenged aspects of the Notified Version as not properly responding to the Statement of Expectations.[55] Others did not do so explicitly, but raised directly relevant substantive concerns about the unnecessary restrictions imposed by the Notified Version. For example, those included landowners whose development prospects would be significantly restricted or curtailed by their inclusion within various of the notified slope instability risk areas,[56] or who were concerned about market perceptions of their properties being included within the flood hazard area.[57]

52 Closing submissions on behalf of the Canterbury Regional Council, para 28.
53 Closing submissions for the Crown, para 1.
54 Closing submissions on behalf of the Council, para 4.1.
55 For example, we refer to the closing submissions on behalf of Carter Group Limited (386) and others, para 2; Southern Response, paras 10-11; IAG New Zealand Limited at paras 17-19; Progressive Enterprises Limited (791, 1450), para 21.
56 Bundy (418).
57 Castle Rock Limited (983), Riach (1050), Dewe (313).

[47] As we have noted, in several cases following site-specific ground truthing,[58] Council experts accepted modifications should be made to remove submitter properties fully or partially from relevant hazard management areas. In light of the changes we have made to implement those recommendations, and further changes we have made to the Proposal, we are satisfied that the Proposal is now consistent with the Recovery Strategy and the LURP and will respond appropriately to the Statement of Expectations (and the Strategic Directions chapter). To that extent, we have responded to submissions challenging this matter, and accept the submissions of the Crown, the Regional Council and the CCC.[59]

The required "s 32" and "s 32AA" RMA evaluations

[48] Our Strategic Directions decision set out the requirements for the Council's s 32 and our s 32AA RMA evaluations.[60]

[49] The Proposal includes objectives, policies and rules. Therefore, our evaluation has to examine:

(a) Whether the objectives are "the most appropriate way to achieve" the RMA's purpose (s 32(1)(a)).

(b) Whether the provisions "are the most appropriate way to achieve the objectives" (s 32(1)(b)). This is to:

(i) identify other reasonably practicable options for achieving the objectives,

(ii) assess the efficiency and effectiveness of the provisions in achieving the objectives, and

(iii) summarise the reasons for deciding on the provisions.

58 This term is used to refer to the checking of remote catchment-wide modelling against the individual site-specific topography and characteristics

59 Closing submissions for Crown at 1; Council at 4.1-4.3; Regional Council at 25-26.

60 Strategic Directions at [63]-[70].

[50] Our assessment of efficiency and effectiveness is to identify and assess[61] the benefits and costs of the environmental, economic, social, and cultural effects that we anticipate from the implementation of the provisions. That includes our consideration of what we anticipate would be provided or reduced, by way of opportunities for economic and employment growth. Those obligations are tempered by the confined subject matter of the Proposal: natural hazards.

[51] We are also directed to assess the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions.

[52] Our evaluation is required to be:

(a) Only for any changes that have been made to, or are proposed for, the Proposal since the Council's evaluation report for the proposal was completed;[62]

(b) At a level of detail that corresponds to the scale and significance of the environmental, economic, social, and cultural effects that are anticipated from the implementation of the proposal (s 32(1)(c)); and

(c) Reported, by this decision, "in sufficient detail to demonstrate that the further evaluation was undertaken in accordance with" s 32AA.[63]

[53] It is in the nature of our role that our ss 32 and 32AA evaluation should be informed by the submissions and evidence that we have heard and our findings on them. Particularly given the nature of the subject-matter, as to natural hazards risk management, our findings on the expert evidence are fundamental to our evaluation.

[54] Therefore, we next discuss themes arising from submissions and then set out our findings on the expert evidence, before returning to consider the Council's s 32 report and our own ss 32 and 32AA evaluation.

61 And we are to quantify benefits and costs, if practicable.
62 RMA, s 32AA(1).
63 RMA, s 32AA(1)(a)-(d).

ISSUES RAISED BY SUBMISSIONS

[55] We have considered all submissions and further submissions received in relation to the Proposal. The submissions can be broadly grouped as follows:

(a) A large proportion of the submissions were from landowners whose land was directly affected by hazard provisions. Several of this group attended pre-hearing meetings, sought and attended mediation with the Council and, where unsuccessful there, attended the hearing. This group included:

(i) Some who asked that we reject the Notified Version, or large parts of it, entirely because of claimed flaws in the underpinning modelling.[64]

(ii) Several who sought that their land be exempted from the provisions. For some, this was on the basis that the submitter considered their property was not in fact subject to the relevant hazard(s).[65] In other cases, submitters considered that natural features and/or physical works had or would render their land sufficiently safe from the hazard(s).[66] Many were concerned about the implications of the provisions on their ability to subdivide, use or develop their land. We heard of the significant stress caused to submitters having to face these planning consequences on top of the stresses of dealing with the aftermath of earthquakes.[67]

(iii) A number were concerned about adverse market perceptions of their land being encompassed within the flooding hazard and land instability areas (without proper justification, in their view).

(b) The submissions on behalf of the Regional Council and the Crown (as well as CCC) were supportive of the risk-based philosophy of the Proposal. The Crown and CCC shared some key expert witnesses.

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64 For example, as per closing submissions of Mr Smyth on behalf of Gurnsey & Crane (694), Tripp (679), Mason (486), Larson (680), Connor & Woodley (289, 1097), Logan & Ng (594) for example.
65 For example Bundy (418), McDonald (952), Collins (955) and Tripp (679).
66 Logan and Ng (594) and Clinton (58).
67 For example, Stubenvoll.

(c) The Crown (and other submitters) identified a range of drafting issues.[68] These included the lack of definition of different terms used to describe levels of risk (e.g. unacceptable, acceptable, intolerable, tolerable, significant). Tonkin & Taylor ('T&T') made similar submissions. T&T also questioned whether the risk-based philosophy of the Proposal was conceptually sound.[69]

(d) Several property developers,[70] and two major insurance companies,[71] raised specific concerns about the impact the Notified Version would have on development, especially in terms of disruption to recovery activity, and costly, inefficient and/or unjustified consenting requirements.

(e) A number of infrastructure providers raised concerns about those aspects of the Notified Version that impacted their operations, including maintenance and upgrade works.[72] LPC called for the activity status for various activities carried out within the natural hazard overlays to be enabling rather than adding increased cost, time and complexity through unnecessarily restrictive regulation.[73]

[56] The themes raised in submissions pertain to our obligations under ss 32 and 32AA. We address the substance of these matters in that part of this decision.

EXPERT EVIDENCE[74]

[57] We heard excellent and informative evidence from the joint witnesses called by the Council and the Crown, from Council technical officers and experts called by submitters. However, the Notified Version once more demonstrated a lack of innovative thinking, took a heavy-handed approach to regulation, and lacked clarity. Regrettably, as with the Strategic Directions chapter, we have found it necessary to do a substantial rewrite of this chapter.

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68 Evidence of Dr W Saunders for the Crown (495), paras 5.13 and 12.1; see also T&T, pages 4 and 8.
69 Submitter 970, submission pages 4 and 8. T&T was neither represented, nor called evidence, at the hearing.
70 Closing submissions for the Carter Group Limited and others, 18 March 2015, paras 2-3; Opening legal submissions on behalf of Te Rūnanga o Ngāi Tahu and Ngā Rūnanga and Ngāi Tahu Property Limited, 5 March 2015, para 5.
71 Closing submissions on behalf of Southern Response Earthquake Services Limited, 17 March 2015, paras 3-5; IAG New Zealand Limited legal submissions, 17 March 2015, para 47.
72 Mobil Oil New Zealand Limited, Z Energy Limited, Banks Peninsula Oil NZ Limited (723, FS1295); Orion (922, FS1339).
73 Legal submissions on behalf of Lyttelton Port Company Limited and Orion New Zealand Limited, 17 March 2015, para 2.
74 Schedule 2 lists witnesses who gave evidence for various parties, and submitter representatives. Counsel appearances are recorded at the beginning of this decision.

[58] Efficiently, the Council and the Crown called a number of joint witnesses. The thrust of this evidence was that a risk-based approach, as opposed to a hazard-based approach, was an appropriate response to the earthquake events in Christchurch. The effect of such an approach is that the likelihood of an occurrence of a hazardous event is included, and taken into account, alongside the consequences of the event. A hazard management approach would simply address the consequences. There was evidence to satisfy us that a risk-based approach was world best practice.

[59] However, before turning to the detail of the evidence, we consider it appropriate to refer to the joint statement that followed expert caucusing ('Experts' Joint Statement').[75] This is in Schedule 4. Importantly, this document stated:

> We acknowledge the possibility that future earthquakes have the potential to cause additional rockfall and cliff collapse in the Port Hills. Published, peer-reviewed geologic data do not exclude the possibility of future rockfall triggering events from the ongoing sequence or other seismic events. Available site-specific geologic data suggest that clusters of severe rockfall events may be separated by hiatuses spanning 1000s of years but further analysis from additional sites is required to test this hypothesis. The seismicity model was developed by an international expert panel using international best practice and has undergone peer review. Given the recent and modelled earthquake clustering activity and the large uncertainties on predicted ground-motion for an individual earthquake, we agree that the level of conservatism is appropriate.

[60] The document (as it relates to slope instability) led to agreement, including from Mr Bell, an expert witness for a number of land instability submitters, that the risk-based approach was appropriate for defining hazard management areas and the recommended level was not too conservative. It was also accepted the modelling undertaken by GNS Science acknowledges key uncertainties, and was an appropriate method for assessing risk in the Port Hills. It was accepted that ground truthing undertaken was appropriate to support the area-wide scale of the mapping and modelling and provided the basis for the development of the District Plan maps. There was acknowledgement that such mapping and modelling was not always sufficient to determine risk on a site-specific basis. It was the view of the experts that the opportunity to undertake individual site assessment must be provided for in the Plan. The document also significantly narrowed the issues before us.

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[75] Report to Hearings Panel on Expert Caucusing on Land Stability, Liquefaction and Flooding, A J Sutherland, 30 January 2015.

[61] Expert conferencing also took place between planning experts, and a joint statement was prepared.[76]

Risk management approach and slope stability

[62] It is clear, from the evidence we heard, that a number of issues arose from the earthquakes that surprised the experts. This included evidence that rocks in the Port Hills did not react as expected in the major aftershocks. Following the February 2011 earthquake, a Port Hills Geotechnical Group ('PHGG') was formed to consider the necessary emergency response to consequential slope instability hazards on the Port Hills. Its task was to assess the consequences of slope instability, risk to life, infrastructure and parks. Once the State of Emergency was lifted at the end of April 2011, the Council assumed responsibility for ongoing work in the Port Hills, and the emphasis then shifted to slope stability investigations to inform both the recovery and longer term planning for the Port Hills and city. As a consequence, a Port Hills Earthquake Remediation and Recovery project was initiated, and a project control group was appointed that comprised senior managers of both Council and the Canterbury Earthquake Recovery Authority ('CERA'). In 2011 the Council engaged GNS Science to get a better understanding of land instability hazard for the purpose of longer term planning and risk reduction.[77] Through 2012 to 2014, GNS Science produced a series of reports that informed both the delineation of the Crown red zone in relation to cliff fall and rock fall (those properties the Crown offered to purchase) and the Council's mapping of land instability hazard management areas. All of this background evidence was given by Ms Beaumont. She also provided a helpful, succinct summary of the risk management approach and the AIFR:[78]

> 6.12 The first of these assumptions is the value chosen for the time an individual is in the dwelling (i.e. probability of a person being present). By considering the occupancy rate over 24 hours (100% of the day) the assumption takes into account the most highly exposed people who spend the majority of their time at home — the very old, the very young, the disabled and the sick. Average occupancy rates have been assessed by GNS and modelled at 67% or 16 hours per day. Using a lower occupancy rate results in a reduction in the modelled AIFR.
>
> 6.13 The decreasing seismicity over time is reflected in the choice of year modelled. The decrease in seismicity is most marked in the first five years — from 2012 to 2016.

[76] Planning Expert Conferencing Statement Regarding Chapter 5 – Natural Hazards, M Chrisp, 29 January 2015.
[77] GNS Science: http://www.gns.cri.nz/.
[78] Statement of Evidence of Helen Mary Beaumont on behalf of Christchurch City Council, 13 February 2015.

6.14 The evacuation or no-aftershock exposure assumption removes major earthquakes that are preceded by a major earthquake — that is, it assumes that residents in high risk areas are already evacuated. This reflects the situation of evacuation in high risk areas of the Port Hills after the February 2011 earthquake, which meant that residents were not in their homes for the June 2011 earthquake when significant rockfalls occurred.

6.15 The less conservative set of assumptions — 67% occupancy, predicted seismicity in 2016 and no aftershocks — represents GNS Science's best estimate of the average risk to the average person in the short term. GNS recommended that this average risk model could be appropriate to use for developing policy for existing homes on the Port Hills and the original, more conservative, risk model could be more appropriate for "greenfield" planning purposes.

[63] Dr Seville gave evidence of the importance of resilience, both in enabling recovery and for the longer term strategy to cope with the seismic events. By 2013, Christchurch was named in the first 33 cities to join the 100 Resilient Cities Network, sponsored by the Rockefeller Foundation, an initiative designed to assist cities to identify, prepare and bounce back from shocks and stresses.

[64] Mr Tony Taig is a UK-based director and principal of TTAC Limited, specialising in risk, safety and uncertainty. He has 37 years' experience in consulting on the effective management of risk and uncertainty. He had acted as adviser to several UK Parliamentary Select Committees, to HM Treasury and many other UK and New Zealand Government departments and regulatory bodies. He had devised and led around 500 projects relating to the management of risk and uncertainty in the course of his career. His involvement in the Natural Hazards proposal had been with slope collapse issues in the Port Hills. Initially he was a peer reviewer of risk assessment reports produced by GNS Science. He was an author of the GNS Science report *Principles and Criteria for the Assessment of Risk from Slope Instability in the Port Hills, Christchurch*.[79] He was also separately engaged by MBIE to prepare a report setting earthquake risk in New Zealand in context against other risks, and advising on policy in relation to earthquake-prone buildings. Over the course of 2011 and 2012, he visited many sites in the Port Hills that were subject to boulder roll and slope collapse hazards. In 2013 he visited most of the mass movement areas as delineated in the pCRDP.

[79] T Taig, C Massey and T Webb, *Canterbury Earthquakes 2010/11 Port Hills Slope Stability: Principles and Criteria for the Assessment of Risk from Slope Instability in the Port Hills, Christchurch* (GNS Science Consultancy Report 2011/319, Christchurch, March 2012).

[65] The scope of Mr Taig's evidence related to the risk management approach, in regard to slope instability provisions of the Notified Version to control development at different levels of life risk. He expressed his view that the Council should:

(a) control development in areas subject to significant risk from slope collapse;

(b) do so by defining zones corresponding to different levels of AIFR;

(c) adopt a policy as to the level of risk it considers intolerable;

(d) control development within areas of significant risk below that which is intolerable; and

(e) decide in view of the uncertainty and likely future diminution of the risk with time, the degree of precaution with which its desired risk criteria are to be compared with risk estimates in arriving at decisions.

[66] While accepting the Notified Version largely gave effect to his (and GNS Science) recommendations, he felt there was room for improvement in:

(a) clearer definition of risk terminology;

(b) avoiding the use of the term "intolerable" to describe risk levels within areas where there is no policy to promote the termination of activity unless the risk can be reduced below such levels;

(c) using common models and assumptions to define the boundaries of risk-based planning zones; and

(d) providing for effective control of development in areas subject to significant levels of risk below any threshold determined to be intolerable, or inappropriate for future development.

[67] Mr Taig stated that, in his opinion, the general framework for managing risks is that:

(a) hazards with potential to harm people are identified;

(b) the associated risk is then estimated in quantitative terms; and

(c) criteria are established as to what level of control over risk is appropriate at what risk level.

[68] He said the focus of the GNS Science report and his evidence is on the third point — that is, the establishment of principles and criteria to help decide what to do in the face of a given level of risk.

[69] Mr Taig then considered who it should be that makes the decision on what risk from slope collapse is acceptable in Port Hills buildings. His advice to the Council was:

(a) this is not a situation where the decision on what is acceptable should be left entirely to the individual;

(b) some form of control of land use in areas of significant risk from slope collapse would be appropriate; and

(c) AIFR would be the most appropriate measure of risk to use as the basis for setting threshold levels of risk.

[70] Mr Taig also acknowledged that the Council has statutory and legal responsibilities with which it needed to comply. He said the final question was where to draw the line between what society (the people of Christchurch via representatives on the Council) wished to control or prohibit, and what was left to individual choice. He stressed, as did other expert witnesses, that that was not a matter for them. He said his advice to the Council was based on considerations of what other regulatory bodies overseas had done to control risk, and on the level of risk New Zealanders face from natural hazards and other sources, to provide a guide for their decisions. His evidence was a stark reminder that many New Zealanders live in areas of significant natural hazard risk.

[71] Next, his evidence turned to risk thresholds. Mr Taig gave evidence that thresholds above which risk is considered "intolerable" are adopted somewhere in a range from 10^{-3} (1 in 1000)

AIFR, where that person at risk has a degree of choice and control over the risk, down to about 10^{-6} (1 in 1,000,000) AIFR where a man-made activity put people at risk who have little or no choice or control.

[72] He found no direct precedent equivalent to the Port Hills slope issues, but pointed to the Australian Geomechanics Society (AGS) guidelines as perhaps the closest.[80] That recommends a risk threshold of 10^{-4} (1 in 10,000) for existing development, and 10^{-5} (1 in 100,000) for new development.

[73] He placed this in a New Zealand context by giving some examples. He said the fatality risk for everyone in New Zealand from earthquake, tsunami, flood and volcanic activity is well above 10^{-6} (1 in 1,000,000) per year. He said tens, or possibly hundreds, of thousands of New Zealanders live with a natural hazard fatality risk level of 10^{-5}, and significant numbers live in particular locations with risk levels in excess of 10^{-4}. The latter locations are generally the subject of action to reduce that risk.

[74] Putting this further into context, he gave readily understandable examples. For instance, the largest contributors to the risk of death over a lifetime are cancer and heart disease, which are $3x10^{-3}$ (3 per 1000) per year, weighted towards elderly people. The risk from accidents is $2\text{-}3x10^{-4}$ (2-3 per 10,000), dominated by falls amongst the elderly, and road accidents for the rest of the population. Road accident risk is about 10^{-4}, but is much higher for young men and elderly people, and lower for children. Such risk is spread unequally among the population. Mr Taig's advice to the Council was that it should decide on a threshold above which they would regard risk as intolerable, and also decide on a lower threshold, above which they would not wish more people to be put at risk in the future. His advice was that 10^{-5} would be too low, and $3x10^{-3}$ would be too high: the first being a risk many New Zealanders already live with, and the second equivalent to the average lifetime risk from such things as cancer and heart disease. He considered a good starting point for consideration would be 10^{-4}, "intolerable for existing development", in line with the AGS recommendation referred to earlier. In relation to new development, Mr Taig recommended a risk threshold perhaps 10x or 100x lower than the intolerable level above which to restrict new development. He saw this as being consistent

[80] Australian Geomechanics Society *Practice Note Guidelines for Landslide Risk Management 2007*, AGS (2007c).

with other risk control regimes which recognise it is easier to stop new development than it is to sort out existing buildings and activities.

[75] Mr Taig also noted two complicating factors in using the type of risk information GNS Science was generating, in that the risk levels estimated are uncertain to within about a factor of 10 either way, and the risk levels are expected to decrease significantly over about a decade.

[76] He considered the approach to the control of development, under the slope instability provisions of the Proposal, was broadly consistent with the principles recommended in the GNS Science report. It was his view that a risk-based approach in defining boundaries of planning zones represented a major step forward in New Zealand practice. First, in establishing when a hazard does or does not give grounds for restricting development, and secondly, in providing an evidence-based framework within which to evaluate the efficacy of solutions to reduce risk in order to enable development. The Council's use of AIFR as the metric to estimate risk and establish boundaries aligned with his recommendations, and he said that the gradated thresholds provided to manage such risk were proper. (We note that the opportunity for community consultation as to what is or is not acceptable was available through steps taken by CCC pre-notification, through the notification of the chapter (based on the Council's decision), consultation and our own hearing process.)

[77] He confirmed, in answer to a question from the Panel, that this risk-management approach was world best practice.

[78] Despite this, Mr Taig did have some concerns with the Notified Version, and considered his suggestions were consistent with the Experts' Joint Statement. First, that the terminology used to describe risk levels as "intolerable" or "acceptable" should be clearly defined. Where the risk is "intolerable", he found it strange there were not companion policies to facilitate removal of existing activities or housing. For example, CCMA1 describes a level of risk above which future development would be prohibited or severely restricted, rather than a level above which there would be a proactive policy to remove people whom he considers are already at risk. The same applies to RFMA1, which restricts future development rather than providing for the removal of people at risk. He recognised that the termination of existing activities within the intolerable areas was outside the Council's ability to progress via this planning process, and that the red zone purchase offers represented a major initiative to facilitate this.

But he considered this to be a one-off initiative, and was unaware of any current policies or mechanisms for the continued facilitation of this process.

[79] He was concerned that the same numerical risk level was used for both RFMA1 and RFMA2, and the distinction between them determined solely by different modelling assumptions. He concluded, and we agree, that was both unusual and confusing. Finally, in some locations risk is described as "acceptable", immediately below the level at which it is described as "intolerable". He considered this to be insufficiently gradated, and logically inconsistent.

[80] We understand this concern as the AIFR of 10^{-4} is used in both RFMA1 and RFMA2. Despite a common factor, the latter zone is at a lower level of risk because of the different assumptions that were used. In RFMA1 the AIFR of 10^{-4} was calculated on the assumption that there would be a 67% occupancy of dwellings and immediate evacuation following a seismic event. For RFMA2 it is based on 100% occupancy and no evacuation. In both cases the seismicity year is 2016.[81] Our extrapolation of Mr Taig's position is that, if the RFMA1 assumptions were applied, the corresponding AIFR at the RFMA2 line would likely be in the order of $3x10^{-5}$ (1 in ~33,000). We accept his evidence that this would be a better approach and accords with the Statement of Expectations' requirement for clarity. The difficulty is that these calculations were not sufficiently tested for us to accept them for inclusion in this decision. If such an AIFR could be rigorously established it would be more appropriate than using 10^{-4}, with differing assumptions, in two areas with quite different risk profiles.

[81] The confusion arises from the Council's decision, following consultation, on the AIFR. Given the Council is representative of the people, it is proper for us to accept this, but to avoid confusion, a suitable explanatory note along the lines of Ms Beaumont's evidence is required. We have adopted Ms Beaumont's table for AIFR in Policy 5.2.4.1. This is accepted by the Council, which represents the considered view of the community, and we agree. It is for the Council in that role to so decide, although we see an opportunity for future improvement to provide clarity and reduce confusion.

[82] Mr Taig considered the AIFR to be the most important factor, but noted that within a few years the risk level will hopefully, but without any certainty, have decreased from the 2016

[81] See also Ms Beaumont's evidence at 6.11-6.15.

levels on which the management areas were based. He said the long-term implication of this is that in practice the risk may well be controlled to levels somewhat below the 10^{-4} level.

[83] In the course of his evidence Mr Taig mentioned that Dr Massey, also a witness before us, had taken him around the Port Hills and shown him houses that had been inundated by rock fall from cliffs. He was concerned that these were houses built in the last 10 to 30 years, when people were "pushing the boundaries". He said his litmus test would be Raekura Place. He said thousands of tons of rock crumbled. He gave evidence that the Council refused consent to build that row of houses, but it was overturned in the Environment Court. He pointed out that under the previous process it came down very much to a matter of "your expert versus my expert" in the Environment Court, and he did not think there were well-defined criteria for what was good or good-enough mitigation.

[84] We have earnestly searched for Environment Court decisions relating to this evidence given to us by Mr Taig. The only case that we have been able to discover relating to Raekura Place was not in the Environment Court. Rather, it was a case in the District Court, where a subsequent purchaser claimed damages against the Council for issuing a building permit for a property in Raekura Place.[82] That claim was successful, except to the extent that the damages were reduced by 60% for voluntary assumption of risk. It is clear from an interlocutory decision that this was initially appealed to the High Court, but the appeal never proceeded.[83] It seems then that Mr Taig's particular criticism of the Environment Court was incorrect.

[85] In answer to questions from Mr Radich, Mr Taig pointed out that even four years on, a lot of people are starting to consider that the GNS Science assessments were very pessimistic. He pointed out that society has a very short memory of bad things happening, so he would not wish to be reliant on the market as a risk-management mechanism.

[86] In answer to Mr Smyth, he stressed that it is not an automatic zoning overlay but, "it is a calculation of risk followed by a process of local tailoring and adjustment and community consultation which is part of what we are doing now. I think you have to start from somewhere.

82 *Grasmueck v CCC* DC Christchurch DC6253/92, 27 November 1995.
83 *Grasmueck v CCC* HC Christchurch A278/95, 15 June 1998.

I feel New Zealand needed an approach which was better based on evidence than what they had before and I think this is a pretty good way to start."[84]

[87] The following exchange took place between Messrs Smyth and Taig:[85]

> MR SMYTH: And I will bring you down to 3.11(e), and there is a principle expressed there of the inadvisability of using quantitive [sic] risk estimates as a sole determinant of decisions.
>
> MR TAIG: Absolutely.
>
> MR SMYTH: So in the context of this planning process, we have a quantitative estimate in relation to risk which — and I accept this isn't your fault or problem in a sense — but it has triggered an automatic zoning overlay in relation to properties in an area wide basis, do you think that is appropriate?
>
> MR TAIG: It is not just a calculation of risk that goes "splat" in there at the zones, it is a calculation of risk followed by a process of local tailoring and adjustment and community consultation which is part of what we are doing now.
>
> I think you have to start from somewhere. I feel New Zealand needed an approach which was better based on evidence than what they had before and I think this is a pretty good way to start.
>
> MR SMYTH: Right, accept that. One of the problems, conceptual problems I have in relation to — this is in relation to rock fall — is the lines on the map, so I am a member of the public and I go to buy a house and I see 10^{-4} rock fall hazard area 1 and I go "No, not buying that".
>
> MR TAIG: Mm'hm.
>
> MR SMYTH: However, that line on the map is a representation, it looks like, as you have said I think in your brief of evidence, it looks like a crisp representation of what is happening, but it is a rather crisp representation of a rather fuzzy calculation and the ambit of that is, the level of uncertainty is one order of magnitude halfway down - - -
>
> MR TAIG: Mm'hm.
>
> MR SMYTH: - - - 10^{-4} which is I understand it is between, 1,000 and 100,000, right?
>
> MR TAIG: One in a thousand, one in a hundred thousand.
>
> MR SMYTH: Yes.
>
> MR TAIG: Yes, yes.
>
> MR SMYTH: I beg your pardon. So the scale of uncertainty is 99,000?
>
> MR TAIG: Yes, it is times or divide by 10.

[84] Transcript, page 76, line 43.
[85] Transcript, page 76, line 30.

MR SMYTH: Yes.

MR TAIG: Yes.

MR SMYTH: So if you look at the risk line of 10^{-4}, on a statistical basis, and this is what this model is, is a statistical model, aren't you nine times more likely to be outside the 10^{-4} level as being inside — and I use the phrase "outside" as being - - -

MR TAIG: No, that is a completely wrong understanding.

MR SMYTH: Right, on a statistical basis why is that?

MR TAIG: Because the things are not distributed neatly according to the number of numbers between — the number of units between a thousand, 10,000 and between 10,000 and 100,000.

MR SMYTH: But — yes, I accept that, but my understanding is, that the model itself is uncertain to that basis.

MR TAIG: Yes.

MR SMYTH: That is the level of uncertainty?

MR TAIG: Yes, but that does not for a moment mean, that you are — if you spend a 100,000 coins but only 10,000 of them come down over there and 900 however many thousand come down over there. I think you are misunderstanding the nature of this uncertainty.

[88] The cross-examination continued:[86]

MR SMYTH: That uncertainty still exists after the ground truthing has happened, is that correct?

MR TAIG: That is an interesting question. There would still be considerable uncertainty but some elements of the uncertainty would have been removed so although it has not been quantified, and I do not think it has been looked at in any detail, I would expect it to be modestly reduced.

MR SMYTH: Well, you are familiar with Dr Massey's evidence?

MR TAIG: Broadly, yes.

MR SMYTH: And in his evidence he says, and I will do this in a broad brush way rather than taking you to the exact quote, but in his evidence he mentions that the properties have been ground truthed in a broad sense.

MR TAIG: Yes.

MR SMYTH: And then that results in the final lines on the map so to speak?

MR TAIG: Yes.

[86] Transcript, page 79, line 26.

> MR SMYTH: And he then says that the order of magnitude of uncertainty is one order up or down?
>
> MR TAIG: That has got to be about right, yes, it is not going to make much difference before and after the ground truthing.
>
> MR SMYTH: So if you threw your 100,000 coins up in the air and quite likely apparently hit me on the head. Basically I suppose the basic point I am trying to make is when we see that line on the map we do not know whether the actual risk line is 10^{-3} or 10^{-5} or somewhere in between, we just know it is within a range of that?
>
> MR TAIG: That is right, yes.
>
> MR SMYTH: And you say that that could be an acceptable risk line in your evidence, as like 10^{-3} to 10^{-5}, you would not be out of step with international practice if you took any intolerable risk line?
>
> MR TAIG: I think we are talking two different things. It is not so much a question of being out of step with international practice as making sense in relation to risks New Zealanders face, I think. But one thing is what is the level of risk, which is uncertain times or divide by 10, and the other is what do we think is okay or not okay.

[89] We did not consider Mr Smyth's cross-examination successfully challenged Mr Taig's evidence. As we understand the questioning (although we are not totally clear), Mr Smyth was trying to suggest that because the gap from 10^{-3} to 10^{-4} and 10^{-4} to 10^{-5} was so great, and because there were inherent uncertainties, using 10^{-4} was too heavy-handed. We do not agree. The uncertainties were recognised and the AIFRs adopted in the Notified Version came out of expert advice and a community consultation process. The advice was confirmed in the expert evidence we heard. The context of what occurred in Christchurch warrants the level of conservatism in the recommended approach. We accept Mr Taig's evidence and opinions.

[90] The next joint witness was Dr Massey, a senior engineering geologist at GNS Science. He has 18 years of consultancy and research experience in investigating and analysing complex geological and geotechnical data for landslide and slope stability. This included ground water problems, underground/surface rock support, foundation design and landslip monitoring. These skills have been applied to geohazard and risk assessments for oil and gas pipelines, highways, railways, mining engineer and town planning projects around the world.

[91] He had been providing the Council and CERA with his expertise in relation to landslide hazards generated by the Canterbury Earthquake Sequence since 24 February 2011. The opinion he expressed in his evidence was based on the results of his own extensive observations of earthquake effects in the Port Hills, independently peer-reviewed reports and scientific

journal papers which he listed in his evidence and an appendix, which are available online.[87] They are very extensive.

[92] His evidence related to the Notified Version as it related to the slope hazard. His evidence covered rock fall, cliff collapse and mass movement hazard and risk assessment. All of this work is a result of the assessments carried out by GNS Science, and detailed in the reports referred to.

[93] His evidence addressed:

(a) the appropriateness of carrying out area-wide risk assessment for landslide hazards, and of the parameters adopted in the risk assessments;

(b) the uncertainties associated with risk estimates and the perceived "conservatism" associated with the adopted parameters used in the risk assessments.

[94] Dr Massey points out that the AIFR metric is recommended for use in the landslide risk assessment by the AGS report referred to earlier. The quantitative risk estimation method GNS Science developed followed that body's framework for risk management. Due to the limitations of an area-wide assessment, he considered it important for the Council to enable detailed site-specific assessments to further refine the risk estimates. He pointed out that what ground truthing had been done had been relatively broad, and that not every site had been specifically ground truthed.

[95] He considered that the parameters used for the risk assessment were appropriate. These were:

(a) annual frequency of a landslide triggering event (earthquake and non-earthquake triggers), the number of boulders/volumes of debris generated by a given slope at different magnitudes of event;

(b) if a person was present on the site, the probability of that person being hit by boulders or debris;

[87] Statement of Evidence of Christopher Ian Massey on behalf of Christchurch City Council and the Crown, Risk Modelling by GNS Science, 13 February 2015.

(c) the probability of the person being present on that slope; and

(d) the vulnerability of the person if hit by boulders/debris.

[96] He further considered that the range of values relating to each parameter in the risk model developed by GNS Science[88] was appropriate, given the uncertainties associated with such parameters. Further, the sensitivity assessments carried out properly explored the effect of the main uncertainties on the risk estimates.

[97] Many submitters criticised the conservatism (i.e. safe, or too safe) of the risk estimates. Dr Massey said this depended on the choice of values associated with each parameter. At paragraph 3.5 of his evidence he stated:

> The level of "conservatism" in the risk estimates depends on the choice of values associated with each parameter used in the model. If a rockfall risk model were to adopt all of the lower "optimistic" values, and the results of that model were compared to a risk model adopting the higher "pessimistic" values (but still from within the ranges considered by GNS Science to be reasonable), then there would be slightly more than one order of magnitude difference between the results. It is my opinion that the choice of which risk model to use and the threshold above which AIFR is considered "intolerable" should be made by, or on behalf of, those affected and not imposed by technical experts. It is my understanding that Council has made the decision on what risk model to adopt, and the threshold above which AIFR is intolerable.

[98] A number of submitters stressed that there was no boulder roll or cliff collapse in their area (particularly those in Governors Bay). However, as the experts pointed out, they were some distance from the epicentre. This fact did not establish that in a future seismic event there would be no cliff collapse and boulder roll in those areas.

[99] The evidence makes clear the assessments were carried out in those areas of the Port Hills adversely affected during the Canterbury Earthquake Sequence — in the main, the 22 February 2011 and June 2011 earthquakes. At paragraph 4.6 of his evidence, Dr Massey summarises the risk assessments relating to rock fall (boulder roll), cliff collapse and other mass movement (landslide). The risk management approach and the level of conservatism was accepted in expert conferencing.

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88 C Massey, M McSaveney, D Heron, B Lukovic, *Canterbury Earthquakes 2010/11 Port Hills Slope Stability: Pilot Study for assessing life-safety risk from rockfalls (boulder rolls)* (GNS Science Consultancy Report 2011/311, March 2012).

[100] Dr Massey referred to the Mackey and Quigley 2014 report, which inferred high ground velocities required for rock fall initiation at the Rāpaki site 6000-8000 years ago.[89] He continued that this did not inform us about other sites in the Port Hills, or about the clustering effects of earthquake sequences. For him, a key question was whether the dated rock fall deposits were generated by one strong earthquake or by an accumulation of debris triggered by a sequence over a period of decades, with only occasional lesser earthquakes. Referring to archaeological evidence and media reports of earthquakes, he continues that in his view it is likely the Canterbury earthquakes of 2010/2011 represented a "cluster" or a "sequence". He continued:

> Therefore, it is likely that for the next many tens of years there will be a higher than average probability of rockfalls being generated by earthquakes, as well as a higher than average probability of rockfalls being generated by non-earthquake events, given the recent earthquake-induced fracturing of the rock forming the slopes.

[101] He accepted that rates would be expected to decrease, but it may take many decades for the current increased rates to decrease to background rates determined from geomorphological records. We accept Dr Massey's evidence.

[102] The next witness was Dr Matthew Gerstenberger, who was the Risk and Engineering Team Leader, Senior Seismologist at GNS Science. He had considerable experience both in New Zealand and the USA. He was responsible for developing the first tool that estimated changes in earthquake hazard through time where the results from such estimation were disseminated as official Government information. He was an initial member of the Collaboratory for the Study of Earthquake Predictability (CSEP), which established standards for the testing of earthquake forecast models and implemented testing centres globally to test forecast models. He was involved in testing centres in California and New Zealand which have been in operation since 2007. He contributed to the 2010 New Zealand National Seismic Hazard Model (NSHM), and was engaged by both the Council and the Crown to give advice in relation to the use by GNS Science of time-dependent probabilistic seismic hazard modelling in relation to rock fall risk in Christchurch.

[103] In his evidence he states that it is expected that the seismic activity in this region, post the 2010/2011 sequence, will be higher than the long-term average. This expectation is

[89] Mackey, B. H., Quigley, M. C. 2014. *Strong proximal earthquakes revealed by cosmogenic ^{3}He dating of prehistoric rockfalls, Christchurch, New Zealand*. Geology, 42 (11), 975-978.

relevant both now and for the next several decades. Such activity would influence rock fall hazard and mass movement in the Port Hills. To provide robust estimates, it was necessary to understand the nature of the increased activity and how it was expected to change.

[104] In the executive summary of his evidence, Dr Gerstenberger states:[90]

> 3.3 Underpinning the rockfall risk estimates calculated by GNS Science (Massey, et al, 2012) and described in the evidence of Dr Chris Massey, is a Canterbury seismic hazard model (CSHM) for which I led the development (Gerstenberger, et al, 2014). This model estimates the amount of ground shaking for the Canterbury region for each year from 2012 to 2061. The model is a collection of computer codes that output the following information for all years considered:
>
> (a) the number and location of possible future earthquakes; and
>
> (b) the predicted amount of ground shaking everywhere in Canterbury based on the possible earthquakes.
>
> 3.4 The amount of shaking is different for each year and for different locations in Canterbury. The CSHM is an ensemble of previously existing and statistically tested earthquake forecast component models. I consider that this model represents international best-practice in time-dependent hazard estimation and is consistent with the operational earthquake forecasting guidelines laid out in Jordan et al (2011). The model was constructed by an international panel of 14 experts using an elicitation procedure outlined in European Commission Procedures Guide for Structured Expert Judgement (Cooke & Goossens, 2000).

[105] In a simplistic sense, this evidence is that there will be increased seismic activity following the Canterbury Earthquake Sequence which will reduce (referred to as "decay" by the scientists) as time passes from that sequence. The risk of rock fall is assessed on the basis of this increased, but reducing, seismic activity.

[106] Dr Gerstenberger considers that the CSHM is realistically based, and, critically, not overly conservative.

[107] A number of submitters, and witnesses called on their behalf, including Mr Bell, relied on a study by Mackey and Quigley (referred to earlier) to submit that the CSHM is overly conservative. Dr Gerstenberger points out the problem with that study is that it was not able to distinguish if one or many rock fall events (i.e. a cluster) occurred within any 1000-year period. This was due to the difficulties in assessing accurate dates calculated for the rock fall. In effect this means that the study is not of assistance in informing us as to ground motions

[90] Evidence-in-chief of Matthew Charles Gerstenberger on behalf of the Council and the Crown, 13 February 2015, 3.3-3.4.

over the next 50-year period. T&T's submission also mentioned conservativeness, lack of physical evidence and incompleteness of the rock fall modelling. Dr Gerstenberger said this is incorrect, as the CSHM is evidence-based and forecasts the size, location and rate of future earthquakes. While the CSHM parameters are informed by the Canterbury Earthquake Sequence, the forecast earthquakes and ground shaking are not the same as have been experienced in the Canterbury Earthquake Sequence.

[108] Dr Quigley, an Associate Professor in Active Tectonics and Geomorphology at the University of Canterbury (and co-author of the report referred to above), gave evidence on behalf of the submitter, Sue Stubenvoll.[91] We deal with that site-specific evidence in the appropriate section of this decision.

[109] Dr Quigley was the co-author of the report referred to earlier. He took some issues with the questioning of that report. However, when we consider his evidence overall, it does not change our view in accepting the evidence adduced by the Council and Crown.

[110] Dr Quigley's evidence was of assistance to the Panel. Where there was disagreement with the Council witnesses, we consider it unnecessary to resolve those disputes. This is because Dr Quigley accepted a cautionary approach was appropriate.

[111] What he said was that the work that he and his team had been involved in should be extended and used to further inform and add to the seismicity model developed by Dr Gerstenberger and the international expert panel. He accepted he could not dismiss the possibility that future earthquakes or non-seismic triggers could induce rock falls at lower thresholds than calculated given the currently weakened state of the rock mass. He also accepted he could not distinguish between single and multiple rock fall triggering events for the prehistoric rock falls observed in his study.

[112] He also considered that the level of seismicity had reduced significantly, but this also accords with other evidence. In answer to questions from the Panel, he accepted that it would be wise to exercise a degree of caution when delineating where hazards may or may not occur, and how they are managed. It was his belief that the location of active faults and such seismic

[91] Submitter 845.

source information should add to the current model. But he accepted, absent that information, the Panel was correct to exercise a degree of caution.

[113] He accepted that pre-earthquake, the faults responsible for September, February and June were not known. He also accepted that it was not an option to do nothing until further work had been carried out. He did suggest that vegetation and other matters can give rise to mitigation, but accepted that someone in future could cut the trees down, and also that vegetation as mitigation would take some time to grow.

[114] While we would urge that Dr Quigley and his team's work continues to further the current level of understanding, we are quite satisfied that the evidence of Dr Quigley is not a basis for taking a less cautious approach. He could not dismiss outright the possibility of future strong earthquakes, and said "even though we find very little evidence for that from a geologic perspective we cannot completely discount that possibility."[92]

[115] The Panel asked:[93]

> … absent that information, because we have to deal with what is in front of us, and absent that information, we should use that statistical information to make the best decision that we can, but exercising a degree of caution in doing so. Is that a fair summary of your evidence?
>
> DR QUIGLEY: Yes, **that is to my knowledge, in the short term, that is the best model going forward, from what I understand of the model, and from what I understand of the quality of the scientist who has done the modelling.** However, I do very much feel that at some stage in the next few years that the validity of that model will need to be questioned against the geologic record, which includes both the location of active faults which have been imaged, and the evidence presented from works, such as my study here. In designing a 10 year plan, using a rapidly decaying aftershock sequence and a statistical model that is designed for short term seismicity, **I would like to see geology play a more prominent role going forward** in that sort of time scale. Particularly when it comes to site specific investigations.
>
> DR MITCHELL: So to the extent that we were able to do so, a regime that allowed lines to be adjusted as better information became available, provided that we set the lines conservatively in the first place, that would be a good outcome from your point of view?
>
> DR QUIGLEY: Yes, whilst acknowledging that the position of any individual contours is also subject to an order of magnitude uncertainty in its current framework and also acknowledging the statements that I believe have been made by Chris Massey

92 Transcript, page 1002, line 25.
93 Transcript, page 1006, line 18.

> and by Matthew Gerstenberger that those AIFR lines do evolve with time, with a decreased seismicity rate.
>
> So, for instance, if we do not have any major earthquakes by 2017 that those lines should perhaps be in different places and that process will go on during the lifespan of the Plan. So I mean from a strictly geological point of view conservativism is a great thing. We do not want people living in dangerous places and **I do not want to be liable** if an isolated boulder come off of a rock mass in a flood or in the absence of a seismic trigger. And I know that there are still loose boulders in many places in the Port Hills which if dislodged could come down and impact on people.
>
> [our emphasis]

[116] Mr Macfarlane, Dr Wright and Dr Yetton gave evidence of their experience in the Port Hills and their physical inspections and ground truthing activities. It is acknowledged by these witnesses that the risk management model developed is based on localised ground truthing, but not on site-specific ground truthing. They also give evidence of a number of site-specific ground truthing exercises they carried out on the basis of submissions received. A number of these led to changes in the various hazard lines. (We will turn to those site-specific ground truthing exercises, and the results of them where we deal with the site-specific submissions received.)

[117] Apart from Mr Bell (whose evidence we will turn to), and Dr Quigley, there was little evidence to challenge the scientific evidence adduced by the Council and the Crown from their combined witnesses. Despite Mr Bell's criticisms, we accept the joint evidence we heard and note to a very large extent it accords with the results of expert caucusing on land stability referred to earlier.[94]

[118] Factually, therefore, we accept the evidence adduced on behalf of the Council and the Crown that a risk management-based approach is appropriate, as was the more generalised ground truthing exercise undertaken for the mapping and modelling. We also accept that the plan and associated objectives, policies and rules should allow a relatively straightforward method to enable site-specific ground truthing which could lead to potential relief for landowners.

[119] On the evidence we also accept that, given what occurred in Christchurch and the results of the various inquiries and modelling, a level of conservatism is appropriate in determining

94 Above, n 76.

the mapped hazard lines. We do not, however, accept criticism that the model advanced by the Council is overly conservative. We are satisfied on the evidence that it is an appropriate response to what has occurred in Christchurch and the continuing risk of rock fall, cliff hazard and mass movement in the Port Hills occasioned by increased seismicity. We acknowledge that such seismicity, and therefore the risk, will reduce over time. For that reason it is important that these issues are kept under regular review, as the experts have urged.

[120] We accept, on the evidence, that there will be areas where the hazard may be completely removed (by removing rock sources, for example), or mitigated, such as by bunds. The difficulty with reliance on mitigation, as the Council and Crown witnesses pointed out, and we accept, is that the hazard remains. Mitigation may reduce a consequential risk from the hazard, but it does not remove the hazard. This is relevant to a number of submitters who spoke of site-specific mitigation and the beneficial mitigatory effects of vegetation. But this overlooks the fact that vegetation may be removed in the future and that mitigation structures will undoubtedly be required to meet standards and be properly maintained (as examples). We would expect the Council to issue guidelines in this regard, but accept the evidence that mitigation can reduce the consequential risk but not remove the hazard. Those site-specific matters are, in our determination, most properly addressed at the individual resource consent stage.

[121] We have already referred to the evidence of Mr Bell, and his agreement with the Experts' Joint Statement. He is a senior lecturer in engineering and mining geology at the University of Canterbury. He also runs a consultancy business. We return to his site-specific evidence on behalf of a number of submitters later in this decision.

[122] Mr Bell took general issue with the GNS Science approach. He based this on his expertise and many years of studying the Port Hills. His approach appears to us to be contrary to the Experts' Joint Statement.

[123] He admitted he had no expertise in seismic modelling. He noted the GNS Science modelling showed a declining seismicity, potentially reducing risk, but not hazard. He referred to Dr Gerstenberger's evidence, stating that a higher than long-term average seismicity can be expected for the next several decades. He stated it would be important to resolve this issue to

avoid undue conservativism. We heard no other expert with similar expertise to Dr Gerstenberger in this area, and accept his evidence.

[124] However, the general view advanced by Mr Bell was that the rock fall modelling that he carried out was superior to GNS Science, that the GNS Science modelling fails to take into account site-specific matters such as topography and vegetation, and is unduly conservative. It was his view that every single property should be visited and an assessment made. It is clear from the evidence that this would be a hugely time-consuming and costly exercise, as more than 2000 properties would be involved. He further stated that he considered that area-wide rock fall or cliff collapse events before the current sequence must have occurred at least 6000 years ago.

[125] We prefer the rebuttal evidence of Dr Massey. He said the age of the relict marine surfaces (beaches) was not constrained and there were large volumes of talus (accumulated rock debris) at the base of cliffs that pre-date the 2010/2011 Canterbury Earthquake Sequence. He said the age of the material forming the beach surface, and the relation between the talus and these materials could, therefore, be used to infer an age for the talus, and could in turn be used to infer timing of any event, possibly an earthquake, that caused the cliffs to collapse and the talus to form. He referred to work by McFadgen and Goff, to say that it was possible the beach surfaces were younger than that quoted by Mr Bell.[95] He said Mr Bell further ignored evidence that rock falls had occurred shortly after Māori arrival, mentioned in Dr Massey's evidence, which may have been triggered by earthquakes.

[126] Dr Massey accepted Mr Bell's statement that some boulder runouts may have been underestimated, stating, however, that this was the case in many areas. He did not accept Mr Bell's view that a thorough analysis of land sliding had not been carried out, for the reasons that Mr Bell gave no evidence to support that opinion, and that GNS Science had carried out detailed site-specific assessment of the CCMA1 areas. This assessment had been independently peer-reviewed by international experts. As to CCMA2 and CCMA3, it was his opinion, and the opinion of GNS Science's independent peer reviewers, that the deformation

95 Rebuttal evidence of Christopher Ian Massey, 27 February 2015, page 4; referring to McFadgen, B.G.; Goff, J.R. 2005. *An earth systems approach to understanding the tectonic and cultural landscapes of linked marine embayments: Avon-Heathcote Estuary (Ihutai) and Lake Ellesmere (Waihora), New Zealand*. Journal of Quaternary Science 20(3): 227-237.

patterns mapped in the field were consistent with those relating to a landslide mechanism such as slumping. Again, we accept Dr Massey's evidence.

[127] Turning to his more specific site analysis, Dr Massey pointed out that Mr Bell's risk assessment did not follow the consistent framework such as those given by the AGS guidelines, and in many cases there was an acceptance of risk because of the mitigation work recommended by Mr Bell. He pointed out that it appears that in each case where Mr Bell has assessed individual sites, he has recommended some form of mitigation to reduce the risk of rock falls. What he failed to do though was quantify any change in the risk based on the site-specific results using a framework such as AGS. Nor did he demonstrate how effective the mitigation solutions would be at reducing risk, and the reports were not independently peer-reviewed.

[128] As Mr Bell did not provide information on the methodology used in his Appendix Four, this created difficulty for other experts, counsel and the Panel in interrogating his comparison of the modelling he had carried out to the AIFR estimated by others using the GNS Science methodology. The reason given by the witnesses was the results cannot be compared, as no information is given on the method used in Mr Bell's Appendix Four. In cross-examination by Mr Winchester, Mr Bell said he did follow the standard AGS2007, but accepted that was not made clear in the evidence. However, he accepted that, except for 8 Balmoral Lane, the modelling he had done had not been peer-reviewed. He also acknowledged that he placed significant reliance on Rapid Mass Movement Simulation modelling ('RAMMS'). Mr Bell said this had been checked in the field with actual rock roll, and he considered there were no more uncertainties with this method than with the GNS Science modelling. He suggested it would probably be superior. He gave further evidence of having done some additional modelling the previous week, but that evidence had not been presented to the Panel. Only the numbers have been presented. Mr Winchester then sought to cross-examine him on some various vulnerability figures based on debris flow data from Hong Kong, and pointed out to Mr Bell that, when a previous witness for the same submitter (Mr Charters) gave evidence, he could at least cross-examine about the assumptions and inputs, because the witness had written them down. In answer to a question from the Panel as to where we could find the workings in his evidence (which was really the question being put by Mr Winchester), Mr Bell answered

that the detail was not in the evidence, "but the evidence was giving the results not conclusions from it, not the workings".[96]

[129] So essentially, Mr Bell considered his modelling superior to GNS Science (even though the workings were not presented to the Panel), that sites should be individually ground truthed, and the GNS Science modelling was far too conservative.

[130] In further questioning from the Panel, Mr Bell said his preference was that, before hazard lines were drawn on a map, every property should be individually assessed. He was asked what would happen about the hazard in the meantime:[97]

> MR BELL: You put in the zoning and you then have a plan in place that allows you to move systematically through site by site.
>
> SJH: So you would draw hazard lines on the map?
>
> MR BELL: Draw a hazard line on the map to begin with.
>
> SJH: Based on what?
>
> MR BELL: You could either establish Port Hill zone within which you required individual properties, again, are we talking about existing places or new developments?
>
> SJH: Just dealing with existing places at the moment. What I'm trying to discover, given that your view is that there should be a specific site assessment of every individual property before a decision is made around its hazard zoning, what do we do in the meantime?
>
> MR BELL: No, I think, what I believe is if the hazard zone needs to reflect the individual properties, and in the short term you may have to put in place another five year transitional, or something of this sort.
>
> SJH: Sorry, that's still not answering my question. What would this five year transitional look like? Would it have the hazard lines for rock fall one and rock fall two and such like on it?
>
> MR BELL: It would have - - -
>
> SJH: With management one and two.
>
> MR BELL: It would have rock fall hazard, full stop.
>
> SJH: Based on, what you would say an "incomplete assessment"?

96 Transcript, page 838, line 30.
97 Transcript, page 846, line 6.

MR BELL: If you are looking to put something in place right now, without doing the site by site assessment, then you have no option but to go for something like that.

SJH: Well I just want to be clear about this, you're not suggesting that nothing should be done at the present time?

MR BELL: No.

SJH: So we would need to, in some form, have a map with hazard zones on it?

MR BELL: Yes.

SJH: And then as you work through site by site assessments, those lines could be varied.

MR BELL: Correct.

[131] We prefer the evidence of the Crown and Council experts to that of Mr Bell. Not only are they cumulatively better qualified, but their work has been far more extensive than Mr Bell's, and has been peer-reviewed by international experts. They confirm their approach is international best practice, and we are satisfied that is the case. We are also satisfied that the work being carried out by GNS Science in New Zealand is now being recognised and applied internationally.

[132] In any event, Mr Bell recognised the need for some hazard lines to appear on the maps immediately, but did not put forward in his evidence any serious alternative to the approach adopted by Mr Taig, GNS Science, and other Crown/Council experts. Those experts recognise that their locally based ground truthing was not as effective as site-specific ground truthing, and that that could lead to changes (also, as noted earlier, Mr Bell's evidence seems to be at odds with the Experts' Joint Statement that he was a signatory to). In our view, the best course is to adopt their recommendations as international best practice, but leave a route available to individual land owners to be able to have their situations re-assessed with the potential for certification that their land is at materially less risk and able to be relieved of associated subdivision, land use and development restriction. In saying that, however, we reiterate that mitigation does not remove hazards, but merely reduces the risk.

[133] Although the focus was on rock fall, we accept the zones proposed for cliff collapse and mass movement. Essentially, apart from Mr Bell's suggestion that two of the mass movement areas should be combined, the evidence relating to cliff collapse and mass movement was unchallenged. We do not accept Mr Bell's view.

Liquefaction

[134] The Council's evidence came from Mr Kingsbury, who is the Principal Advisor Natural Resources for CCC. He explained that liquefaction was a process where soils changed from a solid to a liquefied state. This had happened in Christchurch previously, and is likely to occur again. Many of the soils in Christchurch are prone to this phenomenon. The consequence of liquefaction is ground damage, which can include settlement, lateral spread and cracking. Ground damage can lead to damage to structure, infrastructure and the environment.

[135] Mr Kingsbury stated that there are a number of techniques available to strengthen soils prone to liquefaction and to reduce the risk to the built and natural environments. He further said that risk from liquefaction can be reduced by specific design responses, especially to foundations.

[136] Following the Canterbury Earthquake Sequence a significant review of liquefaction hazard in Christchurch was carried out.[98] This review forms the basis of Mr Kingsbury's evidence. As a consequence of his evidence, the Council's approach to addressing liquefaction in the Notified Version was to define two liquefaction assessment areas. The first, LAA1, was where liquefaction assessments were needed to ensure appropriate measures were taken to reduce the risk to property damage from liquefaction. The second zone, LAA2, is an area where damaging liquefaction was considered unlikely.

[137] The report carried out by GNS Science led to a mapping of greater Christchurch and to the two liquefaction assessment areas. Generally, the boundary between the two liquefaction assessment areas trends from the northeast-southwest (from the Waipara River mouth in the north to the Rakaia River mouth in the south). There were also some smaller areas of LAA1 on Banks Peninsula, which were essentially the lower valley alluvial infill areas.

[138] Mr Kingsbury considered that the two zones provided a basis for helping to ensure sound planning and development decisions were made. A number of submitters questioned their accuracy and appropriateness. Other submitters sought specific detail around the scope

98 Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts, Report No R12/83, prepared for Environment Canterbury by H L Brackley (compiler), Institute of Geological and Nuclear Sciences Limited (GNS Science) Consultancy Report 2012/218, December 2012.

of investigations required, and ground performance standards and concerns on a site-specific basis. We will turn to these when we deal with the individual submissions.

[139] We accept Mr Kingsbury's assessment that the approach adopted by the Council is based on "adequate technical information and a sound decision-making process involving appropriately experienced and qualified people."[99]

[140] Mr Kingsbury explained how liquefaction occurs and the consequences of it. That is a process that is now reasonably well understood in Christchurch, and we need not detail it here, but the link below will give readers more information if required.[100]

[141] There are two ways to reduce the effects of liquefaction: the first by stabilising ground, and the second, by specific foundation design. A combination of both these approaches can also be adopted. Mr Kingsbury's unchallenged evidence was that there were three major methods of increasing the density of soil to increase resistance to liquefaction. The first was called "dynamic compaction", which involved the repetitive dropping of a heavy weight. The second was the removal of liquefiable material and its replacement with coarser material (drainage, or de-watering, can also reduce the risk). Finally, buttressing of lateral spread is another technique which can be used.

[142] In relation to foundation designs, his evidence was that stronger foundations, deeper piles, and piling to non-liquefiable soil layers are the common methods used to reduce the effect of liquefaction that can cause damage to property.

[143] Mr Kingsbury accepted that the assessment area maps did not define areas where it can be said with certainty liquefaction will and will not occur. Rather it shows areas that are more prone to liquefaction, where it is appropriate to carry out further inquiries. He accepted that liquefaction occurring to the west of the line (LAA2) is likely to be localised, with only minor ground damage.

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99 Statement of Evidence of Peter Allan Kingsbury on behalf of Christchurch City Council, 13 February 2015, para 3.6.

100 Statement of Evidence of Peter Allan Kingsbury on behalf of Christchurch City Council, 13 February 2015 (http://www.chchplan.ihp.govt.nz/wp-content/uploads/2015/03/310-CCC-Mr-Peter-Kingsbury-Natural-Hazards-13-2-15.pdf).

[144] In answer to questions from the Crown and the Panel he stated he was unaware of any serious damage occurring from liquefaction in LAA2 during the earthquake sequence, and accepted that any normal geotechnical investigation required would identify any such areas. Essentially, he was accepting that referring to the LAA2 area as a liquefaction area was potentially misleading. It seems to us, on the basis of that accepted evidence, it is unnecessary to so delineate that area on a hazard map. It causes confusion, and does not meet the clarity direction of the Statement of Expectations. We have decided to remove the LAA2 mapping and related provisions.

[145] Finally, in response to questioning from Mr Radich and from the Panel, Mr Kingsbury considered that guidance documents to accompany the Plan would be useful. The first would detail the types of investigations required to determine the suitability of a site for development. The second would set performance standards so readers would know exactly what is expected in terms of performance of the ground, or the design of the structure, to withstand liquefaction. In view of the number of uncertainties, he considered that it would be difficult to have a certification programme, but he conceded that he did not feel competent to answer that.

[146] Mr Kingsbury's evidence was supported by expert witness conferencing. Apart from matters mentioned above in questioning from Mr Radich and the Panel, it was essentially unchallenged. We accept his evidence, noting and accepting the qualifications made by him in answer to questions.

[147] Mr Anderson, a geotechnical engineer, gave evidence relating to liquefaction in relation to the inclusion of reclaimed land at Lyttelton within the liquefaction assessment area. This dealt with what was, in the main, reclaimed land. This reclamation had gone on over a long period of time to provide working space and the expansion of the Port of Lyttelton. While accepting the damage that occurred did not fall within the normal definition of liquefaction, it was undoubtedly land damage that occurred through the earthquake forces. He detailed that damage, and his assessment of it was not seriously challenged.

[148] He was not cross-examined. However, he was questioned by the Panel, and it was put to him as to why the Council needed to be able to control activities on the land to a point where they could decline consent for particular activities, given the value of those assets and the importance of the Port. In other words, the Port had its own intrinsic need to manage those

assets properly. Mr Anderson's response was to express concern that a quality outcome is not an automatic concern for a client, and he referred to "some real gaffes" that had been made via the consenting process. He did accept, however, that he was not qualified to comment on the consenting process, but that if large-scale works were to be carried out, he would expect them to be peer-reviewed given the significance of the capital assessment. We are satisfied separate rules are required for the Port for reasons of clarity and reduced regulatory interference.

Land repair

[149] Mr Long, a senior planner with the Strategy and Planning Group of CCC, was the only witness called by the CCC on this topic. His evidence related to objectives, policies and rules relating to the repair of land damaged by the earthquakes. He referred, by way of background, to the Minister's insertion of provisions into the existing district plan through s 27 of the CER Act to facilitate the repair of land damaged by the earthquake sequence. This occurred in October 2013, and related to the repair of land used for residential purposes on flat land where certain forms of land damage occurred. On 5 September 2014, the Minister amended these provisions to address two additional forms of land damage. The categories of land damage defined by EQC and addressed by the Minister's amendments were:[101]

(i) Land cracking caused by lateral spreading.

(ii) Land cracking caused by oscillation movements.

(iii) Undulating land.

(iv) Local ponding.

(v) Local settlement causing drainage issues.

(vi) Groundwater springs.

(vii) Inundation by ejected sand and silt.

[101] Statement of Evidence of Andrew Jeffrey Long on behalf of Christchurch City Council, 13 February 2015 at 5.3.

(viii) Increased liquefaction vulnerability.

(ix) Increased flooding vulnerability.

[150] Mr Long considered the objectives, policies and rules to repair land damaged by earthquakes were appropriate in terms of s 32. We will address those matters in our s 32AA discussion. However, for present purposes, the important point of Mr Long's evidence, highlighted in the answer to a question from the Panel, is that the intention of the objectives, policies and rules is to repair all earthquake damaged land, where possible, for residential purposes. Mr Long accepted that this facilitated the recovery. That was an acceptance that we need to put in place rules that facilitate the repair of earthquake damaged land, and do that as part of facilitating the recovery. We agree.

Flooding risk

[151] As we have noted, the Council's risk management approach to flooding hazard management used the metric of AEP, and is primarily focused on the prevention of damage to property and increasing the resilience of the building stock. However, there are areas of Christchurch that have had long-term issues with flooding that appear, on the basis of the evidence, to have been exacerbated by the earthquake.[102]

[152] The approach taken to setting the accepted risk level for flooding took into account three parameters. The first was sea level rise. The second was a significant rainfall event. Finally, there was added into the equation high tidal events, such as storm surges, which are normally associated with heavy rainfall events. To this was added a freeboard of 400mm. As most houses have a 150mm freeboard in any event, only a 250mm freeboard was added to map the FLFMA.

Sea level rise

[153] Mr Ivamy, a senior coastal scientist at T&T, gave evidence in relation to sea level rise. He had been advising Council in relation to such matters for approximately two years. He referred to a number of key documents from the Ministry for the Environment, the New

[102] Statement of evidence of Janice Carter, 13 February 2015, paras 7.5 and 7.14.

Zealand Coastal Policy Statement ('NZCPS'), the Royal Society of New Zealand, the International Panel on Climate Change ('IPCC') and the Journal of Geophysical Research. The position he took on this matter was agreed to by the other experts in caucusing, and was not seriously challenged by any submitter. Indeed a number supported Mr Ivamy's position.[103]

[154] Policy 24 of the NZCPS requires that the effects of sea level rise are to be assessed by taking into account national guidance and best available information on climate change and its effects. Policy 25 requires consideration of the effects of climate change over at least a 100-year timeframe. As a consequence, Mr Ivamy said, the Council had taken the 100-year time frame until 2115 in its Natural Hazards Proposal.

[155] Mr Ivamy gave evidence that the IPCC was the leading international body for the assessment of climate change. This was unchallenged. He said the historical rate of sea level rise around New Zealand, including Banks Peninsula and Christchurch, is similar to the global average rates of sea level rise over the 20th century. Extrapolating from the IPCC 2014 RCP 8.5 scenario to 2115 results in a mid-range sea level risk protection of one metre relative to the current baseline sea level as at 2015. That scenario assumes that emissions will continue to rise throughout the 21st century under a "business as usual" approach. He gave unchallenged evidence that such a scenario is prudent until there is hard evidence of emissions stabilising, justifying use of lower projection scenarios. The entire expert witness caucusing group for flooding agreed:[104]

> Issue — Sea Level Rise Projection
>
> Discussion — The 1.0 metre Sea Level Rise projection to 2115 is based on a mid-range projection given by the IPCC AR5 assessment (2014) under the "business as usual" scenario (RCP 8.5).
>
> Expert Witness Recommendation — 1m SLR to 2115 is suitable for use in the plan.

[156] The Crown, in its submission, states that a one-metre sea-level projection was at the high end, and too conservative. Mr Ivamy disagreed, pointing out that the one-metre sea level rise was a mid-range projection, as already discussed. We agree with Mr Ivamy and we do not

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103 Including Generation Zero (1149).

104 Experts' Joint Statement: Natural Hazards – Flooding – Joint Statement for District Plan Review, 19 January 2015 at 2. See also Statement of Evidence of Mark Christopher Ivamy on behalf of Christchurch City Council, Senior Coastal Scientist, 13 February 2015, at 4.2: "1.0m projection for sea level rise to 2115 adopted by Council is considered to be a mid-range projection value suitable for natural hazard planning."

consider such a figure to be too conservative. We assume that is the position now accepted by the Crown, given that it did not seek to cross-examine Mr Ivamy.

[157] Mr Harrington is the Council's senior surface water planner. He referred to Policy 11.3.2 of the CRPS and stated that clearly required that development be avoided in areas subject to flooding in a one in 200-year event. He said the policy does allow mitigation, where there is no increased risk to life, provided the development meets the other aspects of 11.3.2 CRPS. In his view, it was uneconomical for local communal flood protection schemes to be designed to a standard to avoid such floods. Although he was cross-examined by Mr Lewis on this, we accept Mr Harrington's evidence in this regard. He said as a result, where area-wide mitigation was not appropriate, the necessary solution to manage flood risk was to ensure that new floor levels are designed to be above the one in 200-year flood event, factoring two other elements (the one metre sea level rise and a one in 20-year tidal event). This scenario accepts that street flooding and flooding onto properties could occur, but the approach sought to ensure that floors are protected, as they are the most vulnerable assets on a flood plain.

[158] We accept that evidence, and also his evidence, and that of Ms Brookland, that a one in 200-year flooding event can be analysed by taking either a one in 200-year rain event coupled with a one in 20-year high tide event, or alternatively reversing those factors. This, combined with the one-metre sea rise referred to above, led to the assumptions against which the planning response was based in the Notified Version.

[159] As we have noted, the Council's planning response to this flood risk was to identify flood-prone areas and map them as an FLFMA. Within that was an FMFO. An accepted risk level was then reached and a minimum floor height above the agreed risk level was to be used to avoid damage and to increase resilience.

[160] There was no real challenge to this evidence, and it was agreed to in caucusing. We accept the risk levels and the floor freeboard, but not the planning response to it.

[161] The challenges that then arose in submissions related to the basis upon which the lines for the areas were drawn on the maps. There were individual site-specific submissions we address elsewhere. The modelling, being computer-based, also produced zig-zag lines, and it was accepted by Council witnesses some smoothing was appropriate.

[162] There is detailed evidence, to which we do not need to refer, regarding flood modelling in Christchurch. This modelling is computer-based, and takes into account a number of factors set out in the evidence of Messrs Harrington and Whyte. Such modelling projects have been going on for over 25 years, and the models have constantly been upgraded and improved. Mr Harrington's evidence was that the main channels had now been closely modelled, but ongoing development consisted of adding detail to the tributary catchment areas. Typically, where a project is identified in a sub-catchment, a small model of that area will be developed in testing. The same would be done in relation to localised flooding issues.

[163] There are issues with the flood modelling. It is clear that the information available to the Council from flood modelling closer to the water courses is more accurate and comprehensive than areas that are further away. This is compounded by the acceptance by Council witnesses that the areas further away from the water courses were, in the main, less vulnerable to flooding.

[164] The other issues were put in focus by the cross-examination of Council witnesses by Mr Lewis. His cross-examination was based on his experience as an engineer, and as an interested land owner in the Henderson Basin. He sought to establish, through that cross-examination, that the models had not all been peer-reviewed, some were past their use-by dates and accordingly unreliable. Mr Harrington, Mr Whyte and Ms Brookland gave evidence as to the ongoing updating of modelling and the checks that were made against them. In answer to questions from the Panel, Mr Whyte, for example, accepted that there was a level of error in all of the inputs to the model. He felt he could not give a level of uncertainty around the edge of the FMFO, but felt there could be some sensitivity runs of a model. He said if you were perturbed by the data you get a feel for what happens from sensitivity runs. In answer to the following question from the Panel:[105]

> That would be [a] standard part of model ground truthing though, would it not, sensitivity analysis?
>
> MR WHYTE: Yes, but I guess the Council have dealt with that through their freeboards addition, if you like.

[165] Next, Dr Mitchell asked:

[105] Transcript, page 592.

> So the freeboard soaks up, probably a poor choice of words, but that soaks up any inaccuracy that the model may have and any lack of sensitivity analysis, is that what you are saying?
>
> MR WHYTE: Yes, I believe that is purpose of it.

[166] We accept the models have been regularly updated and, despite the limitations mentioned, is the best evidence available.

[167] Ms Brookland is a planning engineer at the Council, and her role was to interpret, review and build flood models advising on flood risk and setting floor levels. She gave evidence of how this was done, including those areas where there was a level of uncertainty that would require site by site assessment. Ms Brookland accepted, however, in answer to questions from Mr Radich, that a certification regime would be appropriate to simplify the consenting process.

[168] These concerns were highlighted by further cross-examination from Mr Chapman, Mr Fowler and Mr Riach which highlighted the unsatisfactory nature of the Council's position. Mr Chapman used the analogy that the area with good information (i.e. within the FMFO) could be described as the "egg yolk" and the area with lesser information (i.e. the wider FLFMA) could be described as the white of the egg. Again, the focus was on the fact that the white of the egg is in general less vulnerable than the yolk, but because of the lack of information the consenting process notified is much more onerous.

[169] Ms Brookland strayed into planning matters beyond her expertise in relation to one specific submitter, Mr Riach. She also gave supplementary evidence, unrelated to her modelling expertise, relating to a culvert and drainage channel near the Lyttelton Tunnel. Her views were completely at odds with our own views based on our site visit.

[170] The difficulty we have with the Council's evidence and its planning approach is that because the areas at a high risk of flooding have a greater degree of certainty around the modelling, land owners know the situation and the regulatory path is straightforward. Those further from the water courses, where modelling is less certain and the risk of flooding is generally lower, are faced with a more complex regulatory path. We do not consider this meets either the Statement of Expectations or our Strategic Directions decision.

[171] We are satisfied that there is a method to bring greater fairness and certainty which we address in our s 32AA evaluation later in this decision.

[172] We also heard additional evidence from Mr Harrington, due to the fact that questioning by Mr Lewis of Mr Whyte revealed that the question should properly have been put to Mr Harrington. He referred to Mr Lewis's evidence that, "they think that the Henderson Basin is theirs to dump flood waters into", "houses flooded, crops ruined, livestock put at risk, and in some cases the areas cannot now be farmed" and, "land that did not flood even with 5 year storm now floods with 2 year storms".[106]

[173] Mr Harrington felt unable to comment, because no specifics had been given to support these assertions. But he confirmed the Council does not allow additional areas to be developed unless flooding risks are properly mitigated. This was in answer to Mr Lewis's claim that development upstream from Henderson Basin was not properly mitigated, which added to the difficulties in Henderson Basin. Mr Lewis's view was that this was compounded by the fact that downstream water courses and waterways had not been properly maintained by the Council, exacerbating the problem. Mr Harrington maintained his view, which we accept, that Henderson Basin had been accurately mapped for present purposes.[107]

[174] Mr Harrington's supplementary evidence was again subject to scrutiny in cross-examination by Mr Lewis, including in relation to the above concerns. Mr Harrington accepted, in a question from the Panel, that any backwater effects associated with sea level and tidal cycle effects do not affect flooding in the Henderson Basin. He also said that he had seen no evidence that Henderson Basin now floods more frequently and more extensively than previously. He was asked questions by the Panel, to the effect that both Mr Lewis and Mr Lee said a lack of maintenance and management, including native planting, downstream contributed to increased ponding in the Henderson Basin. His response, which we accept, was that this was not a deliberate policy. But he accepted it was possible that more rigorous cutting back of vegetation and things of that nature could reduce the resistance to floods. He reiterated it was not Council policy to do nothing downstream, for example in the Heathcote, simply to allow it to be more natural. But he did say that, over the last 10 to 15 years, the Council had

106 Supplementary evidence of Warren Richard Lewis on behalf of Cashmere Park Trust and Cashmere Rural Landowners, 5 March 2015 at 2.2, 4.3 and 4.4.

107 Rebuttal evidence of Graham James Harrington, 9 March 2015 at 2.10.

taken a multi-value approach to the management of waterways, considering not only drainage but ecology, landscape and heritage. And he accepted that planting might have changed over the last few years. The Panel asked:

> So does that mean then that private land upstream, such as in Henderson Basin, is being used more to accommodate flooding in order to provide for those values downstream?
>
> MR HARRINGTON: Not deliberately, no.
>
> MS DAWSON: What do you mean "not deliberately", was it a by-product, an undeliberate by-product of this policy?
>
> MR HARRINGTON: I don't know the extent to which it is happening.

[175] Mr Harrington accepted that the effect of the changes to the Cashmere and Heathcote over the last 10 to 15 years meant that the water was not going to flow away as quickly when such planting partially blocked the waterway. He said as to the Henderson Basin, a consequence of it would be that the water would not drain away as quickly.[108]

[176] He also considered that the Council's modelling process through NIWA was more reliable, more calibrated and more verified than Mr Lewis's calculation.

[177] While we understand Mr Lewis's concern, we are satisfied that the modelling undertaken by the Council is the best evidence available to us to establish the flood zones. We are also satisfied it is robust enough to accept. The consequences of inadequate maintenance and Council policy around planting are not matters that can be addressed by us in this Plan, although we would expect CCC to address it. That is a matter that Mr Lewis needs to address elsewhere.

[178] Overall we are satisfied that the 200-year rainfall assumption plus a one-metre sea rise and a 20-year high tide event is appropriate to apply for a consideration of risk management for flooding. We accept where the modelling is sufficiently accurate, it is an appropriate basis to establish a fixed floor level. We have recorded our concern that in less vulnerable areas the information is less reliable, but consider the regulation under the Notified Version more restrictive. However, we consider this can be addressed appropriately by amending the Notified Version (as we discuss in our s 32AA analysis) so as to reduce the level of regulation and cost, and make the consenting process more straightforward and simple.

[108] Transcript, page 1079, lines 17-22.

THE S 32 REPORT ON THE NOTIFIED VERSION

[179] We are required to have regard to the Council's s 32 report ('s 32 Report'/'Report'). As we commented in our Strategic Directions decision, such reports can serve a useful purpose in identifying where a notified planning instrument is soundly based, and where it is not.

[180] The Council published its Report in conjunction with the Notified Version. The Report references numerous supporting consultant and staff reports, demonstrating that the Notified Version was generally well supported by technical analysis of the various natural hazards it addresses. In particular, that is so for the risk-based philosophy underpinning the slope instability regime. To a lesser extent, this was the case for the flooding risk and liquefaction risk regimes.

[181] The Report reveals that comparatively much less was done to test alternative regulatory approaches to the management of the identified natural hazard risks.

[182] For the purposes of evaluating alternative approaches to the management of natural hazard risks, for the purposes of s 32, there is an important relationship between technical risk assessment and economic analysis. Professor Sharp, the Council's economist, observed that he was not aware of any attempts, in New Zealand, to link technical risk assessments with likely economic outcomes.[109] He explained that technical risk assessments were an essential foundation for economic evidence, needing to be done in advance or at least contemporaneously. In that sense, time pressures can impact upon the nature and extent of the economic analysis that can be undertaken. In this case, Dr Sharp understood that the pressures of time led to a prioritisation of the technical risk assessment work and a limitation of the opportunity to undertake primary research of the economic implications of natural hazard management.[110] Professor Sharp observed:[111]

> It is evident from the section 32 analysis that the pressure of time has resulted in minimal quantitative economic analysis, a reliance on qualitative assessments and minimal exploration of alternatives.

[109] Statement of evidence of Professor Sharp, on behalf of CCC, at para 7.3.
[110] Statement of evidence of Professor Sharp, on behalf of CCC, at paras 3.1(b) and 4.4.
[111] Statement of evidence of Professor Sharp, on behalf of CCC, at para 7.2.

[183] We understand those observations to be fairly made from our review of the Report. The Report itself concedes that the economic analysis undertaken was "at a qualitative level using expert judgements" given time constraints. However, the "expert judgments" it refers to are in quite dated reports and prepared specifically in regard to flooding of the Avon River.[112] As qualitative analysis it was certainly minimalist. For example, the evaluation of potential costs and benefits, for the range of identified stakeholder interests (e.g. "community", "residents — rebuilds, renovations, repairs", "residents — existing", "developers", "insurance industry") is typically by use of a few words such as "very minor", "minor", "minor moderate", "moderate", "significant". On the matters of compliance costs and impacts on property and development rights, there is scant acknowledgement (e.g. "increased compliance costs in assessing site suitability assessments", "loss of property and development rights").

[184] In the Report's evaluation of alternatives for the management of slope instability, there is no obvious recognition given to the acknowledged limitations of the area-wide modelling. That is also the case for the flooding hazard provisions, for which there is also no obvious acknowledgement of compliance costs associated with the proposed regime.

[185] We agree with Dr Sharp that discovering "the mix of approaches that provides the community with an acceptable level of risk… is not a trivial exercise if the decisions are to be informed by empirical evidence".[113] His comments capture our concerns as to where development of the Notified Version fell short. The CCC's sound technical approach to natural hazard risk assessment was significantly let down by its deficient follow through in testing alternative regulatory approaches. The nett result is seen in the most significant deficiencies we have identified in the Notified Version.

OUR EVALUATION UNDER S 32AA

[186] As s 32AA requires, we have evaluated the Proposal as modified by this decision, as against other available approaches. Specifically, that has included the Notified Version and various changes that have been recommended to that Notified Version by expert witnesses and in submissions.

112 One dated December 2003, and the other dated November 1995.
113 Statement of evidence of Professor Sharp, on behalf of CCC, at 7.2.

[187] In our discussion of the Statutory Framework, we set out our understanding of what ss 32 and 32AA require us to evaluate. As we have set out, an aspect of that is that we must assess the efficiency and effectiveness of provisions (particularly policies and rules) in achieving the relevant objectives. As part of that assessment, we are to identify and assess the benefits and costs of the economic, social, and cultural effects that we anticipate from the implementation of the provisions. As part of doing that, we must consider what we would anticipate would be provided or reduced, by way of opportunities for economic and employment growth.

[188] As we have also noted, that exercise of evaluation is within certain boundaries. One is that we are not considering the pCRDP as a whole but a Proposal on the specific topic of natural hazards. In addition, our evaluation is only required to be undertaken for any changes that have been made to, or are proposed for, the Proposal since the Council undertook its s 32 Report on the Notified Version.

[189] We are satisfied that we are able to fulfil our obligations under s 32AA by reference to the findings we have set out in this decision on the expert evidence, and on the applicable statutory documents.

[190] That is particularly so because we have found that expert evidence to be of sufficient assistance to us in identifying the inadequacies of the Notified Version's regulatory approach and solutions for those inadequacies. While we find those inadequacies serious, in terms of imposing undue costs and uncertainties, we are also satisfied that they are overcome by the amendments we have made.

[191] As we have recorded in our findings on the expert evidence, the various amendments we make are designed to make the regime fairer for those most impacted and to reduce unnecessary regulation and attendant cost and uncertainty. We are, therefore, satisfied that the changes will (in each case and as a whole) enhance the benefits and reduce the costs of the economic, social, and cultural effects that we anticipate from the implementation of the provisions. To that extent, we can be satisfied that (in a relative sense), our changes will better provide for (rather than reduce) opportunities for economic and employment growth.

[192] Those are our findings, following s 32AA evaluation, for each of the objectives, policies and rules we have added, amended, confirmed or rejected in this decision. As such, it is unnecessary for us to repeat this in an analysis of each such provision.

[193] We are directed to report our s 32AA evaluation at a level of detail that corresponds to the scale and significance of the environmental, social, and cultural effects that are anticipated from implementation of the Proposal.

[194] In that respect, we are particularly mindful of the very personal impact the Notified Version has for individual landowners. The large number of submitters who actively engaged in our hearing (and in pre-hearing meetings and mediation sessions) speaks clearly of that. That also resonated in the fact that some submitters were understandably emotional in addressing us. For those, and many other submitters, the Notified Version has come as an unwelcome regulatory aftershock of the traumas of the earthquakes themselves.

[195] Hence, in our s 32AA evaluation, we pay particular and individual attention to each of the submitters who have sought specific relief for their properties.

[196] Our following evaluation is structured in the following order:

(a) First, we set out our evaluation of the soundness of the "risk based" approach and its application in the overall design of each of the natural hazard sub-parts (i.e. the regimes for the "slope instability", "flooding hazard" and "liquefaction" areas);

(b) Secondly, we evaluate the appropriateness of the natural hazards objectives, policies and rules. We deal first with the general provisions, before addressing provisions on each natural hazard topic.

(c) Lastly, we evaluate the requests in submissions for individual properties to be excluded from particular natural hazard areas (with associated changes to the relevant pCRDP maps).

The "risk-based" approach of the Proposal is sound and appropriate

[197] In our discussion of the expert evidence, we set out why we find that the risk-based approach that the Proposal takes to natural hazards management is soundly supported.

[198] In its written submission, T&T questioned whether use of the language of risk could conflict with the RMA's approach to natural hazards' management. Specifically, T&T queried whether objectives framed to manage risk could be at odds with "the effects language… of the RMA".[114] T&T referred to the RMA's definition of "effect" and to the fact that this was also reflected in the RMA's definition of "natural hazard", i.e.:[115]

> Natural hazard means any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.

[199] As T&T also noted, the CCC's relevant functions for giving effect to the RMA refer to "the control of any actual or potential effects of the use, development or protection of land, including for the purposes of… the avoidance or mitigation of natural hazards".[116] However, it does not follow that a risk-based approach (including objectives on risk management) is incompatible with the RMA. Looking just at the definitions referred to, "effect" is defined to include "any potential effect of high probability" and "any potential effect of low probability which has a high potential impact".[117] "Risk" is also a term connoting possibility. As such, effect is defined to encompass risk.

[200] It is within the CCC's functions under s 31(1)(b) concerning the avoidance or mitigation of natural hazards to adopt a risk-management based approach. Furthermore, as we have noted, the CRPS (to which the pCRDP must give effect) espouses a risk-based approach to natural hazards' management. Hence, we find there is no legal bar to the Proposal's risk-based approach espoused by these objectives. Rather, such an approach reflects the direction given by the CRPS. Therefore, we reject T&T's submission on this matter.

[201] In the language of s 5, we are satisfied that a risk-based approach to natural hazards management best enables people and communities to provide for their wellbeing, health and

114 T&T submission 970.
115 Definition of "natural hazard" in section 2.
116 Section 31(1)(b).
117 Section 3(e) and (f).

safety. Specifically, that is because this approach best ensures the management response (through Plan rules) is properly targeted and proportionate and best reflects community expectations.

[202] We agree with CCC's closing submissions that, for all natural hazard topics addressed by the Notified Version, the risk-based approach has been substantiated as appropriate.

Whether the slope instability provisions should be entirely rejected

[203] Section 32 directs that we "assess the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions".

[204] That direction is relevant to our consideration of the slope instability provisions. It relates to the acknowledged position (as we have addressed above) that modelling underpinning the provisions is area-based (i.e. with a degree of localised ground truthing). As the slope instability experts agreed, this "is not always sufficient to determine risk on a site-specific basis".[118]

[205] Mr Smyth, on behalf of a number of submitters whose land would be impacted by the slope instability provisions, argued for rejection of the Proposal.

[206] Part of Mr Smyth's argument was that "if the likelihood of the effect occurring is very low this balances out the severity of the effect in terms of the need to regulate".[119] We understood Mr Smyth's reference to "very low" to be to the choice of 10^{-4} as the trigger for the imposition of severe restrictions on land use and development within the various slope instability hazard areas.[120] However, the validity of the 10^{-4} benchmark or trigger (as well as the other 10^{-2} trigger) is based on the fact that it seeks to reflect community tolerance of the degree of life-safety risk of natural hazards. As we have addressed, these triggers are derived from both expert evidence and community engagement. It is meaningless for Mr Smyth to characterise such benchmarks or triggers as "very low". The proper question to ask is whether

118 Experts' Joint Statement: Memorandum summarising the slope hazard expert discussion from caucusing undertaken ('Slope Instability Experts' Joint Statement'), 13 January 2015, at para 3.

119 Closing submissions on behalf of Gurnsey & Crane (694), Tripp (679), Mason (486), Larson (680), Connor & Woodley (289, 1097), Logan & Ng (594), at para 48, referencing *Long Bay-Okura Great Park Society Inc v North Shore City Council* EnvC A78/2008 Auckland, 16 July 2008 at [309]-[321].

120 With the exception of the Cliff Collapse Area 1, where 10^{-2} is applied.

they are valid in terms of being properly informed and in accordance with community expectations of what would be unacceptable life-safety risk. That is what is anticipated by the CRPS (particularly Objective 6.2.1, as to the protection of people from "unacceptable risks"). We are satisfied that they have such validity.

[207] Mr Smyth also questioned whether it was appropriate for the Proposal to adopt a precautionary approach to land development, "where the uncertainty in relation to [natural hazard] risk" is "largely due to the lack of adequate investigation by the Council rather than an outcome of site-specific analysis".[121]

[208] On that submission, the evidence of Professor Sharp provides some support, to the extent that he stressed the importance of considering the opportunity costs (or the costs of what is being foregone, such as in land development benefits) in adopting a precautionary approach in the design of the plan.[122] However, Professor Sharp was careful to note that he was not saying that the precautionary approach should be set aside.

[209] Nor do we consider that the uncertainties of area-wide modelling are such that the slope-instability provisions should be rejected in their entirety. On the contrary, as we have discussed in our findings on the expert evidence, that evidence overwhelmingly satisfies us that the modelling and other methodology that underpins the Notified Version represents world's best practice and was appropriate.

[210] Therefore, we do not accept Mr Smyth's further argument that site-specific risk assessment was required for the formulation of appropriate slope instability plan controls.[123]

[211] Instead, the response that ought to be taken to the acknowledged limitations of area-wide modelling is what was recommended to us in the Slope Instability Experts' Joint Statement, i.e. "opportunity to undertake individual site assessment must be provided for in the plan".[124] We shortly explain the changes we have made to the Proposal to address this.

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121 Closing submissions on behalf of Gurnsey & Crane (694), Tripp (679), Mason (486), Larson (680), Connor & Woodley (289, 1097), Logan & Ng (594), at para 46.

122 Statement of evidence of Professor Basil Sharp on behalf of CCC, at 5.8.

123 Closing submissions on behalf of Gurnsey & Crane (694), Tripp (679), Mason (486), Larson (680), Connor & Woodley (289, 1097), Logan & Ng (594), at para 46.

124 Slope Instability Experts' Joint Statement, at para 3: a statement to which Mr Bell (the relevant expert called by Mr Smyth) was a signatory.

Whether the land repair, earthworks or flooding hazard provisions should be rejected

[212] We have already set out that we accept the CCC's expert evidence in support of the land repair and earthworks, and flooding hazard provisions. For completeness, we record that none of the expert evidence called by any party supported rejection (as opposed to modification) of these provisions. We have already explained how these provisions are well-supported by the CRPS.

[213] As an apparent consequence of a lack of rigour in the s 32 evaluation process, the Notified Version imposes unnecessary compliance costs and consenting uncertainties, especially in those parts of the district that fall outside the FMFO ("yolk") of the FLFMA ("egg"). However, as we shortly discuss, we are satisfied that those (and other) deficiencies are satisfactorily overcome by the changes we make to the provisions.

Whether the LAA2 liquefaction hazard provisions can be sustained

[214] As we have set out in our discussion of the expert evidence, we do not consider that LAA2 can be sustained. To the extent that the provisions here address other geotechnical hazards, we are satisfied that this matter is readily able to be addressed in the context of the subdivision and earthworks chapter, which will be the subject of a later hearing. Therefore, we reject this aspect of the Notified Version. Our decision confines provisions as to liquefaction hazard management to the LAA1 area (which we have named the "Liquefaction Management Area" ('LMA').

[215] In addition, we have confined the subdivision consent assessment matters to those pertaining to the natural hazard risks. We consider this most appropriate on the evidence so far heard. Other assessment matters will be considered when we address the subdivision chapter later in our inquiry.

The general natural hazards objectives and policies

[216] Schedule 5 to this decision is a table summarising how our decision changes the Notified Version. This summarises the key changes that our decision makes to the general natural hazard objectives and policies.

[217] As the table records, in several instances the nature of our changes is purely of a drafting nature, to improve the clarity of intention. In some cases, we have adopted refinements proposed by the CCC to this end, in its evidence. In other cases, we have further refined the CCC's recommended drafting changes. We do not discuss such changes here, as they are non-contentious and do not raise any substantive matters for consideration under ss 32 and 32AA.

Why we consider it most appropriate to retain Objective 3.3.6 in tandem with a revised Objective 5.5.1

[218] Our Strategic Directions decision included Objective 3.3.6 as to natural hazards, but recorded that we would reconsider it as part of considering this Proposal.[125]

[219] Objective 3.3.6 espouses a risk-based management philosophy. As we also discussed in our Strategic Directions decision, that philosophy is also central to the approach in the CRPS, to which the pCRDP must give effect. We consider that philosophy is appropriate, for the reasons we have already stated in this decision.

[220] A number of submitters argued that Objective 3.3.6 superseded the more general proposed Objective 5.1.1 that was included in the Notified Version.[126]

[221] We have revised Objective 5.1.1 such that it is now very similar to Objective 3.3.6. Given our revision, we consider that, when we come to use our revision powers at the end of our inquiries, we may consider it appropriate for Objective 5.1.1 to replace Objective 3.3.6. However, we have determined that we should leave Objective 3.3.6 in place for now, but have included a note, in italics, to that effect.

Revised and modified general policies "are the most appropriate way to achieve the objectives"[127]

[222] Policy 5.2.4 of the Notified Version was as follows:

> Adopt a precautionary approach to subdivision, use and development in areas at risk of natural hazards where:

125 Under cl 13(5) of the Order, we have the ability to reconsider earlier decisions, and amend them.
126 For example Mr A Willis for the Crown, Transcript, page 508.
127 RMA, s 32(1)(b).

i there is uncertainty as to likelihood and scale of a natural hazard;

ii there are multiple natural hazards, with potential cumulative effects; or

iii there is potential for serious or irreversible effects from a natural hazard.

[223] Policy 11.3.5 of the CRPS provides the following direction (as part of a policy addressing the general risk management approach):

> Where there is uncertainty in the likelihood or consequence of a natural hazard event, the local authority shall adopt a precautionary approach.

[224] We are satisfied that the Proposal, including the changes we have made to it, gives effect to the direction in CRPS Policy 11.3.5. In particular, we are satisfied that proper account has been taken of the uncertainty inherent in the area-wide modelling and other information on which hazard mapping has been undertaken. This is through the design of rules and other provisions to ensure effective site-by-site management of risks for particular properties, including through certification mechanisms we have specified for slope instability and flooding hazards regimes.

[225] We accept Dr Sharp's evidence as to the importance of considering the opportunity costs of adopting a precautionary principle or approach. As Policy 5.2.4 would be relevant to the consideration of individual consent applications, we find that it would be a source of added uncertainty and cost. As we are satisfied that Policy 11.3.5 of the CRPS is given effect through the design of the provisions, we find that Policy 5.2.4 would not serve any useful purpose.

[226] For those reasons, we have deleted it.

Explicit basis for hazard mapping — Policies 5.2.2.1a, 5.2.3.1a and 5.2.4.1a and Introduction

[227] We have included these specific policies to give guidance both for future plan change, and resource consent, processes. As we have noted, we endorse the risk-based approach of the Notified Version as appropriate. The evidence explained to us the basis upon which that approach was formulated for each of the natural hazard topics. We consider it particularly important that faith is maintained with that approach.

[228] In relation to future plan changes, that is so as to help guard against any undermining of the design of the chapter.

[229] In relation to resource consents, the policies will be of particular relevance for the consideration of applications for non-complying activities. That is, we expect that in the weighted analysis of objectives and policies for determination of whether an activity is "not contrary" to them, these policies will have particular weight given they speak of the underlying design intention of the CRDP on natural hazards' management.

[230] We have framed the Introduction on a similar basis, for the same reasons.

[231] With regard to our obligations under s 32AA, we note that the essential choice of options we have considered was between the status quo of the Notified Version and the inclusion of these policies. We are satisfied that including the policies is the most appropriate course in that it will improve transparency and, hence, assist in making the CRDP effective and efficient. As to the matters of enabling opportunities for economic and employment growth, their only significance is positive in that such enablement would be assisted by such transparency.

[232] Therefore, we find our changes are the most appropriate way to achieve the relevant objectives (both of the Proposal and of the Strategic Directions chapter).

General policy as to infrastructure — 5.2.1.3

[233] We have adopted the version of this policy as recommended by the CCC, with minor amendments. These pick up on suggestions by Mr Willis (for the Crown) and Mr Rachlin (for the Regional Council) as to the broadening of the application of paragraph (c) to apply to all infrastructure. We have also made some minor drafting clarifications.

[234] On that basis, we are satisfied that our Policy 5.2.1.3 is the most appropriate for achieving the relevant objectives. Below, we discuss other infrastructure provision issues.

Slope instability provisions — rock fall

Policy 5.2.4.1b.i — Unacceptable life safety risk, and mitigation

[235] This policy is to avoid subdivision, use and development where the activity will result in an unacceptable risk to life safety (AIFR $\geq 10^{-4}$ using the GNS Science method and parameters for establishing life safety risk), taking into account all relevant site-specific information and any mitigation proposed. It sits with Policy 5.2.4.1b.ii as to the management of subdivision use and development in regard to the risk of damage to property and infrastructure.

[236] In its submissions on our Minute as to our draft wording of this policy, CCC raised concerns about the explicit reference in our drafting to AIFR $\geq 10^{-4}$. Generally, those concerns were that such prescription may not suit some categories of more sensitive land use (e.g. retirement villages, educational institutions). Hence, the Council sought deletion of this formula to allow for greater flexibility.

[237] We do not accept the Council's submissions on this matter for several reasons. First, our inclusion of this explicit reference is on the basis of the expert evidence we have already discussed. By contrast, the Council's submission is not supported on the evidence. Secondly, we consider clarity is important on this matter, so as to avoid risks of argument and attendant uncertainty. As we have made clear, it is very important that integrity is maintained with the design intentions of this risk-based planning regime, including on the matter of what best represents community tolerance of risk. That was indeed a very strong theme of Mr Taig's evidence for the Council, as we have noted. Thirdly, if on a proper evidential basis it is demonstrated that greater stringency is warranted for certain "more sensitive" categories of activity, that can be addressed in the context of the consideration of applicable resource consent applications. We record we find Ms Carter's evidence surprising, given that the methodology caters for vulnerability. For completeness, we note that the last point could also apply where evidence demonstrates that particular activities can be treated as less sensitive (i.e. on the basis that those activities are pursued through normal resource consent application processes without prior certification).

[238] For completeness, we have renamed these risk areas as 'Rockfall Management Area', 'Cliff Collapse Management Area' and 'Mass Movement Management Area'.

Site-specific assessments and certification to provide relief from rock fall hazard restrictions

[239] The package of provisions we have included and approved in the Proposal on this topic are:

(a) Policy 5.2.4.3c — Control of hazard mitigation and hazard removal works;

(b) Policy 5.2.4.2 — Site-specific risk assessment in areas potentially affected by rock fall;

(c) Policy 5.2.4.1a — This sets out the risk basis for considering site-specific exceptions from the mapping;

(d) Rule 5.5.1.2 — Exceptions to Rule 5.5.1.1 — Rock fall AIFR Certificate.

[240] As we have noted in our discussion of the expert evidence, those who undertook expert conferencing reached a consensus, expressed in the Slope Instability Experts' Joint Statement,[128] that "the area-wide mapping and modelling is not always sufficient to determine risk on a site-specific basis. The opportunity to undertake individual site assessment must be provided for in the plan".

[241] The Slope Instability Experts' Joint Statement's recommendation, on its face, applies to all categories of slope instability hazard. The evidence satisfies us that it is appropriate to implement the recommendation for the rock fall management areas but not for the mass movement and cliff collapse areas.

[242] Specifically, the only adjustments to slope instability hazard mapping boundaries for specific submitter properties that CCC experts recommended to us, following site-specific ground truthing, were within the rock fall management areas. Furthermore, the methodology those experts have applied in making those adjustment recommendations (of which Dr Massey was a co-author) was specific to rock fall hazards.[129] For rock fall areas, the acknowledged limitations of the area-wide modelling make it important that provision is made for what the experts have jointly recommended.

128 Above, n 118 at para 3.
129 Above, n 88.

[243] By contrast, the only example where experts argued for release from a hazard area other than for rock fall, was 8 Balmoral Lane, Redcliffs (within CCMA1 and CCMA2). We explain later why we have not accepted the recommendations of Mr Bell and Mr Charters about that property.

[244] As such, the evidence only supports having a means for moderating land use restrictions for the two rock fall management areas.

[245] For those areas, the importance of finding a suitable mechanism for site-specific risk assessment and associated relief was highlighted by Mr Theelen's evidence. That revealed that, even if a landowner were to invest in a site-specific assessment that demonstrated that the continued inclusion of their property within a hazard area was unwarranted, there would be no assured or timely plan change path. In particular, the CCC did not have either a timetable for such plan changes or any dedicated budget for this.[130]

[246] The Slope Instability Experts' Joint Statement indicates that the experts contemplated plan change or resource consent processes as the means for giving effect to their recommendation.

[247] For the reasons just discussed, we do not consider it appropriate to rely on future plan change processes.

[248] The Order allows some flexibility for further changes to the modified Proposal attached to this decision, even after it has been made operative. If necessary, this can involve the notification of a supplementary proposal to make specified further changes to Chapter 5, including the hazard maps. However, we are not satisfied that relying on that relatively limited further window for change is sufficient.

[249] Therefore, in fairness to landowners we consider that a suitable mechanism for giving effect to the recommendation in the Slope Instability Experts' Joint Statement should be included in the Proposal.

[250] Some of the necessary elements of this mechanism are relatively clear:

130 Transcript, page 1039, lines 36-37.

(a) It needs to target those restrictions that the Proposal would otherwise apply to subdivision, development and use of land within the rock fall management areas.

(b) It needs to allow opportunity for full or partial release from those restrictions, where the case for doing so has been made out by a properly-defined process of site-specific assessment. Specifically, the intent is to determine whether or not the risk presented for the site in question is an AIFR materially less than 10^{-4}, according to the relevant AIFR calculation inputs (i.e. for RFMA1 or RFMA2).

(c) It needs to recognise that it is possible that the AIFR can be materially reduced by physical or engineering works that remove rock fall hazards from the land or vicinity. Therefore, it needs to provide suitable rules to enable such physical works without endangering other people or property.

(d) It needs to adequately give effect to Policy 11.3.5 of the CRPS as to the precautionary approach.[131]

[251] In light of the Experts' Joint Statement, we issued a Minute to the parties on 27 February 2015 ('Minute'). This was prior to the hearing commencement. The Minute invited parties to consider and address us on whether it would be legally viable to have a permitted or controlled activity regime involving "certification" for various hazards.[132] We also queried whether a technical assessment might be an appropriate standard for a permitted activity.[133]

[252] In their opening and closing submissions, counsel for CCC and the Crown assisted us as to applicable legal principles, including as to certification. We return to these principles shortly. However, despite the common desire of both the CCC and the Crown to find a suitable solution, neither could offer one through the course of the hearing. Mr Radich QC colourfully alluded to having scrawled a number of attempts, only to bin them.

[253] However, in view of that position, we elected to adjourn rather than close the hearing after the presentation of closing submissions.

131 That is, as noted, "Where there is uncertainty in the likelihood or consequence of a natural hazard event … adopt a precautionary approach".
132 Minute concerning aspects of Natural Hazards proposal dated 27 February 2015, at [21] (page 6).
133 Minute concerning aspects of Natural Hazards proposal dated 27 February 2015, at [10] (page 8).

[254] After giving some further consideration to this matter, on 18 June 2015 we issued a further Minute ('Further Minute') attaching a draft policy and rule ('draft provisions') and inviting parties to make submissions and comments on legal, minor or technical errors (including, in particular, whether as drafted the policy and rule framework would be *intra vires*).[134] Schedule 6 is a copy of the Further Minute.

[255] As recorded in the Further Minute, a preliminary check on the technical accuracy of the draft provisions was undertaken with Dr Yetton and Dr Wright.

[256] We received responses on behalf of the following parties:

(a) The Crown (495);

(b) KI Commercial Limited (789);

(c) Port Hills Property Owners Group Limited (847);

(d) D W and S M Collins (955) and S R Collins and P J McDonald (952) ('Collins & others');

(e) Gurnsey and Crane (694), R & S Tripp (679), R&H Larson (680), I Connor and Ruth Woodley (289, 1097) and R Logan and S Ng (594) ('Gurnsey & others'); and

(f) CCC (310).

[257] The Crown reported that it had taken advice from Dr Massey. In his memorandum of counsel for the Crown, Mr Allen noted that draft Policy 5.2.4.1 does not contain all of the parameters contained in the GNS Science Consultancy Report, and that the risk associated with the areas mapped should refer to "greater than or equal to 10^{-4}" rather than "greater than 10^{-4}". Associated with those difficulties, Mr Allen noted that the processes set out in proposed Rule 5.5.1.2a and b were not technically correct and, as such, would not achieve the draft rule's intentions.

134 Minute – Rockfall Certification – Natural Hazards Proposal, 18 June 2015.

[258] One particular issue Mr Allen pointed out was that the draft rule failed to account for a subtle but important difference between RFMA1 and RFMA2. In particular, the AIFR for each was the same ($\geq 10^{-4}$), but the input parameters for calculating that AIFR differed. In particular, the assessment of risk to derive RFMA2 is more conservative (for example, it assumes 100% occupancy and no evacuation) than RFMA1 (67% occupancy, and evacuation).

[259] Therefore, the Crown proposed refinements to the site-specific risk assessment regime in terms of which separate risk assessment processes are described for each of RFMA1 and RFMA2. The Crown's recommended processes for site-specific assessment are somewhat complex, but can be summarised as follows:

Steps	**RFMA1**	**RFMA2**
1	Apply the method for assessing the risk as set out in the GNS Science Consultancy Report 2011/311, using the parameters listed in the Table to Policy 5.2.4.1 for RFMA1 along with any relevant (i) site-specific information, (ii) other parameters in the GNS Science Report ('Calculation 1(a)')	Apply the method for assessing the risk as set out in the GNS Science Consultancy Report 2011/311, using the parameters listed in the Table to Policy 5.2.4.1 for RFMA2 along with any relevant (i) site-specific information, (ii) other parameters in the GNS Science Report ('Calculation 2(a)')
2	If the AIFR from Calculation 1(a) is greater than or equal to 10^{-4}, the rules for RFMA1 continue to apply unchanged	If the AIFR from Calculation 2(a) is 10^{-4}, the rules for RFMA2 continue to apply unchanged
3	If the AIFR from Calculation 1(a) is less than 10^{-4}, then using the same method for assessing the risk as set out in the GNS Science Consultancy Report 2011/311, calculate the AIFR using the parameters listed in in the Table to Policy 5.2.4.1 for RFMA2 along with any relevant (i) site-specific information, (ii) other parameters in the GNS Science Report ('Calculation 1(b)')	If the AIFR from Calculation 2(a) is less than 10^{-4}, the rules for the Remainder of Port Hills and Banks Peninsula Slope Instability Management Area apply.
4	a. If the AIFR resulting from Calculation 1(b) is greater than or equal to 10^{-4}, the rules for RFMA2 apply. b. If the AIFR is less than 10^{-4}, the rules for the Remainder of Port Hills and Banks Peninsula Slope Instability Management Area apply.	If the AIFR from Calculation 2(a) is greater than 10^{-4}, then using the same method for assessing the risk as set out in the GNS Science Consultancy Report 2011/311, calculate the AIFR using the parameters listed in in the Table to Policy 5.2.4.1 for RFMA1 along with any relevant (i) site-specific information, (ii) other parameters in the GNS Science Report ('Calculation 2(b)')
5	N/A	a. If the AIFR from Calculation 2(b) is greater than or equal to 10^{-4}, the rules for RFMA1 apply.

Steps	RFMA1	RFMA2
		b. If the AIFR is less than 10^{-4}, the rules for RFMA2 apply.

[260] As can be seen from Step 5(a) of the table, the Crown's recommended methodology could see land in RFMA2 treated according to the more stringent RFMA1 activity classes, where a site-specific calculation derived an AIFR greater than or equal to 10^{-4}.

[261] The Crown also sought a range of other changes, including:

(i) An express requirement that the Council regularly update the planning maps as part of the issuing of the AIFR certificates;

(ii) Greater clarification as to the proposed two year duration of certificates, including express recognition that, if an activity is commenced within a two year window or the planning maps are updated to exclude the land, re-certification is not required;

(iii) Express provision to the effect that the applicant for certification should bear the costs, including of peer review;

(iv) Changes to the Introduction section to the Proposal to make clear the purposes of certification, including to reflect the Crown's position that planning maps be regularly updated; and

(v) Simplification of draft Policy 5.2.4.2, noting that the Crown had a concern that a concept of "safeguarded" was introduced in relation to property and infrastructure where previously the Council had sought that risk to property and infrastructure was reduced to an acceptable level.

[262] As to the law regarding certification and permitted activities (particularly as to unlawful delegation, certainty that is capable of objective (and replicable) analysis and able to be readily understood by the community), the Crown referred to its opening and closing submissions. The Crown acknowledged that the assessment process involved elements of subjectivity involving expert judgment. However, with parameters objectively set, and a peer review

process, it submitted that any subjective assessment is appropriately limited such that certainty and replicability can be reliably obtained. It characterised the certification regime as a condition precedent. Once certification was obtained, the Crown submitted that the activity status would be both certain and clear to the applicant. As such, the Crown submitted that the certification regime (including its suggested amendments) met the case law requirements for legal validity.

[263] The submissions from the various landowner interests were generally supportive in principle of allowing for a certification regime, but noted various qualifications to those positions:

(a) Mr Pedley, counsel for KI Commercial, considered that the proposed approach was intra vires. That was in the sense that it provided for objective criteria through the use of a specified AIFR and a certification process with a defined methodology to be carried out by a person with specified qualifications and experience. He noted that his client did not have a direct interest in land within RFMA1 or RFMA2 but submitted that the certification regime should be extended to apply to the Cliff Collapse Management Area.

(b) Mr David Collins, for Collins & others,[135] reiterated that these submitters questioned the principle of a regulator imposing controls through a district plan with serious consequences for property owners "based, in some cases on superficial, theoretical assessment of risk". He argued that there was no urgency to impose controls and the onus should be on the regulator to show that there is actual risk and that the maps should be deleted until the Council has done proper ground truthing. Subject to those riders, he said these submitters supported "provision for exemption through provision of expert reports indicating that the risk of using a site meets a specified standard". However, he sought that the calculation of risk also takes into account mitigation for the purpose of certification.

(c) Ms Watson, for the Port Hills Property Group, recorded that this group considered, on the whole, that the proposed certification regime was "a real improvement" that would go "a long way towards addressing the issues which were

135 DW Collins and SM Collins (955); SR Collins and PJ McDonald (952).

raised by the Group over the course of the hearing". The group considered that AIFR certificates should endure for 5 years (rather than 2) before lapsing. They also considered that on-site mitigation measures that have been approved by a Chartered Professional Engineer and peer reviewed should be given recognition as an input to the calculation of AIFR for certification purposes.

(d) Mr Smyth's legal submissions for Gurnsey & others attached a letter from Mr Bell to Mr Smyth which made various comments about the draft regime in the Minute. Mr Smyth prefaced the position of these submitters by noting that the proposed policy and rule offer "a significant amelioration of the harshness of the proposed application of the area wide mapping as proposed by the Council, in particular non-complying activity status for development within Rockfall Hazard Management Area 1". He observed that this was notwithstanding that the certification process would shift "… potentially significant… investigative and peer review costs from the Council to the individual landowner". As to jurisdiction, Mr Smyth commented, "there seems to be broad agreement that certification could be used in a rule for a permitted activity on the basis that there is no unlawful delegation of a Council's decision making power and the certification process is sufficiently certain so as to be capable of objective ascertainment and is understandable to a reasonably informed lay person". However, Mr Smyth recorded that these submitters:

(i) disputed the area-wide model with respect to calculation of AIFR, and consider it inappropriate that the GNS Science report be used as a basis for site-specific modelling or subsequent certification;

(ii) were concerned as to the reference to "best practice methods" and "best practice amendments to modelling and other inputs into those calculations". For this matter, the submitters sought further expert caucusing, or the engagement of IPENZ in the promulgation of best practice methods for carrying out site-specific assessments.

(iii) sought that mitigation be taken into account for the purpose of certification; and

(iv) sought that certificates endure for five years, rather than two years.

[264] The Council indicated that it "is supportive of clear provisions that could reduce the consenting burden on property owners by reducing the activity status for activities to permitted where it found that the AIFR is to be less than the Rockfall 2 mapping threshold contained in the [pCRDP]" (sic).[136] However, the Council considered there to be "minimal benefit" for property owners obtaining a certificate, if the activity status was simply changed to discretionary activity. As such, it considered that certification should only apply to a permitted activity status. The Council emphasised that it does not support mitigation or mitigation structures as a means of achieving certification (except to the extent that the source is removed).

[265] The Council also raised a range of technical drafting concerns. However, unlike the Crown, the Council offered little drafting assistance for addressing these concerns, recording that it had not had time to do so (but would be happy to do so, if more time were made available). In summary, the Council's technical drafting concerns were as to the following:

(a) Draft Policy 5.2.4.1, in terms of which the Council submitted that:

(i) Clause (a) was expressed more as a method than a policy;

(ii) Clause b(i), in specifying a threshold of 10^{-4} , would not allow the Council to consider a "higher threshold" for " more sensitive developments, such as a school or a retirement village", or a different (perhaps lower) threshold for new greenfield developments, or industrial activities. The Council noted that this could make it more difficult to secure non-complying activity consent for suitable industrial activities (perhaps with no residential occupancy and minimal worker occupancy).

(b) Draft Policy 5.2.4.2a and c, in terms of which the Council submitted that:

(i) The drafting to be more akin to rules than policies;

(ii) The meaning of "best practice methods" was uncertain;

136 Memorandum of counsel for CCC on rock fall certification, 25 June 2015 at 2.1.

(iii) The provision should be amended to specify a minimum area for certification, considering that unacceptable levels of risk could remain for substantial parts of a site including gardens.

(c) Draft Policy 5.2.4.2b and c in terms of which the Council submitted that:

(i) The record-keeping obligation imposed was both significant for the Council (e.g. in terms of the need for database updating following site-specific assessments) and uncertain (e.g. as to how to treat reports, including those unfavourable to landowners, where certification processes were not completed);

(ii) The obligation as to regularly updating the planning maps was also uncertain (with the Council recording that it would not be acceptable if this were to bypass RMA Schedule 1 processes), and the Council sought clarity that this obligation would not extend to expired certificates.

[266] Draft Rule 5.5.1.2, in terms of which the Council:

(a) Made a similar submission to that of the Crown, namely that the method of obtaining a site-specific AIFR calculation needed to be altered so that it also referred to the different RFMA1 and RFMA2 inputs; and

(b) Also noted that the expression "the Council will issue a Rockfall AIFR certificate" did not acknowledge that the Council may have to exercise some judgment in doing so.

[267] As a whole, we found the range of submissions received particularly helpful in identifying the necessary elements of a sound regime, but were disappointed that the Council's submissions were not more helpful in offering drafting solutions for such a regime.

[268] We start with the certification regime.

[269] The Council submitted that this would offer "minimal benefit", unless it was to automatically release land from restriction in the manner of a permitted activity. We reject that submission.

[270] First, as our findings of the expert evidence make clear, there would be no justified basis for having a certification regime that resulted in the automatic release of subdivision and other land use activities from all land use restrictions, in the manner of a permitted activity. Rather, that evidence (including the Experts' Joint Statement) makes it clear that a more calibrated approach is called for.

[271] Secondly, we reject the Council's contention that the calibrated regime we have provided for would offer "minimal benefit". At the outset, we observe that this submission is not reflected in those of the several landowners who express qualified support for what we floated in the Further Minute.

[272] Procedurally, a landowner contemplating subdivision or other land use activities would be able to run an application for certification and the preparation of a resource consent application together, with little or any procedural slippage. Assuming the Council will ensure it has the internal administrative efficiencies in place to ensure proper co-ordination and assistance to landowners, we see significant benefits for landowners.

[273] As we have noted in our discussion on the Council's s 32 Report, we consider it regrettable that the Notified Version failed to provide for this matter. It is also disappointing that the Council did not address it subsequently, despite what the Experts' Joint Statement (including by the CCC's own experts) recommended.[137] It means we have less measure on whether what we have now provided for is optimal. However, we are without doubt that it is much more appropriate for achieving the relevant objectives than the Notified Version.

[274] However, the Council's concern highlights the importance of giving landowners procedural choices. In particular, where activities are classed as "non-complying", the prospects of being able to secure consent are particularly influenced by the objectives and policies of the plan. Provided that the CRDP policies give due recognition to the role of site-specific ground truthing for the purposes of consideration of non-complying activity

137 Above, n 118.

applications, some landowners may prefer to proceed by that route rather than to seek certification. We are satisfied that our Policy 5.2.4.1b is properly framed for these purposes.

[275] Other submissions were generally supportive of providing for a certification regime in the form we floated in the Further Minute, subject to addressing a number of technical and drafting issues.

[276] No-one argued that the certification regime would be ultra vires, but Mr Collins reiterated the point he made in the hearing that, in principle, the Council bore an onus as regulator to ensure the stringent burden that its proposed regulations would impose were sufficiently supported and justified. In particular, he considered that actual demonstration of risk following proper ground truthing was called for, absent which we should delete the entire proposed natural hazards regime. For the reasons we have already stated, we do not accept that we should take that approach.

[277] On the other hand, the Crown referred to its opening and closing submissions on the law as to certification and submitted that the regime (including its suggested amendments) satisfied relevant requirements of legal validity. We found both the Crown's and the Council's submissions on the applicable legal principles helpful. Both noted the two essential parameters for a legally valid rule, namely that it does not involve an unlawful delegation of the Council's decision-making powers and is not void for uncertainty. These matters are inter-related. In particular, they direct that we are satisfied that the rule itself specifies clear guidelines or principles for how certification is to be determined.[138]

[278] It is not fatal, necessarily, that the process of certification calls for judgment to be exercised. What is important, in that respect, is the nature of the judgment called for. As the Environment Court observed in *Re Canterbury Cricket*,[139] "[w]hile a condition of consent may leave the certifying of detail to another person (typically a Council officer) using that person's skill and experience, the court cannot delegate the making of *substantive* decisions" (our emphasis).

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138 Here, we note *Director-General of Conservation v Marlborough District Council* [2004] 3 NZLR 127, particularly at [27], as referred to by Mr Winchester.

139 *Re Canterbury Cricket Association Inc* [2013] NZEnvC 184 at [126], the Court citing *Royal Forest and Bird Protection Society Inc v Gisborne District Council* W2612009 and *Turner v Allison* [1971] NZLR 833 (CA), particularly Richmond J at 856.

[279] In this case, certification is not as to the appropriateness or otherwise of activities per se, or whether or not those activities comply with specified rules. Rather, as we have designed it, it is directed to the state of the land on which activities would take place and, in particular whether that land would be subject to an AIFR less than the applicable 10^{-4} threshold.

[280] Inherently, that involves judgment and associated uncertainty. However, several aspects of the process of certification, as we floated it in the Further Minute, narrow the scope for subjectivity and/or bias in the exercise of that judgement:

(a) An application for certification would need to include a report of either a Chartered Professional Engineer with experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered) providing an AIFR calculation;

(b) The calculation would have to be according to the specified methodology (in respect of which the Crown and the Council have recommended refinements, as we address shortly);

(c) The report would be subject to Council-commissioned peer review, by an independent expert with equivalent professional qualifications (in respect of which the Crown and the Council have recommended refinements, as we address shortly), and that peer review would need to concur with the calculation method and the calculated AIFR for the identified land in order that certification be given.

[281] We agree with the Crown's submission that the certification regime as we have now determined be included in the Proposal satisfies relevant case law requirements for legal validity.

[282] The Crown, and also the Council, made several recommendations for technical and drafting changes to ensure the regime more accurately aligned with the recommendations of relevant experts.

[283] We deal first with the recommendations we have accepted.

[284] We are satisfied as to the essential soundness of the methodology proposed for the processes of certification. As such, we do not consider it necessary to take up Mr Smyth's proposal for further caucusing and/or IPENZ engagement. In essence, we are satisfied that we have been sufficiently guided by caucusing to date, and by the opinions of the experts that we have noted as world-leading. A starting point for our consideration of methodology was the recommendation of the Slope Instability Experts' Joint Statement that site-specific risk assessment must follow "the agreed scientific methods as explained by GNS Science in its various technical reports available on the Council website" and "…industry best-practice".[140] Related to that, we noted that a report by Massey et al., entitled *GNS Science Consultancy Report 2011/311 Port Hills Slope Instability: Pilot Study for assessing life-safety risk from rockfalls (boulder rolls)* ('GNS Science Report') was used by the various CCC experts when they undertook site-specific assessments in order to inform their recommendations to us. We are satisfied that it is appropriate for any mechanism for site-specific assessment to require the application of the methodology of that report. There should also be some recognition of the potential for that methodology to be updated, from time to time, in accordance with best practice. However, we have tightened the expression of this methodology as was recommended by the Council, Crown and others. In particular:

(a) We have maintained the essential elements of expert certification and Council-initiated peer review. As to the topic of independent peer review, the CCC's closing submissions supported this as being the unanimous view of the geotechnical experts.[141] We found the case of 8 Balmoral Lane illustrative of the importance of peer review being Council-initiated. There, Mr Bell's work was peer reviewed by Mr Charters but we have rejected both their assessments for the reasons we state. We have also considered the question of whether having this peer review initiated by the Council could unduly expose the CCC to legal liability for negligence. For instance, that was what occurred in the example of the Raekura Place property that Mr Taig referred us to,[142] but in regard to the issuance by the Council of a building permit where the statute imposed specific duties and discretions as to natural hazard identification and response. By comparison, the Council's role in this case would be limited to the commissioning of peer review.

140 At para 4.2.
141 Closing submission on behalf of CCC, 7.27.
142 At [90].

Certification would be on the basis of information supplied by the applicant and independent experts, including the peer review expert. In addition, certification would be an administrative prior step for the purposes of informing the Council's exercise of its quasi-judicial function. We consider that the legal exposure the Council could face would be comparatively low. Given that, we consider the balance weighs in favour of maintaining this aspect of the process.

(b) Both the Council and the Crown noted, and we agree, that a problem with the draft in our Further Minute was it failed to account for the different input parameters that apply in RFMA1 and RFMA2. We have modified the calculation regime to account for that, and have largely followed the Crown's recommendations as to this.

(c) We have also tightened the methodology on the aspect of best practice, to the effect that this now references only the GNS Science Report and any updates to it by GNS Science.

[285] We now deal with a range of further matters which we have not accepted or where we have preferred an approach proposed by one party over another.

[286] There are clearly divergent views on whether structures can be considered for the purposes of certification. The Council's submission opposes allowance for structures, except where these remove the source of the hazard. For completeness, we note that our approach is that removal of a hazard will affect the AIFR calculation, but this is different from the installation of a structure to mitigate risk. For the same reason, we do not accept the submission of several landowners that we should recognise the capacity of structures to mitigate risks for certification purposes (e.g. this was sought by Mr Smyth, Mr Collins and Ms Watson).

[287] In the final analysis, what is important is whether or not site-specific calculation of AIFR, according to the specified methodology, demonstrates a material downward adjustment of the AIFR.

[288] For the reasons we have already given, we do not agree with Mr Pedley that the certification regime should be extended to apply to the CCMAs. In essence, we do not have a sound basis for doing so on the expert evidence we have considered.

[289] We do not agree with Mr Allan's submissions for the Crown that the certification regime should also allow for an upwards adjustment of land use restrictions if the site-specific assessment demonstrated that to be justified. If activities are classified as "restricted discretionary" before certification, we do not consider it would be appropriate that certification could render those activities "non-complying". The more appropriate course for making the activity classification more stringent would be a plan change, in our view. Of course, the factual situation would be highly relevant when a site-specific resource consent application was considered.

[290] On the matter of the duration of certification, we have elected in favour of retaining a two-year duration rather than extending the duration to five years as was the preference of most landowners who submitted.

[291] Whilst we acknowledge the significant investment that would be involved in securing certification, it is also important to recognise the potential for environmental conditions and circumstances to change. However, we consider it important that certification remains current and tied to activities for which resource consent applications are intended to be pursued. As certification is directed to changing activity status, it should last for such reasonable time as necessary for an application to be made and determined. The Crown supported retention of a two-year window, but clarification that re-certification would not be needed if an activity were commenced or a resource consent lodged within that time. We generally agree with that position, and have provided for a two-year window for either commencement of a permitted activity or lodgement of a resource consent application.

[292] The Crown sought an express requirement that the Council regularly update its planning maps as part of issuing AIFR certificates. By contrast, the Council opposed the draft Policy 5.2.4.2c as being "more akin to a rule". In the final analysis, we have retained Policy 5.2.4.2c, but modified its language to refer to regular notification of plan changes in order to reflect updated information from site-specific assessments. We reach that view after considering the respective positions of the Crown and Council, in terms of what the RMA specifies in terms of

the Council's functions in regard to the management of natural hazards and the administration of its plan, including plan change initiation.

[293] Fundamentally, we do not consider it appropriate to express a policy that would be so directive or mandatory as to be mistaken to override the intended discretions expressed by the RMA in plan administration. We think the Crown's approach goes too far in that regard. However, we consider the Council's alternative view too ambivalent and indeed contradictory of the design intention underpinning the Proposal. As the various experts for CCC acknowledged, the area-wide modelling underpinning the plan is inherently limited and explicit acknowledgement should be given to the validity of site-specific ground truthing in better informing the position on natural hazard risks. A plan that is fundamentally designed on a risk-based approach ought to specify an explicit policy intention that it will be regularly updated when better information is available. We consider Policy 5.2.4.2c, as we have redrafted it, serves to assist that by expressing unambiguous policy concerning the Council's administrative functions.

[294] The Council raised concerns that draft Policy 5.2.4.1 was "more akin" to a methodology. The Council did not support those submissions with case authority. We are guided by *Environmental Defence Society Incorporated v The New Zealand King Salmon Company Limited & Ors.*[143] We understand that a policy serves to give direction as to the implementation and achievement of rules, according to ss 75(1) and 76(1), RMA. Policies can give direction allowing for more or less discretion as to the administration of associated rules. The associated rule in this case is fundamentally concerned with the methodology and effect of certification. We are satisfied that Policy 5.2.4.1, in giving direction as to that methodology, is both legally valid and appropriate.

[295] However, we acknowledge the Council's concern that the language and effect of draft Policy 5.2.4.2c is closely akin to a rule. As we have drafted it, it would have largely duplicated draft Rule 5.5.1.2 in any event. To address those concerns, we have modified the expression of Policy 5.2.4.2.

143 *Environmental Defence Society Incorporated v The New Zealand King Salmon Company Limited & Ors* [2014] NZSC 38 at [111]-[116], and [127].

[296] As to the Council's concern with the expression "the Council will issue a Rockfall AIFR Certificate" in draft Rule 5.5.1.2, we do not consider any change is warranted. While it is correct that the Council may have to exercise judgment in doing so, that is only judgment in a limited sense. In particular, where an independent Council-commissioned peer review supports the methodology and calculation of AIFR presented with an application for certification, the Council will have no residual discretion.

[297] As to the Council's concern that the wording of draft Policy 5.2.4.2b would impose an onerous and uncertain record-keeping obligation, we agree that some moderation of this obligation would be appropriate. There is a clear public interest in disclosure of such information and disclosure is consistent with the CCC's statutory obligations under the RMA and the Local Government and Official Information and Meetings Act 1987. However, it should only be of information of risk revealed by certification and the policy can be more plainly and clearly expressed. We have simplified the policy to the effect that the Council will make information from site-specific assessments of risk from rock fall (which have been certified) readily publicly available.

[298] Finally, on the matter of the drafting we proposed in the Further Minute, we note one matter that for several other activities (particularly non-infrastructure related earthworks, and non-specified buildings, structures and other activities) the outcome would be that the Proposal would not include any regulation. This is within what is described as "Remainder of Port Hills and Banks Peninsula Slope Instability Management Area". The nett effect of this is that such activities would continue to be regulated as they are now, under the existing district plan. That will remain the case pending Stage 3, when it is understood that further provisions for the remainder of the Port Hills and Banks Peninsula will be considered.

[299] This was not a matter challenged by submissions made in response to the Minute, and we have maintained this approach in this decision.

[300] In a table in the Notified Version a number of activities are given full discretionary status, and a number given restricted discretionary status. We consider the matter of natural hazards to be relatively confined, and capable of ascertainment with the required technical input, assessment and peer review. The proposed assessment criteria we have included address matters such as transfer of risk to other sites. We do not consider that matters relating to slope

instability warrant intervention or submission from other parties, or a full consideration of all effects in relation to a particular consent proposal. We have also had regard to the Statement of Expectations. Having regard to all of the matters, we consider that it is more efficient and appropriate to replace the discretionary status of the Notified Version with the more focussed restricted discretionary status in our Rule 5.5.1.1.

[301] As we have earlier noted, we consider it important to also provide suitable rules to enable physical works to remove hazards without endangering other people or property. We have made some targeted changes to the Notified Version to that end.

[302] However, the evidential basis for approaching this has been minimal and largely confined to the maintenance and repair of infrastructure works.[144]

[303] On that basis, we consider that it would be prudent to retain restricted discretionary status for hazard removal works, including earthworks.

[304] We consider that these can be appropriately processed on a non-notified basis. That is because life-safety risks can be appropriately managed through technical engineering methods that the CCC can be satisfied of without the need for submissions. Therefore, we have made provision to that effect.

[305] We consider these provisions should be backed by a policy that pertains to the securing of requisite consents for hazard removal. We have made provision to that effect.

[306] We consider, with the addition of that policy, there is a properly-balanced and appropriate regime to enable those whose properties are impacted the opportunity to take steps to remove hazards so as to be able to have activities classified according to the more benign classifications we have specified.

[307] The findings we have set out lead us to the following conclusions concerning the provisions on this topic, for the purposes of our obligations under s 32AA:

144 Transcript, page 686, lines 1-39; pages 1121-1123.

(a) On the evidence before us, we have explored various options, and have assessed their relative effectiveness and efficiency, as we have set out. Specifically, we have considered and set out our findings on the submissions made in response to our Minute;

(b) As against the Notified Version (that did not include any means of relief for property owners as recommended by the Experts' Joint Statement) we are satisfied that the provisions we have included will enhance opportunity for property owners to subdivide, use and develop their land. This will be in a manner that continues to give effect to the CRPS, and will not jeopardise the health and safety, and wellbeing, of people and communities.

(c) As such, we are satisfied that the changes we make will render the Proposal better able to enable opportunities for economic and employment growth. An important matter of context, as we have noted, is that many landowners are in the position of having already invested in the purchase of their land on the basis of zoning patterns in Christchurch that, in the past, failed to take proper cognisance of natural hazard risks. While we are satisfied, for the reasons we have given, that the CRDP must now take cognisance of those risks, doing so amounts to retrofitting the planning framework against the background of those past investment choices. Part of enabling people and communities to provide for their economic wellbeing, for the purposes of s 5, RMA, is to moderate the regulatory intervention now made;

(d) Therefore, we find our changes are the most appropriate way to achieve the relevant objectives (both of the Proposal and of the Strategic Directions chapter).

Treatment of infrastructure in relation to slope instability hazards

[308] We have already addressed why we consider our Policy 5.2.1.3 as to infrastructure most appropriate for achieving relevant objectives. In addition, we have provided for the following provisions to be included in the slope instability provisions:

(a) In all slope instability areas outside of the Specific Purpose (Lyttelton Port) Zone, Rule 5.5.1.1 (Table 5.5.1.1a) provides that:[145]

(i) Repair and maintenance of existing infrastructure, including minor upgrading of existing infrastructure of electricity network providers ('f') is a permitted activity in all of the natural hazard areas;

(ii) Earthworks associated with the activities listed in ('f') referred to above is a controlled activity other than in respect to the "Remainder of Port Hills & Banks Peninsula" where it is a permitted activity;

(iii) Upgrading of existing infrastructure or development of new infrastructure (where there is a functional need to locate in the overlay), including earthworks associated with these works, is a restricted discretionary activity other than in the "Remainder of Port Hills & Banks Peninsula" where it is not regulated (with the effect that it continues to be regulated according to the existing district plan at this stage).

(b) Within the Specific Purpose (Lyttelton Port) Zone (under Rule 5.5.1.3) a bespoke set of activity classifications are provided with the following differences to the general activity classifications:

(i) Repair and maintenance of existing infrastructure (including minor upgrading of existing infrastructure of electricity network providers), and of buildings, and access ways is a permitted activity in all of the natural hazard areas. However, within the RFMA1 and RFMA2 areas, those activities are specified to also include earthworks associated with these works on flat land or where the earthworks are less than $10m^3$ cut or fill on sloping land;

(ii) That change, in regard to RFMA1 and RFMA2 is then reflected in the regime for earthworks. That is, earthworks are classified as controlled, other than when they are specified as permitted above. Permitted activity classification also applies in the "Remainder of Port Hills & Banks Peninsula".

[145] P = permitted activity, C = controlled activity, RD = restricted discretionary activity.

(iii) Upgrading of existing infrastructure is treated differently in various respects. First, this activity is grouped with buildings and access ways, including associated earthworks. For infrastructure, the proviso as to the functional need to locate in the overlay is replaced with limitation on the scope of what "upgrading" covers. That is to the effect that upgrades are limited to an increase in capacity, efficiency or security of an existing structure or route. The activity status varies. In CCMA1, it is a discretionary activity. In CCMA2, RFMA1 and RFMA2, it is a restricted discretionary activity. In the "Remainder of Port Hills & Banks Peninsula", this activity is not regulated under the Proposal (with the effect that it continues to be regulated according to the existing district plan at this stage).

[309] We find the consensus position reached as between CCC and the infrastructure providers to be supported by the weight of evidence we have considered.

"All of Port" natural hazard provisions

[310] As notified, the Council proposed a set of provisions for all slope stability management areas. LPC, based on the specific nature of activities on their site, sought through its submissions and the evidence of Mr Clease, a bespoke set of activity statuses to be included as an option to be considered by us.

[311] Ms Carter, for the Council, provided a very limited rebuttal of Mr Clease's relatively extensive evidence and provisions. In response to cross-examination by Ms Appleyard, Ms Carter agreed to provide a supplementary statement of evidence on the provisions LPC were seeking, which was filed on 10 March 2015.

[312] We have reviewed the options before us, and considered the particular circumstances of the Lyttelton Port. As Ms Carter recognises, LPC is a large single land owner and is able to fund, organise and manage work more easily than works in relation to land held under multiple ownership, and has responsibilities under health and safety legislation. She also acknowledges that the Port's location is essentially fixed and it has flat land constraints, and that many, but not all activities, are low occupancy. However, in her assessment of LPC's proposed provisions, she does not generally support controlled activity status. Nor does she consider the

more focussed approach of restricted discretionary status more appropriate than discretionary status.

[313] We disagree with Ms Carter on these matters. We consider that the very nature of the activities proposed for the Port support a lesser level of control. Coupled with that, we consider that the Port's value as strategic infrastructure is relevant in ensuring no unwarranted control is imposed. That is important because it pertains to the efficient functioning of the Port. An obvious proviso to that proposition is we need to be satisfied that the provisions and assessment criteria accompanying the activity status are effective at managing adverse effects, particularly externally to the site, in order to satisfy the requirements of Part 2, RMA. We are so satisfied, given the receiving environment. Specifically, in the locations where there are natural hazards overlays, the Port is generally surrounded by Council-owned road. This limits the impact that activities within these overlays may have on private property. There is also limited potential for "downstream" slope stability impacts as the Port land is located at the bottom of the slopes. And lastly, we consider that, in view of the range of matters that the amended Proposal would address through assessment criteria for restricted discretionary activities and controlled activities, consent conditions would able to be imposed so as to appropriately address impacts external to the Port managed area. That leads us to be also satisfied that the lesser level of control sought by LPC will be more appropriate in responding to directions under the higher order objectives and policies to both avoid impacts from natural hazards and provide for the continuation of strategic infrastructure.

[314] As such, we find in favour of the provisions proposed by LPC, as being the most appropriate for implementing the objectives of the Plan.

Subdivision assessment criteria

[315] We have confined the subdivision consent assessment matters to those pertaining to the natural hazard risks. We consider this most appropriate on the evidence so far heard. Other assessment matters will be considered when we address the subdivision chapter in our inquiry.

Other provisions

[316] As between the Notified Version and this decision, the changes we have made to the various other slope instability provisions is to improve the clarity and intention of drafting. As

such, there is nothing further we need add to our earlier findings and reasoning for the purposes of s 32AA.

Flooding hazard management provisions

[317] As noted, within the mapped FLFMA, there is a management regime aptly referred to as the Fixed Minimum Floor Overlay ('FMFO') in which a specified minimum floor level applies.

Permitted activity based on Minimum Floor Level Certificate for properties outside the Overlay

[318] The relevant provisions approved or included by this decision are:

(a) Policy 5.2.2.1(f) to "reduce potential flood damage by ensuring floor levels for new building or additions to buildings, except those unlikely to suffer material damage, are above flooding predicted to occur in a major flood event including an allowance for appropriate freeboard";

(b) Rules 5.3.1.1, P3 and P4 which specify as permitted activities "New buildings outside the Fixed Minimum Floor Overlay" and "Additions to existing buildings which increase the ground floor area of the building outside the Fixed Minimum Floor Overlay",[146] subject to the following "activity specific standard": "Minimum floor levels shall be the level specified in the Minimum Floor Level Certificate (refer to Rule 5.3.1.2)";

(c) Rule 5.3.1.2 which:

(i) Requires new buildings and additions under Rules 5.3.1.1, P3 and P4 to have a floor level greater than or equal to that specified in a Minimum Floor Level Certificate; and

(ii) Specifies that the Council "will issue" such a Certificate, that it will be valid for two years from the date of issue and will specify "the design flood level for a building calculated as the highest of the following:

[146] In each case, unless specified in P5, P6, P7, P8, or P9 in Rule 5.3.1.1.

1. flooding predicted to occur in a 0.5% (1 in 200-year) rainfall event concurrent with a 5% AEP (1 in 20-year) tidal event, including 1m sea level rise plus 400mm freeboard, as predicted by the most up to date Christchurch City Council model and any relevant field information; or

2. flooding predicted to occur in a 0.5% AEP (1 in 200-year) tidal event concurrent with a 5% AEP (1 in 20-year) rainfall event, including 1m sea level rise plus 400mm freeboard, as predicted by the most up to date Christchurch City Council model and any relevant field information; or

3. 12.3m above Christchurch City Council Datum.

(d) Rule 5.3.1.3, which provides an associated exemption from the recession plane restrictions within both the Overlay Rules 5.3.1.1 P1 and P2, and for Rules 5.3.1.1 P3 and P4 (where a Minimum Floor Level Certificate has issued).

[319] The Council and the Crown both noted the applicable principles for legal validity of a permitted activity certification regime (i.e. no unlawful delegation, not void for uncertainty). However, neither of these parties suggested these principles would be offended. We are satisfied that the certification regime we have provided for is intra vires. That is because it simply calls for a technical assessment to be made against specified criteria and by reference to the CCC's relevant information database.

[320] We now turn to the only matter of contention, our approach to recession planes.

[321] We have determined that we should specify that Minimum Floor Level Certificates should endure for two years from their date of issue. That is in simple recognition of the fact that they are based on data and predictive modelling information that could become dated. Hence, a "use by" date is appropriate.

[322] Under the Notified Version, exemptions for recession plane controls in residential areas were provided only within the Fixed Minimum Floor Overlay. Within that overlay, they were

to the effect of exempting any intrusion into the recession plane where that intrusion was necessitated by compliance with the specified minimum floor level. We have effectively extended this exemption to the wider "egg white" area.

[323] We have also reworded expression of these exceptions, for greater clarity. In effect the revised rules specify that the applicable recession planes are to be determined as if the ground level at the relevant boundary was the greater of the natural ground level or "the minimum floor level". This is the case either as set under Rule 5.3.1.1 P1 and P2 (for buildings within the Fixed Minimum Floor Overlay) or as specified in the Minimum Floor Level Certificate (for buildings outside that overlay).

[324] Ms Carter, for CCC, recommended against the approach we have taken. She supported the status quo of the Notified Version.[147] However, she considered it would be preferable to remove the recession plane exemption entirely than extend it beyond the Fixed Minimum Floor Overlay.[148]

[325] We find Ms Carter's recommended approach anomalous. We acknowledge that extending the exemption will have some environmental consequences. Specifically, those are that neighbouring properties will have proportionately less protection from sunlight loss. However, that would also have been the case under the Notified Version within the Fixed Floor Level Overlay. We can find nothing either in the evidence or the s 32 Report that can assist us on why the exemption would be appropriate inside the Overlay, but not beyond it. We accept that we do not have specific environmental effects' assessment information before us to determine, in any precise way, the relative environmental consequences of giving exemption from the recession planes or not doing so.

[326] We are required to have particular regard to the maintenance and enhancement of amenity values.[149] However, that is not a trumping consideration. In this case, we consider it overwhelmed by the greater community importance of enabling recovery, including enabling greater resilience in the construction of new dwellings and other buildings, and additions to them, in giving effect to applicable CRPS policy directives. That is the case whether buildings are within the Overlay or beyond it.

147 Carter evidence-in-chief, 10.67.
148 Transcript, page 445, line 39 to page 446, line 32.
149 RMA, s 7(c).

[327] Apart from the recession plane matter raised by Ms Carter, we are satisfied that the changes we have made generally accord with the relief pursued by submitters and the relevant expert evidence.

[328] In terms of the requirements of s 32AA, we have tested our approach against the available alternatives (i.e. exemption just within the Overlay; no exemption anywhere). For the reasons we have given, we are satisfied that our approach is the most appropriate for the relevant objectives. Our across-the-board regime will be clearer, and hence more effective and efficient. It will better enable recovery, specifically in assisting the community to secure more resilient housing. Its cost will be in the marginal difference of loss of sunlight access for some neighbours of some properties. That is outweighed by the greater community benefits that will ensue, including for recovery.

Grandfathering for building work that is imminent or in train

[329] The relevant provisions included by this decision are in Rule 5.3.1.4 — Exemption for buildings in certain circumstances where a Project Information Memorandum ('PIM') has been issued.

[330] This is to the effect of providing for a grandfathering regime such as to allow certain repair and rebuilding works to proceed. That is achieved by exempting from compliance with the requirements of Rule 5.3.1.1 P1–P4 (as to new buildings within the Flood Management Area), on specified provisos.[150] Those provisos are that:

(a) On or before the date on which Rule 5.3.1.3 becomes operative, the Council has received an application for a PIM for a new building on a specific site.

(b) In response to that application, the Council has issued a PIM that confirms the minimum floor level for the new building on that site. The PIM may be issued before or after the date at which Rule 5.3.1.3 becomes operative, but shall be based on the requirements of the relevant district plan that was operative on the date that

[150] We note that additions up to 25m^2 in any continuous period of 10 years are exempt from the minimum floor level standards by Rule 5.3.1.1 (P6).

the PIM was received, or if no rules were relevant under that plan, the New Zealand Building Code as at the date that the application was received.

(c) The exemption will cease to apply if construction of the new building is not commenced by 30 April 2018.

[331] This provision was initiated in response to submissions by two major insurance providers involved in residential and commercial rebuild and recovery — Southern Response and a further submitter in support of Southern Response, IAG.[151] Both were represented at the hearing and gave evidence.

[332] Neither the CCC nor any other party took issue with the need for transitional provisions. Southern Response pointed out that some 25,000 properties (measured by rating units) would be affected when one measures the regime of the Notified Version against what is already in place under the existing district plan.[152]

[333] In the final analysis, the points of contention (as between these submitters and the CCC) were narrow. Primarily, it centred on the CCC's preference that it apply from the time of building consent application, rather than application for the PIM. However, that was not a matter the CCC emphasised in its closing submissions. We understood the substance of the CCC's interest being as to the duration of grandfathering.[153] On the evidence and associated submissions on behalf of the insurance company submitters, we are satisfied that the practical trigger point for the grandfathering exemption should be the issuance of the PIM, on the basis that the exemption will cease to apply if construction of the new building is not commenced by 30 April 2018.

[334] For those reasons, we find that our grandfathering regime is the most appropriate for giving effect to the objectives on these matters.

151 Southern Response Earthquake Services Limited (809, FS1365); IAG (FS1438).
152 Southern Response submission 809, para 11.
153 We refer in particular to Mr Winchester's observations, as recorded on the Transcript, page 1171, lines 1-20.

Liquefaction management provisions

[335] As we have noted, we have decided to delete what the Notified Version referred to as LAA2, such that there is now only a single management area, which we have renamed the "Liquefaction Management Area" ('LMA').

[336] There is only one other substantive matter. That is our decision to classify subdivision, in Rule 5.4.2, as a controlled activity rather than a restricted discretionary activity as was the status under the Notified Version.

[337] The essential legal difference concerns the discretion available in decision-making. Subject to some exceptions under s 106, RMA, consent must be granted to a controlled activity subdivision, with the discretion limited to the setting of conditions. The decision-making discretion for a restricted discretionary activity extends to also being able to decline consent.

[338] Council witnesses explained that the Council's preference for restricted discretionary activity classification was to ensure consistency with the Council's intended approach to subdivision generally. All technical witnesses confirmed that addressing liquefaction risk was a technical issue relating to the importance of standard conditions, and they were not aware of any reasons why a consent would need to be declined. The subdivision chapter hearing commenced on Tuesday 23 June 2015, and we have yet to issue our decision.

[339] In terms of the matters we are required to evaluate, particularly under s 32AA, we find the Council's rationale for its approach unpersuasive. The evidence we tested satisfied us that all relevant resource management issues associated with liquefaction management were capable of being addressed through conditions, and as such that controlled activity status is appropriate. That is in the sense that, on truly relevant matters, there is no valid call for a discretion to decline consent. Removing that discretion (other than to the extent that s 106 provides) confers greater certainty, as is intended by the Statement of Expectations and our Strategic Directions decision.

[340] Hence we find, in terms of relevant s 32AA matters, that controlled activity classification is the most appropriate.

[341] We record that this does not signal any position we have reached on the proper activity classification for subdivision for other purposes. Nor does our decision in any way compromise what we may decide on that. That is because case law has established that the RMA allows for a "bundling" approach where activity classification is ultimately to be determined, in the round, for the activity considered as a whole (with the more restrictive activity classification prevailing).[154]

Release of properties from natural hazard areas

Acceptance of recommendations following mediation and expert conferencing

[342] In a number of cases, Panel-directed mediations between the CCC and particular submitters (often with input from experts) resulted in agreement that properties could be released in part, or completely, from particular natural hazard areas.

[343] In addition to these agreed changes, we received a number of recommendations from relevant CCC experts (following their undertaking of site-specific ground truthing) that particular properties for which submitters sought relief could be released in part or in full from natural hazard areas.[155]

[344] Those changes include recommendations made by the CCC for some adjustments of slope instability hazard area boundaries to correspond with cadastral boundaries on some properties where the relevant CCC expert was satisfied this did not give rise to any material life-hazard risks.[156] The fact that the land over which a hazard line traverses is not built on or is used as an access or driveway does not necessarily make it appropriate for the adjustment back to cadastral boundaries to be made. Things can of course change over time in terms of development patterns for any land. For example, a future house addition could be undertaken. What is important is whether the adjustment would give rise to any material life-hazard risk. One example where we were satisfied it was appropriate, following our site visit, was for 57 Morgans Valley Road.

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154 *Locke v Avon Motor Lodge* (1973) 5 NZTPA 17; *Aley v North Shore City Council* [1999] 1 NZLR 365 (HC) and confirmed in *Tairua Marine Ltd v Waikato Regional Council* HC Auckland CIV-2005-485-1490, 29 June 2006 at [30]; see also *Bayley v Manukau City Council* [1999] 1 NZLR 568 at 576.

155 For a number of other submitter properties, following site-specific ground truthing investigations, relevant CCC experts also recommended no changes.

156 For example Hills (1096), Floerl and Peacock (1120).

[345] We have accepted all such agreed or recommended changes, all of which are supported by the accepted evidence. They are listed in Schedule 7 (and will also be, as directed, shown by change to the relevant hazard maps).

Our approach to consideration of other requests for release from natural hazard areas

[346] In a number of cases, Council experts did not support the removal or relaxation of hazard area controls from properties as sought by submitters.

[347] What follows are our findings concerning remaining submitter properties, in regard to the topics of the "slope instability provisions" the "flooding — floor level and fill management areas" and the "liquefaction assessment area provisions".

[348] Those findings are informed by our findings on the expert evidence, and on the statutory framework including the CRPS. In regard to the CRPS, we have found Policy 11.3.5, as to "general risk management approach" of particular significance, including its direction that the local authority "shall adopt a precautionary approach" where there "is uncertainty in the likelihood or consequences of a natural hazard event".

[349] Where submitters requested it, we undertook individual property site inspections to assist our consideration of the evidence. The total number of site visits was 17. In some cases, individual submitters took the opportunity of these visits to further their submissions for relief. However, we emphasise that the purpose of these visits is a narrow one. It is for the purposes of assisting us to understand evidence we have heard, by putting it in context. It is not intended as an opportunity for lobbying or further representations to us outside the parameters of the hearing.

Particular submitter requests for release from slope instability provisions

[350] We have considered all of these submissions in light of Dr Yetton's evidence, which we accept, that there are limited circumstances where further site-specific investigation might result in hazard lines being moved or removed.

[351] Hazard and risk are not one and the same. This was a matter where some confusion arose for some submitters. If there are rocks that could fall, or cliffs that could fail and impact on

life or property, there is a hazard. The risk is the probability and consequences of this happening.[157]

[352] An aspect of that opinion, which we accept, is that mitigation works do not remove the hazard or justify the removal of the hazard lines.[158] The proper place for considering the effectiveness of actual or proposed mitigation works is in the consenting process.

[353] For the various submissions where the CCC has not supported requests for the full or partial release of properties from the mapped slope instability areas, we have been guided by Dr Yetton's evidence. We have determined that no change to the boundaries of mapped hazard areas is appropriate unless the evidence satisfies us that:

(a) The hazard itself is completely removed, or is demonstrated not to be present; or

(b) There are site-specific natural topographical features that provide sufficient protection to a property from that hazard.

[354] However, we have also determined that the Notified Version should be changed to provide a suitable pathway for relief where it can be substantiated that site-specific conditions (and/or potentially hazard removal works) mean that a particular property is certified to be sufficiently safe. This pathway is intended to alleviate the position for landowners who could otherwise be faced with having to rely on the uncertain prospect of a plan change.

[355] The provision of this new certification pathway will give some relief to submitters, despite the fact that, for the reasons we set out, we have declined their particular requests for full or partial release of their properties from relevant slope instability hazard areas. We now deal with these individual submitter requests by geographic location for ease of reference.

157 Council closing submissions, para 7.23.
158 Yetton Supplementary Evidence, 6 March 2015, para 3.1.

Preliminary comments as to the evidence of Mr Bell and Mr Charters

[356] Several submitters called Mr Bell as an expert in relation to their properties.[159] Mr Neil Charters, a geotechnical engineer, was also called by some submitters. We have set out our findings on aspects of their evidence, in our expert evidence discussion. That discussion explains why we prefer the contrary evidence of Dr Massey and Dr Wright[160] on the general matters of the reliability of CCC's modelling for the determination of slope instability areas. We do not repeat that here, but set out our related findings on site-specific considerations for the various submitter properties.

Connor and Woodley (289): 8 Balmoral Lane, Redcliffs

[357] Connor and Woodley sought to have CMA2 realigned on their property so that it runs along the fenceline (approximately 1.5m back from the cliff).[161] They were represented at the hearing by Mr Smyth, and called two experts — Mr Bell (earlier noted) and Mr Charters. Mr Connor also made a statement in support of his submission.

[358] Dr Massey and Mr Macfarlane gave evidence for CCC, rebutting the evidence of Mr Bell and Mr Charters, and commenting on the statement by Mr Connor.

[359] Their property at 8 Balmoral Lane is located at the top of a 12-metre excavated cliff. Photos of the site were produced in the evidence of Mr Charters and, for CCC, Dr Massey.[162] We also observed the cliff on our site visit. We attach the photographs in Schedule 8. The photos were consistent with our own observations that a number of large boulders had fallen or been dislodged from the site post-earthquakes.

[360] It was not in dispute that the cliff was a hazard and that mitigation works were required. However, the submitters disputed the degree of risk the cliff posed and therefore the justification for the location of the hazard lines on the property.

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159 Connor and Woodley (298), Gurnsey (694), Mason (603), Tripp (679), Logan and Ng (594), Larson (680). This group of submitters was represented by Mr Smyth, who also lodged a group submission in their names (1097 and FS1243), albeit with a coversheet purporting to indicate it as a submission only for Connor and Woodley.

160 Dr Wright Rebuttal, paras 6.1-6.7.

161 The submitter was also part of a group of submitters represented by Mr Smyth (1097) which objected more broadly to the objectives, policies and rules in the Notified Version.

162 Massey Rebuttal, Appendix 1, figure 2 and 2b; Charters statement of evidence, 25 February 2015, Appendix A, figure 2.

[361] For the submitters, Mr Bell considered that the CCMA2 should be removed because the cliff top showed no evidence of recession. However, he also recommended that significant remedial work be undertaken to secure part of the cliff.[163] Mr Charters,[164] who peer reviewed a report prepared by Mr Bell on the property, considered that the AIFR for 8 Balmoral Lane was less than 10^{-4}. In response to criticisms by Dr Massey of the calculations he made in his report on the site,[165] Mr Charters made some corrections in his evidence. Despite those corrections, he maintained his position that the AIFR was less than 10^{-4}.

[362] Dr Massey considered that the potential for further collapse of the cliff edge in future earthquakes could not be ruled out. That was for a range of reasons. He noted that instability was recorded for the 22 February and 13 June 2011 earthquakes and that both URS NZ Ltd and Mr Bell recommended that remediation be carried out.[166] He considered that the dimensions of the slope are similar to other unstable slopes in the Port Hills that had cliff-top recession during the 2010/11 earthquakes. He considered that a future earthquake with similar or larger ground accelerations to the February and June 2011 earthquakes could lead to cliff collapse. He also pointed to the fact that the cliff was unlikely to be as strong now as it was on 22 February and 13 June 2011 due to the accumulated earthquake-induced fracturing and deformation of the rock mass. Dr Massey also noted that stability assessments based on visual inspections alone are not adequate to assess how a slope may perform in a future earthquake.[167]

[363] Dr Massey did not agree with Mr Charters' risk assessment because it did not follow an independently peer reviewed methodology. He was unable to verify Mr Charters' risk assessment method because the steps had not been fully documented and the calculations undertaken were incorrect.

[364] The evidence of Mr Bell and Mr Charters served to demonstrate the risk that can be associated with the approach to risk assessment. Each applied their professional judgments and experience in their application of the model. They derived different AIFR from those of the CCC experts, but applied different parameters (e.g. as to the debris quantity likely to fall in

163 Statement of evidence of David Bell, paras 43 and 44.
164 Initially presented as a report appended to the Statement by Ian Connor, but leave was granted to file a late statement of evidence.
165 Dr Massey Rebuttal, 27 February 2015, paras 4.18-4.25.
166 URS NZ Limited is an engineering and construction consulting company that carried out scaling of the slope between 19 October and 14 December 2012 as described by Dr Massey in his rebuttal statement, para 4.15, footnote 12.
167 Massey Rebuttal, 27 February 2015, para 4.15 and evidence-in-chief, 13 February 2015, paras 6.20 and 6.24.

a seismic event or a variable rather than fixed occupancy rate). That gave force to Mr Winchester's closing submission that "there is also a danger [that] individual experts, even when they do use the generally accepted model, can simply manipulate inputs and assumptions on a subjective basis in order to reach an artificial target that their client's property is faced with a risk that is, in their opinion, less than 10^{-4} AIFR".[168]

[365] We do not go as far as Mr Winchester. In particular, we do not find cause to criticise Mr Bell or Mr Charters on the honesty of their approach. Rather, we accept their approaches as simply an exercise of their professional judgments in the application of the model in the circumstances they considered to apply to this property. What it points to, however, is the importance of ensuring explicitly clear methodology for any mechanism included in the CRDP for the purposes of allowing for release of properties from restrictions on the basis of site-specific ground truthing. It also highlights the importance of independence in peer review. We have considered this in making the changes we have to the Notified Version.

[366] As to the site-specific matters concerning 8 Balmoral Lane, we prefer the evidence of Dr Massey and Mr Macfarlane. We are satisfied that the modelling undertaken by GNS Science correctly identifies the existence of the hazard and the location of the hazard lines are appropriately located on the property.

[367] As such, we decline this requested relief.

Larson (680): 6 Avoca Valley Road

[368] Mr Larson owns a property at 6 Avoca Valley Road. He sought to have the MMA3 and RFMA overlays removed from his property because of its site-specific features and a proposal to deconstruct rock at source above the site.

[369] Mr Bell considered that the GNS Science "Shadow angle" approach did not take into account vegetation or potential upslope protection/remediation. He presented a revised AIFR calculation accounting for these characteristics. On these matters, we prefer Dr Wright's opinion that it would be inappropriate to rely on either vegetation (which could be removed)

168 Closing submissions on behalf of CCC, at 7.29, 7.30.

or upslope protection and/or remediation works (that do not remove the hazard, and require a maintenance regime).

[370] On the weight of evidence, we find that the MMA3 and RFMA overlays should remain unchanged for the Larson property.

Gurnsey (694) and Mason (603): 58 Zephyr Terrace, 18 Hays Rise, Governors Bay

[371] Gurnsey and Mason sought the release of their properties from the hazard overlay areas.

[372] In relation to the Gurnsey property at 58 Zephyr Terrace, Mr Bell was concerned that the RFMA1 zoning did not take "reasonable account of topographic 'forcing'" and that the RFMA1 hazard area should be removed from the dwelling and immediately adjacent areas.[169]

[373] Dr Wright gave evidence that he had concerns about Mr Bell's evidence, because even his modelling indicated rock fall runout running close to or reaching the dwelling.[170]

[374] In relation to the Mason property at 18 Hays Rise, Mr Bell referred to the gully along the south part of the land that contains four chalets. He observed that, although no boulder has come within 200m of the site, modelling indicates the possibility for topographically-constrained run out in the gully area. He recommended that an engineered 30m long bund ~3.5m high be placed across the gully as a precaution.[171] He considered that the current RFMA 'zoning' was not appropriate for that portion of the property on the end of the ridge and should be removed.

[375] Dr Wright accepted that the dwelling was at a lesser risk than the chalets, and that the risk varied across the property. However, he did not accept the level of risk to have been proven to be less than that calculated by GNS Science, and confirmed that the hazard lines should remain unchanged.[172] He accepted that, from a technical perspective, subject to detailed design, a bund could reduce the risk. However, he considered this did not mean the hazard was removed.[173]

169 Bell, para 33.
170 Dr Wright, Rebuttal, paras 8.1-8.3.
171 Bell, para 32.
172 Transcript, page 187, lines 38-39.
173 Dr Wright Rebuttal, paras 5.1-5.8.

[376] As we have not found reliable Mr Bell's evidence as to modelling, for the reasons we have stated, we do not consider we can rely on his opinion that the particular topography of either of these properties would justify the release of the properties from the hazard areas. On all matters of difference, we prefer the evidence of Dr Wright.

[377] As such, we decline this requested relief for these submitters.

Tripp (679): 42 Zephyr Terrace, Governors Bay

[378] Tripp sought removal of 42 Zephyr Terrace from the hazard areas.

[379] Mr Bell considered that there was an absence of source areas on the slopes above the property and that a major gully in the centre of the property, with extensive vegetation reduced the risk to less than 10^{-4} AIFR.

[380] Following our site visit, we issued a Minute dated 11 May 2015. In it, we recorded our observations that a deep gully to the north of the dwelling on this property would appear to reduce the hazard of rock fall from the hill above it. We asked Dr Wright to provide a further supplementary statement clarifying his rebuttal statement[174] as to whether or not the gully associated with the property would effectively reduce the AIFR risk below 10^{-4} and if so the hazard mapping that he would recommend for the property.

[381] Dr Wright filed a supplementary statement on 21 May 2015, reporting on his further site visit and explaining that he considered the property to be at risk of rock fall from two different sources. He accepted that the risk from the north is negligible due to the gully which acts as a natural rock trap. However, he went on to observe that the main risk is from a separate rock source to the west. He advised that it was the source from the west that the risk model identifies for the easterly facing part of the property. He clarified that it was this western source, rather than the slope to the north of the gully, that was the basis for the property being included in RFMA1 and RFMA2. He recommended against any change to the hazard areas.

[382] Again, for the reasons stated, we do not find reliable Mr Bell's evidence as to modelling. On the specific matters of the sources of rock fall risk and the influence of local topography

174 Dr Wright Rebuttal, 27 February 2015, paras 7.1-7.3.

and vegetation, we prefer Dr Wright's opinion. In particular, we consider it better informed of the relevant risk sources within the environment and more reliably founded on modelling assessment.

[383] As such, we decline this requested relief.

KI Commercial (789): 2 Cannon Hill Road

[384] Mr Charters gave evidence for KI Commercial on this property. He accepted the GNS Science assessment for the property and therefore agreed that the property should remain subject to CCMA2. He also proposed that, if certain engineering works were carried out, this would reduce the risk to less than 10^{-4} AIFR, and enable the future removal of the hazard area from the property.[175] Dr Wright made the obvious point that whether that is the case would depend on the specific design and works undertaken.[176]

[385] In essence, the evidence did not provide any basis for us to make any change to the CCMA2 boundaries for this property. Therefore, we decline that relief.

Logan and Ng (594): 5 Hammerton Lane, Heathcote Valley

[386] Mr Logan and Ms Ng were represented by Mr Smyth.

[387] Mr Bell gave evidence as to how he has recommended to the owners an "area-wide" solution using a ditch-and-bund construction in relation to the former rock quarry areas on the Council-owned land upslope from the property. He did not recommend for any adjustment being made now to the boundaries of the RFMA for this property.[177] In his evidence, Mr Logan explained the history of rock fall hazards affecting Hammerton Lane. We visited the property, and Mr Logan pointed out a rock fall mitigation structure he had constructed on his property, involving a catch bench and ballasted container (which Mr Bell indicated was certified by the late John Spence, a structural engineer).

175 Statement of evidence of Charters, 20 February 2015.
176 Dr Wright Rebuttal, 27 February 2015, para 11.3.
177 Statement of evidence of David Bell, paras 39–42.

[388] As to Mr Bell's recommended area-wide solution, Mr Logan explained that such works were proposed to be funded by the Council, in order to protect the few remaining houses in this location that had not been red zoned.

[389] The evidence satisfies us that it would not be appropriate to make any change to the RFMA overlay for this property at this time, given the acknowledged presence of the hazard.

[390] The relief sought by submitters concerned that area-wide solution. They sought that, once those works are completed, the hazard lines be automatically removed from their property. However, we consider that allowing for the automatic uplifting of the mapped hazard overlays under the CRDP, outside of the Schedule 1, RMA processes for plan change, is likely to be ultra vires.

[391] Mr Smyth also argued that we should consider a deferred zone where remediation works were proposed. We do not consider we have any sound basis for doing that, as we cannot safely assume that the works are certain and have no basis to safely draw any conclusions as to their effectiveness.

[392] For the reasons given, the requests for automatic uplift of hazard overlays and deferred zoning to similar effect are declined.

Stubenvoll (845): 40 Brenchley Road

[393] Ms Stubenvoll called Mr Frederick Maurer Jr, Principal Geotechnical Engineer with Coffey Geotechnics, Dr Mark Quigley, Associate Professor Active Tectonics and Geomorphology in the Department of Geological Sciences at the University of Canterbury, and Mr Marton Sinclair, a civil and geotechnical engineer.[178]

[394] Mr Maurer gave evidence as to his firm's site-specific risk assessment for 40 Brenchley Road. He considered that, although the hillside behind the site is subject to falling debris, the site was subject to a low geotechnical hazard risk.

[178] Ms Stubenvoll also tabled a compendium of various reports and other documents. In addition to evidence from the experts we name here, this included a report by Coffey Geotechnics (NZ) Ltd and a signed statement of evidence by Marton David Sinclair, dated 26 February 2015. That short evidence statement attached a report Mr Sinclair had prepared on his investigation as to the safety of siting a barn on Ms Stubenvoll's property. We have considered these additional materials.

[395] He considered hazard mitigation measures could reduce risk to life to a tolerable level (i.e. to an AIFR of 10^{-4} or better). However, as we have noted, we agree with the CCC that it is inappropriate to make any adjustments to mapped hazard areas on account of hazard mitigation works.

[396] As noted earlier, Dr Quigley gave evidence of a research paper that he had co-authored, and supplementary information that accompanied the research paper. The essence of the paper was that geology and paleoseismology play important roles in predicting future rock fall risk. Dr Quigley participated in and was a co-signatory to the Experts' Joint Statement. On that basis, he accepted the appropriateness of the GNS Science modelling for AIFR, in the Christchurch context. However, he pointed out the limitations of a statistical approach which may be not be borne out by further site-specific assessment. Dr Quigley acknowledged that in the short term, the Council's statistical approach to risk is the best mode going forward.

[397] Although Ms Stubenvoll called Dr Quigley to give evidence in support of her case to have the hazard lines removed from her property on the basis that the Council's hazard mapping had failed to take into account site specific assessment of hazard risk on her property, Dr Quigley was not advocating for the abandonment of the Council's methodology. We understood, in response to questions from the Panel, that Dr Quigley's opinion with regard to site-specific assessment was that there needed to be an ongoing assessment of hazard risk based on the best available evidence over time. Dr Quigley was supportive of a regime that would allow hazard lines to be adjusted when better information becomes available, provided that the lines were set conservatively.[179]

[398] Dr Yetton was initially of the opinion that the hazard overlays were broadly appropriate for the property and would target further site-specific investigations at resource consent or building consent stages.[180] However, after consideration of Mr Maurer's site-specific geotechnical assessment,[181] Dr Yetton agreed that there was some scope for a boundary adjustment in the RFMA overlays within the property.[182] He provided plans (R3.1 and R3.2) to show his recommended revision.

179 Transcript, page 1006, lines 24 -35.
180 Yetton, para 22.7.
181 Evidence of Frederick Maurer Jr, 26 February 2015.
182 Yetton Rebuttal, para 7.1-7.3.

[399] Mr Maurer supported Dr Yetton's suggested revisions to the RFMAs. However on the basis of Dr Yetton's approach, Mr Maurer argued that there was cause for the Panel to consider such zoning changes on the southern portion of the site (in view of similarities in landform).[183] He illustrated his position as to that on a copy of Dr Yetton's Plan R3.2.[184] We do not consider Mr Maurer's argument, by reference to that information, a sufficient or reliable basis for making further changes beyond the revisions proposed by Dr Yetton. In particular, we reach that view on the basis that there is no assessment of AIFR to support Mr Maurer's argument, and Dr Yetton has not had an opportunity to peer review the further adjustment. We consider that the certification process we have included in the Proposal will provide sufficient opportunity to address any further adjustments if the evidence supports that approach.

[400] We note Ms Stubenvoll confirmed to us that she accepted Dr Yetton's suggested revision.[185]

[401] On the basis of that evidence, we accept that relief should be granted to the extent that the hazard lines are moved as specified in Dr Yetton's plans.

Odering (726) and Radford (729): 77 and 87 Avoca Valley Road

[402] Odering and Radford requested that the hazard line overlay be removed or realigned on the properties.

[403] The submitters wished to ensure the lines were regularly reviewed and would take into account rock blasting work that had been undertaken following the earthquakes. That aspect of their relief is addressed to the extent that our decision provides for a certification regime where it can be substantiated that site-specific conditions (and/or potentially hazard removal works) mean that a particular property is certified to be sufficiently safe.

[404] However, on the basis of Dr Yetton's evidence, we find that the current condition of the land is such that no change should be made to the hazard area for this property. In particular, Dr Yetton informed us that whilst some rock blasting work had been undertaken, the hazard had not been removed and therefore the hazard area remained appropriate at this location[186].

183 Transcript, page 993, lines 8-41.
184 Exhibit 20.
185 Transcript, page 1016, line 23.
186 Dr Yetton, paras 9.1 to 9.3.

In the absence of contrary expert or other evidence, we accept Dr Yetton's evidence and decline this requested relief.

K Clinton (58): 315 Port Hills Road, Hillsborough

[405] Kathleen Clinton, at 315 Port Hills Road, Hillsborough, sought the removal of both the rock fall hazard and liquefaction assessment overlays from her property.[187] Ms Clinton urged that a site inspection be undertaken. Members of the Panel viewed the property from nearby.

[406] Ms Clinton spoke to her submission at the hearing, and explained that an engineering consultancy, Geotech Ground Engineering, was undertaking rock blasting on the site.[188]

[407] On the matter of the slope instability provisions, Dr Wright confirmed to us, in his supplementary evidence following his assessment of the property, that there was no technical justification for Ms Clinton's request that the property be released from the hazard area.[189]

[408] In the absence of any contrary expert opinion, we accept Dr Wright's evidence and decline this requested relief.

MacDonald (952) and Collins (955): 28 Zephyr Terrace and 1105 Dyers Pass Road

[409] Collins and MacDonald have adjoining properties and each sought the release of their properties from the RFMA1 and RFMA2 overlay areas. Mr David Collins attended the hearing and made representations in support of both submissions, arguing that there was insufficient justification for the properties being included. This was in particular on the basis of the distance between the rock fall source and the affected properties and the presence of vegetation on site. He argued for the same outcome for a number of properties in the rock fall catchment north of Zephyr Stream.[190] This was on the basis of his overall position that it was the Council's

187 As Schedule 7 records, the CCC recommended (and we accept) that the liquefaction assessment overlay should be removed.

188 Geotech Ground Engineering has been engaged by a number of Avoca Valley residents to undertake rock blasting work; Transcript, page 878, lines 19-28; Exhibit 17.

189 Dr Wright Supplementary Evidence, paras 6.1-6.5.

190 Collins, statement presented at hearing, dated 12 March 2015, para 4; and Transcript, page 826, lines 27-32. Mr Collins did not indicate he was representing other property owners; rather, he submitted in general that there was no justification for including the RFMA areas on about a dozen other properties in the catchment.

responsibility to justify the imposition of the restrictions and that he considered the Council had failed to do so.

[410] Under s 32AA of the RMA, it is now our responsibility to determine the most appropriate outcome for these properties on the evidence before us. Mr Collins did not call evidence in support of his submission.[191] We received ample evidence from the CCC on the issue of risk affecting these properties.

[411] We have already set out our reasons for why we accept the CCC's relevant evidence, including its underpinning modelling. In addition, we heard from Dr Yetton specifically as to the Collins and MacDonald properties. He explained that his site inspection confirmed to him the existence of rock outcrops on and above the properties, and he recommended against any change. We observed the position of those rock outcrops in relation to these properties on our site visit. We accept Dr Yetton's evidence that no change should be made for these properties and, as such, decline this requested relief.

Bundy (418) and Chambers (1480): 104 and 388 Governors Bay Road

[412] Mr Bundy made representations at the hearing and provided us with photographs of his property which he says was not affected by rock fall during the earthquakes and had not been susceptible to slips and rock fall in the time his family had owned the land. Mr Bundy was supported by a Mr Thomson.[192] Mr Chambers did not attend the hearing.

[413] Following his site visit, Dr Yetton confirmed the existence of a rock fall hazard for these properties and his opinion that the hazard lines were appropriate for them.[193] In the absence of any contrary expert opinion, we accept Dr Yetton's evidence. As such, we decline this requested relief.

191 Collins Submitter Statement, 20 February 2015, paras 8-10.
192 Transcript, from page 894, line 33.
193 Dr Yetton, paras 7.1-7.4 and 21.1-21.4.

Laryn and Blue Sun Limited (399): 110 Shalamar Drive, Cashmere

[414] Laryn and Blue Sun Limited accepted the evidence of Dr Yetton with regard to rock fall.[194] We are satisfied, on Dr Yetton's evidence, that the rock fall and cliff hazard management areas should be retained as notified in the Proposal.

Alexander (274 and 1016) and Aldridge (272): Quarry Road, Redcliffs

[415] The properties of Alexander and Aldridge at Quarry Road, Redcliffs are each within the MMA overlays. Mr Aldridge did not attend the hearing. Mr Alexander made representations at the hearing in support of his submission requesting the removal of the MMA from his land. He produced correspondence from the Council which he said indicated that the Council intended to remediate the land to enable him to rebuild. We requested supplementary evidence from Mr Theelen and Dr Wright to explain what is proposed.

[416] We heard evidence from Dr Wright[195] and Mr Theelen[196] that these properties are subject to a Council programme that could see arrangements being resolved for removal of the hazard. However, as there is presently no certainty on those arrangements, we agree with Dr Wright that the location of hazard lines remains appropriate. As such, we decline the requested relief.

Newman (1141) and Butt (1472): 148G and 148H Panorama Road

[417] Newman and Butt each requested the removal of rock fall hazard areas from their properties. Neither attended the hearing.

[418] Dr Yetton noted that he had inspected both properties. He considered it would be feasible to undertake mitigation works on the properties to enable building on the sites, but he considered that this would not remove the hazard. In his opinion there was no basis to remove the hazard lines.[197] We accept that evidence and, therefore, decline the relief sought.

194 Consent Memorandum, 20 February 2015 CCC and Submitter 399.
195 Dr Wright supplementary evidence, 16 March 2015, paras 7.9-7.12.
196 Theelen supplementary evidence, 16 March 2015.
197 Statement of evidence of Dr Yetton, paras 14.1-14.5.

Schurr (890): 20 Iles Place

[419] Mr Schurr requested that the hazard lines be removed from the property because the risk of rock fall was low. Mr Schurr did not attend the hearing. Dr Yetton inspected the site and advised that, whilst some rocks may be able to be removed and the risk mitigated, the source and hazard remained. As such, he considered the location of the RFMA on the property was appropriate and would assist in informing future decisions around mitigation works and building on site.[198] We accept Dr Yetton's evidence and decline the relief requested.

Cook (1194): 347A Worsleys Road

[420] Ms Cook submitted out of concern that the imposition of RFMA1 and RFMA2 over part of her property could mean that its restrictions applied to the whole of her property including land outside the overlays. Ms Cook's concerns were allayed by the explanation that Ms Carter for the Council gave that the restrictions only apply to the areas of the property that are within the hazard areas.[199]

[421] Ms Cook's submission demonstrates the importance of ensuring clear drafting of the CRDP as a document intended to be for, and to serve, the community. We can confirm that Ms Carter's understanding is correct. Therefore, we make no change to the boundaries of the RFMA1 and RFMA2 overlays for this property.

Johansen and Hendren (531): 10 Reservoir Lane

[422] Johansen and Hendren seek that the RFMA1 and RFMA2 hazard areas be removed from their property because works have been undertaken to stabilise the area and remove some rocks.

[423] Following inspection, Dr Yetton confirmed that some works had been undertaken. However, he considered the works to be a form of 'hazard management' rather than to remove the hazard. In his opinion, no change should be made to the boundaries of the hazard areas for this property. We accept his evidence on these matters and, therefore, decline the requested relief.

198 Dr Yetton para 11.1-11.4.
199 Tracey Cook Submitter Statement.

Taylors Mistake, Hobsons Bay and Boulder Bay baches

[424] The Taylors Mistake Association ('TMA')[200] and Taylors Mistake Association Land Company Limited ('TMALC'),[201] along with individual bach owners at Taylors Mistake and Boulder Bay,[202] made submissions seeking the removal of hazard management overlays in relation to rock fall and cliff collapse from the baches.

[425] Dr Gilpin, the treasurer of the TMA, made representations on behalf of the TMA and TMALC.

[426] Several of the baches at Taylors Mistake and Hobsons Bay have been in existence for more than 100 years.

[427] A number of them are perched very close to, and in some cases, on the rocky foreshore. Several others are further back, but located on a paper road. Rising up behind the baches and walking tracks are grassy hills. We observed various boulders on them, and a few that appeared to have rolled down towards the area of the baches. It was unclear whether or not any of these rolled as a consequence of the earthquakes, although a lack of any evident moss or lichen on some we observed indicated they may have been recently mobile. Mr Macfarlane (an engineering geologist), for the CCC, also observed previously fallen rocks in the gully upslope of bach 31.[203]

[428] We did not undertake a site visit of Boulder Bay, due to time constraints. However, we found photographs presented by Mr Abbott to give us a sufficiently clear understanding of their setting and context. In particular, photographs revealed the proximity and slope of nearby hills, and other aspects of the setting of those baches, including the location and nature of vegetation (including some large trees).

200 Submitter 1058.
201 Submitter 1059.
202 Abbott (904) and Scott(923)
203 Macfarlane evidence-in-chief, para 7.3.

[429] Dr Gilpin explained that a number of bach owners were worried that the existence of the hazard areas could put the continued existence of the baches at risk.[204] That was in the sense that it could result in their tenure arrangements being reviewed and/or terminated.[205]

[430] We record that it is not our role to make any determinations on, or seek to influence, legal tenure matters. These fall beyond the auspice of the RMA and the Order. Rather, we are to consider and determine whether the hazard overlays and associated controls on the subdivision, use and development of land are appropriate according to the specified tests in the RMA and Order.

[431] A number of individual bach owners (Mr Abbott (904), Mr Scott (923) and Ms Slemint (1057)) elaborated on their submissions at the hearing. Mr Turpin, the owner of a bach, also made representations on behalf of the bach community. None of the submitters called any expert or other evidence.

[432] For the CCC, Mr Macfarlane (an engineering geologist) gave evidence about the extent of the hazards that existed at Taylors Mistake, Hobsons Bay and Boulder Bay. He provided a table setting out the hazard assessment for individual baches and a recommendation with regard to the retention or removal of the hazard area.[206]

[433] Dr Gilpin explained that the TMA and TMALC agreed with Mr Macfarlane's assessment of the Hobsons Bay baches,[207] but did not agree with his assessments of bach 30 (cliff collapse) and 31 and 32 (rock fall) at Taylors Mistake or baches 1, 2, 4, 8, 9 and 10 at Boulder Bay (cliff collapse and rock fall hazard).[208] He indicated that he accepted that there were hazards that affected the baches. However, he questioned whether the Council had properly considered the degree of risk, given that the baches are principally occupied for leisure rather than on a permanent basis.

[434] In his rebuttal, Mr Macfarlane revised his initial view concerning some of the baches:

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204 Transcript, page 159, line 42.

205 That concern was expressed as a loss of "existing use rights" in some of the written submissions. As was explained to the submitters, s 10, RMA provides for existing use rights to enure despite changes to district plan controls.

206 Macfarlane, Attachment 1.

207 Transcript, page 957, lines 27-30.

208 Gilpin, para 24.

(a) As for Taylors Mistake, he considered that:

(i) baches 30, 31 and 32 should be included in the relatively more permissive RFMA2 (rather than RFMA1);[209] but

(ii) baches 39–43 and the TMALC land (Lot 3 DP59234) and baches 33–38 should remain in the hazard management areas notwithstanding that he considered them "relatively safe".[210]

(b) As for Boulder Bay, he considered that:

(i) baches 1 and 10 should be included in the relatively more permissive RFMA2 (rather than RFMA1);[211] but

(ii) baches 2, 4, 8 and 9 are all exposed to cliff collapse or rock fall hazard.

[435] Dr Gilpin stated that TMA and TMALC strongly opposed baches 2, 4, 8 and 9 remaining in CCMA2, and sought movement to RFMA2 at a bare minimum.[212]

[436] Mr Scott, the occupant of bach 31 at Taylors Mistake, indicated that he did not agree with Mr Macfarlane's revised assessment. He argued that the hazard lines should be removed.[213] However, as he was not an expert on these matters but a submitter with associated vested interests, we prefer Mr Macfarlane's evidence on this matter.

[437] During cross-examination, Mr Macfarlane explained that his assessment was limited to whether or not the baches were located in an area subject to a hazard, and he did not factor in the life risk model.[214] From his response to our questions, however, we understand that the AIFR did inform the judgments made because the initial GNS Science modelling was mapped, and then the baches were re-evaluated on the basis of whether or not there was a hazard.[215]

209 Macfarlane Rebuttal, para 3.4(a).
210 Mr Macfarlane confirmed that "relatively safe" meant they were just inside or outside the hazard areas but still potentially hazardous: see Transcript, page 169, lines 24-31.
211 Macfarlane Rebuttal para 3.4(a).
212 Transcript, page 958, lines 6-8.
213 Transcript, page 955, line 33.
214 Transcript, from page 168, line 45.
215 Transcript, from page 171, line 30.

[438] As for Dr Gilpin's observation that baches are for leisure usage rather than being permanent residences, we are mindful that Mr Taig accepted that it would be appropriate to tailor rules in the plan to recognise low occupancy activities (such as for baches).[216]

[439] However, our difficulty in taking this any further is that we have very little evidence on which we can adjudge typical occupancy levels. Mr Macfarlane, in his rebuttal evidence, commented that it is problematic to seek to factor in whether or not baches were occupied temporarily or on a permanent basis.[217] Dr Gilpin estimated that the average occupancy was 15%.[218] However, Mr Scott commented that he was a permanent resident and there were at least three others he understood to be permanent residents.[219] That supports Mr Macfarlane's observations.

[440] We agree that the level of occupancy can be a relevant consideration to activity status and/or assessment criteria for resource consent application purposes. For example, as Ms Beaumont explained, CCC used different assumptions including as to occupancy, when calculating AIFR for different slope instability risks.

[441] However, we do not consider ourselves equipped to undertake such an exercise for the baches, given the relatively limited and somewhat inconsistent evidence we received as to typical occupancy.

[442] That leads us to the view that the exercise of determining occupancy assumptions for the purposes of calculating AIFR, and hence the boundaries of risk management areas, is best undertaken by CCC for and on behalf of the community. That was, in essence, the evidence of Mr Taig as we have earlier noted.

[443] As such, we have determined to make no change to the Proposal on the matter of periodic leisure occupancy. However, we record that it could be a matter that the CCC could choose to revisit through a later plan change, or at the time any particular resource consent application is considered. In particular, a consent application process could allow for the assessment of life hazard risk in the context of the consideration of the suitability of conditions as to occupancy.

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216 Evidence of Anthony Taig, para 8.5.
217 Transcript, from page 69, line 41.
218 Gilpin, para 33.
219 Transcript, page 956, line 4.

[444] We accept Mr Macfarlane's evidence and agree that the method of assessment undertaken is appropriate in this context and therefore reject the submissions that seek to have the baches removed from the hazard areas. We accept the reclassification of baches as recommended by Mr Macfarlane is appropriate.

[445] As such, beyond the changes recommended by Mr Macfarlane, we decline the requested relief of the TMA and TMALC and bach occupants concerning the extent of the hazard areas at Taylors Mistake and Boulder Bay.

[446] In their submission the TMA and TMALC seek alternative relief regarding the status of activities within the hazard areas.

[447] In regard to that relief, we have added to the Proposal a process for certification that land is sufficiently hazard free as to be released from associated land use restrictions.

Zimprich (801): 9 Endeavour Place

[448] Mr Zimprich spoke in support of his submissions requesting the removal of the RFMA hazard lines from his property. Dr Wright gave evidence as to an assessment of the properties at Endeavour Place and had recommended changes to the RFMA1 and RFMA2 hazard lines on properties at 5 and 7 Endeavour Lane, and 1 and 2A Norton Close, which resulted in consequential minor adjustments to the hazard lines on 9 Endeavour Place.[220] Following Mr Zimprich's presentation to us, we requested that Dr Wright undertake a further site visit. Dr Wright subsequently filed a supplementary statement, in which he explained that he had undertaken a number of site visits in recent times.[221] Dr Wright presented an assessment report for the property and others nearby, outlining the appropriateness of the hazard lines contained in the pCRDP. Based on his assessment, Dr Wright confirmed his opinion that there was no basis to recommend any further changes to the location of the hazard lines. We have considered Dr Wright's supplementary evidence and, in the absence of any other expert evidence, we accept his opinion.

220 Wright, statement of evidence, 13 February 2015 at paras 6.5-6.9.
221 Wright, supplementary evidence, 16 March 2015.

Ballard (1020) and McIntyre (1481), Oakley (949), McLauchlin (295) and Wintrob (736): Cressy Terrace, Walkers Road and Buxtons Road, Lyttelton

[449] These submitters did not attend the hearing but lodged submissions requesting the release of their properties from RFMA1 and/or RFMA2.

[450] Dr Yetton undertook specific site assessments and confirmed the GNS Science modelling, and consequential inclusion of the properties within the relevant hazard areas is appropriate.[222] In the absence of any contrary expert opinion, we accept Dr Yetton's evidence and so decline the requested relief.

Particular requests for release from the "FLFMA" and/or "FMFO" flooding risk overlays

[451] A number of submitters sought reconsideration of the identification of their properties within the FLFMA or the FMFO for site-specific reasons.

[452] Generally, submitters requested the removal of the overlays because of concerns about their potential effect on the future development potential of their properties. A number of submissions requested changes to the activity status within the FMFO. Some submitters requested removal or adjustment of the FMFO.[223] To the extent that we have accepted the removal of the FLFMA from these properties in Schedule 7, the FMFO is also removed.[224] Appendix 5.1 to CCC's submission also identified a number of areas to be removed from the FMFO.[225] These are accepted.

[453] With the exception of the Cashmere Rural Owners,[226] the submitters who attended the hearing did not call evidence challenging the modelling undertaken by the Council witnesses.[227] A number were concerned about the potential for the overlays to detract from the development potential of their properties. Some were concerned about the negative market perception the overlay(s) for their properties.

222 Yetton, para 10.1-10.3, 12.1-12.5 and 13.1-13.4.
223 King (3); CCC Appendix 5.1 (310); Castle Rock Limited (983); Williams (1064); Alpine View Retirement Village (1125).
224 For completeness, we note that we have changed these areas to 'Flood Management Area' and 'Fixed Minimum Floor Level Overlay'.
225 Submission 310, Attachment 1, Appendix 5.1: Removal of Fixed Minimum Floor Overlay in Specified Locations; Iris Brookland, statement of evidence, 13 February 2015, paras 8.7-8.9.
226 Submitter 328.
227 Crozier (324), Bacon (731), Case (957), Castle Rock Limited (983 and 582), Lee and Sparks Road Ltd (929).

The Case family (957): Cranford Street

[454] The Case family submitted in relation to their property at Cranford Street just north of McFaddens Road on Planning Map 25. This is within FLFMA and Flood Ponding overlays.

[455] Mr Hughes-Johnson QC, counsel for the Case family, informed us that the family accepted the location of the overlays on their property at Cranford Street, but continued to seek more flexible policies to enable the development of their property.[228]

Castle Rock Limited (983 and 582): 195 Port Hills Road and 125 Scruttons Road

[456] Castle Rock Limited submitted in relation to their properties at 195 Port Hills Road (Hillview) and 125 Scruttons Road, Heathcote. Both properties are subject to the FLFMA overlay. Castle Rock Limited was represented by Ms Foxton and Mr McCulloch at the hearing. Mr McCulloch spoke to the company's submission. Castle Rock request that the FLFMA be removed from their property, or decisions in relation to it be deferred until Stage 2.

[457] Castle Rock questioned whether the modelling accurately reflected the topography of their properties at 195 Port Hills Road and 125 Scruttons Road.

[458] In the case of the property at 195 Port Hills Road, Mr McCulloch explained that prior to the earthquakes the property had resource consent for fill. However the resource consent had lapsed. Mr McCulloch wished the consideration of the FLFMA be deferred until the zoning of the property was addressed in Stage 2.

[459] In the case of the property at Scruttons Road, Mr McCulloch argued that the Council modelling did not take account of recent filling of the site which was subject to a certificate of compliance issued in 2014.[229] We have already noted our concerns about inadequate culvert maintenance. This would appear to be a contributing factor, but it is not a matter we have jurisdiction to address.

[460] In the case of the Port Hills Road property, Ms Brookland confirmed that the LiDAR data was accurate unless there had been recent lawful changes to the site level as a result of fill.

228 Memorandum of Counsel, 27 February 2015.
229 Transcript, page 924, line 36.

The positioning of the FLFMA was appropriate and could not be altered in anticipation of possible future filling of the site.[230]

[461] In the case of 125 Scruttons Road, Ms Brookland confirmed that the modelling undertaken did take into account the June 2011 earthquakes and the most recent LiDAR data, and was accurate.[231] She presented aerial photographs to show the extent of the fill.

[462] We visited the site, and accept Ms Brookland's evidence that the modelling is sufficiently accurate and the FLFMA and the FMFO are properly overlaid on both of these properties. Therefore, we decline Castle Rock's submission that the FLFMA and FMFO be removed.

Riach (1050): 22 Rugby Street

[463] Mr Hamish Riach submitted in relation to his property at 22 Rugby Street, Merivale. A small part of his property along the road frontage, and along the western boundary, is within the FLFMA.

[464] The Chair recused himself in relation to the consideration of this submission.[232]

[465] In his representations, Mr Riach explained that the FLFMA caught a small part of his property however there is a retaining wall down the western side and along the front of the property which meant there was no real risk of flooding. Mr Riach requested that the jagged line across his property should be a straight to exclude his property.[233]

[466] In light of Mr Riach's representations, we requested further evidence from Ms Brookland as to whether the FLFMA was appropriate. Ms Brookland undertook a site visit and reported that the modelling was not entirely accurate in light of development of the site. However, she considered that driveway would be affected by the FLFMA.[234] On that basis, she recommended against removal of the FLFMA, but suggested it could be shifted to the driveway.[235]

230 Brookland Rebuttal, 27 February 2015, paras 3.6-3.12.
231 Brookland Rebuttal, 27 February 2015, paras 3.1-3.5.
232 Transcript, page 950, lines 3-5.
233 Transcript, page 950, lines 11-17.
234 Transcript, page 1052, lines 21-24.
235 Brookland's third supplementary statement of evidence, 18 March 2015; Transcript, page 1056, lines 7-8.

[467] Ms Brookland's evidence was not contested. We accept that evidence and, therefore, have decided that the FLFMA is to be moved so that it now effectively only encompasses the driveway.[236]

Cashmere Park Trust and Cashmere Rural Owners (328): Henderson's Basin

[468] A submission was made on behalf of a group known as the Cashmere Park Trust and Cashmere Rural Owners. They were represented by Mr Lewis, an engineer, who owns property in Henderson's Basin and who was the signatory of the submission. Mr Lewis gave evidence in support of the group's submission. He was not cross-examined, but was questioned by the Panel.[237]

[469] The submitters requested the FLFMA and ponding areas to be removed from their properties. The submission sought that the planning maps be altered by removing the 400mm freeboard as an interim measure until more planning is carried out and works are planned, and then adjusting the flood management areas on the maps.

[470] Mr Lewis did not dispute the history of flooding in Henderson's Basin.[238] However, as we have already discussed in our section on expert evidence, Mr Lewis was critical of the Council's modelling. As we set out there, we find that the models, despite their limitations, are the best available evidence.

[471] Therefore, we decline the submitters' requested relief.

Lee, Sparks Road Garden Limited (929): Sparks Road

[472] Mr Lee is a land owner and market gardener from Sparks Road. In his written submission, he sought that focus be given to effective storm water infrastructure upgrading. He asked "Reduce flooding in all areas, reduce subdivision cost. All waterway [sic] need to be upgraded to cater for all stormwater flooding."

[473] He told us about storm water management issues in Henderson Basin and the impact of this on his business. In his view, flooding issues would be resolved if the Council better

236 Transcript, page 1056, line 7.
237 Transcript, page 975.
238 Warren Lewis, para 4; Harrington Rebuttal, para 3.2.

managed its storm water control and other physical infrastructure assets. He discussed examples of riparian planting along local stream edges, which he considered to have aggravated flooding risks. He illustrated his points with photographs.

[474] We acknowledge Mr Lee's point that sound asset management by the Council is an important ingredient for effective flooding risk management. However, it is not a substitute for sensible land use and subdivision controls (and is beyond our jurisdiction to address in any event). Flooding risks are part of the environment of parts of Christchurch, and subdivision, use and development of land needs to be prudently managed in light of those risks. We have already discussed the direction that the CRPS gives on this topic. More broadly, having sensible flooding risk management provisions in the CRDP is an important aspect of giving effect to the RMA's "sustainable management" purpose.

[475] Therefore, we decline Mr Lee's requested relief.

Bacon (731): Sparks Road

[476] Ms Bacon owns a property at 376 Sparks Road and was concerned that the FLFMA overlay would preclude further residential development of the site. We have considered her submission and note that the existence of the FLFMA does not preclude a property owner from applying for a resource consent, but rather requires the particular circumstances to be assessed at the time. We decline Ms Bacon's requested relief.

Crozier (324): Croziers Road, Cranford Basin

[477] Mr and Mrs Crozier did not attend the hearing but lodged a submission seeking the rezoning of a part of their land that they proposed to subdivide at 60 Croziers Road that is to be rezoned as part of Stage 2. The submission describes the land as a small pocket of relatively elevated land sandwiched between the existing residential area to the south and the Cranford storm water management area to the north. The extent of the land is shown in a subdivision concept plan in attachment A to the submission ('subdivision plan'). Planning Map 25 shows a small area of the northern boundary of the subdivision plan as being subject to the FLFMA and Flood Ponding overlays. Although the submission does not expressly seek the removal of the overlays, the Council addressed the submission in its evidence.

[478] Ms Brookland indicated that the overlays were appropriately located on the property, and recommended against reducing the ponding areas. However Ms Carter recommended some reduction of the overlay, i.e. "remove ponding only, maintain FLFMA".[239] We have considered the written submission and note that the adjustment affects a very small portion of the subdivision plan. Removal of this area from the ponding overlay will be of assistance to Mr and Mrs Crozier in seeking the rezoning of their land, and is unlikely to impact on the functioning of the Cranford Basin stormwater management area. We accept the recommendation of Ms Carter to make the minor adjustment to remove the ponding area from the land within the subdivision plan.

[479] In this decision, we make no determination as to the requested rezoning relief. This will be determined as part of Stage 2 of our inquiry.

Smoothing of flooding hazard lines

[480] Council witnesses explained that it would be possible to "smooth" the boundary lines of the FLFMA in a manner that would not result in any addition of any sites to the FLFMA. By minute, we directed the Council to provide an updated set of planning maps to implement this refinement.[240] As a number of further changes will be required to those maps to implement changes made by this decision, we have made a direction to the Council to provide us with a further updated set of maps.

CCC (310) various additions to FLFMA

[481] The Council seeks to replace the relevant planning maps with maps that include areas within and adjacent to stream channels which create gaps in the FLFMA due to modelling idiosyncrasies. The additions are detailed in Appendix 5.2 to the Council's original submission (310) and are addressed in the evidence of Ms Brookland.[241] We have considered those changes and agree that they are necessary to ensure the accuracy of the planning maps. Without the proposed additions there is clearly an anomaly in that areas of land adjoining streams and waterways are not captured by the provisions in the plan. We accept those changes as requested.[242]

239 Carter evidence-in-chief, Appendix G.
240 Minute – Smoothing of Natural Hazard Lines Relative to Flooding, 22 June 2015.
241 Brookland evidence, 13 February 2015, para 8.1-8.6.
242 Shown in Schedule 7.

Particular requests for release from the liquefaction assessment area provisions

Vivian and Currie (312): Worsleys Road

[482] Vivian and Currie submitted in relation to their property at 14A Worsleys Road. They argued that their property should be excluded from the LAA1 area on the basis that there was no liquefaction on their property during the earthquakes.

[483] For CCC, Mr Kingsbury explained that that the lack of liquefaction during the 2010/2011 earthquakes was not evidence that liquefaction would not occur in the future. Mr Kingsbury gave evidence that the LAA1 classification simply indicates that the soils generally have a greater potential for liquefaction to occur than LAA2 areas and that more detailed investigations may be required to determine the appropriateness of a site for development. In his opinion, the property was in an area more susceptible to liquefaction than those identified in LAA2.[243]

[484] We note that we have determined there is to only be one Liquefaction Management Area ('LMA'). In the absence of any contesting expert opinion on this matter, we accept Mr Kingsbury's evidence and decline the relief sought by Vivian and Currie.

Laryn and Blue Sun Limited (399): Shalamar Drive

[485] In relation to Laryn, Mr Kingsbury also confirmed the appropriateness of the LAA1 overlay. The submitter accepted that position.[244] As such, we decline the relief sought (although noting we have changed the area title to LMA).

Lyttelton Port Company Limited (915)

[486] LPC sought the removal of port reclaimed 'flat land' from the LAA1 and a change of status of activities on reclaimed land. It called evidence as to planning issues, particularly focussed on its concerns as to the status of activities within the LAA1 (now LMA) which we address above. Mr Anderson, a geotechnical engineer, gave evidence for the Council that even if the exact technical performance of the land would not meet the geological definition of

243 Kingsbury para 10.1 and 10.2
244 Consent Memorandum, 20 February 2015.

liquefaction it is more maybe akin to things like cyclic mobility which is an associated phenomenon with liquefaction.[245] Mr Anderson was of the opinion that for consistency with the hazard management of land known to be prone to the effects of strong earthquake shaking and possibly liquefaction, it is appropriate that the reclaimed land at Lyttelton Port be included within LAA1 (now LMA). Mr Clease, who gave planning evidence for the LPC accepted the LMA as a proxy for potential land damage to occur.[246] In light of this, we accept Mr Anderson's evidence, including that the LMA overlay is appropriate and reject the LPC submission seeking its removal.

Submitters seeking release from hazard areas who were not heard

[487] In the case of the submitters who were not heard, we record that we have considered each submission but, in the absence of evidence supporting the removal of the hazard lines, we have declined to do so.

Evaluation of specific changes to various provisions

[488] As can be seen from Schedule 5, we have decided to make a host of changes to provisions of the Notified Version. We are satisfied that these changes, individually and together, are more appropriate, in terms of the various matters we must consider under s 32AA. We have already set out our reasons for preferring these provisions over the other alternatives.

[489] Our evaluation below is of those key changes we have made to reduce unnecessary regulation and attendant cost and uncertainty.

Replacement of provisions

[490] When making this decision, we are required to identify those parts of the existing district plans that are to be replaced.[247] To that end, the Council included, with the Stage 1 proposals, tables identifying those provisions in the existing district plan to be replaced. For this decision, we have considered those parts of the table relevant to the Natural Hazards proposal.

245 Anderson dated 13 February 2015, paras 5.1-5.10.
246 Evidence of Jonathan Clease, 20 February 2015, para 35.
247 Order, cl 13(3).

Schedule 3 identifies some provisions of the existing district plans that it would be appropriate to delete or replace.

Overall evaluation and conclusions

[491] In light of the submissions and evidence we have considered, and for the reasons we have set out, we are satisfied that:

(a) We have exercised our function, in making this decision, in accordance with the provisions of Part 2, RMA (there are no applicable regulations).

(b) As part of the CRDP, the Natural Hazards proposal in Schedule 1 to this decision will:

(i) accord with and assist the Council to carry out its statutory functions for the purposes of giving effect to the RMA;

(ii) give effect to NPSET, the NZCPS and the CRPS (to the extent relevant);

(iii) duly align with other RMA policy and planning instruments, the land use recovery plans and the Order (including the Statement of Expectations).

(c) As part of the CRDP, the objectives we have included in Schedule 1 (individually and collectively), and the changes we have listed in Schedule 7 are the most appropriate for the district and will achieve the purpose of the RMA. We are also satisfied that they accord with the Statement of Expectations.

(d) As part of the CRDP, the provisions we have included in Schedules 1 and 7 (individually and collectively) are the most appropriate for implementing the objectives.

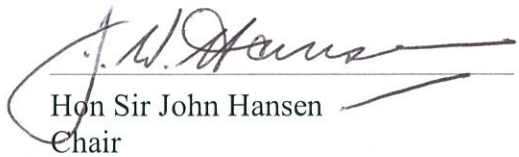
[492] This decision therefore amends the Notified Version in the manner set out in Schedules 1 and 7.

[493] We direct the Council to provide the Panel with an updated set of planning maps to give effect to this decision.

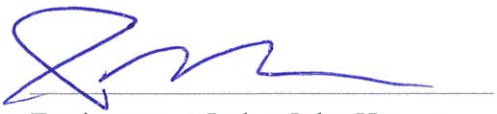
[494] A second decision will then issue to the effect of further amending the Notified Version by inclusion of updated planning maps. For those purposes, we direct the Council to provide to the Panel, within 14 working days of the date of this decision, an updated set of maps.

Dated 17 July 2015

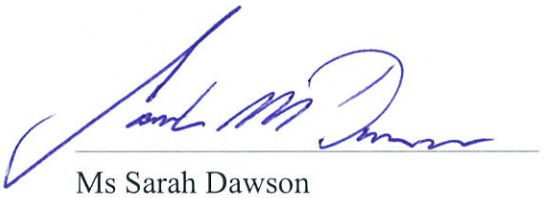
For the Hearings Panel:



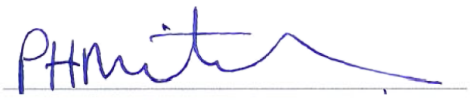
Hon Sir John Hansen
Chair



Environment Judge John Hassan
Deputy Chair



Ms Sarah Dawson
Panel Member



Dr Philip Mitchell
Panel Member

Ms Jane Huria
Panel Member

SCHEDULE 1

Changes that the decision makes to the Proposals

Change Proposal 2 Definitions (Part) by:

(a) Deleting the definitions shown to be replaced and replacing those deleted provisions with the following definitions as specified; and

(b) Including in Proposal 2 the other definitions shown to be included; and

Change Proposal 5 Natural Hazards (Part) by:

(a) Deleting all of the provisions on that proposal; and

(b) Replacing those deleted provisions with the following provisions as specified; and

Change associated pCRDP hazard maps:

(a) To give effect to the relief described in Schedule 7.

Chapter 2 – Definitions (Part)

(a) Definitions to be replaced

Critical infrastructure[1]
means infrastructure necessary to provide services which, if interrupted, would have a serious effect on the communities within the Christchurch District and which would require immediate reinstatement. This includes any structures that support, protect or form part of critical infrastructure. Critical infrastructure includes:

a. Christchurch International Airport;
b. Lyttelton Port of Christchurch;
c. Gas storage and distribution facilities;
d. Electricity sub-stations, networks and distribution installations, including the electricity distribution network;
e. Supply and treatment of water for public supply;
f. Storm water and sewage disposal systems;
g. Telecommunications and radiocommunications installations and networks;
h. Strategic road and rail networks (as defined in the Canterbury Regional Land Transport Strategy);
i. Petroleum storage and supply facilities;
j. Public health care facilities, including hospitals and medical centres;
k. Emergency service facilities; and
l. New Zealand Defence Force facilities.

Hazard mitigation works[2]
for the purposes of Chapter 5 Natural Hazards in relation to slope instability hazards, means engineering works to prevent and control land instability, rockfalls, boulder roll and the extent of debris travel and includes the building of rockfall protection structures, the mechanical fixing of rocks in-situ, the re-contouring of slopes and/or land and any necessary on-site geotechnical investigations required as part of the works. Retaining walls not required for a hazard mitigation purpose are excluded from this definition.

High flood hazard
means subject to inundation events where the water depth (metres) x velocity (metres per second) is greater than or equal to 1, or where depths are greater than 1m, in a 0.2% AEP (1 in 500-year) flood event (as identified in the Canterbury Regional Policy Statement, Chapter 11) and shown on the planning maps.

1 Note: this definition may be amended as part of the Panel's decision on the Definitions Proposal.
2 Note: this definition may be amended as part of the Panel's decision on the Definitions Proposal.

Infrastructure[3]
for the purposes of Rule 5.5.1, means water mains, sewerage mains, pump stations and reservoirs, electricity networks and sub-stations, telecommunications networks, the strategic road network, other roads, rail and bulk storage fuel facilities and associated pipelines, but does not include services from the street to residential units.

Pressurised injection
for the purposes of Rule 5.3.2, means injection of grout at more than 40 bar at the pump.

Strategic infrastructure[4]
means those necessary infrastructure facilities, services and installations which are of greater than local importance, and includes infrastructure that is nationally significant.

Explanatory note

The following are non-exclusive examples of strategic infrastructure:

a. strategic transport networks;
b. Christchurch International Airport;
c. Lyttelton Port of Christchurch;
d. bulk fuel supply and storage infrastructure including terminals, wharf lines and pipelines;
e. defence facilities;
f. strategic telecommunication and radiocommunication facilities;
g. the National Grid; and
h. public water supply, wastewater and stormwater networks and associated facilities.

(b) Definitions to be included

Minor upgrading of the existing electricity network
for the purposes of Rule 5.5.1, means increasing the carrying capacity, efficiency and security of electricity and associated telecommunications facilities, and utilising the existing support structures or structures of a similar scale and character, and includes the:

a. addition of circuits and/or conductors;
b. re-conductoring of the line with higher capacity conductors;
c. re-sagging of conductors;
d. addition of longer or more efficient insulators;

[3] Note: this definition may be amended as part of the Panel's decision on the Definitions Proposal.
[4] Note: this definition formed part of the Panel's Strategic Directions and Strategic Outcomes decision and may be amended as part of the Panel's decision on the Definitions Proposal.

e. addition of earthwires (which may contain telecommunication lines, earthpeaks and lightning rods); and
f. replacement or alteration of existing telecommunication antennas.

Minor upgrading shall not include an increase in voltage of the line.

Repair and maintenance of existing infrastructure
for the purposes of Rule 5.5.1, means repairing and keeping a structure, land or vegetation in good and safe condition and includes upgrading and minor alterations provided that any upgrading or minor alteration does not materially increase the footprint, height or external envelope of the structure.

Chapter 5 Natural Hazards (part)

Contents

Introduction

Natural hazards are defined in the Resource Management Act 1991 as:

> *any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.*

This chapter identifies the ways in which the impacts from a range of natural hazards can be managed, particularly in relation to the use, development and maintenance of land, buildings and infrastructure.

Natural hazard risk can arise from:

- intense rainfall events causing flooding from rivers, streams, overland flow and lakes;
- earthquakes;
- liquefaction;
- slope instability, being cliff collapse, rockfall or boulder roll, and mass movement;
- tsunami;
- inundation from the sea and storm surge;
- coastal erosion;
- fire;
- exacerbation of some of the hazards above through climate change and sea level rise; and
- multiple hazards consisting of combinations of the above.

The primary approach to managing natural hazards in this Plan is to take what is called a "risked-based" approach. Such an approach considers various scales of a particular natural hazard event (for example different magnitude earthquakes and different intensities and durations of rainfall events), together with the likelihood of that particular event occurring and the effects that it would cause, particularly on people and property.

In this chapter, risk is expressed in a number of ways. For example, in areas at risk from slope instability such as cliff collapse, rockfall, or mass movement, it is the degree of risk to people's lives that is of primary concern. In most areas at risk from flooding, the primary concern relates to damage to property and how often this may occur.

In areas of slope instability, risk is expressed as an "Annual Individual Fatality Risk" or AIFR, being the probability of a fatality for an individual occupying a specific site in any one year as a result of slope instability. Calculating this risk involves a number of underlying assumptions such as the percentage of time an individual is on site or in a dwelling, the level of seismicity (taking into account that the Canterbury earthquakes are expected to decrease over time) and whether or not people would be evacuated following a major seismic event. Given the range of inputs into AIFR, there is an uncertainty in the calculated value of the AIFR which can mean there is a higher or lower level of actual risk. Recognising this, and the area-wide scale of the slope instability mapping, a process has been included that allows for rockfall risk to be

recalculated on a site-specific basis through an independent risk assessment that has been supported by an independent peer review.

In areas of flooding, the term "Annual Exceedance Probability" or AEP is used to describe the likelihood of a flooding event of a certain size occurring. This is a different way of expressing the commonly used term "return period" – for example a storm with a return period of 200 years has an AEP of 1/200 (i.e. the reciprocal of the return period) or 0.5%, and means there is a 0.5% chance of a storm of that size happening in any one year.

In areas where there is likely to be a liquefaction risk to property, no specific measure of risk is applied. The area mapped is based on whether liquefaction is more likely to occur than not. Within that area, liquefaction risk and appropriate mitigation is assessed on a site specific basis using best practice geotechnical and engineering methods to determine the performance of infrastructure and buildings.

The level of control over activities in the plan is related to the consequence of the various natural hazards and whether such risks are considered to be acceptable or not. There is also a category in between where following proper assessment risk may be able to be managed such that the risk is reduced to acceptable levels.

In locations where the risk from natural hazards is considered to be unacceptable and such risks cannot practically be reduced to acceptable levels, new activities in those areas are generally to be avoided. This includes areas such as Cliff Collapse Management Area 1, Cliff Collapse Management Area 2 and Rockfall Management Area 1, but also includes adjacent areas where risk cannot be adequately remedied or mitigated.

Where risk from natural hazards is able to be managed to acceptable levels, the Council may require assessment and mitigation in relation to potential effects on development from natural hazards in order to reduce risk to a level that is deemed acceptable in the circumstances. Examples are Rockfall Management Area 2, the Flood Management Area and the Liquefaction Management Area. The planning maps also include Flood Ponding areas which are required for flood storage capacity, thereby reducing impacts of downstream flooding, and the function of these is recognised in the plan.

Where risk is considered to be acceptable without any interventions, and is similar to the levels of many everyday risks that people face and accept each day, there is no intervention required by the Plan.

5.1 Natural hazards objective

5.1.1 Objective – Natural hazards[1]

a. New subdivision, use and development (other than new critical or strategic infrastructure to which paragraph b. applies):

   i. Is to be avoided in areas where the risks from natural hazards to people, property and infrastructure are assessed as being unacceptable; and
   ii. In all other areas, is undertaken in a manner that ensures the risks of natural hazards to people, property and infrastructure are appropriately mitigated.

b. New critical or strategic infrastructure may be located in areas where the risks of natural hazards to people, property and infrastructure are otherwise assessed as being unacceptable, but only where:

   i. there is no reasonable alternative; and
   ii. the strategic or critical infrastructure has been designed to maintain, as far as practicable, its integrity and form during natural hazard events; and
   iii. the natural hazard risks to people, property and infrastructure are appropriately mitigated.

c. There is increased public awareness of the range and scale of natural hazard events that can affect Christchurch District.

d. The repair of earthquake damaged land is facilitated as part of the recovery.

5.2 Natural hazards policies

5.2.1 General natural hazards policies

5.2.1.1 Policy - Avoid new development where there is unacceptable risk

Avoid new subdivision, use and development, including new urban zonings, where the risk from a natural hazard is assessed as being unacceptable.

5.2.1.2 Policy - Manage activities to address natural hazard risks

Manage activities in all areas subject to natural hazards in a manner that is commensurate with the likelihood and consequences of a natural hazard event on life and property.

[1] Note: Chapter 3 Strategic Directions includes Objective 3.3.6. In a later decision, the Panel may consider it appropriate to replace Objective 3.3.6 with Objective 5.1.1 for the coherency and consistency of the Plan.

5.2.1.3 Policy - Infrastructure

a. Avoid locating new critical infrastructure where it is at risk of being significantly affected by a natural hazard unless, considering functional and operational requirements, there is no reasonable alternative location or method.

b. Enable critical infrastructure to be designed, maintained and managed to function to the extent practicable during and after natural hazard events.

c. Recognise the benefits of infrastructure and the need for its repair, maintenance and ongoing use in areas affected by natural hazards.

5.2.1.4 Policy - No transferring of natural hazard risk

Ensure that subdivision, use and development (including proposals for hazard mitigation works or hazard removal) do not transfer or create unacceptable natural hazard risk to other people, property, infrastructure or the natural environment.

5.2.1.5 Policy - Natural features providing hazard resilience

Protect natural features which assist in avoiding or reducing the risk of natural hazards, such as natural ponding areas, coastal dunes, wetlands, waterway margins and riparian vegetation from inappropriate subdivision, use and development and where appropriate restore, maintain or enhance the functioning of these features.

5.2.1.6 Policy - Awareness of natural hazards

a. Ensure people are informed about the natural hazards relating to their properties and surrounding area, including through provision of relevant information on Land Information Memoranda and hazard mapping on the Council's website.

b. Encourage property owners to incorporate measures into buildings including earthquake damaged buildings beyond existing use rights or minimum building standards to avoid or mitigate natural hazards affecting their property.

5.2.1.7 Policy - Repair of earthquake damaged land

a. Facilitate recovery by enabling property owners to make repairs to earthquake damaged land for residential purposes, where these repairs will appropriately manage adverse effects on people, property or the natural environment.

b. To recognise that the repair of other earthquake damaged land is necessary as part of recovery.

5.2.1.8 Policy – Assessment of hazards

Ensure that the level of assessment undertaken for plan changes, subdivision or development reflects the potential scale and significance of the hazard; and the nature and scale of the re-zoning, subdivision or development and its susceptibility to those hazards.

5.2.2 Policy for managing risk from flooding

5.2.2.1 Policy – Flooding

a. Map hazard risk for the Flood Management Area based on:

   i. a modelled 0.5% AEP (1 in 200-year) rainfall event plus a 5% AEP (1 in 20-year) tide event (5% AEP) plus 250mm freeboard; OR a modelled 5% AEP (1 in 20-year flood event) plus a 0.5% AEP (1 in 200-year) tide event plus 250mm freeboard; OR 11.9m above Christchurch City Datum (the maximum 200-year tidal contour) plus 250mm freeboard; whichever is the greater; and
   ii. allowance for 1 metre of sea level rise and an increase in rainfall intensity by 16% through to 2115 as a result of climate change; and
   iii. a maximum buffer extension of the modelled rainfall event areas by 60 metres in a north/south and east/west direction.

b. Avoid subdivision, use or development in areas where there is a high flood hazard where it will increase the potential risk to people's safety, well-being and property.

c. Avoid activities locating where they could undermine the integrity of the Waimakariri River primary stopbank system, and restrict activities locating where they could undermine the integrity of the Waimakariri River secondary stopbank system.

d. Maintain the flood storage capacity and function of natural floodplains, wetlands and ponding areas, including the Hendersons Basin, Cashmere Stream Floodplain, Hoon Hay Valley, Cashmere-Worsleys Ponding Area, Cranford Basin, and Lower Styx Ponding Area[2].

e. Except for filling required to meet minimum floor levels, ensure that filling in urban areas at risk of flooding in a major flood event does not transfer flooding risk to other people, property, infrastructure or the natural environment.

f. Reduce potential flood damage by ensuring floor levels for new buildings or additions to buildings, except those unlikely to suffer material damage, are above flooding predicted to occur in a major flood event, including an allowance for appropriate freeboard.

[2] This Policy does not foreclose compensatory storage being provided for where filling is required.

5.2.3 Policy for managing risk from liquefaction

5.2.3.1 Policy – Management of liquefaction risk

a. Map the Liquefaction Management Area based on a district-wide assessment of where damaging liquefaction is more likely to occur.

b. Provide for re-zoning, subdivision, use and development on flat land where liquefaction risk has been appropriately identified and assessed, and can be adequately remedied or mitigated.

5.2.4 Policies for managing risk from slope instability

5.2.4.1 Policy - Slope instability

a. Map areas of slope instability risk at an area-wide scale using the following fixed inputs into calculations[3] that establish the Annual Individual Fatality Risk (AIFR) for a typical residential site[4]:

b.

Slope instability hazard management area	**Inputs**			**Mapped risk (AIFR)**
	Percentage of a day the property is assumed to be occupied (%)	Year of predicted seismic activity used in modelling	Whether or not the property is evacuated immediately following a Natural Hazard Event	
Cliff Collapse Management Area 1	100	2012	No	$\geq 10^{-2}$
Cliff Collapse Management Area 2	100	2012	No	$\geq 10^{-4}$
Rockfall Management Area 1	67	2016	Yes	$\geq 10^{-4}$
Rockfall Management Area 2	100	2016	No	$\geq 10^{-4}$
Mass Movement Management Area 1	67	2016	Yes	$\geq 10^{-4}$

[3] Using the method and parameters described in GNS Science Consultancy Report 2011/311 Canterbury Earthquakes Port Hills Slope Stability: Pilot study for assessing life-safety risk from rockfalls (boulder rolls), and any subsequent updates to this report by GNS Science. Calculations also include modelling and estimates such as probability of a rockfall event, vulnerability, rockfall volumes, and rockfall run-out. The mapping does not take account of hazard mitigation works. Rocks can, and will, fall outside of the mapped hazard risk areas, however the risk of a fatality is lower.

[4] Except Mass Movement Management Areas 2 & 3 which are mapped based on potential effect on property, not Annual Individual Fatality Risk.

Mass Movement Management Areas 2 & 3	Refer to natural hazard maps

c. In slope instability hazard management areas in the Port Hills and across Banks Peninsula:

i. Avoid subdivision, use and development where the activity will result in an unacceptable risk to life safety (AIFR $\geq 10^{-4}$ using the GNS Science method and parameters for establishing life safety risk), taking into account all relevant site-specific information and any hazard mitigation works proposed; and

ii. Otherwise, manage subdivision, use and development so that risk of damage to property and infrastructure is mitigated to an acceptable extent.

5.2.4.2 Policy – Site-specific risk assessment for AIFR Certificates[5] in areas potentially affected by rockfall

a. Provide for site-specific assessment of risk from rockfall in accordance with the method and parameters described in Policy 5.2.4.1a.[6] (along with all relevant site-specific information) in order to allow for the issue of Rockfall AIFR certificates.

b. Make information from site-specific assessments of risk from rockfall (which have been certified by the Council) readily publicly available.

c. Regularly notify changes to the Plan, as required to change the planning maps, in order to reflect updated information from site-specific assessments of life-safety risk from rockfall which have been certified by the Council.

5.2.4.3 Policy - Slope instability for all of the Port Hills and Banks Peninsula

a. In areas not already identified in Policy 5.2.4.1a as being subject to cliff collapse, rockfall or mass movement, but where the land may be subject to slope instability:

i. to the extent appropriate require proposals for subdivision, use and development to be assessed by a geotechnical specialist to evaluate the presence of hazards and level of risk to people and property (including infrastructure) from slope instability hazards; and

ii. only allow subdivision, use and development where risk can be reduced to an acceptable level.

b. Avoid hazard mitigation works in areas of the Port Hills and across Banks Peninsula where cliff collapse or mass movement is likely to destroy or significantly damage such

5 Refer to Rule 5.5.1.2

6 This method does not take account of hazard mitigation works

works, or where construction or maintenance of hazard mitigation works creates a safety hazard, unless reasonably required to protect critical infrastructure.

c. Control hazard mitigation works and hazard removal works for slope instability across all other areas of the Port Hills and Banks Peninsula, to ensure that works:

i. are effective; and
ii. do not worsen any existing natural hazard; and
iii. do not transfer or increase the risk to other people, property, including critical infrastructure or the natural environment.

5.3 Flood hazard rules

Areas identified as being subject to high hazard flooding[7] currently exist in relation to the Waimakariri River Stopbank Floodplain only.

Areas identified as being subject to inundation in a major flooding event are identified as Flood Management Area. Within this area, where the required floors levels are certain and already established by the Council, they are identified on the planning maps as being within the Fixed Minimum Floor Level Overlay. Where they are not accurately modelled and further modelling is required, the Council will, on request, review its current information and issue a Minimum Floor Level Certificate that will certify the floor level necessary for that site based on available information.

Areas that are important for stormwater retention are also identified on the planning maps as Flood Ponding areas – there are no specific rules in relation to these however they are located in the Flood Management Area and have policies that relate to them.

5.3.1 Residential, commercial and industrial zones - activities and earthworks in the Flood Management Area

Click here for Planning Maps

5.3.1.1 Permitted activities

The activities listed below are permitted in all residential, commercial and industrial zones where the activity is located in the Flood Management Area subject to compliance with:

1. activity status rules and any standards specified elsewhere in the Plan for that activity (in particular in relation to subdivision and earthworks); and
2. the standards specified in this Rule 5.3.1.1.

Exemptions relating to this rule can be found in Rule 5.3.1.4.

[7] High hazard flooding includes areas that flood to a depth greater than 1 metre, or the depth (m) x velocity (ms^{-1}) of the over land flow is greater than 1 in a 0.2% AEP (1 in 500-year) flood event

For filling or excavation (before 31 December 2018) for repair of land used for residential purposes and damaged by earthquakes, see Rule 5.3.2.

For the purpose of determining appropriate flood levels for P1 and P2, the following models will be used:

Table 5.3.1.1a

Flood Management Area Catchment	**Model**	**Version**
Styx	Styx River Hydrologic andHydraulic Model	R004
Avon	Avon River Hydrologic and Hydraulic Model	D13
Heathcote	Heathcote River Hydrologic and Hydraulic Model	2012 Design
Sumner	Sumner Floodplain Hydrologic and Hydraulic Model	12N

Table 5.3.1.1b

Activity		**Activity specific standards**
P1	New buildings located within the Fixed Minimum Floor Level Overlay, unless specified in P5, P6, P7, P8 or P9 in Rule 5.3.1.1.	a. Minimum floor levels shall be the highest of the following: i. flooding predicted to occur in a 0.5% AEP (1 in 200-year) rainfall event concurrent with a 5% AEP (1 in 20-year) tidal event, including 1m sea level rise plus 400mm freeboard, as predicted by the relevant Christchurch City Council model and version identified in Table 5.3.1.1a; or ii. flooding predicted to occur in a 0.5% AEP (1 in 200-year) tidal event concurrent with a 5% (1 in 20-year) rainfall event, including 1m sea level rise plus 400mm freeboard, as predicted by the relevant Christchurch City Council model and version identified in Table 5.3.1.1a; or iii. 12.3m above Christchurch City Council Datum. (Link to table with floor levels)
P2	Additions to existing buildings which increase the ground floor area of the building located within the Fixed Minimum Floor Level Overlay, unless specified in P6, P7, P8 or P9 in Rule 5.3.1.1.	
P3	New buildings outside the Fixed Minimum Floor Level Overlay unless specified in P5, P6, P7, P8 or P9 in Rule 5.3.1.1.	a. Minimum floor levels shall be the level specified in the Minimum Floor Level Certificate (refer to Rule 5.3.1.2)
P4	Additions to existing buildings which	

Activity		Activity specific standards
	increase the ground floor area of the building outside the Fixed Minimum Floor Level Overlay unless specified in P6, P7, P8 or P9 in Rule 5.3.1.1.	a. Minimum floor levels shall be the level specified in the Minimum Floor Level Certificate (refer to Rule 5.3.1.2)
P5	Additions to existing buildings that do not increase the ground floor area of the building.	Nil
P6	Additions other than garages provided for in P7 which do not increase the ground floor area of an existing building by more than $25m^2$ within any continuous period of 10 years.	Nil
P7	Garages of $40m^2$ or less in area, and any other accessory buildings without floors.	Nil
P8	Decks, swimming pools, and unenclosed buildings without floors.	Nil
P9	Utilities and LPG storage tanks.	Nil
P10	Filling or excavation for residential building platforms only to the extent necessary to achieve the minimum floor levels specified for P1, P2, P3 and P4 in Rule 5.3.1.1 for new buildings and for additions to buildings.	Nil

Activity		Activity specific standards
P11	Filling or excavation associated with the maintenance of flood protection and bank erosion protection works; and the maintenance of existing drains or ponds.	Nil
P12	Filling or excavation associated with utilities, or the replacement, repair or maintenance of existing utilities.	Nil
P13	Any other filling or excavation in residential zones.	a. A maximum height of 0.3m of fill above ground and 0.6m depth of excavation below ground; and b. A maximum volume of filling above ground level of $10m^3$ per site, and a maximum cumulative volume of filling and excavation of $25m^3$ per site, in each case within any continuous period of 10 years. Or c. The excavation and filling is associated with the maintenance and/or replacement of underground petroleum storage systems and where, following reinstatement of the underground petroleum storage systems, the site will have a finished contour that is equivalent to the ground level at the commencement of the works.
P14	Any other filling or excavation in commercial and industrial zones.	a. A maximum height of 0.3m of fill above ground and 0.6m depth of excavation below ground; and b. A maximum volume of filling above ground level of $20m^3$ per site, and a maximum cumulative volume of filling and excavation of $50m^3$ per site, in each case within any continuous period of 10 years. Or c. The excavation and filling is associated with the maintenance and/or replacement of underground petroleum storage systems and where, following reinstatement of the underground petroleum storage systems, the site will have a finished contour that is equivalent to the ground level at the commencement

Activity		Activity specific standards
		of the works.
P15	Outdoor storage of transiting shipping containers in commercial and industrial zones.	a. Nil

5.3.1.2 Minimum floor level certificate

a. For P3 and P4 in Table 5.3.1.1b, new buildings or additions to existing buildings within the Flood Management Area, but outside of the Fixed Minimum Floor Level Overlay shall have a floor level that is greater than or equal to that specified in a Minimum Floor Level Certificate. The Council will issue a Minimum Floor Level Certificate (which will be valid for 2 years from the date of issue) which specifies the design flood level for a building calculated as the highest of the following:

   i. flooding predicted to occur in a 0.5% AEP (1 in 200-year) rainfall event concurrent with a 5% AEP (1 in 20-year) tidal event, including 1m sea level rise plus 400mm freeboard, as predicted by the most up to date Christchurch City Council model and any relevant field information; or

   ii. flooding predicted to occur in a 0.5% AEP (1 in 200-year) tidal event concurrent with a 5% AEP (1 in 20-year) rainfall event, including 1m sea level rise plus 400mm freeboard, as predicted by the most up to date Christchurch City Council model and any relevant field information; or

   iii. 12.3m above Christchurch City Council Datum.

5.3.1.3 Exemptions for daylight recession planes in the Flood Management Area

a. With regard to P1 and P2 in Rule 5.3.1.1, the applicable daylight recession plane in residential zones shall be determined as if the ground level at the relevant boundary was the minimum floor level set in the activity specific standards in Rule 5.3.1.1, or natural ground level, whichever is higher.

b. With regard to P3 and P4 in Rule 5.3.1.1, the applicable daylight recession plane in residential zones shall be determined as if the ground level at the relevant boundary was the minimum floor level specified in the Minimum Floor Level Certificate issued under Rule 5.3.1.2, or natural ground level, whichever is higher.

c. For the purposes of a and b above, the applicable daylight recession plane in residential zones are:

i. Rule 14.2.3.6 Daylight Recession Planes - Residential Suburban Zone and Residential Suburban Density Transition Zone;
ii. Rule 14.3.3.5 Daylight Recession Planes - Residential Medium Density Zone; and
iii. Rule 14.6.3.5 Daylight Recession Planes - New Neighbourhood Zone.

5.3.1.4 Exemption for buildings in certain circumstances where a PIM has been issued

a. Replacement of earthquake-damaged buildings (including partial replacement) in the Flood Management Area are exempt from compliance with the requirements of P1-P4 in Rule 5.3.1.1, provided that:

i. On or before the date at which Rule 5.3.1.4 becomes operative, the Council has received an application for a Project Information Memorandum (PIM) for a building on a specific site; and
ii. In response to that application, the Council has issued a PIM that confirms the minimum floor level for the building on that site. The PIM may be issued before or after the date at which Rule 5.3.1.4 became operative, but shall be based on the requirements of the relevant district plan that was operative on the date the PIM was received, or if no rules were relevant under that plan, the New Zealand Building Code as at the date that the application was received.

The exemption to Rule 5.3.1.1 outlined above will cease to apply if construction of the building is not commenced by 30 April 2018.

5.3.1.5 Restricted discretionary activities

The activities listed below are restricted discretionary activities in all residential, commercial and industrial zones where the activity is located in a Flood Management Area.

Table 5.3.1.5a

Activity		**Matters of discretion and assessment criteria**
RD1	New buildings or additions to buildings which are not permitted by the activity status rules and/or activity specific standards for P1 – P9 set out in Rule 5.3.1.1.	a. The Council's discretion is restricted to the following matters: i. Setting of minimum floor levels ii. Mitigation of the effects of flooding b. These restricted discretionary activities will be assessed against the following criteria: i. The frequency at which any proposed building or addition is predicted to be

Activity		Matters of discretion and assessment criteria
	Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.	flooded and the extent of damage likely to occur in such an event. ii. Whether any mitigation measures are proposed, their effectiveness and environmental effects, and any benefits to the wider area associated with flood management. iii. Whether there are any positive effects from the reduction in floor levels in relation to neighbouring buildings or streetscape.
RD2	Filling or excavation which is not a permitted activity under P10, P11 or P12 set out in Rule 5.3.1.1, or filling or excavation that exceeds the standards in P13 or P14 set out in Rule 5.3.1.1.	a. The Council's discretion is restricted to: i. Timing, location, scale and nature of earthworks ii. Earthworks method iii. Mitigation of effects as they impact flooding and surface drainage b. These restricted discretionary activities will be assessed against the following criteria: i. Whether any effects arise from filling or excavation on land stability, flooding, waterways, groundwater and natural ground levels on and/or off site, including: A. Any likelihood of exacerbation of flooding, erosion, or siltation either upstream or downstream of the site. B. Any likelihood of affecting the stability of adjoining land, including its susceptibility to subsidence or erosion. C. Any adverse effects on other properties from disturbances to surface drainage patterns. D. Effects on flood storage capacity and function in the immediate area, and any wider effects on the flood storage in the catchment including any compensatory storage proposed; and any effects on existing stormwater and flood protection works. E. Any implications for groundwater and the water table, on or off site. F. Any benefits associated with flood

Activity		Matters of discretion and assessment criteria
		management. ii. Whether there are any benefits arising that enable the reasonable use of the site. iii. Whether any mitigation measures are proposed, their effectiveness and whether, and to what extent there is a transfer of adverse effects to other properties.

5.3.1.6 Discretionary, non-complying and prohibited activities

There are no discretionary, non-complying or prohibited activities in respect of Rule 5.3.1.

5.3.2 Repair of land used for residential purposes damaged by earthquakes within Flood Management Area

5.3.2.1 Permitted activities

The activities listed below are permitted activities in the Flood Management Area provided the activity:

i. Complies with all of the activity status rules and activity specific standards in Rule 5.3.2.1.
ii. Occurs in the Suburban Residential (except for the Suburban Residential Zone on the corner of Hendersons and Sparks Road), Residential Suburban Density Transition, Medium Density Residential and New Neighbourhood Zones only.
iii. Is commenced prior to the expiry date of this rule on 31 December 2018.

Exemptions from the permitted activity standards are listed in Rule 5.3.2.3.

Table 5.3.2.1a

Activity		Activity specific standards
P1	Any filling or excavation activity undertaken to repair land used for residential purposes and damaged by the earthquakes, where any site or part of a site is located within Flood Management Area unless specified by P2 in Rule 5.3.2.1.	a. Any filling, excavation or disturbance of soils shall not exceed the standards in Tables 5.3.2.1b or 5.3.2.1c under Rule 5.3.2.1. b. There shall be no filling, excavation or disturbance of soil within: i. 3m from any utility waterway to be piped; ii. 5m from any open utility waterway; Note: The Canterbury Regional Council manages earthworks within 10m of other rivers and lakes and 20m of the coast and land use consent may be required from that Council. Refer to the Natural Resource Regional Plan rule WQL36A, and the Land and Water Regional Plan Rules 8.5.2, 9.5.6 and 11.5.1. c. All filling, excavation or disturbance of soil:[8] i. is not within the dripline of any listed heritage or notable tree; or ii. is not within any Ecological Heritage Site; or iii. is not at or within 5m of any listed heritage item including items of significance to Ngāi Tahu, where the heritage item is on the same site. d. Erosion and sediment control measures are implemented and maintained in accordance with Environment Canterbury's Erosion and Sediment Control Guidelines for Small Sites to minimise erosion and the discharge of sediment laden water to surface water. e. All filling, excavation or disturbance of soil greater than 0.3m in depth shall be in accordance with New Zealand Standard NZS 4431:1989 Code of Practice for Earth Fill for Residential Development. Certification is not required except as specified at activity specific standards k and l in Rule 5.3.2.1. f. All land repair works are to be managed in accordance with New Zealand Standard NZS
P2	Any filling or excavation activity undertaken to repair land used for residential purposes and damaged by the earthquakes involving soil mixing, aggregate piers, or grout, where any site or part of a site is located within Flood Management Area.	

[8] This is a reference to the Operative Plan, until such time as it is dealt with as part of Natural and Cultural Heritage in Stage 3.

Activity		Activity specific standards
		6803:1999 Acoustics – Construction Noise and DIN 4150 1999-02 Structural Vibration. g. Land repair works involving mixing or insertion of grout shall not involve: i. mixtures with a flow time greater than 30 seconds when tested in accordance with the grout flow test at NZS 3112: Part 1:1986 (Test 3) or a flowable concrete/ grout including cement and inert additives which exceed a diameter of 300mm when tested in accordance with the inverted cone test at NZS 3112: Part 1:1986 (Test 11) except for in-situ mixing; or ii. pressurised injection of grout into the ground. h. Where grout is deposited into land: i. using in-situ mixing the grout shall be mixed evenly through the augured soil column and the percentage of grout within the augured soil column shall not exceed 20%; or ii. Where grout is deposited into land using methods other than in-situ mixing, the percentage of cement in the dry grout mixture shall not exceed 30%. i. Land repair materials shall consist only of: i. soil, gravel, rocks, concrete, sand, silt (such as exists on site already), or clean, inert material; or ii. cement and/or bentonite grout including inert additives. iii. Timber foundation piles; and shall not iv. Include or disturb putrescible, pollutant, inflammable or hazardous components; and/or v. Include fill which comprises more than 5% vegetation of any load by volume. j. Land repair works, other than dust and sediment control measures, shall not be undertaken outside of the hours of 7.30am to 6.00pm Monday to Friday and 8.00am to 5.00pm on Saturday. No

Activity		Activity specific standards
		works shall occur on public holidays. k. Where the land repair and earthworks are designed, supervised or certified by a Chartered Professional Engineer with experience in geotechnical engineering, or Professional Engineering Geologist (IPENZ Registered), at least 3 working days prior to commencing any work on the site, including stockpiling and preparatory works: i. Written notice shall be provided to the Council informing it of the location of the land repair and the name and contact details of the supervising engineer; and ii. Written notice shall be provided to any occupier of a residential dwelling adjoining the land repair site to inform them that the works will be taking place, the expected duration of the works and provide contact details of the site supervisor; and iii. A sign shall be erected at the front of the property including the name and contact details of the site supervisor. l. Where the land repair and earthworks are designed, supervised or certified by a Chartered Professional Engineer with experience in geotechnical engineering , or Professional Engineering Geologist (IPENZ Registered), a statement of professional opinion completed by a Chartered Professional Engineer with experience in geotechnical engineering must be provided to the Council within 3 months of the land repair being completed to the effect that the works will meet all applicable standards and requirements and be suitable for its intended purpose. This shall include as-built plans of the works.

Standards where the land repair and earthworks are not designed, supervised or certified by a Chartered Professional Engineer with experience in geotechnical engineering. All activity specific standards in Rule 5.3.2.1 must also be met:

Table 5.3.2.1b

	Column A Max. Volume (Cumulative)	**Column B Max. depth (m)**	**Column C Max. depth of fill (m) [below ground level]**	**Column D Fill (m) [above ground level]**	**Column E Setback from boundary**
P1	50m^3/site	0.6	0.6	0.3 max. depth; and 10 m^3/site max. volume	Setback from boundary must be equivalent to or greater than the depth of filling or excavation.
P2	Not more than 10m^3 of grout/site	1.0	1.0	0.3m max. depth	

Standards where the land repair and earthworks are designed, supervised or certified by a Chartered Professional Engineer with experience in geotechnical engineering. All activity specific standards at Rule 5.3.2.1 must also be met:

Table 5.3.2.1c

	Column A Max. Volume (Cumulative)	**Column B Max. depth (m)**	**Column C Max. depth of fill (m) [below ground level]**	**Column D Fill (m) [above ground level]**	**Column E Setback from boundary**
P1	Nil	Nil	Nil	0.3 max. depth and 10m^3/site max. volume	Nil
P2	Not more than 80m^3 of grout/site	Nil	Nil	Nil	1m

5.3.2.2 Restricted discretionary activities

The activities listed below are restricted discretionary activities.
Exemptions from the restricted discretionary activities are listed in Rule 5.3.2.3.

Table 5.3.2.2a

Activity		**Matters of discretion and assessment criteria**
RD1	Any filling or excavation undertaken to repair land used for residential purposes damaged by earthquakes that does not comply with P1 or P2 set out in Rule 5.3.2.1.	a. The Council's discretion shall be limited to the following matters: i. The matters for discretion reserved for RD2 set out in Rule 5.3.1.5.

	Any application arising from this rule will not require written approvals and shall not be publicly or limited notified.	b. These restricted discretionary activities will be assessed against the following criteria: i. The assessment criteria set out for RD2 in Rule 5.3.1.5

5.3.2.3 Exemptions to Rules 5.3.2.1 and 5.3.2.2

a. Works involving the establishment, repair or replacement of any permitted utilities or the maintenance of existing drains or ponds by a utility operator.

b. Works permitted by or exempted from a building consent (including work forming part of foundations for a building) do not require resource consent under Rules 5.3.2.1 or 5.3.2.2 where:

   i. they comply with the criteria in column D of Tables 5.3.2.1b and 5.3.2.1c in Rule 5.3.2.1 controlling fill above ground level in a Flood Management Area; or

   ii. they are designed, supervised and certified by a Chartered Professional Engineer with experience in geotechnical engineering, including where they exceed the criteria at columns A, B, C or E of Tables 5.3.2.1b and 5.3.2.1c in Rule 5.3.2.1; or

   iii. they comply with activity specific standards b and c of P1 and P2 in Rule 5.3.2.1.

c. Testing or investigation preceding land repairs or remediation as a result of land damaged by earthquakes is permitted provided it meets the activity specific standards for P1 and P2 in Rule 5.3.2.1.

d. Filling or excavation associated with the maintenance of flood protection works.

e. Post holes for the erection of fences or for permitted or approved buildings and signs.

f. Planting holes for trees and plants.

Clarification of Rule

a. For the purposes of this rule, the building consent platform extends to a maximum of 2.5m from the exterior wall of an enclosed structure or support structures of open structures.

b. Measurement of volume shall include only areas which have been disturbed, including by filing, excavation, soil mixing or injection of materials. Soil above or between these areas which remains undisturbed does not form part of the allowable volume, including where those undisturbed soils are compacted or otherwise altered by the works.

c. For the purposes of this rule, when land repairs are being undertaken over a number of properties at the same time and by the same contractor, the site

boundary for the purpose of the setback is the outer perimeter of the properties which are subject to the land repair works.

Advice Notes:

a. For the avoidance of doubt, where the earthworks are associated with the repair of land damaged by earthquakes and used for residential purposes in the zones listed in Rule 5.3.2.1, Rule 5.3.2 substitutes for all other earthworks rules in this Plan.
b. For the purposes of this rule, "repair of land used for residential purposes damaged by earthquakes" does not include repair of land on the Port Hills or Banks Peninsula.
c. Those intending to do land repair earthworks are responsible for complying with the National Environmental Standard (NES) for Assessing and Managing Contaminants in Soil to Protect Human Health (2011). Such persons should contact the Christchurch City Council or Environment Canterbury to find out whether their land has been used for hazardous activities which might trigger the need for compliance with the NES.
d. Any vegetation removed during land repairs should not be replaced with pest species as listed in Appendix 1 to the Infrastructure Design Standard (Part 10). The Council prefers that replanting occurs in accordance with its Streamside Planting Guideline to ensure bank stability is not compromised.
e. Information regarding the disposal of excavated material and the Standards and Guidelines referenced in the rule is available from the Council.
f. Archaeological sites are subject to a separate consent process under the Heritage New Zealand Pouhere Taonga Act 2014. The Heritage New Zealand Pouhere Taonga 2014 makes it unlawful for any person to destroy, damage or modify the whole or any part of an archaeological site without the prior authority of the Heritage New Zealand. This is the case regardless of whether the land on which site is located is designated, or the activity is permitted under the Distinct or Regional Plan or a resource or building consent has been granted. The Heritage New Zealand Pouhere Taonga Act 2014 also provides for penalties for unauthorised destruction, damage or modification.

5.4 Liquefaction hazard rules

Liquefaction is a process that can occur during strong earthquake shaking which causes loss of stiffness and strength in generally loosely consolidated fine grained water saturated soils and can result in ground damage from lateral spreading, settlement, ground cracking, sand boils and deposition of sediment, as well as localised flooding.

Click here for Planning Maps
Click here for Liquefaction Management Area maps

5.4.1 Permitted activities

All activities in the Liquefaction Management Area are a permitted activity unless specified in 5.4.2 or 5.4.3, or as otherwise specified elsewhere in the plan.

5.4.2 Controlled activities

The activities listed below are controlled activities in any zone within the area shown on the planning maps as the Liquefaction Management Area and are subject to compliance with the activity status rules and any standards specified elsewhere in the Plan for that activity. Where subdivision is specified, a subdivision consent is also required under Chapter 8 Subdivision, Development and Earthworks.

There may be other areas that are not identified at the district scale that are susceptible to liquefaction risk based on site specific characteristics – these may require specific geotechnical investigations as part of subdivision to satisfy the Council with respect to Section 104 and Section 106 of the RMA.

Table 5.4.2a

Activity		**Matters of control and assessment criteria**
C1	Any subdivision which creates an additional vacant allotment or allotments in the Liquefaction Management Area. Note: This rule does not apply to boundary adjustments, amalgamations, or the creation of unit titles. Any resource consent application arising from this rule will not require written approvals and shall not be publicly or limited notified.	a. The Council's control is limited to the following matters: i. Location, size and design of allotments, structures, roads, access, services or foundations as they relate to the liquefaction hazard ii. Timing, location, scale and nature of earthworks as they relate to the liquefaction hazard iii. Liquefaction hazard remediation methods b. These controlled activities will be assessed against the following criteria: i. Whether techniques proposed for remediation and/or mitigation of the effects of any liquefaction hazard identified are appropriate, including but not limited to: A. Provision for ground-strengthening, foundation design, provision of resilient services and the ability of these to be

		incorporated into the subdivision consent as conditions or consent notices. B. Setbacks in relation to any waterway or waterbody, or any sharp change in ground elevation, sloping ground or free face. Alternatively, whether ground-strengthening or other proposed engineering or geotechnical solutions are identified to address any identified potential for lateral spread. ii. The extent to which the layout of the subdivision in relation to the liquefaction hazard is appropriate, including the proposed location of earthworks, roads, access, servicing and building platforms in relation to the liquefaction hazards identified. iii. The effect of the remediation and/or mitigation on the reasonable use of the site.

5.4.3 Restricted discretionary activities

The activities listed below are restricted discretionary activities in any zone within the area shown on the planning maps as the Liquefaction Management Area and are subject to compliance with the activity status rules and any standards specified elsewhere in the Plan for that activity.

Table 5.4.3a

Activity		**Matters of discretion and assessment matters**
RD1	Any activity located on a site with an area of 1500m^2 or more, qualifying as a restricted discretionary activity under any of the following residential rules:[9] 1. Enhanced Development Mechanism - Rule 14.7.2.1 RD1, RD2; 2. Community Housing Redevelopment	a. The Council's discretion is restricted to the following matters: i. Location, siting and layout, design of buildings, car-parking, access, services or foundations as they relate to the liquefaction hazard ii. Timing, location, scale and nature of earthworks as they relate to the liquefaction hazard iii. Liquefaction hazard remediation methods b. These restricted discretionary activities will be assessed against the following criteria:

[9] Note: the cross-reference to the following residential rules will be updated as part of the Panel's decision on the Residential Proposal.

	Mechanism - Rule 14.8.2.1 RD1, RD2; 3. Residential Suburban Zone and Residential Suburban Density Transition Zone - Rule 14.2.2.3 RD7, RD8, RD9; 4. Residential Medium Density Zone - Rule 14.3.2.3 RD7; 5. Residential Banks Peninsula Zone - Rule 14.4.2.3 RD3 6. Residential Conservation Zone - Rule 14.5.2.3 RD3. 7. New Neighbourhood Zone - Rule 14.6.2.3 RD5; Resource consent application/s arising from this rule in respect to the Enhanced Development Mechanism or the Community Housing Redevelopment Mechanism will not require written approvals and shall not be publicly or limited notified.	i. Whether techniques proposed for remediation and mitigation of the effects of any liquefaction hazard identified are appropriate, including but not limited to: A. Provision for ground-strengthening, foundation design, and provision of resilient services B. Setbacks in relation to any waterway or waterbody, or any sharp change in ground elevation, sloping ground or free face. Alternatively, whether ground-strengthening or other proposed engineering or geotechnical solutions are identified to address any identified potential for lateral spread. ii. The extent to which the siting and layout of the proposal is appropriate, including the proposed location of buildings, earthworks, car-parking areas, servicing, access and building platforms in relation to the liquefaction hazards identified.

5.4.4 Discretionary, non-complying and prohibited activities

There are no discretionary, non-complying or prohibited activities in respect of Rule 5.4.

5.5 Slope instability rules

Click here for Planning Maps

5.5.1 Activity status for Slope Instability Management Areas

5.5.1.1 Activity status for Slope Instability Management Areas excluding land within the Specific Purpose (Lyttelton Port) Zone

The activities listed below have the activity status listed within each Slope Instability Management Area, and are subject to compliance with any activity status, rules and any standards specified elsewhere in the Plan for that activity. Where subdivision is specified, a subdivision consent is also required under the provisions of Chapter 8.

Table 5.5.1.1a

Activity		**Cliff Collapse Mgmt Area 1**	**Cliff Collapse Mgmt Area 2**	**Rockfall Mgmt Area 1. For exceptions, refer to Rule 5.5.1.2**	**Rockfall Mgmt Area 2. For exceptions, refer to Rule 5.5.1.2**	**Mass Mvmt Mgmt Area 1**	**Mass Mvmt Mgmt Areas 2 & 3**	**Remainder of Port Hills and Banks Peninsula Slope Instability Mgmt Area**
Key: P = Permitted; RD = Restricted Discretionary; D = Discretionary; NC = Non-complying; PR = Prohibited.								
a.	Subdivision	PR1/NC1*	NC2	NC3	RD1	NC4	RD2	RD3
b.	Earthworks except where specifically provided below in Rule 5.5.1.1	PR2	NC5	NC6	RD4	NC7	RD5	No rule until PHASE 2 REVIEW
c.	Hazard mitigation works or hazard removal works, including earthworks associated with those works unless provided for in d	PR3	NC8	RD6	RD7	NC9	RD8	RD9

Activity		Cliff Collapse Mgmt Area 1	Cliff Collapse Mgmt Area 2	Rockfall Mgmt Area 1. For exceptions, refer to Rule 5.5.1.2	Rockfall Mgmt Area 2. For exceptions, refer to Rule 5.5.1.2	Mass Mvmt Mgmt Area 1	Mass Mvmt Mgmt Areas 2 & 3	Remainder of Port Hills and Banks Peninsula Slope Instability Mgmt Area
d.	Hazard mitigation works to protect infrastructure including earthworks associated with those works	RD10	RD11	RD12	RD13	RD14	RD15	RD16
e.	Demolition of buildings	RD17	RD18	RD19	RD20	RD21	RD22	P1
f.	Repair and maintenance of existing infrastructure, including minor upgrading of the existing electricity network	P2	P3	P4	P5	P6	P7	P8
g.	Earthworks associated with activities listed in f above	C1	C2	C3	C4	C5	C6	P9

Activity		Cliff Collapse Mgmt Area 1	Cliff Collapse Mgmt Area 2	Rockfall Mgmt Area 1. For exceptions, refer to Rule 5.5.1.2	Rockfall Mgmt Area 2. For exceptions, refer to Rule 5.5.1.2	Mass Mvmt Mgmt Area 1	Mass Mvmt Mgmt Areas 2 & 3	Remainder of Port Hills and Banks Peninsula Slope Instability Mgmt Area
h.	Upgrading of existing infrastructure or development of new infrastructure (where there is a functional need to locate in the overlay), including earthworks associated with these works.	RD23	RD24	RD25	RD26	RD27	RD28	No rule until PHASE 2 REVIEW
i.	Retaining walls which are both less than $6m^2$ in area and less than 1.8m in height including earthworks associated with those works.	RD29	RD30	RD31	P10	RD32	P11	P12
j.	Signage and fencing for warning or excluding the public including post holes associated with those works.	RD33	P13	P14	P15	P16	P17	No rule until PHASE 2 REVIEW
k.	Hazard mitigation works and associated	NC10	P18	P19	P20	NC11	P21	P22

Activity		Cliff Collapse Mgmt Area 1	Cliff Collapse Mgmt Area 2	Rockfall Mgmt Area 1. For exceptions, refer to Rule 5.5.1.2	Rockfall Mgmt Area 2. For exceptions, refer to Rule 5.5.1.2	Mass Mvmt Mgmt Area 1	Mass Mvmt Mgmt Areas 2 & 3	Remainder of Port Hills and Banks Peninsula Slope Instability Mgmt Area
	earthworks and planting in accordance with the Port Hills Parks and Tracks Reopening Process (dated 19 December 2012)							
l.	Recreation activities within parks and reserves and associated park management and maintenance activities, including grazing and track repair.	NC12	P23	P24	P25	NC13	P26	No rule until PHASE 2 REVIEW
m.	Farm buildings and farm tracks, including earthworks associated with these works.	NC14	NC15	RD34	RD35 except that farm tracks up to 2m wide shall be permitted.	NC16	RD36	No rule until PHASE 2 REVIEW
n.	Any building or structure not listed in activities a to g of Rule 5.5.1.1	PR4	NC17	NC18	RD37	NC19	RD38	No rule until PHASE 2 REVIEW
o.	Any other activity not	NC20	NC21	NC22	RD39	NC23	RD40	No rule until PHASE 2

Activity		Cliff Collapse Mgmt Area 1	Cliff Collapse Mgmt Area 2	Rockfall Mgmt Area 1. For exceptions, refer to Rule 5.5.1.2	Rockfall Mgmt Area 2. For exceptions, refer to Rule 5.5.1.2	Mass Mvmt Mgmt Area 1	Mass Mvmt Mgmt Areas 2 & 3	Remainder of Port Hills and Banks Peninsula Slope Instability Mgmt Area
	otherwise listed in this table.							REVIEW

* Prohibited where site subject to proposed subdivision is solely located within Cliff Collapse Management Area1; non-complying activity where it is proposed to subdivide off land within Cliff Collapse Management Area 1 from an area of land not within Cliff Collapse Management Area 1.

Any resource consent application arising from C1-6 RD1 – RD40 set out in Rule 5.5.1.1 above will not require written approvals and shall not be publicly or limited notified.

5.5.1.2 Exceptions to Rule 5.5.1.1 – Rockfall AIFR Certificate

a. The Council will issue a Rockfall AIFR Certificate (which will be valid for 2 years from the date of issue) which specifies the calculated AIFR from i. and ii. below for an identified area of land, when the following procedure is undertaken and the requirements of the procedure are satisfied:

i. The Council has received a report, in respect of an identified area of land, prepared by a Chartered Professional Engineer with requisite experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered), which calculates the AIFR from rockfall for the identified land in the following manner:[10]

If the land is in **Rockfall Management Area 1:**

A. Apply the method for assessing the risk as set out in the *GNS Science Consultancy Report 2011/311 Port Hills Slope Stability: Pilot Study for assessing life-safety risk from rockfalls (boulder rolls)*, and any subsequent updates to this report by GNS Science, using the parameters listed in the Table in Policy 5.2.4.1a. for Rockfall Management Area 1 along with any relevant site-specific information, and other parameters in the GNS Science report (calculation 1(a)).

B. If the risk (AIFR) resulting from calculation 1(a) is **less than** that shown in the Table in Policy 5.2.4.1a for Rockfall Management Area 1 ($\geq 10^{-4}$), then using the same method set out in the *GNS Science Consultancy Report 2011/311 Port Hills Slope Stability: Pilot Study for assessing life-safety risk from rockfalls (boulder rolls)*, and any subsequent updates to this report by GNS Science, calculate the AIFR using the parameters listed in the Table in Policy 5.2.4.1 for Rockfall Management Area 2 along with all relevant site-specific information, and other parameters listed in the GNS Science report (calculation 1b).

If the land is in **Rockfall Management Area 2**:

C. Apply the method for assessing the risk as set out in the *GNS Science Consultancy Report 2011/311 Port Hills Slope Stability: Pilot Study for assessing life-safety risk from rockfalls (boulder rolls)*, and any subsequent updates to this report by GNS Science, using the parameters listed in the Table in Policy 5.2.4.1a. for Rockfall Management Area 2 along with all relevant site-specific information, and other parameters in the GNS Science report (calculation 2(a)).

AND

ii. The Council has commissioned and received a peer review report from a Chartered Professional Engineer with requisite experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered)**, which concurs with the application of the method required in i. above, and with the calculated AIFR(s) for the identified land.

[10] The calculation shall not take account of hazard mitigation works.

**The peer reviewer must not, at the time of undertaking the review, be employed by either: a) the same company as the company that authored the report received in i. above, or b) the Council.

b. Where a valid Rockfall AIFR Certificate has been issued by the Council for an identified area of land, in accordance with the procedure described in Rule 5.5.1.2a. above, the activity status (for activities listed in Table 5.5.1.1a) that applies to that land shall be that which applies to the Slope Instability Management Area specified in Table 5.5.1.2a. below. A Rockfall AIFR Certificate is valid for 2 years from the date of issue. If the activity is commenced (in the case of a permitted activity) or a resource consent is lodged within 2 years from the date of issue of the Rockfall AIFR Certificate, no further Certificate is required after the 2 year term expires.

Table 5.5.1.2a

Slope instability hazard management area applying to the land on the planning maps	**AIFR as specified in the site-specific Rockfall AIFR Certificate**		**Slope Instability Management Area for the purpose of determining activity status for activities on the land (Table 5.5.1.1a)**
Rockfall Management Area 1	Calculation 1(a)	$\geq 10^{-4}$	Rockfall Management Area 1
	Calculation 1(b) where required	$\geq 10^{-4}$	Rockfall Management Area 2
		$< 10^{-4}$	Remainder of Port Hills and Banks Peninsula
Rockfall Management Area 2	Calculation 2(a)	$\geq 10^{-4}$	Rockfall Management Area 2
		$< 10^{-4}$	Remainder of Port Hills and Banks Peninsula

Notes:

1. Calculated AIFRs specified in issued, valid Rockfall AIFR Certificates for identified areas of land, and valid certificates themselves, will be made freely available to the public, recorded in the Council's Geographical Information System and provided in Land Information Memoranda.
2. Changes to the District Plan will be regularly notified, as required to change the planning maps, in order to reflect updated information regarding life-safety risk from rockfall from issued Rockfall AIFR Certificates.

5.5.1.3 Activity status for Slope Instability Management Areas within the Specific Purpose (Lyttelton Port) Zone

The activities listed below have the activity status listed within each Slope Instability Management Area, and are subject to compliance with any activity status rules and any standards specified elsewhere in the Plan for that activity. Where subdivision is specified, a subdivision consent is also required under the provisions of Chapter 8.

Table 5.5.1.3a

	Activity	Cliff Collapse Mgmt Area 1	Cliff Collapse Mgmt Area 2	Rockfall Mgmt Area 1	Rockfall Mgmt Area 2	Remainder of Port Hills and Banks Peninsula
a.	Subdivision	C7	C8	C9	C10	No rule until PHASE 2 REVIEW
b.	Earthworks except as provided for below	NC24	RD41	C11	C12	No rule until PHASE 2 REVIEW
c.	Hazard mitigation works, including earthworks associated with those works	C13	C14	C15	C16	No rule until PHASE 2 REVIEW
d.	Demolition of buildings	C17	C18	C19	C20	No rule until PHASE 2 REVIEW
e.	Repair and maintenance of existing infrastructure, buildings, and accessways, including minor upgrading of existing infrastructure of electricity network providers.	P1	P2	P3, includes earthworks associated with these works on flat land or where the earthworks are less than $10m^3$ cut or fill on sloping land.	P4, includes earthworks associated with these works on flat land or where the earthworks are less than $10m^3$ cut or fill on sloping land.	P

	Activity	Cliff Collapse Mgmt Area 1	Cliff Collapse Mgmt Area 2	Rockfall Mgmt Area 1	Rockfall Mgmt Area 2	Remainder of Port Hills and Banks Peninsula
f.	Earthworks associated with the activities listed in e above unless identified as permitted.	C21	C22	C23	C24	P
g.	Upgrading of existing infrastructure, buildings, and accessways including associated earthworks, provided such upgrades are limited to an increase in capacity, efficiency or security of an existing structure or route	D1	RD42	RD43	RD44	No rule until PHASE 2 REVIEW
h.	Construction of new non-habitable** buildings or structures used for storage or infrastructure	D2	RD45	RD46	RD47	No rule until PHASE 2 REVIEW
I.	Construction of new retaining walls	RD48	C25	P5	P6	No rule until PHASE 2 REVIEW
j.	Quarrying and associated haul road formation on land below Sumner Rd	Not applicable	Not applicable	C26	C27	No rule until PHASE 2 REVIEW
k.	Bulk storage of cargo or construction material, outdoors on flat land	RD49	C28	P7	P8	No rule until PHASE 2 REVIEW

	Activity	Cliff Collapse Mgmt Area 1	Cliff Collapse Mgmt Area 2	Rockfall Mgmt Area 1	Rockfall Mgmt Area 2	Remainder of Port Hills and Banks Peninsula
l.	Signage and fencing for warning or excluding the public including postholes associated with those works	P9	P10	P11	P12	No rule until PHASE 2 REVIEW
m.	Minor earthworks associated with tree planting, ecological restoration and the formation and maintenance of pedestrian walking and cycle tracks	D3	P13	P14	P15	No rule until PHASE 2 REVIEW
n.	Any activities not otherwise listed above, including buildings not otherwise provided for under h	NC25	NC26	NC27	D4	No rule until PHASE 2 REVIEW

Any resource consent application arising from any controlled or restricted discretionary activities set out in Rule 5.5.1.3 above will not require written approvals and shall not be publicly or limited notified.

**Note: for the purpose of Rule 5.5.1.3h, 'non-habitable' buildings means those buildings or structures where the building is not designed for human occupation and will not be used for human occupancy. Examples of such buildings include bulk storage silos, tanks, plant rooms and electricity substations.

5.5.1.4 Slope Instability Management Areas - C1 to C6 matters of control

a. The Council's control is limited to the following matters:
   i. Timing, location, scale and nature of earthworks.
   ii. Earthworks method.
   iii. Mitigation of effects as they impact slope instability hazards.

b. Controlled activities C1 to C6 will be assessed against the following criteria:

i. Whether proposed earthworks could trigger slope instability or exacerbate risk posed by natural hazard(s) to people or property, and any measures required to avoid or mitigate that risk.
ii. Measures proposed to reinstate the excavated or filled area on completion of the earthworks to reduce the natural hazard risk(s) and ensure long-term land stability.
iii. Whether the earthworks could have any adverse effects as a result of disturbance to drainage patterns and any measures required to avoid or mitigate such effects.

5.5.1.5 Slope Instability Management Areas - C7 to C28 matters of control

a. The Council's control is limited to the following matters:
i. Effects of natural hazards on people and property.
ii. Location, size and design of allotments, structures, roads, access, services or foundations in relation to natural hazard risk.
iii. Location, scale and design of buildings in relation to natural hazard risk.
iv. Clearance or retention of vegetation or other natural features that mitigate natural hazard risk.
v. Timing, location, scale and nature of earthworks.
vi. Earthworks method.
vii. Potential for the proposal to exacerbate natural hazard risk.
viii. Benefits of infrastructure and performance of critical infrastructure following a natural hazard event.
ix. Mitigation of effects as they impact slope instability hazards.

b. Controlled activities C7 to C28 will be assessed against the following criteria:
i. Whether the proposal and associated hazard mitigation works:
A. can be shown, based on evaluation by a Chartered Professional Engineer with experience in geotechnical engineering, using best practice methods, to increase the stability of land and/or protect structures and buildings and their occupants;
B. can be shown, based on evaluation by a Chartered Professional Engineer with experience in geotechnical engineering, using best practice methods, to achieve an acceptable risk to life or property, including the extent to which an Annual Individual Fatality Risk of 10^{-4} (1 in 10,000) or better can be achieved;
C. will have appropriate monitoring procedures applied, with inspections and maintenance undertaken and reported to the Council.
ii. Whether, due to the sensitive nature of the proposed activity (for example, childcare centre, playground, hospital), an Annual Individual Fatality Risk lower than 10^{-4} is appropriate.
iii. Whether development of the site transfers risk to another site.
iv. Whether the location and design of proposed building platforms, access, earthworks, retaining walls and services to the site are the most appropriate considering the risk of natural hazards on the site.
v. Provision for ground-strengthening, foundation design, protection structures and the ability of these to be incorporated into the subdivision consent as conditions or consent notices.

vi. The extent that surface or subsurface drainage patterns and stormwater management are impacted as a result of hazard mitigation works, and whether these have an effect on the site or surrounding sites.

vii. Where critical infrastructure is involved, whether the infrastructure is designed in a way to continue to operate safely in the event of a significant natural hazard occurring, including containment of any hazardous substances associated with that infrastructure.

viii. For infrastructure generally, the extent of benefits associated with that infrastructure, whether there is a functional or operational requirement for that location and whether there are any practical alternatives.

ix. Whether or not the work would be carried out under the supervision of either a Chartered Professional Engineer with experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered).

5.5.1.6 Slope Instability Management Areas - RD1 to RD49 matters of discretion

a. The Council's discretion is restricted to the following matters:

i. Effects of natural hazards on people and property

ii. Location, size and design of allotments, structures, roads, access, services or foundations in relation to natural hazard risk

iii. Location, scale and design of buildings in relation to natural hazard risk

iv. Clearance or retention of vegetation or other natural features that mitigate natural hazard risk

v. Timing, location, scale and nature of earthworks

vi. Earthworks method

vii. Potential for the proposal to exacerbate natural hazard risk

viii. Benefits of infrastructure and performance of critical infrastructure following a natural hazard event

ix. Mitigation of effects as they impact slope instability hazards

b. Restricted discretionary activities RD1 to RD49 will be assessed against the following criteria:

i. Whether the proposal and associated hazard mitigation works:

A. can be shown, based on evaluation by a Chartered Professional Engineer with experience in geotechnical engineering, using best practice methods, to increase the stability of land and/or protect structures and buildings and their occupants;

B. can be shown, based on evaluation by a Chartered Professional Engineer with experience in geotechnical engineering, using best practice methods, to achieve an acceptable risk to life or property, including the extent to which an Annual Individual Fatality Risk of 10^{-4} (1 in 10,000) or better can be achieved;

C. will have appropriate monitoring procedures applied, with inspections and maintenance undertaken and reported to the Council.

ii. Whether, due to the sensitive nature of the proposed activity (for example, childcare centre, playground, hospital), an Annual Individual Fatality Risk lower than 10^{-4} is appropriate.

iii. Whether development of the site transfers risk to another site.
iv. Whether the location and design of proposed building platforms, access, earthworks, retaining walls and services to the site are the most appropriate considering the risk of natural hazards on the site.
v. Provision for ground-strengthening, foundation design, protection structures and the ability of these to be incorporated into the subdivision consent as conditions or consent notices.
vi. The extent that surface or subsurface drainage patterns and stormwater management are impacted as a result of hazard mitigation works, and whether these have an effect on the site or surrounding sites.
vii. Where critical infrastructure is involved, whether the infrastructure is designed in a way to continue to operate safely in the event of a significant natural hazard occurring, including containment of any hazardous substances associated with that infrastructure.
viii. For infrastructure generally, the extent of benefits associated with that infrastructure, whether there is a functional or operational requirement for that location and whether there are any practical alternatives.
ix. Whether or not the work would be carried out under the supervision of either a Chartered Professional Engineer with experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered).

5.6 General procedures – information requirements

5.6.1 Additional information requirements for resource consent applications in the Liquefaction Management Area where a geotechnical report is required

Liquefaction potential

a. Applicants will be required to supply the results of a detailed geotechnical investigation and interpretation. The level of investigation should correspond with the scale and significance of the liquefaction hazard. Plans and information shall:
   i. identify any areas which require particular ground strengthening or other mitigation measures, and recommendations for such mitigation;
   ii. identify any areas which should be excluded from built development, due to geotechnical constraints, or which require geotechnical setbacks, including areas near the edges of rivers, streams, lakes, wetlands, stormwater detention areas and swales where lateral spread is likely to occur; and
   iii. indicate any options and recommended locations for the proposed land use, transport features and other infrastructure recommended by the geotechnical engineer.
b. All geotechnical reports in respect of liquefaction potential are to be prepared by a Chartered Professional Engineer with experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered), and should contain all relevant geotechnical information, presented in both a factual and interpretive manner.

5.6.2 Additional information requirements for resource consent applications within Slope Instability Management Areas

a. Plans and accompanying information shall show:
   i. the geological and geotechnical constraints across the site, including any relationship to or effect on areas of actual or potential instability of the site, including the location of any inferred faults.
   ii. the location of the site in relation to the natural hazard, or the location of the hazard on the site itself, and the location of building platforms in relation to the hazard.
   iii. the nature of the proposed activities on the site and the impact on other sites potentially affected by the natural hazard, and the effect of the hazard on the activity and vice versa.

b. All geotechnical reports are to be prepared by a Chartered Professional Engineer with experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered), and should contain all relevant geotechnical information, presented in both a factual and interpretive manner. The design of rockfall protection structures must be carried out by a Chartered Professional Engineer with specific experience in the investigation, design and/or construction of rockfall protection structures, who has registered with the Council.

5.6.3 Additional information requirements for all resource consent applications for subdivision

5.6.3.1 Liquefaction Management Area

Liquefaction potential

a. At subdivision consent application stage, detailed liquefaction susceptibility assessment and reporting will be required in accordance with the densities, depth, methods and reporting specified in Ministry of Business, Innovation and Employment (December 2012): Part D of "Guidance: Repairing and rebuilding houses affected by the Canterbury Earthquakes": Guidelines for the geotechnical investigation and assessment of subdivisions in the Canterbury region: Minimum requirements for geotechnical assessment for land development (‘flatland areas‘ of the Canterbury region).

b. Subdivision consent applications will be required to include sufficient information and proposed measures to satisfy the Council that liquefaction risk (if present) can be adequately avoided, remedied or mitigated, including the potential effects of lateral spread within 200 metres of the edges of rivers, streams, lakes, wetlands, stormwater detention areas, swales or other areas with a sharp change in ground elevation.

c. Subdivision plans shall show:
   i. any areas which require particular ground strengthening or other mitigation measures, and recommendations for such mitigation;

ii. any areas which should be excluded from built development due to geotechnical constraints, or which require geotechnical setbacks; and

iii. any features of subdivision layout recommended by the geotechnical engineer, for example any recommended locations for proposed land uses, transport features and other infrastructure as a result of geotechnical constraints.

d. All geotechnical reports with respect to liquefaction potential are to be prepared by a Chartered Professional Engineer with experience in geotechnical engineering, or a Professional Engineering Geologist (IPENZ registered), and should contain all relevant geotechnical information, presented in both a factual and interpretive manner.

SCHEDULE 2

Table of submitters heard

This list has been prepared from the index of appearances recorded in the Transcript, and from the document register of evidence and submitter statements, as shown on the Independent Hearing Panel's website.

Submitter Name	№	Person	Expertise or Role if Witness	Appeared /Filed
Andrew and Brigit Craig	4	A Craig		Appeared
Kathleen Clinton	58	K Clinton		Appeared
Otto Snoep	80	O Snoep		Filed
Rachel Malloch	115	R Malloch		Appeared
John and Heather Young	136	J Young		Appeared
Simon Kingham	162	S Kingham		Filed
Riccarton/Wigram Community Board	254 FS1412	M Mora		Appeared
Eric John and Susan Stevens	282	J Stevens		Appeared
Ian Connor and Ruth Woodley	289 1097 FS1243	N Charters	Geotechnical Engineer	Appeared
		I Connor		Appeared
		D Bell	Geotechnical Engineer	Appeared
Carlo Stark	298	J Aramowicz	Geotechnical Engineer	Filed
Toothill Family Trust	299	M Toothill		Appeared
Christchurch City Council	310	H Beaumont	Strategic Natural Hazards Policy	Appeared
		E Seville	Resilience	Appeared
		B Sharp	Economics	Appeared
		A Taig	Risk	Appeared
		C Massey	Engineering Geologist	Appeared
		M Gerstenberger	Seismologist	Appeared
		D Macfarlane	Engineering Geologist	Appeared
		I Wright	Geotechnical Engineer	Appeared
		M Yetton	Engineering Geologist	Appeared
		G Harrington	Surface Water Planner	Appeared
		I Brookland	Planning Engineer	Appeared
		A Long	Planning	Appeared
		M Ivamy	Senior Coastal Scientist	Appeared
		P Kingsbury	Engineering Geologist	Appeared
		J Carter	Planning	Appeared
		C Anderson	Geotechnical Engineer - Liquefaction	Appeared

Submitter Name	№	Person	Expertise or Role if Witness	Appeared /Filed
		G Whyte	Flood Modelling	Appeared
		M Theelen	Planning	Appeared
Cashmere Park Trust and Cashmere Rural Landowners	328	W Lewis	Engineer	Appeared
Canterbury Regional Council	342	M Rachlin	Planning	Appeared
Allessandro and Wilma Laryn and Blue Sun (NZ) Limited	399	A Laryn		Appeared
Gregory Flynn	406	G Flynn		Appeared
David Manley	411	D Manley		Appeared
David Bundy	418	D Bundy		Appeared
Crown	495 FS1347	C Massey	Engineering Geologist	Appeared
		M Gerstenberger	Seismologist	Appeared
		E Jacka	Policy	Appeared
		N Traylen	Geotechnical Engineer	Appeared
		W Saunders	Planning	Appeared
		A Willis	Planning	Appeared
Roland Logan and Sharon Ng	594 1097 FS1243	R Logan		Appeared
		D Bell	Geotechnical Engineer	Appeared
David Mason	603 1097 FS1243	D Bell D Mason	Geotechnical Engineer	Appeared Filed
R J Holyoake Family Trust	606	R Holyoake		Appeared
Grassmere Street Residents Group and Grants Road Holdings	646	R Nixon	Planning	Appeared
Richard and Sally Tripp	679 1097 FS1243	D Bell	Geotechnical Engineer	Appeared
Richard and Heather Larson	680 1097 FS1243	D Bell R Larson	Geotechnical Engineer	Appeared Filed
Simon Gurnsey and Sara Crane	694 1097 FS1243	D Bell	Geotechnical Engineer	Appeared
Z Energy Limited	723 FS1295	D Wypych	Company Evidence	Appeared
Mobil Oil New Zealand Limited	723 FS1295	C Taylor	Company Evidence	Appeared
Z Energy Limited, Mobil Oil New Zealand Limited, BP Oil New Zealand Limited (The Oil Companies)	723 FS1295	P Horrey	Engineering Geologist	Appeared
		D Le Marquand	Planning	Appeared

Submitter Name	№	Person	Expertise or Role if Witness	Appeared /Filed
Ngaire Bacon	731	N Bacon		Appeared
Kiwi Property Group Limited	761	R Nixon	Planning	Appeared
KI Commercial Limited	789	N Charters	Geotechnical Engineer	Appeared
Progressive Enterprises Limited	790 FS1450	R Nixon	Planning	Appeared
Christine Zimprich	801	W Zimprich		Appeared
Southern Response Earthquake Services Limited	809 FS1365	C Hurren	Company Evidence	Appeared
		R Nixon	Planning	Appeared
L Borren and S Cotterill	830	J Aramowicz	Geotechnical Engineer	Filed
Transpower New Zealand Limited	832	A McLeod	Planning	Filed
Ngāi Tahu Property Limited	840 FS1375	M Jacka	Geotechnical Engineer	Appeared
		D Millar	Planning	Appeared
Susan Stubenvoll	845	F Maurer	Geotechnical Engineer	Appeared
		M Quigley	Geomorphologist	Appeared
		S Stubenvoll		Appeared
		M Sinclair	Civil and Geotechnical Engineer	Filed
Christchurch International Airport Limited	863 FS1359	J Clease	Planning	Appeared
Chris and Janet Abbott	904	C Abbott		Appeared
Lyttelton Port Company Limited	915 FS1444	J Clease	Planning	Appeared
		N Charters	Geotechnical Engineer	Appeared
		N McLennan	Engineering Manager	Appeared
Waterloo Park Limited	920 FS1277	J Clease	Planning	Appeared
Theobald Holdings Limited	921	J Aramowicz	Geotechnical Engineer	Filed
Orion New Zealand Limited	922	S Watson	Network Assets Manager	Appeared
		P Lemon	Planning	Appeared
Martin Scott	923	M Scott		Appeared
David Lee	929	D Lee		Appeared
Castle Rock	983 FS1202	C McCulloch		Appeared
Pete McDonald and Rose Collins	952	D Collins		Appeared
		P McDonald & R Collins		Filed
David and Siobhan Collins	955	D Collins		Appeared
Gavin Case, Margaret Case and Michael Case	957	M Sinclair	Civil and Geotechnical Engineer	Filed

Submitter Name	№	Person	Expertise or Role if Witness	Appeared /Filed
		M Case		Filed
		B Thompson	Planning	Filed
Murray Thacker	963	M Thacker		Appeared
Mobil Oil New Zealand Limited	988	D Le Marquand	Planning	Appeared
David Alexander	1016	D Alexander		Appeared
Hamish Riach	1050	H Riach		Appeared
M Slemint	1057	M Slemint		Appeared
Taylors Mistake Association	1058	B Gilpin		Appeared
Taylors Mistake Association Land Company Limited	1059	B Gilpin		Appeared
Oliver Floerl and Lisa Peacock	1120	O Floerl & L Peacock		Filed
Graeme Inglis and Jennifer Garing	1139	G Inglis		Filed
Mahaanui Kurataiao Ltd & Te Rūnanga o Ngāi Tahu	1145 FS1448	T Vial	Planning	Appeared
Generation Zero and others	1149	T Dumont and others[1]		Appeared
Tracey Cook	1194	T Cook		Filed
Brian Farrant	1196	B Farrant		Appeared
Fox and Associates Limited	1422	D Fox		Appeared
IAG New Zealand Limited	1438	C Jenkins	Company Evidence	Appeared
		R Nixon	Planning	Appeared
Helena McIntyre	1481	H McIntyre		Filed

[1] Email from Terra Dumont to the Independent Secretariat dated 12 March 2015, listing submitters Ms Dumont represented.

SCHEDULE 3

Table 1

Provisions of existing district plans that we replace or delete by this decision as identified by the Council:[1]

Operative provision to be replaced or deleted	Our reasons for replacing or deleting
Christchurch City Plan	
Volume 2	
Policy 2.5.3 – Earthquake - To ensure that buildings are constructed in a manner (or where appropriate reconstructed) to ensure that their stability in times of earthquake is sufficient to avoid, or at least minimise, loss of life or damage to property	Matters addressed by decision
Policy 2.5.5 – Flooding - To impose standards in areas subject to flood hazard in order to ensure that the risk of adverse effects on property and people's wellbeing and safety from flooding and inundation is not increased	Replaced by Policy 5.2.2.1
Policy 2.5.6 – Waimakariri River Stopbank Floodplain	Replaced by Policy 5.2.2.1
Policy 2.5.7 – Floodwaters, storage and flood flow control – To maintain the storage and flood flow capacity of floodplains, wetlands and ponding areas, particularly those located in the upper Heathcote river catchment and the lower Styx catchment so as to protect the hydraulic function of such areas	Replaced by Policy 5.2.2.1
Policy 2.5.8 – Flooding mitigation – To ensure that any measures proposed to avoid or mitigate the adverse effects of flooding and inundation are environmentally acceptable	Replaced by Policy 5.2.2.1
Volume 3	
Part 9 – Rule 5.3.3(a), (b) and (c) (only to the extent that they address a zone notified in Stage 1)	Replaced by Rule 5.3.1.1
Part 9 – Rule 5.2A in relation to areas WITHIN a Flood Management Area	Replaced by Rule 5.3.2
Banks Peninsula District Plan	
Chapter 38 Policy 1G and 1H	Replaced by Policies 5.2.2.1, 5.4.2.1 and 5.4.2.3

[1] http://proposeddistrictplan.ccc.govt.nz/PropertySearch/ContentContainer.html?page=whatschanging.

Table 2

Provisions of the existing district plans that this decision does not replace or replace in part, contrary to what the Council has so identified:[2]

Provision not replaced	Our reasons for not replacing or deleting
Christchurch City Plan	
Volume 2	
Section 2 Policy 2.2.6	Not replaced as it relates to Hendersons Basin, and covers matters in Stage 3 which have not yet been notified.
Objective 2.5 – Natural hazards	Not replaced as it relates to a general natural hazards objective and covers matters in Stage 3 which have not yet been notified.
Policy 2.5.1 – Presence of natural hazards	Not replaced as it relates to a general natural hazards policy and covers matters in Stage 3 which have not yet been notified.
Policy 2.5.2 – Limitations on development	Not replaced as it relates to natural hazards generally and covers matters in Stage 3 which have not yet been notified.
Policy 2.5.4 – Sea level rise	Not replaced as it covers matters in Stage 3 which have not yet been notified.
Policy 2.5.9 – Works	Not replaced as it relates to natural hazards generally and covers matters in Stage 3 which have not yet been notified.
Policy 2.5.11 – Intervention	Not replaced as it relates to natural hazards generally and covers matters in Stage 3 which have not yet been notified.
Policy 2.5.12 – Mitigation works	Not replaced as it relates to natural hazards generally and covers matters in Stage 3 which have not yet been notified.
Policy 2.7.6 – Erosion and disturbance of land	Not replaced as it relates to erosion and disturbance of land generally and covers matters in Stage 3 which have not yet been notified.
Policy 6.3A.6 - Hazards	Not replaced as it relates to natural hazards generally and covers matters in Stage 3 which have not yet been notified.
Objective 10.1 – Subdivision and natural hazards	Not replaced as it relates to natural hazards generally and covers matters in Stage 3 which have not yet been notified.
Policy 10.1.1 – Inundation, flooding and sea level rise	Not replaced as it relates to subdivision of land and potentially high hazard flooding which are matters in Stage 3 which have not yet been notified.

[2] http://proposeddistrictplan.ccc.govt.nz/PropertySearch/ContentContainer.html?page=whatschanging

Provision not replaced	Our reasons for not replacing or deleting
Policy 10.1.2 – Erosion	Not replaced as it relates to erosion and disturbance of land generally and covers matters in Stage 3 which have not yet been notified.
Policy 10.1.3 – Alluvion and avulsion	Not replaced as it relates to subdivision of land and possible other natural hazards which are a matter for Stage 3 which have not yet been notified.
Policy 10.1.4 – Hazard mitigation	Not replaced as it relates to subdivision of land and hazard mitigation generally which are matters in Stage 3 which have not yet been notified.
Volume 3	
Part 9 - Rule 5.3.3(a), (b) and (c) (as it relates to zones that were not notified in Stage 1)	Not replaced as it relates to matters which the Council has identified is also applicable to a Stage 2 or 3 matter, which are yet to be decided.
Part 9 – Rule 5.3.3(c)	Not replaced as it relates to buildings in a Stage 3 matter that has not yet been notified.
Part 9 – Rule 5.3.4	Not replaced as it provides exceptions to matters within Rule 5.3.3 which will remain operative.
Part 9 – Rule 5.6 to the extent that earthworks are taking place in an area identified in this decision as CCMA1 or 2, RFMA 1 or 2, MMA1, 2, or 3 or incorporated into hazard mitigation work or hazard removal works for the Remainder of the Port Hills and Banks Peninsula Slope Instability Management Area	Not replaced as assessment criteria cover a wider range of matters than this decision, which is confined to natural hazard impacts. General earthworks rules are likely to be notified at a later stage.
Part 14 - Rule 7.1	Not replaced as it relates to a range of matters that are in other chapters and later stages which are yet to be decided, as well as reference to critical standards in 7.2 for flood ponding and coastal hazards.
Banks Peninsula District Plan	
Chapter 38 Objectives 1, 2, Policy 1A, Policy 1C, Policy 1D, Policy 1E, Policy 1F, Policy 1I, and Policy 2A	Not replaced as these relate to natural hazards generally and covers matters in Stage 3 which have not yet been notified.
Chapter 38 Rule 1, Rule 2, Rule 3, and Rule 4	Not replaced as these relate to matters in Stage 3 which have not yet been notified.
Chapters 16 Rule 1 & Chapter 19 Rule 1, Rule 3.5, and 5.1, Chapter 20 Rule 1.2 and 2.6	Not replaced as these rules relate to a range of matters that are in Stage 3, in particular various zones that have not yet been considered. In general the thresholds are more permissive than those provided for in this decision.

SCHEDULE 4

Experts' joint statement

IN THE MATTER of the Resource Management Act 1991 and the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014

AND Hearing 5 on the Natural Hazards provisions (Proposal 5) of the Christchurch Replacement District Plan

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Report to Hearings Panel on Expert Caucusing on Land Stability, Liquefaction and Flooding

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A J Sutherland

Facilitator

30 January 2015

This report is to meet the requirement of paragraph 6 of Appendix 2 to the CHRISTCHURCH REPLACEMENT DISTRICT PLAN HEARINGS PROCEDURES dated 1 December 2014.

Plenary Session

The natural hazards experts met in plenary session with the planning experts on Monday 12 January 2015. Procedural matters were discussed and agreed. To assist the planning experts a listing of the topics to be discussed under each of three headings, land stability, flooding and liquefaction was developed.

The topics listed were: Time series and severity of earthquakes; Basis of zoning – residential/industrial; Rockfall, boulder roll and ground truthing; Possibility of mitigation re zoning; Use of area wide approaches; Use of a risk based approach, its parameters; Relationship between vulnerability and actions; Flooding overlays and modelling; Sea level rise; Liquefaction – performance standards and investigations required; Liquefaction at the Port.

Group Sessions

The Planning Group caucused with Mark Chrisp as facilitator. He will provide the report on this meeting.

The Liquefaction Group ran their caucusing throughout Monday 12 January 2015 and provided their joint statement on Tuesday 13 January 2015. The group worked effectively reaching an agreed position on all issues considered.

The Flooding Group also worked independently. Two members of the group had been given leave and thus missed the session on Monday 12 January 2015. The full group met on Monday 19 January 2015 and provided their joint statement on 27 January 2015. No areas of disagreement are noted.

The Land Stability Group caucusing was facilitated by Alex Sutherland.

Two members of the group, Taig and Massey, participated by way of an audio link from the UK. This did not work very well principally because of the quality of the link but also by reason of the time difference between Christchurch and the two participants. The group chose to address first the issues of concern to

these members. After an hour it was clear to all that the process was not effective. The facilitator then excused the two with an assurance that they would have the opportunity to comment on and contribute to any joint statement that emerged from the caucusing.

The group met again on Tuesday 13 January 2015 completing and signing their joint statement on that day.

The Joint Statements from the Liquefaction, Flooding and Land Stability groups are appended to this report.

Additional Statements

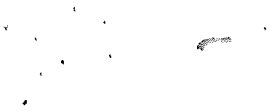
Seismicity. With the seismicity model being such a specialised topic I asked the three experts in this area to prepare a separate joint statement. This is appended to the main statement.

Mr Elmey having signed the joint statement asked to make an individual statement as he felt insufficient attention had been paid to the possibility of land owners in hazardous areas being given the opportunity to undertake hazard mitigation on their property. I agreed to him making such a statement. It is appended to the main statement.

Taig and Massey. The signed statement was e-mailed to Taig and Massey for their comments. Each responded expressing large agreement with the statement and offering their thoughts on individual topics within it. I felt this was appropriate as they had had limited opportunity, by virtue of the unsatisfactory audio link with them, to contribute to the group's discussions. Their statements are appended to the main statement.

Massey raises the question of the area beyond Rockfall Hazard Management Area 2 out to the likely limit of rockfall runout which was not discussed by the main group. In this regard he poses some questions around the policy that may be adopted in this area. The Panel may wish to consider or seek advice on the matters raised.

Taig draws attention to the need for consistent terminology throughout the plan and for clear definition of the terms being used. He agrees with the main group that there is confusion over the meaning of the descriptors used in



connection with risk assessment and provides a possible solution. It is his view that the range within which the group suggested the threshold for intolerable risk should lie is too wide in that it should only extend down to $5x10^{-5}$ rather than to 10^{-5}.

AJ Sutherland 30 January 2015

Christchurch Replacement District Plan Independent Hearings Panel

Joint Statement of the Liquefaction Sub-Panel – 13 January 2015

Panel Members:
Peter Kingsbury (Principal Advisor Natural Resources, CCC)
Nick Traylen (Geotechnical Engineer, Geotech Consulting Ltd)
Michael Jacka (Geotechnical Engineer, Tonkin and Taylor Ltd)
Clive Anderson (Geotechnical Engineer, Golder Associates (NZ) Ltd)

Objectives:

The objectives of the liquefaction sub-panel were to:

- Provide technical advice on liquefaction to the CCC planning group preparing the Replacement District Plan (RDP).

- Consider issues raised by submitters about the RDP and provide technical advice on them to the planning group.

This document is the Joint Statement agreed to by the sub-panel members. It is brief and the issues highlighted can be expanded upon if the planning group wishes to have more detail.

1. Key Facts and Assumptions Agreed by the Experts

- The Canterbury Earthquake Sequence (CES) clearly demonstrated that large areas of the soils underlying Christchurch City are vulnerable to liquefaction induced by earthquake shaking.

- The likelihood that future earthquakes will trigger liquefaction in Christchurch combined with the scale of the socio-economic impacts on the built environment means that the RDP needs to actively promote resilience in these future events.

- Community sustainability and resilience to natural hazards to reduce community disruption and dislocation relies on preserving the integrity of a number of factors including:

    a. Buildings – residential, commercial, industrial and community facilities (considering the need to preserve social as well economic well-being of the community)
    b. Infrastructure – e.g. power supply, roads, buried services
    c. Community amenity and "normality"

- Management of natural hazards involves a balance between land-use controls, building controls, insurance, and acceptance of risk. Historically in New Zealand communities have relied heavily on transferring much of the natural hazard risk to insurance, particularly with respect to land. Recent events have demonstrated that insurance alone does not always provide for all aspects of community resilience. Furthermore the nature of earthquake insurance cover may change in the future.

- The New Zealand Building Code and Civil Defence Emergency Management Act 2002 and allied legislation now require specific measures to consider the impact and consequences of liquefaction on new buildings and lifeline services. It is appropriate that the RDP is aligned with the requirements of these documents.

2. Methodology/Standards Used by the Experts

The principal documents considered by the sub-panel in forming its views on liquefaction are:

- The MBIE Guidelines for Repairing and Rebuilding Houses affected by the Canterbury Earthquakes (MBIE Dec 2012) and updates

- The Building Act 2004
- The New Zealand Building Code
- The Resource Management Act 1991
- Civil Defence Emergency Management Act 2002

In particular the first three documents contain specific requirements for design and construction on land susceptible to liquefaction hazards. The RMA addresses the subdivision of land subject to liquefaction hazard and the CDEM contains requirements for lifeline utility owners to consider hazard mitigation during the design of new infrastructure. The RDP should align with the requirements of these documents.

3. Matters/Issues agreed to by the Experts

The Expert Sub-Panel agreed the following matters:

A. RDP Consistency with Current Legislation and Guidelines

The sub-panel considers that the objectives and liquefaction policies of the RDP Chapter 5 align with the principles of the documents referred to in Section 2 above with respect to liquefaction.

B. New Residential Subdivisions

A key objective for the development of new subdivisions on liquefiable land should be to provide for the resilience of communities from the effects of liquefaction.

There are two possible approaches to mitigating liquefaction effects:

1. One way is to accept that liquefaction may occur and design foundations and buildings to tolerate the resulting ground deformation and other consequences.

2. An alternative method is to improve the ground in such a manner that either liquefaction does not occur or the severity of effects is reduced. This second approach is likely to be more resilient than the first in many cases particularly where the land improvement is applied on an area-wide basis e.g. large scale subdivisions. This

approach may not be applicable in all situations depending on the nature and scale of the development.

Often a combination of the two approaches above is appropriate.

It is important to consider the intensity of proposed development when assessing the consequences of liquefaction on community resilience, as this can influence the scale of effects, and the feasibility of mitigation options. For higher intensity development the scale of effects on the overall community can increase significantly, however it is often more feasible to carry out area-wide land improvement during subdivision construction to manage the effects of liquefaction.

For example low density lifestyle developments or small-scale in-fill subdivisions could adopt the first approach above, relying more on foundations that tolerate land deformation. For higher density subdivisions it may be more appropriate to carry out treatment of the ground (e.g. the second approach above) to mitigate the effects of liquefaction on both buildings and in particular associated infrastructure.

As well as seeking to reduce the future likelihood of widespread social economic disruption to communities the panel also recognised that the ability to transfer liquefaction risk to insurers may change over time leaving private home owners more vulnerable to the financial consequences of liquefaction induced damage. This provides a further reason why in many cases it may be preferable to rely more on improving the performance of land (option 2 above) than relying on buildings being designed to tolerate large ground deformations (option 1 above).

Flexibility should also be provided to enable the adoption of new foundation and ground treatment systems as these are developed.

C. Industrial and Commercial Land Uses

Similar considerations as discussed above for residential subdivisions will also apply for both industrial and commercial land uses. The panel recognises however that the required land performance may vary according to the nature of the land use.

D. Land Performance Standard

The sub-panel recommends that the Christchurch City Council prepares a land performance standard to provide clarity for how the liquefaction provisions of the RDP are to be implemented. This standard should provide specific guidance on required land performance following earthquake shaking with respect to the nature and scale of the proposed development.

E. Investigations for Liquefaction

The panel agrees with the adoption of the MBIE guidance on the scope of investigations for liquefiable ground recognising that it may be appropriate to stage these investigations for large projects.

F. Infrastructure

The sub-panel supports the requirements of the RDP to provide resilience to key infrastructure such as gravity sewers, electricity and water supplies, particularly for new subdivisions. All infrastructure should consider the requirements of the Civil Defence Emergency Management Act 2002 as indicated in the following extract from the guidelines for lifeline utilities:

> Lifeline utilities' responsibilities during risk reduction include reducing the magnitude of the impact of any emergency, as well as minimising the likelihood of the lifeline utility being the cause of an emergency. This includes hazard risk management being undertaken when locating new assets. (Lifeline Utilities and the CEDM June 2014)

The land performance standard discussed in D. above should also include specific guidance for infrastructure. In particular the phrase "the fullest extent possible" should be clarified (Policy 5.2.2).

G. Lyttleton Port Reclaimed Land

Considering the following facts:

- Severe lateral and vertical movement was observed of reclaimed land at the Port during the CES, and
- The Port is a vital lifeline for post-earthquake and business recovery

it was agreed that it was appropriate that the RDP has included the reclaimed land at Lyttleton Port within the defined LAA1 area.

H. LAA1 Boundary with the Port Hills

The boundary of the LAA1 land with the Port Hills should be consistent with the MBIE technical category maps. The sub-panel recommends that the LAA1 boundary be adjusted as necessary.

I. Technical Expertise

It was agreed that the proper assessment of liquefaction and application of risk management strategies to mitigate liquefaction affects should be carried out under the direct guidance of either:

- A Chartered Professional Engineer (CPEng) with competence in geotechnical earthquake engineering, or

- A Professional Engineering Geologist (PEngGeol) with competence in geotechnical earthquake engineering.

4. Matters/Issues Not agreed to by the Experts

The experts did not disagree on any matters.

5. Primary Data

Primary data for the identification of liquefaction susceptible land and assessment of the liquefaction hazard are contained in:

- The Canterbury Geotechnical Database.

- 'Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts (2012)' published by ECAN.

6. Published Standards and Papers relied upon by the Experts

- The MBIE Guidelines for Repairing and Rebuilding Houses affected by the Canterbury Earthquakes (MBIE Dec 2012) and subsequent revisions and clarifications, which sets out key principles for the investigation and mitigation of liquefaction hazard in Christchurch.

7. Confirmation of Compliance with the Code of Conduct for Expert Witnesses

All expert witnesses confirm, by signature below, that they have read and complied with the Code of Conduct for Expert Witnesses:

Peter Kingsbury ..... 13/1/15.

Nicholas Traylen 13/1/15

Michael Jacka 13/1/15

Clive Anderson ..... 13/1/15.

19/1/2015 Natural Hazards – Flooding - Joint Statement for District Plan Review

1) Issue - Rules and polices attached to the Flood Hazard overlays in particular the FLFMA and Fixed Minimum Floor Overlay area may not provide sufficient flexibility to enable local compensatory storage adjustments, or filling within the catchment which does not affect the flood storage. (Polices 5.2.6 Chapter, 5.3.3 Chapter 5, and Flood Hazard Rules 5.8.1.1 and 5.8.1.1).
Discussion – Flood ponding areas could be used to provide compensatory storage if there is no adverse effect on local flooding. This could enable the efficient use of land and infrastructure

Expert Witness Recommendation – Hearings panel review wording of relevant polices, rules and objectives to ensure such activities are not precluded.

2) Issue – Sea Level Rise Projection.

Discussion –The 1.0 metre Sea Level Rise projection to 2115 is based on a mid-range projection given by the IPCC AR5 assessment (2014) under the "business as usual" scenario (RCP 8.5).

Expert Witness Recommendation – 1m SLR to 2115 is suitable for use in the plan.

3) Issue – Confidence in floor level estimates within the FLFMA outside of the fixed floor overlay.

Discussion – The expert panel received clarification over how the modelled results were automatically processed to delineate the extent of the FLFMA. Floor levels outside of the fixed floor overlay, but within the FLFMA, will be determined on a site by site basis and use the base CCC model results, but also draw on the various other data available (Rain on Grid model results, historical flooding, anecdotal flood reports and detailed topographic data) as supporting information, to provide a best estimate of the minimum floor level for the 200 yr design event. Some of the models that cover areas of the FLFMA, outside of the Overlay area (e.g. Dudley Creek Catchment model, Heathcote Valley/Avoca Valley Stream Model), have been developed to a very detailed level and reviewed. These models could provide floor level information with a high degree of confidence and do not require other data sources to be considered.

Expert Witness Statement – The panel is satisfied that, within the FLFMA, there are sufficient model results, supplemented by additional data, to set minimum floor levels for a 200 year design event.

4) Issue – Need to obtain a resource consent for development within the FLFMA areas outside of Fixed Floor Overlay.

Discussion – The expert panel discussed uncertainty of application outcome from the applicant's perspective, cost of consent and timing of obtaining consent. Also concern that the risk lies with landowner if Council cannot provide adequate information.

Expert Witness Recommendations –

The Hearings Panel should consider options for implementing a streamlined, simplified, cost effective process specifically for resource consents associated with setting floor levels within the FLFMA area, outside of the Fixed Floor Overlay.

5) Issue - Peer Review of Flood Models

Discussion - The panel understands there has not been comprehensive formal peer reviews of the main river models, Avon, Heathcote, Heathcote/Avoca Valley Streams, Styx, Sumner, Halswell and Bells Creek. There has been a peer review of the Dudley Creek model, the Avon model and the Heathcote/Avoca Valley Streams model. The panel agrees the river models are the best available information and we note the assessment and statement (T&T Ref. 52010.1500 Final, August 2014) by Tonkin and Taylor on the three main models (Styx, Heathcote and Avon) for EQC flood assessments across the whole of Christchurch. *"T&T consider the use of the river flood models represents the best available information for assessing fluvial flooding across the whole of Christchurch. We consider that the river models, coastal extensions used together with the overland models (T&T, Volume 3, August 2014) address the majority of the limitations described in Table 3-5".*

Council have had in place for some time a process whereby new models or redeveloped models are peer reviewed before they are brought into the wider catchment models such as has occurred for the Dudley Creek model and the Wairarapa/Wai-iti model. The panel acknowledges that all of the models are in a constant state of development so a peer review is limited to the model version at the time. The panel also notes that the main models have all been developed by reputable companies that specialise in hydrodynamic modelling.

Expert Witness Recommendation The panel agrees that peer reviews should continue to be carried out where possible in the future at key stages in model development

6) Issue – Provision of uniform freeboard above estimated flood levels

Discussion The panel also agrees that it is not appropriate to vary the freeboard across the city because it allows for the effects of a number of independent components such as survey error, waves, wind, blockages and model uncertainty.

The panel notes that a freeboard of 250 millimetres is used to determine the horizontal extent of the FLFMA - on the basis that the finished floor level of a residential building is required to be 150 millimetres above the ground level.

This achieves a freeboard of 400 millimetres for the finished floor levels and minimises the extent of the FLFMA.

Expert Witness Recommendation

The panel agrees that a uniform freeboard is required for dealing with a number of uncertainties when setting floor levels.

7) Issue – Water proofing below 200 year level - (tanking)

Expert Witness Recommendation – The panel would not support this as an area wide solution but there is provision within the rules to apply for consent for such a solution.

8) Issue – Boundary and resolution of FLFMA

Discussion - The boundary of the FLFMA runs along the model grid cells which in some instances partially project across property boundaries and some steep changes in topography.

The FLFMA extent has been minimised by using a freeboard of 250 millimetres as described in (6) above with no scope to reduce this further.

Expert Witness Recommendation The panel suggests appropriate LIM wording be created - that distinguishes a minor incursion of the FLFMA into the property from the larger incursions on other properties.

9) Issue – Fixed Floor Level Overlay does not cover the whole of the FLFMA

Discussion The expert panel received confirmation from the CCC experts that the goal of Council was a permitted activity status within all of the FLFMA, provided proposed finished floor levels complied with the 200-yr standard. The panel agreed that the requirement for a restricted discretionary activity was essentially a quirk of the RMA, as the coverage and quality of modelling, at time of Plan notification, did not facilitate a permitted activity status in many areas. Advice from planners had been that if setting floor levels needed a subjective assessment of outputs from different sources (eg different models, historical flood records) to confirm an appropriate level, then this did not meet the requirement for permitted activity status.

The expert panel received clarification regarding the automatic GIS process used to convert the modelled water level outputs into finished floor levels. It was also discussed that this automatic process is not completely reliable and requires a degree of auditing. For example, the automatic floor level allocation process for the Fixed Floor Overlay area resulted in approximately 5% of properties being allocated the incorrect level, which needed to be corrected through a manual audit process. The advice to the expert panel was that the use of the automatic process across the FMFLA, outside the Fixed Floor Overlay, would require a higher degree of auditing and would take considerable time to complete. This audit is essentially what constitutes the onsite assessments in areas such as the Dudley Creek model catchment, where modelling results are good but the conversion of the appropriate water level into a finished floor level requires a manual check to ensure the appropriate water level from the model is used.

It is possible that this audit process could meet the criteria for Permitted Activity Status. It is not a subjective assessment of various data sources, but rather an audit to ensure the appropriate water level from the designated model is selected in order to set the floor level for a property. If this was the case, this could result in the Overlay area extending across much of the Dudley Creek model catchment, and other areas where there is a high degree of confidence in the modelling outputs and floor level determination.

Expert Witness Recommendation

The Hearings Panel should consider options for further increasing the extent of the Fixed Floor Overlay area based on current good modelling information and further auditing by CCC. Confirmation of the finished floor level for each site could be undertaken as part of the Building Consent process by a simple audit by CCC, on a property by property basis as

required, to confirm that the floor level for the site has been calculated from the appropriate water level result in the model version specified in the District Plan

The panel have read and agreed to comply with the Code of Conduct for Expert Witnesses as set out in the Environment Court of New Zealand, Practise Note 2014.

Signed:

Eoghan O'Neill, Marton Sinclair, Mark Ivamy, Graham Harrington, Iris Brookland, Greg Whyte.

Marton Sinclair. 26/01/15

26/01/15.

Iris Brookland 26/01/15

27/01/15

27/1/15

Before the Christchurch Replacement District Plan Independent Hearings Panel

In the Matter of	the Resource Management Act 1991 and the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014
And	
In the Matter of	Priority Hearing 5 on the provisions regarding natural hazards (Slope Hazard) in the Christchurch Replacement District Plan

Memorandum summarising the slope hazard Expert discussion from caucusing undertaken

Dated: 13 January 2015

We wish to acknowledge and record our expertise does not extend in all cases to all matters considered in this report. However we have read and abided by the Code of Practice.

CHRISTCHURCH CITY COUNCIL
PO Box 73013
Christchurch 8154

Summary of the key issues discussed during the expert witness caucusing on Slope Hazards:

Agreed

1. The risk-based approach is appropriate for defining the Hazard Management Areas. The modelling undertaken by GNS Science acknowledges key uncertainties and is an appropriate method for assessing risk in the Port Hills.

2. Field investigations (ground-truthing) undertaken were appropriate to support the area-wide scale of the GNS Science mapping and modelling. This provided the basis for the development of the district plan maps.

3. We acknowledge that the area-wide mapping and modelling is not always sufficient to determine risk on a site-specific basis. The opportunity to undertake individual site assessment must be provided for in the plan (as identified in Section 4 below).

4. Council should, as part of their proposed district plan, include explanations to clarify their policy or policies which should include:

   4.1 Explaining that as the GNS Science modelling and/or mapping of slope hazards was undertaken at an area-wide level; a site-specific estimation of risk should be provided to support any future plan change or resource consent application;

   4.2 The site-specific risk assessment for any plan change process must follow the agreed scientific methods as explained by GNS Science in its various technical reports available on the Council website. For a resource consent, a site-specific assessment provided by an applicant should follow the industry best-practice approach specific to that hazard;

   4.3 It will assist applicants by providing relevant technical data that it may have available.

4.4 It will collate site-specific information to inform any future reviews of hazard mapping in the district plan; and

4.5 It should provide further explanations on what the various land activity rules mean and their implications. For example, would a resident who already has a consented Rockfall Protection Structure that has been maintained and certified still have to obtain a new (additional) resource consent for specific activities?

5. Council should define the downslope limits of Rockfall Hazard Management Areas (RHMA) 1 and 2 using a single model.

6. "Intolerable risk" is a subjective term used in a number of different ways in the plan.

7. We agree that a suitable starting point for determining intolerable risk is to set a threshold at 10^{-4} (1/10,000 per year) annual individual fatality risk (AIFR), acknowledging what is tolerable may be in the range between 10^{-5} to 10^{-3} per year. This is consistent with risk levels currently tolerated in New Zealand and with regulatory practice elsewhere.

8. We consider that a risk-based expression is more appropriate (e.g. intolerable risk) than an effects-based expression (significant adverse effect) as suggested by Tonkin & Taylor in their submission.

9. We have discussed the proposed prohibited and some non-complying activity status for specific industrial areas including the land owned by Lyttelton Port of Christchurch, strategic fuel storage facilities and Lyttelton to Woolston fuel pipeline. It is recognised that industrial activity and critical infrastructure has a different risk profile from residential activity, and that some activities like routine maintenance, hazard mitigation and limited new work required to maintain the operational status of key existing facilities should not require an 'onerous' consenting regime. Council should review the activity status in these areas in light of this concern.

10. The Professional Engineering Geologist (PEngGeol) qualification should be recognised alongside CPEng within the slope instability section of the Plan.

Disagree

11. We acknowledge that there is disagreement amongst the experts with regard to the policy of having two different rockfall zones. The majority of experts support two RHMAs. Two members believe there should be one (P. Elmey, J. Aramowicz) for the following reasons:

    (a) Allows application of a consistent assessment methodology to all properties in the RHMA using one set of parameters (occupancy, seismic hazard, scale factors etc.);

    (b) Avoids creation of a narrow, ineffective strip of land with rockfall hazard determined using a separate second set of parameters; and

    (c) Should include all properties with an intolerable risk as some properties at risk of rockfall may not currently be shown in an RHMA.

12. The group accepts that there are three Mass Movement Hazard Management Areas (MMHMA). One member, D. Bell, considers that MMHMA 2 and 3 should be combined into one area for the following reasons:

    (a) The separation is arbitrary between MMHMA2 and 3, being apparently set at 300mm of displacement;

    (b) There is insufficient robust monitoring data available to make the separation between the two categories;

    (c) Any competent geotechnical professional would carry out an assessment of surface and sub-surface data that is appropriate;

    (d) Since MMHMA 2 & 3 are both considered non-life-threatening, the distinction between the two zones is unnecessary; and

    (e) This would follow Cliff and Rockfall HMAs 1 & 2

The undersigned have all read and agreed to abide by the Environment Court Practice Note 2014 Code of Practice for Expert Witnesses. The experts have also read and agreed to abide by the Hearing Procedures for the Christchurch Replacement District Plan dated 1 December 2014.

The above statement is agreed upon by the following expert witnesses:

Name	Signature	Date
Dr Wendy Saunders		13.1.15
Dr Mark Quigley		13/1/15
Philip Elmey		13.1.15
David Bell		13/01/2015
Dr Ian Wright		13/1/15
Don Macfarlane		13.1.15
Dr Mark Yetton		13.1.15
Paul Horrey		13.1.15
Dr Matt Gerstenberger		13/1/15
John Aramowicz		13/1/15.
Neil Charters		13/1/15
Dr Frederick Maurer		13/1/15
Richard Justice		14/1/15
Tony Talg		
Dr Chris Massey		

In addition to the caucused statement, the following statement is made by Philip Elmey in relation to rockfall hazards:

1. It is my view that 'mitigation' of hazards within much of Rockfall Hazard Management Area (RHMA) 1 and 2 is not practically difficult and is economically beneficial.

2. I consider that the proposed plan effectively treats RHMA1 as if it is undesirable that the hazard is mitigated and encourages 'retreat'. I consider that site specific and/or area wide mitigation to reduce the hazard to acceptable levels in much of this area is technically and economically feasible.

3. The design of structures and earthworks to mitigate rockfall hazards will be informed by a hazard based guidance document which I understand was first developed by the Ministry of Business Innovation and Employment (MBIE) in 2012, but has yet to be issued.

4. I consider that because of the lack hazard based guidance on rockfall - residents and landowners who are subject to the restrictions imposed by the new district plan, are unable to assess their options properly because, as yet:

    a. The lack of a guidance document makes it impossible to determine its technical requirements for, and so estimate the costs involved in, mitigation of the hazard to their property.
    b. No advice has yet been given by Christchurch City Council (CCC) that compliance with the above hazard-based guidance will be a means of satisfactorily mitigating the identified hazards threatening RMHA1 and RMHA2 and thus allow normal building activities (subject to any non-rockfall related constraints)

5. CCC refer to their own Technical Guidelines for Rockfall Protection (TGRPS) as a means of determining the requirements for mitigation in rockfall affected areas, however I note that these have never been accepted by MBIE as a means of compliance with the Building Code. It is my opinion that as risk-based guidelines they are highly subjective leading to inconsistency in approach and inappropriate conservatism (or un-conservatism).

6. I do not accept the TGRPS as adequate for the Engineering profession to properly inform residents of the implications of the Christchurch Replacement District Plan on their properties. Urgent issue of hazard-based guidelines for rockfall mitigation will assist the community with understanding the implication of the district plan provisions on their properties.

Signed

..... Date: 28/04/15

Phil Elmey B.E.(Civil), MIPENZ

The undersigned experts make the following statement in relation to the seismicity model:

We acknowledge the possibility that future earthquakes have the potential to cause additional rockfall and cliff collapse in the Port Hills. Published, peer-reviewed geologic data do not exclude the possibility of future rockfall triggering events from the ongoing sequence or other seismic events. Available site-specific geologic data suggest that clusters of severe rockfall events may be separated by hiatuses spanning 1000s of years but further analysis from additional sites is required to test this hypothesis. The seismicity model was developed by an international expert panel using international best practice and has undergone peer review. Given the recent and modelled earthquake clustering activity and the large uncertainties on predicted ground-motion for an individual earthquake, we agree that the level of conservatism is appropriate.

Name	Signature	Date
Dr Matt Gerstenberger		13/1/15
Dr Mark Quigley		13/1/15
Dr Mark Yetton		13.1.15

Dated 13 January 2015

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www.gns.cri.nz

27 January 2015

The office of the Secretariat of the Independent Hearings Panel

In the matter of:
Priority hearing 5 on the provisions regarding natural hazards (slope hazard)
in the Christchurch Replacement District Plan

Dear Sir/Madam,

Statement of my general agreement with the "Memorandum summarising the slope hazard expert discussion from caucusing undertaken", dated 13 January 2015.

I attended the caucusing on Monday 13 January 2015, for the first two hours of the discussion via telephone from the UK. Given the technical issues associated with the telephone link it was not possible to contribute to the on-going discussions in a meaningful way.

After reading the summary memorandum ("the memo") of these discussions, sent to me on the 14 January 2015, I do not disagree with anything stated in it. I would, however, like to clarify my views and comment on specific points made in the memo, these are as follows – adopting the same numbering as per the memo:

Sections:

4.1 Any site-specific assessments should be mindful of the stated ± one order of magnitude uncertainty in either direction on the absolute risk values given in the GNS Science reports CR2011/311, CR2011/57, CR2012/123, CR2012/124 and CR2012/214.

5. Council should define the downslope limits of rockfall Hazard Management Areas (HMA) 1 and 2 using a single model. Was there any discussion on land use policy for land in the zone between the downslope limit of HMA2 and the assessed limit of rockfall runout, defined by GNS Science as the "10^{-6} annual individual fatality risk line", even if the policy is to have no controls? Please refer to the attached "sketch" for clarification.

9. Acknowledgement that some dwellings may also have a different risk profile, if for example they are only occupied for short periods of time through the year i.e., "baches".

The statement in relation to the seismicity model

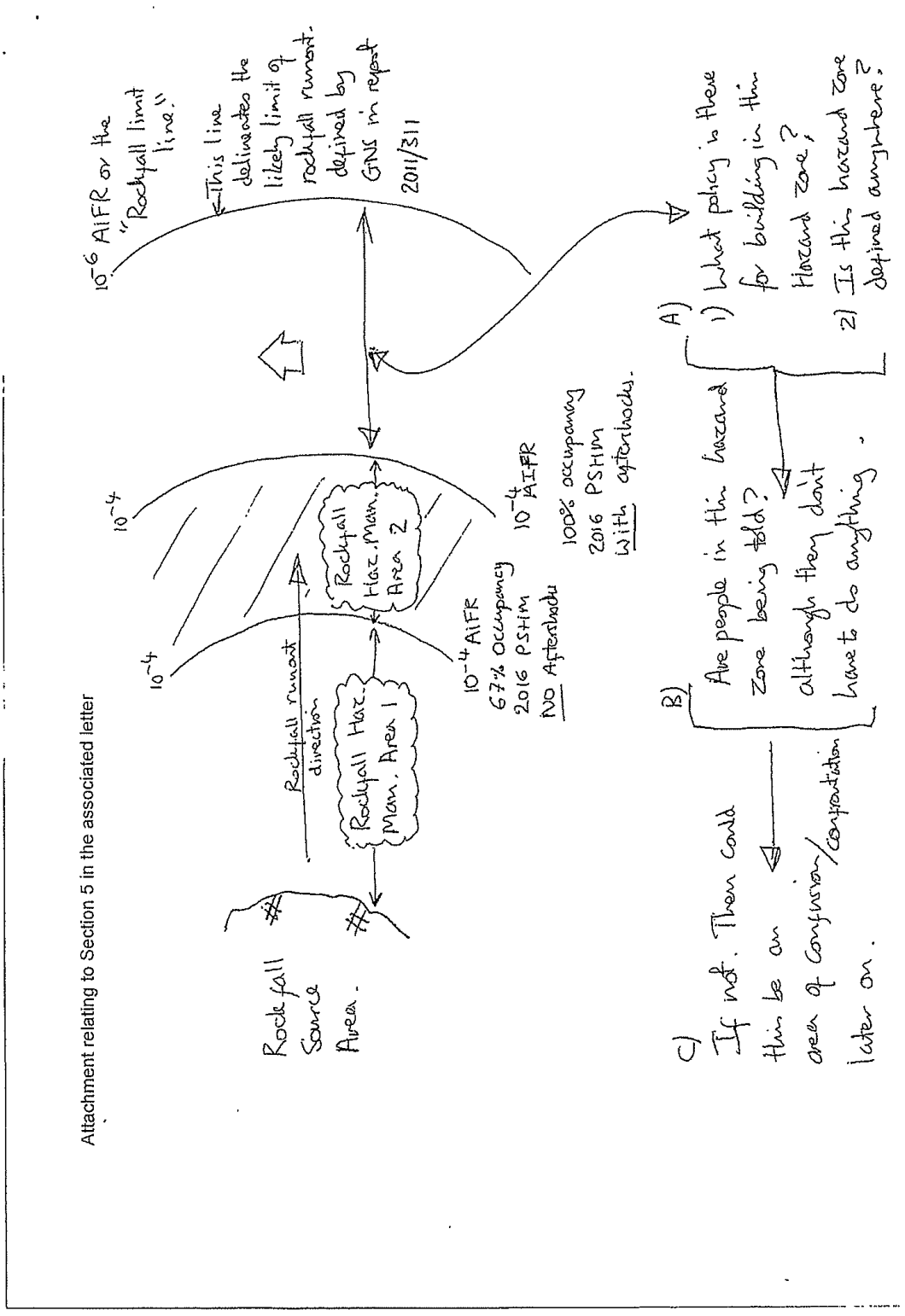
It should also be noted that the stability of the rock mass has changed post 22 February 2011 earthquake(s). Therefore the seismic thresholds for triggering future rockfalls and cliff collapses have also changed post 22 February 2011 earthquake(s). Refer to the peer reviewed GNS Science reports 2014/34 and CR2014/78 for details.

General comment on the caucusing

The assembled experts taking part in the caucusing all have different levels and ranges of technical experience. Is it assumed by the hearings panel that the opinion of each "expert" has equal weighting in the discussions?

Yours faithfully,

Dr Chris Massey


Attachment relating to Section 5 in the associated letter
Rock fall Source Area.
Rockfall Haz. Man. Area 1
Rockfall runout direction
Rockfall Haz. Man. Area 2
10^{-4}
10^{-4}
10^{-4} AIFR 67% occupancy 2016 PSHM NO Aftershocks
10^{-4} AIFR 100% occupancy 2016 PSHM With aftershocks.
10^{-6} AIFR or the "Rockfall limit line."
This line delineates the likely limit of rockfall runout. defined by GNS in report 2011/311
A) 1) What policy is there for building in this Hazard Zone?
2) Is this hazard Zone defined anywhere?
B) Are people in this hazard Zone being told? although they don't have to do anything.
C) If not. Then could this be an area of confusion/confrontation later on.

Christchurch Replacement District Plan ('the Plan') Independent Hearings Panel

Statement of my general agreement with the "Memorandum summarising the slope hazard expert discussion from caucusing undertaken", dated 13 January 2015 ("The Memo") and associated clarification of my interpretation of the related issues.

From A. R. (Tony) Taig, Director, TTAC Ltd, UK

I do not disagree with anything said in The Memo. But for the avoidance of doubt I wish to make clear my views on a number of points in relation to the definition of, and criteria adopted in relation to, different levels of risk applied for the control of development (Points 5, 6 and 7 in The Memo).

I would like to preface my remarks by stating my support for the adoption of a risk-based approach to defining planning zones that provide clear and unambiguous means of controlling development in areas of particular natural hazard risk. I think this is much needed in New Zealand and the approach proposed in the Plan represents a major step forward. There will inevitably be some teething problems in introducing a new approach of this kind, but this should not be allowed to prevent the approach being introduced. While we should do our best to sort out as many of these issues as we can before the Plan takes effect, the "very much better" should not be deferred too long in agonising over "the perfect".

The points on which I would like to clarify my views are as follows.

1. While in general agreement with Point 7 of The Memo I consider 10^{-5} too low a level to be considered as a threshold for intolerable risk due to natural hazards in New Zealand. Many thousands of people all over New Zealand live with such levels of risk; its adoption would set precedents that would be unmanageable nationally. In my work with GNS Science a reasonable range within which to set a threshold of intolerability was suggested to be from $5x10^{-5}$ up to 10^{-4}.
2. Terms used to describe threshold levels of risk and hazard (such as "intolerable risk", "acceptable risk" and "Remainder of the Port Hills and Banks Peninsula Slope Instability Management Area" require clear definition and consistent use throughout the Plan.
3. In particular the terms "Intolerable" and "Acceptable" as used in the Plan could cause confusion. A widely used framework for risk management and regulation internationally is that first proposed by the UK Health & Safety Executive, which considers risk levels in three categories:

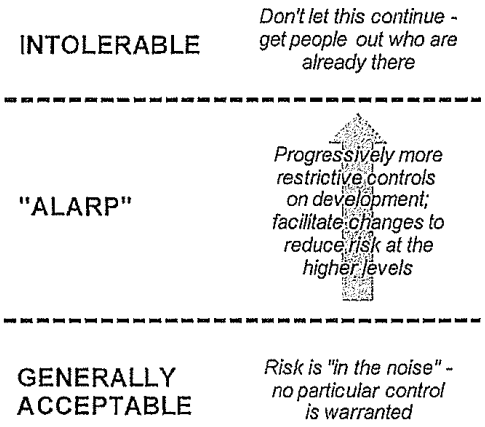
    a) "Intolerable" – the risk is so bad we will not tolerate the continuation of people being exposed at this level; if it cannot be reduced the activity giving rise to the risk should be stopped.

    b) "ALARP" (As Low As Reasonably Practicable) – risk here should be controlled to the lowest reasonably practicable level, with controls becoming progressively more restrictive as the intolerable threshold is approached, and

c) "Generally Acceptable" – to describe a risk level sufficiently small that no special precautions are needed to control risk.

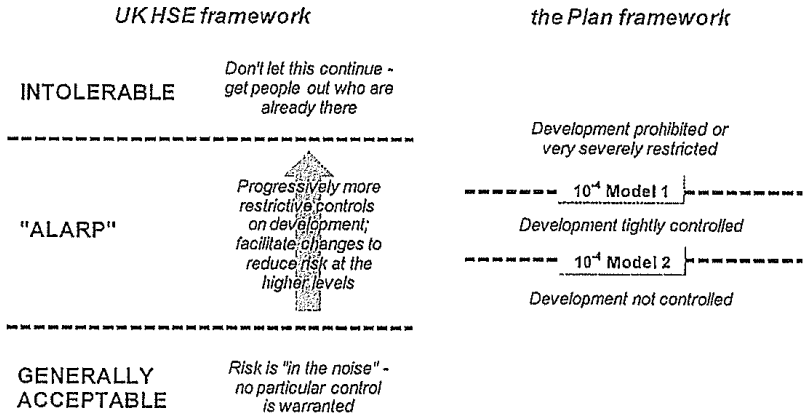
This framework is illustrated in Figure 1, along with my rather crude interpretation of its implications in a land use/planning context.

FIGURE 1: UK HSE Tolerability of Risk Framework



4. In practice, what appears to be the case in the Plan is that two different levels of risk (each 10^{-4} but calculated using Models 1 and 2 so as to define Hazard Management Areas 1 and 2) are used to define zones subject to more and less restrictive planning control. I have tried to express this graphically in Figure 2 in relation to the framework of Figure 1.

5. FIGURE 2: My Interpretation of the Plan 10^{-4} Risk Levels (not to scale!)



6. While the Plan does provide for planning controls gradated in relation to risk I think there is possibility of confusion in a number of areas:

   a) If a risk level is described as "Intolerable" it may seem strange to many people that those already living at such levels of risk can carry on regardless, or are not helped or encouraged to relocate.

   b) The use of the same risk level but different risk models to differentiate zones subject to different levels of control seems unusual (this is a long-winded way of saying I agree very much with point 5 of The Memo)

   c) Potentially substantial risk levels just below that which is described as "intolerable" are classed as "acceptable" and are not controlled. In the way in which these terms are generally used, as well as in the widely applied UK HSE framework, there logically should be a significant gap between that which is "intolerable" and that which is "acceptable". (The proposals made in response to point 4 of the request for clarification from Michael Rachlin of ECan appear to provide a sensible way in which such a distinction might be introduced – e.g. by introducing risk levels of 10^{-4} and 10^{-5} AIFR as the upper and lower boundaries of Hazard Management Area 2).

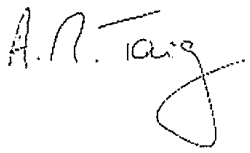
7. I am sympathetic to the views expressed in a number of submissions that different rules or criteria may be appropriate for different types of land use. For example

   a) For particularly sensitive buildings (such as schools), more restrictive rules or criteria may be appropriate, while

   b) For low occupancy leisure uses (such as baches), less restrictive rules or criteria may be appropriate.

It is common practice in the risk-based regulatory regimes applied to planning with which I am familiar to apply different rules for different land uses, consistent with the overarching principle of controlling the risk people face.

I apologise if these points are re-iterating ground that was well covered in the caucusing discussion; it is entirely possible having read The Memo and subsequent correspondence that had I been there and been involved in the full context of the discussion I would have wholeheartedly concurred. But I felt it important, in view of the limitations imposed by distance, time and technology on my participation (and my long experience of the substantial differences that may be associated with different interpretations of statements about risk and what it means), to ensure that I clarified my views as above.



A. R. Taig

SCHEDULE 5

Key changes to the notified proposal made by our decision.

Notified Proposal's provision	Changes made by our decision
Introduction	Introduction rewritten to address core concepts of the Natural Hazards chapter.
Objective 5.1.1 – Reduced risk	Deleted. New Objective 5.1.1 introduced which expands on Strategic Objective 3.3.6 and incorporates awareness of natural hazards and repair of earthquake damaged land.
Objective 5.1.2 – Awareness of natural hazards	Incorporated into new Objective 5.1.1.
Objective 5.1.3 – Repair of earthquake damaged land	Incorporated into new Objective 5.1.1.
Policy 5.2.1 – Avoid development where there is unacceptable or intolerable risk	Replaced with new Policy 5.2.1.1 – Avoid new development where there is unacceptable risk. Concepts of "unacceptable" and "intolerable" combined.
Policy 5.2.2 – Critical infrastructure	Renumbered to Policy 5.2.1.3 - Infrastructure, minor drafting changes for better clarity. Expanded to recognise all infrastructure.
Policy 5.2.3 – Restrict land use to avoid or mitigate hazards	Re-numbered to Policy 5.2.1.2 – Manage activities to address natural hazard risk, minor changes for clarity.
Policy 5.2.4 - Precautionary approach	Deleted
Policy 5.2.5 - Worsening, adding or transferring hazard	Renumbered to Policy 5.2.1.4, retitled "No transferring of natural hazard risk", minor drafting changes for better clarity
Policy 5.2.6 – Natural features providing hazard resilience	Renumbered to Policy 5.2.1.5
Policy 5.2.7 – Awareness of natural hazards	Renumbered to Policy 5.2.1.6, and expanded to specify how people will be informed of natural hazards.
n/a	New Policy 5.2.1.8 derived from old 5.4.1b, applied to all hazards.
Policy 5.3.1 – High flood hazard	Incorporated into new Policy 5.2.2.1 – Flooding as (b) and amended for clarity. New policy includes the basis of the mapping of the Flood Management Area (old Floor Level and Fill Management Area), incorporating sea-level rise and climate change. Combines proposed Policies 5.3.1-5.3.4.
Policy 5.3.2 – Flood protection works	Incorporated into new Policy 5.2.2.1 – Flooding as (c) and amended for clarity. Transfer of flood risk already addressed by Policy 5.2.1.4, so transfer of risk in relation to stopbanks removed.
Policy 5.3.3 – Protection of flood storage and overflow areas	Incorporated into new Policy 5.2.2.1 – Flooding as (d) and amended for clarity. Transfer of flood risk already addressed by Policy 5.2.1.4, so transfer of risk removed. New (e) added to address fill management.
Policy 5.3.4 – Flood damage mitigation by raising floor levels	Incorporated into new Policy 5.2.2.1 – Flooding as (f). Provision made for buildings not likely to suffer material damage.

Notified Proposal's provision	Changes made by our decision
Policy 5.3.5 – Repair of earthquake damaged land	Moved to new general Policy 5.2.1.7.
Policy 5.4.1 – Geotechnical risk including liquefaction susceptibility	New Policy 5.2.3.1 – Management of liquefaction risk combining parts of old 5.4.1 and 5.4.2, repetition removed. New (a) to describe how mapping derived. 5.4.1b moved to new general Policy 5.2.1.8 applying to all hazards.
Policy 5.4.2 – Management of geotechnical risks on flat land.	Incorporated into new Policy 5.2.3.1 and repetition removed. Term "geotechnical risk" removed.
Policy 5.5.1 – Areas subject to an intolerable risk to life-safety from potential cliff collapse.	New Policy 5.2.4.1 – Slope instability incorporating old 5.5.1 to 5.5.3. New part (a) which sets out how mapping derived. Avoids subdivision where unacceptable risk to life safety greater than 10^{-4}. Otherwise mitigate damage to infrastructure and property to an acceptable extent.
Policy 5.5.2 – Areas potentially affected by rockfall or boulder roll.	Incorporated into new Policy 5.2.4.1. Reference to boulder roll removed as it is part of rockfall.
Policy 5.5.3 – Areas potentially affected by mass movement.	Incorporated into new Policy 5.2.4.1.
n/a	New Policy 5.2.4.2 Site-specific risk assessment in areas potentially affected by rockfall, providing for site-specific assessment of rockfall and certification to enable different rules to apply to certified land.
Policy 5.5.4 – Slope instability in areas not already identified as cliff collapse, rockfall or mass movement (remainder of Port Hills and Banks Peninsula).	Provides basis for new Policy 5.2.4.3 which incorporates old 5.5.4 and 5.5.5.
Policy 5.6 1 – Climate change and sea level rise	Deleted, deferred to Stage 3.
Policy 5.7 – Multiple natural hazard areas	Deleted.
Rule 5.8.1.1 – Permitted activities (in flood areas)	Floor Level and Fill Management Area renamed Flood Management Area. New introductory text to 5.3.1. Old 5.3.1 and 5.8.3 combined, so that single table addresses commercial, industrial and residential zones. Permitted activities largely the same as caucus version, tables re-ordered. New P3 and P4 which enable certification for floor levels outside of the Fixed Minimum Floor Level Overlay.
n/a	New Rule 5.3.1.2 providing for certification of a minimum finished floor level within a Flood Management Area and outside of the Fixed Minimum Floor Level Overlay.
n/a	New exemption Rule 5.3.1.3 for recession planes in Flood Management Area that provides for ground level at the boundary to be the same as any minimum floor level requirement, or natural ground level, whichever is the higher.
n/a	New exemption Rule 5.3.1.4 which provides for an exemption for compliance with minimum floor levels where a PIM has been issued for an earthquake-damaged building.
Rule 5.8.1.2 – Restricted discretionary activities (in flood areas)	Incorporated into Rule 5.3.1.5 Restricted discretionary activities. Reduced number of activities. Matters of discretion differentiated from assessment criteria. Matters that were not assessment criteria or did not relate directly to the hazard removed.

Notified Proposal's provision	Changes made by our decision
Rule 5.8.1.3 – Discretionary, non-complying and prohibited activities (in flood areas)	Incorporated as Rule 5.3.1.6.
Rule 5.8.2 – Repair of land used for residential purposes damaged by earthquakes within a Floor Level and Fill Management Area	Incorporated into 5.3.2, minor changes for clarity, activity standards incorporated into table 5.3.2.1a.
Rule 5.8.3 – Commercial and industrial zones – activities and earthworks in FLFMAs	Incorporated into Rule 5.8.1.
Rule 5.9.1 – Permitted activities (liquefaction)	New permitted activity Rule 5.4.1.
Rule 5.9.2 Restricted discretionary activities – Liquefaction Assessment Areas 1 and 2	Liquefaction assessment area 2 deleted. Liquefaction assessment area 1 renamed Liquefaction Management Area. Subdivision made a new controlled activity under Rule 5.4.2. Matters of control differentiated from assessment criteria. Matters that were not assessment criteria or did not relate directly to the liquefaction hazard removed.
Rule 5.9.3 Restricted discretionary activities – Liquefaction Assessment Area 1	Re-numbered to Rule 5.4.3. Matters of discretion differentiated from assessment criteria. Matters that were not assessment criteria or did not relate directly to the hazard removed.
Rule 5.9.4 Discretionary, non-complying and prohibited activities (liquefaction)	Re-numbered to Rule 5.4.4.
Rule 5.10.1 – Activity status for Port Hills and Banks Peninsula Slope Instability Management Areas	Re-numbered to Rule 5.5.1. All discretionary activities made restricted discretionary. Excludes land within Specific Purpose (Lyttelton Port) Zone. New provisions inserted for earthworks associated with repair and maintenance of existing infrastructure, which is a new controlled activity. New activities relating to walking tracks, farm buildings and farm tracks inserted. Notification and written approval removed from all restricted discretionary and controlled activities. Areas renamed.
n/a	New Rule 5.5.1.2 – Exceptions to Rule 5.5.1 – Rockfall AIFR Certificate enables application of risk area rules based on site specific rockfall certificate.
n/a	New Rule 5.5.1.3 Activity status for Slope Instability Management Areas within the Specific Purpose (Lyttelton Port) Zone.
n/a	New Rule 5.5.1.4 Slope instability management areas – C1-C6 matters of control addressing earthworks.
n/a	New Rule 5.5.1.5 Slope instability management areas – C7-C28 matters of control addressing controlled port activities.
Rule 5.10.2 Remainder of Port Hills and Banks Peninsula Slope Instability Management Areas RD1-3 matters of discretion.	Incorporated into new single set of matters of discretion and restricted discretionary assessment criteria at Rule 5.5.1.6.
Rule 5.10.3 – Slope instability management areas D5-D26 assessment matters for land use resource consent applications.	Incorporated into new single set of matters of discretion and restricted discretionary assessment criteria at Rule 5.5.1.6.

Notified Proposal's provision	Changes made by our decision
Rule 5.10.4 – Slope instability management areas D1-D13 assessment matters for subdivision or earthworks resource consent applications.	Incorporated into new single set of matters of discretion and restricted discretionary assessment criteria at Rule 5.5.1.6.
Rule 5.11.1 – Information requirements for all plan changes	Deleted.
Rule 5.11.2 – Additional information requirements for all resource consent application for subdivision	Re-numbered to Rule 5.6.3, refers to Liquefaction Management Area. Advice notes removed.
Rule 5.11.3 – Additional information requirement for land use activities in flat areas where a geotechnical report is required	Re-numbered to Rule 5.6.1. Advice notes removed.
Rule 5.11.4 – Additional information requirements for resource consent applications within Port Hills and Banks Peninsula Slope Instability Management Areas	Re-numbered to Rule 5.6.2. Advice notes removed.
Rule 5.12 - General procedure – compliance with other chapters	Deleted.
Definition of critical infrastructure	Retained and "radiocommunications" installations added.
Definition of high flood hazard	Retained with addition of "and shown on the planning maps".
Definition of infrastructure	Retained with changes recommended by Council.
Definition of pressurised injection.	Retained and changed to "40 bar".
Definition of strategic infrastructure	Retained as per Strategic Directions decision.
Definition of hazard mitigation	Retained with removal of "the removal and/or relocation of some rock hazards".
n/a	New definition of "maintenance and repair of existing infrastructure".
n/a	New definition of "minor upgrading of the electricity network".
Planning maps	To be amended as directed, and subject of a further decision.

SCHEDULE 6

Further Minute

Minute – Rockfall Certification – Natural Hazards Proposal, 18 June 2015

Independent Hearings Panel
Christchurch Replacement District Plan
Te paepae motuhake o te mahere whakahou a rohe o Ōtautahi

IN THE MATTER OF the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014

AND

IN THE MATTER OF Directions pursuant to Schedule 3 Clause 7 and 8 of the Canterbury Earthquake (Christchurch Replacement District Plan) Order 2014

Date: 18 June 2015

MINUTE
ROCKFALL CERTIFICATION - NATURAL HAZARDS PROPOSAL

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1. A number of submissions on the Natural Hazards Proposal sought a permitted activity status in relation to the matter of rockfall. As a Panel, we explored whether this could be undertaken by way of certification. In the time available, no parties were able to provide a workable option.

2. This was a matter traversed throughout the Hearing, and resulted in the following exchange[1]:

> *SJH: Because it has been a clear, so much of the Board of Inquiry procedure has been drafted, a clear decision has been made not to include the draft decision process - - -*
>
> *MR RADICH: Yes.*
>
> *SJH: - - - possibly because of the urgency that is perceived here.*
>
> *MR RADICH: Yes, an interim decision, yes. Is that a possibility? I wonder if there is a possibility of that or whether there is a possibility to keep the Hearing open, you know, while that sort of - - -*
>
> *JUDGE HASSAN: So an adjournment with a Minute which raises questions but does not say that the decision has been made and makes it clear that it hasn't.*

[1] Transcript for the Natural Hazards Proposal, page 1164

Independent Hearings Panel
Christchurch Replacement District Plan
Te paepae motuhake o te mahere whakahou a rohe o Ōtautahi

SJH:I think we can indicate we will be adjourning and not closing the Hearing because there are so many difficult questions that we are still wrestling with that we made need assistance on.

MR RADICH: I can certainly see that, sir. And so the position that the Crown gets to, for example, in slope instability, is that at the moment it was too challenged to be able to find a way through the doorway of using criteria to provide further economic fairness.

If the Panel can think of a way, and therefore the Crown was saying, what there is now is a socially acceptable balance that ticks sufficient boxes and if the Panel was of that view too then that would be a regime that would be in place for a number of years, subject to the ability for there to be plan changes when further information comes out. That is reluctantly the Crown's position.

However, if there is the ability for a mechanism to enable adjustments to made without a plan change in the Panel's mind that would benefit from further testing through experts, then that would have the Crown's full support.

JUDGE HASSAN: Potentially, I suppose it could be on a more limited basis that assistance is sought on whether in fact it is legally sound.

MR RADICH: Yes.

JUDGE HASSAN: In other words by legal submission based on the evidence before the Panel.

MR RADICH: Yes, I see. Yes.

JUDGE HASSAN: I wonder out loud for instance about the capacity to have a zone map which defines an area but within that a capacity for ground truthing and a ready reference map that allows for certain properties once ground truth to be determined to be hazard free then to have it in mind locked to a permitted activity regime at that point for activities on that land possibly.

I mean that is probably a lot to take in at 6.05 pm, and it is only a half formed thought but those are the sorts of things that you end up testing which are not drafted in any sense but maybe things we need to think about on the evidence before us.

MR RADICH: Yes, if there was a pathway along those lines, your honour, then that would be embraced. We have struggled with finding it. That is not to say it cannot be found. If there was a pathway then I think it should be pursued because we have all heard the effects that lines of the maps do have, and there is no doubt about that at all.

JUDGE HASSAN: Yes, and I suppose the other thing we do have available to us, limited though it is, is some flexibility on time and when the final decision should issue.

MR RADICH: Yes, that is so, sir. I guess the concern is – and this is a more challenging chapter in this sense, perhaps than some others where you may be able to bite the bullet more readily and close a hearing fully. It would be problematic for the Panel obviously if they were all left open for

a while but this is one of them where I think the evidence has reached a point where if the Panel thinks it can find a pathway then rather than biting the bullet, I think an adjournment along the lines you suggest, sir, could well be appropriate.

3. As such, we adjourned the Hearing for the Natural Hazards Proposal.

4. Draft policy and rule constructs have been prepared to be considered as an option as Attachment A, based on the evidence before the Panel. Given the technical nature of the policy, and with our knowledge, this was checked by the Independent Secretariat with Dr Mark Yetton and Mr Ian Wright to ensure that it was technically correct in terms of the geotechnical matters expressed. Notes recording that are provided as Attachment B.

5. We reiterate that we have not made any decision on this matter. We seek to ensure all parties who submitted on this matter of rockfall have the opportunity to provide legal submissions on it.

6. We now seek submissions and comments from submitters (including the Council) on this matter on legal, minor or technical matters on the attached draft, to be filed by **5pm Wednesday 24th June 2015** identifying:

(a) Whether there are any technical errors in the provisions; and

(b) Whether, as drafted, the policy and rule framework is *intra vires*.

Hon Sir John Hansen
Chairperson

ATTACHMENT A
DRAFT PROVISIONS FOR LEGAL SUBMISSIONS

5.2.4 Policies for managing risk from slope instability

5.2.4.1 Policy - Slope instability

a. Map hazard risk areas for slope instability at an area-wide scale using the following fixed inputs into risk calculations[2] that establish the Annual Individual Fatality Risk (AIFR) for a typical residential site[3]:

	Inputs			Mapped risk (AIFR)
Slope instability hazard management area	Percentage of a day the property is assumed to be occupied (%)	Year of predicted seismic activity used in modelling	Whether or not the property is evacuated immediately following a Natural Hazard Event	
Cliff Collapse Management Area 1	100	2012	No	$>10^{-2}$
Cliff Collapse Management Area 2	100	2012	No	$>10^{-4}$
Rockfall Management Area 1	67	2016	Yes	$>10^{-4}$
Rockfall Management Area 2	100	2016	No	$>10^{-4}$
Mass Movement Management Area 1	67	2016	Yes	$>10^{-4}$
Mass Movement Management Area 2	Refer to natural hazard maps			

b. In slope instability hazard management areas in the Port Hills and across Banks Peninsula:

i. Avoid subdivision, use and development where, taking into account any mitigation proposed, it will result in an unacceptable risk to life safety (AIFR $>10^{-4}$ based on the fixed inputs in (a) above into risk calculations using the GNS method for establishing life safety risk, and any best practice amendments for modelling and other inputs into those calculations); and

ii. Manage subdivision, use and development so that property and infrastructure is safeguarded.

[2] Using the method described in *GNS Science Consultancy Report 2011/311 Canterbury Earthquakes Port Hills Slope Stability: Pilot study for assessing life-safety risk from rockfalls (boulder rolls).* Calculations also include modelling and estimates such as probability of a rockfall event, vulnerability, rockfall volumes, and rockfall run-out. The mapping does not take account of mitigation measures. Rocks can, and will, fall outside of the mapped hazard risk areas, however the risk of a fatality is lower.

[3] Except Mass Movement Management Area 2 which is mapped based on potential effect on property, not Annual Individual Fatality Risk.

5.2.4.2 Policy – Site-specific risk assessment in areas potentially affected by rockfall

a. Where a site-specific assessment of risk from rockfall, undertaken in accordance with best practice methods, calculates that the Annual Individual Fatality Risk (AIFR) for all or part of a site is less than the AIFR that was mapped at an area-wide scale (in accordance with Policy 5.2.4.1), the rules applying to that land will correspond with the site-specific risk assessment.

b. Ensure that the most recent and relevant information is made readily available to existing and future landowners, and other interested people, from all site-specific risk assessments of land identified in this Plan as being potentially affected by rockfall.

c. Regularly update the maps in this plan to reflect updated information certified by the Council in relation to life-safety risk (refer to rule 5.5.1.2).

5.5.1.2 Exceptions to Rule 5.5.1 – Rockfall AIFR Certificate

a. Within Rockfall Management Area 1, where land is specified in a Rockfall AIFR Certificate, issued by the Council in accordance with the procedure described in Rule 5.5.1.2c. below, as having a calculated AIFR within the range specified for Rockfall Management Area 2 in Policy 5.2.4.1(a) but less than that specified for Rockfall Management Area 1, the activity status listed for the relevant activity in Rockfall Management Area 2 shall apply to that identified land.

b. Within Rockfall Management Area 1 or 2, where land is specified in a Rockfall AIFR Certificate, issued by the Council in accordance with the procedure described in Rule 5.5.1.2c. below, as having a calculated AIFR less than the range specified for Rockfall Management Area 2 in Policy 5.2.4.1(a), the activity status listed for the relevant activity in the Remainder of Port Hills and Banks Peninsula Slope Instability Management Area shall apply to that identified land.

c. Procedure for issuing a Rockfall AIFR Certificate:

i. The Council will issue a Rockfall AIFR Certificate (which will be valid for 2 years from the date of issue) which specifies the calculated AIFR from A. and B. below for an identified area of land, when the following procedure is undertaken and its requirements are satisfied:

A. The Council has received a report, in respect of an identified area of land, prepared by a Chartered Professional Engineer with requisite experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered), which calculates the AIFR from rockfall for the identified land in accordance with the method in *GNS Science Consultancy Report 2011/311 Port Hills Slope Stability : Pilot Study for assessing life-safety risk form rockfalls (boulder rolls)*, and any best practice amendments for modelling and other inputs into those calculations; and

B. The Council has commissioned and received a peer review report from a Chartered Professional Engineer with requisite experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered), who is professionally independent from the person who prepared the report

received in A. above and from the Council, which concurs with the application of the method required in A. above, and with the calculated AIFR for the identified land.

Note: Calculated AIFRs specified in issued Rockfall AIFR Certificates for identified areas of land will be made freely available to the public, recorded in the Council's Geographical Information System and provided in Land Information Memoranda. Planning maps will also be regularly updated to reflect this information.

ATTACHMENT B
RECORD OF MEETING

Memorandum – Record of discussion with Dr Mark Yetton and Mr Ian Wright

1. The Hearings Panel tasked me, based on deliberations and directions from the Panel Members, to draft policy as it related to the possible use of site specific certification to establish a permitted activity standard. This might apply where AIFR on a site was shown to be less than those levels mapped by the Council in its proposal at an area-wise level.

2. Notwithstanding that the Hearings panel had not made any decisions on the matter, I was asked to test the draft provisions with Dr Mark Yetton and Mr Ian Wright to ensure they were technically correct in relation to the geotechnical matters in the provisions.

3. I met with Dr Mark Yetton and Mr Ian Wright on Tuesday 2 June at 9am. I provided a draft policy 5.2.41 and Rule 5.5.1.2 (as attached). I sought their comments, from a technical point of view, as to whether the proposals were accurate and technically workable, taking into account the work they had done recommending hazard lines based on site specific visits.

4. My understanding is they confirmed:
    a. No technical issues.
    b. The provisions provide a sound summary of rockfall risk analysis and determination of AIFR.
    c. They were comfortable with the concept.
    d. They noted that there was a question around the work "certificate" given the wide margin of error being an order of magnitude either side of the certified AIFR.
    e. They noted that vegetation wasn't referred to and was not mitigating factor in modelling.

5. I re-confirmed with them at the end of the meeting that the policy was a draft option and no decisions had been made by the Panel, and retained copies of the draft proposals provided.

Marcus Langman
Independent Secretariat

5.2.4.1 Policy - Slope instability

a. Map hazard risk areas for slope instability at an area-wide scale using the following fixed inputs into risk calculations[1] that establish the Annual Individual Fatality Risk (AIFR) for a typical residential site[2]:

	Inputs			Mapped extent of risk (AIFR)
Slope instability hazard management area	Percentage of a day the property is assumed to be occupied (%)	Year of predicted seismic activity used in modelling	Whether or not the property is evacuated immediately following a Natural Hazard Event	
Cliff Collapse Management Area 1	100	2012	No	$>10^{-2}$
Cliff Collapse Management Area 2	100	2012	No	$>10^{-4}$
Rockfall Management Area 1	67	2016	Yes	$>10^{-4}$
Rockfall Management Area 2	100	2016	No	$>10^{-4}$
Mass Movement Management Area 1	67	2016	Yes	$>10^{-4}$
Mass Movement Management Area 2	Refer to natural hazard maps			

b. In slope instability hazard management areas in the Port Hills and across Banks Peninsula:

i. Avoid subdivision, use and development where, taking into account any mitigation proposed, it will result in an unacceptable risk to life safety (AIFR $>10^{-4}$ based on the fixed inputs in (a) above into risk calculations using the GNS method for establishing life safety risk, and any best practice amendments for modelling and other inputs into those calculations); and

ii. Manage subdivision, use and development so that property and infrastructure is safeguarded.

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[1] Using the method described in *GNS Science Consultancy Report 2011/311 Canterbury Earthquakes Port Hills Slope Stability: Pilot study for assessing life-safety risk from rockfalls (boulder rolls).* Calculations also include modelling and estimates such as probability of a rockfall event, vulnerability, rockfall volumes, and rockfall run-out. The mapping does not take account of mitigation measures. Rocks can, and will, fall outside of the mapped hazard risk areas, however the risk of a fatality is lower.

[2] Except Mass Movement Management Area 2 which is mapped based on potential effect on property, not Annual Individual Fatality Risk.

5.5.1.2 Exceptions to Rule 5.5.1 – Rockfall AIFR Certificate

a. Within Rockfall Management Area 1, where the land is specified in a Rockfall AIFR Certificate, issued by the Council in accordance with the procedure described in Rule 5.5.1.2c. below, as having an AIFR less than the levels specified for Rockfall Management Area 1 in Policy 5.5.1(a), the activity status listed for the relevant activity in Rockfall Management Area 2 will apply;

b. Within Rockfall Management Area 1 or 2, where the land is specified in a Rockfall AIFR Certificate, issued by the Council in accordance with the procedure described in Rule 5.5.1.2c. below, as having an AIFR less than the levels specified for Rockfall Management Area 2 in Policy 5.5.1(a), the activity status listed for the relevant activity in the Remainder of Port Hills and Banks Peninsula Slope Instability Management Area shall apply.

c. Procedure for issuing a Rockfall AIFR Certificate:

i. The Council will issue a Rockfall AIFR Certificate (which will be valid for 2 years from the date of issue) which specifies the AIFR for identified land when the following procedure is undertaken and its requirements are satisfied:

A. The Council has received a report, prepared by a Chartered Professional Engineer with experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered), which calculates the AIFR from rockfall for the identified land in accordance with the method in *GNS Science Consultancy Report 2011/311 Port Hills Slope Stability : Pilot Study for assessing life-safety risk form rockfalls (boulder rolls*), and any best practice amendments for modelling and other inputs into those calculations.

B. The Council has commissioned and received a peer review report from a Chartered Professional Engineer with experience in geotechnical engineering or a Professional Engineering Geologist (IPENZ registered), who is professionally independent from the person who prepared the report received in (A) above, which concurs with its assessed AIFR for the identified land.

Exemptions will be made freely available to the public, recorded in the Council's Geographical Information System and in provided in Land Information Memoranda, as well as being regularly updated in the planning maps.

SCHEDULE 7

Submitter relief tables with decision and associated direction

ROCK FALL, CLIFF COLLAPSE, MASS MOVEMENT	
Submitter	**Decision and associated direction**
136: Young, 72 Landsdowne Tce, Cashmere	Amend RFMA1 and RFMA2 in accordance with Dr Yetton Rebuttal Evidence dated 27 February 2015 R2.*
149: Taylor, 62 Governors Bay Road, Cass Bay	Amend RFMA1 and RFMA2 in accordance with Dr Yetton Evidence dated 13 February 2015 Appendix 9 Plans 9.1 and 9.2.
162: Kingham, 101E Bowenvale Ave, Cashmere	Amend RFMA in accordance with Dr Wright Supplementary Evidence dated 16 March 2015 Figure 2.*
268: Ging, 90 Avoca Valley Road, Heathcote Valley	Amend CCMA1 and CCMA2 in accordance with Dr Wright Evidence 13 February 2015 Figure 2.
282: Stevens, 90 Governors Bay Road, Cass Bay	Amend RFMA in accordance with Dr Yetton Evidence 13 February 2015 Appendix 10 Plan 10.2.
290: Angelo, 6 Endeavour Lane, Lyttelton	Remove RFMA1 in accordance with Dr Wright Evidence 13 February 2015 Figure 1.
298: Stark, 37 The Terrace, Governors Bay	Remove RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 12.
299: Toothill, 34 Taupata St, Redcliffs	Remove MMA1 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 16.
316: Wright, 1 Trecastle Lane, Huntsbury	Remove MMA2 in accordance with Carter Supplementary Evidence dated 19 February 2015, para 5.1, Appendix B.
326: Lewis, 319 Worsleys Road, Cracroft	Amend RFMA1 and RFMA2 in accordance with Dr Yetton Evidence 13 February 2015 Appendix 11 Plan 11.3.
383: Peterson, 21 Morgans Valley Road, Akaroa	Amend RFMA1 and RFMA2 in accordance with Dr Wright Rebuttal dated 27 February 2015 Figure 2.
384: Wright, 17 Morgans Valley Road, Akaroa	Amend RFMA1 and RFMA2 in accordance with Dr Wright Rebuttal dated 27 February 2015 Figure 2.
406: Flynn, 160 Bridle Path Road, Heathcote	Amend RFMA1 and RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 3.
411: Manley, 4 Hays Road, Governors Bay	Remove RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 9.
457: Kilduff, 101 Clifton Tce, Sumner	Remove RFMA1 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 17.
478: Van Huttum, 24 Bridle Path Road, Heathcote	Remove RFMA1 and RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 4.

ROCK FALL, CLIFF COLLAPSE, MASS MOVEMENT	
Submitter	**Decision and associated direction**
599: Clark and Millar, 57 Morgans Valley Road, Akaroa	Remove RFMA1 and RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 10.
605: Altments, 77A and 79 Bowenvale Road, Cashmere	Remove RFMA1 and RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 5.
606: Holyoake, 105 Hollis Ave, Cashmere	Amend RFMA1 and RFMA2 in accordance with Dr Yetton Evidence dated 13 February 2015, Appendix 17 Plans 17.1 and 17.3.*
762: Lyttelton/Mt Herbert Community Board/Lyttelton Group /(various), 5 and 7 Endeavour Lane and 1, 2A and 4 Norton Close, Lyttelton	Remove RFMA1 and RFMA2 in accordance with Dr Wright Evidence 13 February 2015 Figure 1.
789: KI Commercial, 51 Heberden Ave, Sumner	Remove CCMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 6.
792: Lyttelton/Mt Herbert Community Board/Lyttelton Group /(various), 5 and 7 Endeavour Lane and 1, 2A and 4 Norton Close, Lyttelton	Remove RFMA1 and RFMA2 in accordance with Dr Wright Evidence 13 February 2015 Figure 1.
801: Zimprich, 9 Endeavour Lane, Lyttelton	Amend RFMA1 slightly and add RFMA2 in accordance with Dr Wright Evidence 13 February 2015 Figure 1.
830: Borren and Cotterill, 52 Morgans Valley Road, Akaroa	Remove RFMA1 and RFMA2 in accordance with Dr Wright Rebuttal Evidence dated 27 February 2015 Figure 4.
845: Stubenvoll, 40 Brenchley Road, Lyttelton	Amend RFMA1 and RFMA2 in accordance with Dr Yetton Rebuttal Evidence dated 27 February 2015, R3.1 and R3.2.
847: Port Hills Property Group, 75 and 77 Heberden Tce	Remove CCMA2 in accordance with Dr Wright Rebuttal Evidence dated 27 February 2015 Figure 3.
847: Port Hills Property Group, Morgans Valley Road, Akaroa	Amend RFMA1 and RFMA2 in accordance with Dr Wright Rebuttal Evidence dated 27 February 2015 Figure 4.
915: Lyttelton Port Company, 7 Simeon Quay, Lyttelton	Remove CCMA2 in accordance with Dr Wright Rebuttal dated 27 February 2015 Figure 1.
921: Theobald, 55 Morgans Valley Road, Akaroa	Remove RFMA1 and RFMA2 in accordance with Dr Yetton Evidence dated 13 February Figure 8.
1015: Ablett, 15 Somes Road, Lyttelton	Remove RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 11.

ROCK FALL, CLIFF COLLAPSE, MASS MOVEMENT	
Submitter	**Decision and associated direction**
1039: Hurl, 5 Endeavour Lane, Lyttelton	Remove RFMA1 in accordance with Dr Wright Evidence 13 February 2015 Figure 1.
1057: Slemint, Boulder Bay/Taylors Mistake/Hobsons Bay	Remove Bach 28 from CCMA 2 in accordance with Macfarlane Evidence dated 13 February Attachment 2a and 2b.
1058: Taylors Mistake Association and Taylors Mistake Association Land Company Limited, Boulder Bay/Taylors Mistake/Hobsons Bay	Amend RFMA1 and RFMA2 to locate baches 30, 31 and 32 at Taylors Mistake and 1 and 10 at Boulder Bay in RFMA 2.
1059: Taylors Mistake Association and Taylors Mistake Association Land Company Limited, Boulder Bay/Taylors Mistake/Hobsons Bay	Amend RFMA1 and RFMA2 to locate baches 30, 31 and 32 at Taylors Mistake and 1 and 10 at Boulder Bay in RFMA 2.
1059: Taylors Mistake Association Land Company Limited,	Remove Baches 55-59 and 60 from CCMA 2 in accordance with Macfarlane Evidence dated 13 February Attachment 2a and 2b.
1066: Mulgrew, 97 Wakefield Ave, Sumner	Remove RFMA1 and RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 18.
1075: Campbell, 30 The Terrace, Governors Bay	Amend RFMA1 and remove RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 12.
1080: Cleary, 68 Landsdowne Tce, Cashmere	Amend RFMA1 and RFMA2 in accordance with Dr Yetton Evidence dated 13 February 2015 Appendix 17 Plans 17.1 and 17.3.*
1096: Hills, 7 Emerald Lane, Cashmere	Remove RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 13.
1099: Jung, 37 Ticehurst, Lyttelton	Remove RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 14.
1102: McLean, 73 Morgans Valley Road, Akaroa	Remove RFMA1 and RFMA2 in accordance with Dr Wright Evidence dated 13 February 2015 Figure 15.
1107: Van der Wal, 8 Glas Brae, Governors Bay	Remove RFMA1 in accordance with Dr Wright Supplementary Evidence dated 16 March 2015 Figure 1.
1120: Floerl and Peacock, 25H Walkers Road, Lyttelton	Remove RFMA in accordance with Carter Supplementary Evidence dated 19 February 2015, para 5.2, Appendix B.
1139: Inglis and Garing, 80 Cressy Tce, Lyttelton	Remove RFMA in accordance with Dr Yetton Rebuttal Evidence dated 27 February 2015 Figure R1.
1474: Childs, 19 Morgans Valley Road, Akaroa	Remove RFMA1 and RFMA2 in accordance with Dr Wright Rebuttal dated 27 February 2015 Figure 2.

ROCK FALL, CLIFF COLLAPSE, MASS MOVEMENT	
Submitter	**Decision and associated direction**
1483: Fox, 22 Bridle Path Road, Heathcote Valley	Amend RFMA1 and RFMA2 in accordance with Dr Wright Supplementary Evidence dated 16 March 2015 Figure 1.*

*Excluding any changes to the hazard lines which would consequentially include the addition of land within the hazard lines, unless expressly provided for in this decision.

FLOODING	
Submitter	**Decision and associated direction**
3: King, 21 Allstone Place, Burwood	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.83, Attachment F.
12: Jones, 55 and 77 Sherborne Street, Saint Albans	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
30: Williams, 2 Nabob Lane, Cracroft	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
33: Clark, 1/199 Linwood Ave, Linwood	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
36: Douglas, 10 Soleares Ave, Mt Pleasant	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
37: Douglas, 10 Soleares Ave, Mt Pleasant	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
40: Jones, 55 and 77 Sherborne Street, St Albans	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
64: Leith, 43 Beckford Road, St Martins	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
79: Ritchie, 18 Worsleys Road, Cracroft	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
118: Grant, 89 Waimea Tce, Beckenham	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
139: Bargh, 46 Worsleys Road, Cracroft	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015, Carter Evidence dated 13 February 2015, para 10.81, Attachment F and Brookland Evidence dated 13 February 2015, para 5.4.

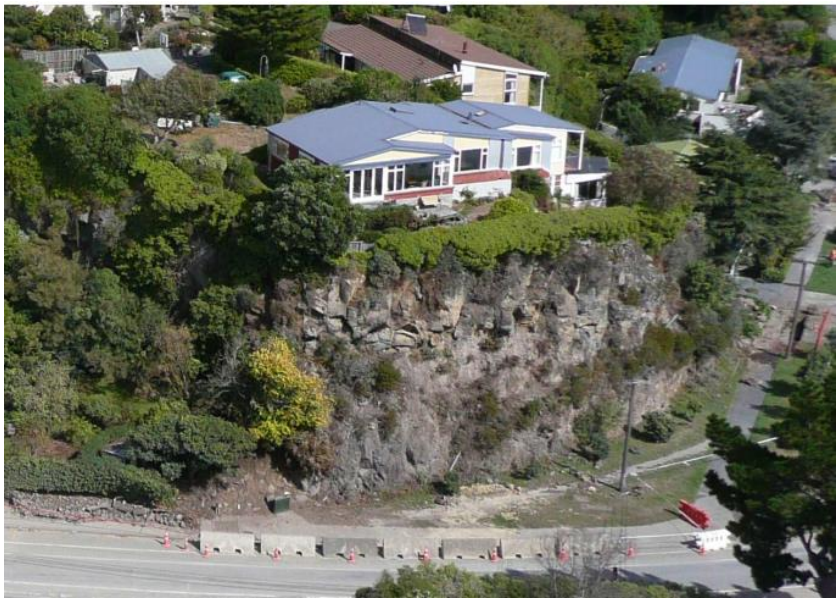
FLOODING	
Submitter	**Decision and associated direction**
142: Meek, 20 Van Asch Street, Sumner	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
153: Richards, 117 Garlands Road, Hillsborough	Remove from FLFMA in accordance with Carter Supplementary Evidence dated 19 February 2015, para 4.1, Appendix A.
310: CCC, Various as noted in Appendix 5.2 to written submission 310.	Amend to make additions to include areas in the FLFMA in accordance with Appendix 5.2 of CCC submission 310.
310: CCC, Various as noted in Appendix 5.1 to written submission 310.	Remove from FMFO as requested in Appendix 5.1 to CCC written submission 310.
312: Vivian and Currie, 14A Worsleys Road, Cracroft	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
313: Dewe, 162 Papanui Road, Merivale	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
324: Crozier, 60 Croziers Road, St Albans	Remove ponding area in accordance with Carter Evidence 13 February 2015 Attachment G. Limited to the area of land shown on Attachment A to submission 324, being 2.56 hectares of section 2 SO461421 and Lot 3 DP17794.
371: Kelly, 15A Winton St, St Albans	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
399: Laryn/Blue Sun Ltd, 110 Shalamar Drive, Cashmere	Amend Ponding Area as agreed by the parties Joint Memorandum 20 March 2015, in accordance with Iris Brookland Evidence 13 February 2015, Image 1.
717: Richards, 100 Barbour Street, Waltham	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
959: Gladstone, 128 Packe Street, Edgeware	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
972: Maley, 48 Rochester Street, North Linwood	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.

FLOODING	
Submitter	**Decision and associated direction**
1050: Riach, 22 Rugby Street, Merivale	Amend RFLMA to driveway only in accordance with Brookland, Transcript 1056, lines 7-8.
1064: Williams, 20 Linwood Ave and 48 Trent Street, Linwood	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Supplementary Evidence, 19 February 2015, para 4.2, Appendix A.
1101: McFadden, 19 Nancy Avenue, Mairehau	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
1118: Broad, 137 Knowles Street, St Albans	Remove from FLFMA in accordance with Carter Supplementary Evidence, 19 February 2015, para 4.3, Appendix A.
1125: Alpine View, 448 Prestons Road, Marshlands	Remove from FLFMA in accordance with Brookland Evidence dated 13 February 2013 para 8.43.
1133: Waters, 2/3 Capri Lane, Hoon Hay	Remove from FLFMA in accordance with Attachment 1 Memorandum of Counsel for CCC on site-specific submissions accepted in Council Evidence, 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.
1175: Reid, 1B Trist Place, Edgeware	Remove from FLFMA in accordance with Attachment 1 Memorandum of counsel 19 February 2015 and Carter Evidence dated 13 February 2015, para 10.81, Attachment F.

LIQUEFACTION	
Submitter	**Decision and associated direction**
58: Clinton, 315 Port Hills Road, Hillsborough	Remove LAA1 in accordance with Kingsbury second Supplementary, 17 March 2015, para 3.7.
80: Snoep, 233 Taylors Mistake Road, Sumner	Remove liquefaction in accordance with Macfarlane Evidence dated 13 February 2015, Attachment 3.
976: Bergamot Valley Family Trust, 18A Valley Road, Cashmere	Remove LAA1 in accordance with Kingsbury Supplementary Evidence, 27 February, paras 3.4-3.5.

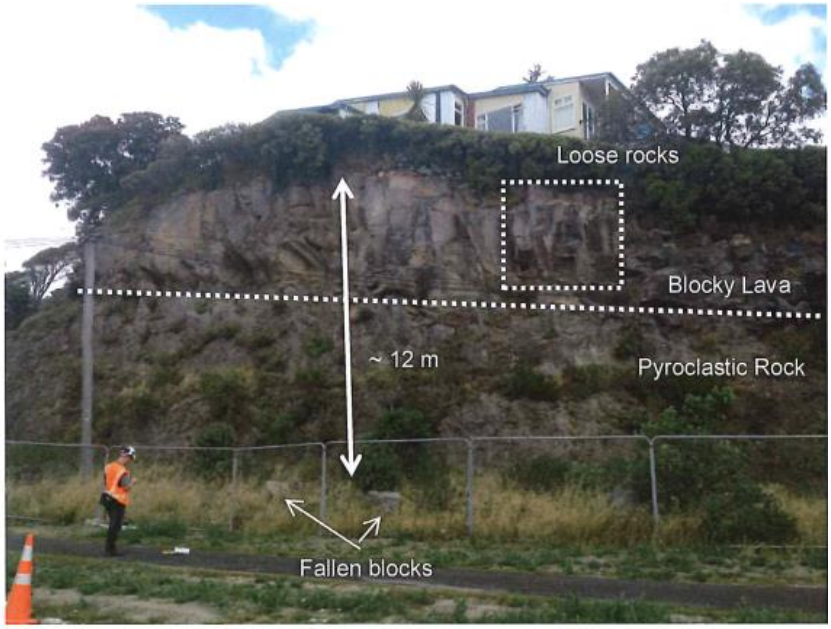
SCHEDULE 8

Photographs – 8 Balmoral Lane



Massey Rebuttal Appendix 1 Figure 2: 8 Balmoral Lane, 24 March 2011, after the 22 February 2011 earthquake – note boulders at the slope toe. Photograph taken by C. Massey, GNS Science.

Massey Rebuttal Appendix 1 Figure 2b: 8 Balmoral Lane, 21 June 2011, after the 13 June 2011 earthquake – note boulders at the slope toe. Photograph taken by M. Yetton, Geotech Consulting Ltd.



Mr Charters Appendix A Figure 2: Photograph of the cliff at 8 Balmoral Lane.