EARTHQUAKE COMMISSION
Kōmihana Rūwhenua

IN CONFIDENCE

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Briefing to the Public Inquiry into the Earthquake Commission

Title	Canterbury Land Programme
Date	24 May 2019

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Canterbury Land Programme

Purpose

1 The purpose of this paper is to set out a high level description of the Canterbury Land Programme. The paper covers:

a a brief overview of the "residential land" insurance provided under the Earthquake Commission Act 1993;

b an overview of the consequences of the 2010/2011 Canterbury earthquakes for residential land;

c the initial assessment and identification of residential land damage after September 2010;

d further land damage and decisions concerning zones after February 2011;

e identifying categories of residential land damage;

f assessing and settling visible land damage;

g assessing and settling Increased Flooding Vulnerability (IFV) and Increased Liquefaction Vulnerability (ILV) land damage;

h settling land claims in the residential red zones;

i community engagement and communications with customers on complex land damage claims; and

j some thoughts on the future of EQC residential land insurance.

Executive summary

2 EQC insures residential land against natural disaster damage on an indemnity basis. This cover is separate from EQC residential building cover. To EQC's knowledge, its residential land insurance is unique in the world.

Severe residential land damage as a result of the Canterbury earthquakes

3 The 2010/2011 Canterbury earthquakes caused severe and widespread damage to residential land. This included:

a liquefaction-related land damage throughout the Christchurch area affecting more than 50,000 residential properties. The extent of this type of land damage was the most ever witnessed worldwide in an urban setting; and

b subsidence affecting 85% of residential properties. Of these, 60,000 subsided by more than 0.2 metres, 12,000 by more than 0.5 metres, and 500 by more than 1 metre.

4 The scale and complexity of the land damage, together with the unique nature of EQC's land insurance cover, created significant challenges. EQC needed to resolve approximately 142,000 residential land exposures. Some of the land damage was obvious. But some types of change to the land caused by the earthquakes were invisible and took time to recognise and understand.

5 This type of damage had never previously been identified as land damage for insurance purposes anywhere in the world.

Land damage assessments

6 EQC instructed its engineers (Tonkin + Taylor) to undertake a proactive assessment programme after each main earthquake, and to co-ordinate engineering resources. EQC also created extensive datasets using modern techniques, including airplane LiDAR surveys of land levels and geotechnical investigations.

7 EQC coordinated the exchange of information with private insurers and other government agencies. This enabled an overall dataset to be collected that could be used for multiple public and private purposes.

EQC's role in additional land remediation

8 After the 4 September 2010 earthquake, EQC undertook assessments and prepared to settle land claims. However, at this stage, it was also recognised that in some areas of Christchurch (for example, those adjacent to parts of the Avon River) it be would impossible to rebuild without carrying out significant area-wide works. Those works were needed to reduce the pre-existing potential in those areas for severe lateral spreading in future earthquakes.

9 This additional area-wide work was beyond repairing damage caused by the earthquakes. It was therefore also beyond the scope of EQC's land insurance. The government tasked EQC (under a Ministerial direction) with leading an area-wide land repair programme, to be funded separately by the government.

Change of course after February 2011 earthquake

10 After the 22 February 2011 earthquake, the government abandoned its plans for area-wide works, in part because of the extensive additional land and building damage suffered. Instead, it declared certain areas of Christchurch "residential red zones". Crown offers were made to residential property owners in these zones to acquire the land and residential building (or the land only). These offers were widely accepted by the property owners.

11 The offers in residential red zones involved assignment of the EQC land claims to the Crown. As a result, EQC's settlement of many of the most complex and severely damaged properties could be de-prioritised. The new priority was customer land settlements for residential green zone properties and the residential red zone properties not sold to the Crown.

12 For these land settlements, EQC determined that it would:

a settle by making cash payments, rather than undertaking repairs; and

b proactively undertake engineering, valuation, legal and policy work before commencing payments. This was so customers received a robust, enduring settlement.

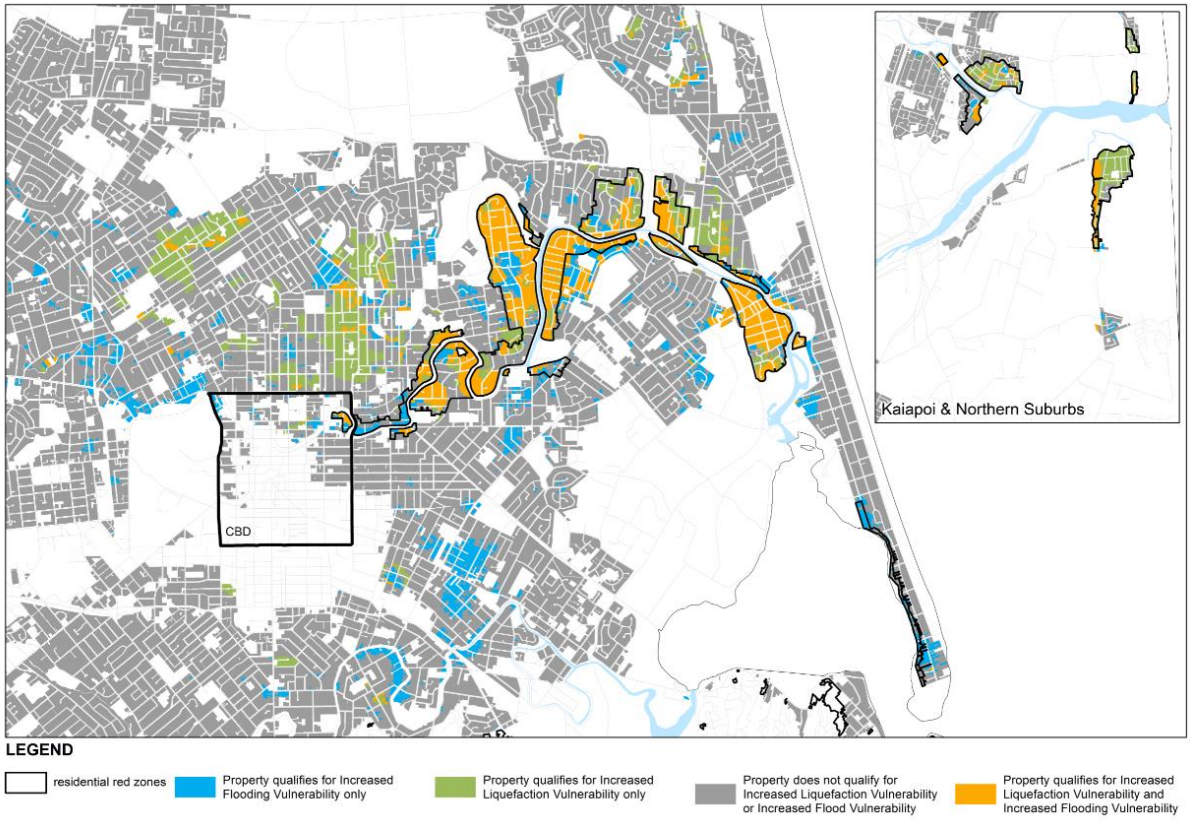
Identifying and settling complex land damage

13 Following the February and June 2011 earthquakes, Tonkin + Taylor identified that land subsidence caused by the earthquakes may have led to worsening land performance. Specifically, the land had become more vulnerable in future flooding events and in future earthquake events. These invisible, complex forms of land damage were ultimately recognised by EQC as Increased Flooding Vulnerability (IFV) and Increased Liquefaction Vulnerability (ILV).

14 The scale of Increased Flooding Vulnerability and Increased Liquefaction Vulnerability is shown in **Figure 1** below. In the residential green zone, 4,985 properties had Increased Flooding Vulnerability, 3,185 properties had Increased Liquefaction Vulnerability, and 787 had both. In the residential red zones, 1,278 properties had Increased Flooding Vulnerability, 1,563 properties had Increased Liquefaction Vulnerability, and 3,356 properties had both.

Figure 1: *Increased Liquefaction Vulnerability and Increased Flooding Vulnerability qualification assessment results*

NB. White areas represent the non-urban and non-residential land in Christchurch, which were not assessed



15 Developing settlement approaches for this complex land damage on an individual property basis posed unique challenges. In particular:

a new engineering techniques had to be developed;

b the nature of damage meant that a repair solution would often not be technically feasible or lawful, or would not be undertaken in practice. In those circumstances, settling based on repair costs (as EQC has traditionally done) was inappropriate. EQC therefore determined to settle, in appropriate circumstances, based on the reduction in value of the property caused by the increased vulnerability. This basis for settlement was called "diminution of value"; and

c new valuation techniques had to be developed to enable the assessment of the diminution of value.

16 EQC wanted to obtain certainty that settlement payments under the policies would be lawful. It also wanted to enhance customer confidence in EQC's approach before the payments were made. Accordingly, EQC sought a declaratory judgment from the High Court to test its policies before settlements commenced.

17 In addition, EQC sought independent peer review of all engineering and valuation methodologies. It also engaged with private insurer experts. The purpose was to test methodologies, so far as possible, before they were operationalised with customer settlements.

18 EQC obtained a declaratory judgment in December 2014. The judgment confirmed that EQC's basic policies were lawful, if applied in good faith and in a non-mechanical way to the circumstances of individual properties.

19 EQC next commenced the significant engineering and valuation practical work required to make individual property settlement decisions for Increased Flooding Vulnerability and Increased Liquefaction Vulnerability. Settlements commenced:

a for Increased Flooding Vulnerability properties, in early 2015; and

b for Increased Liquefaction Vulnerability properties, in mid-2016.

Communicating settlements to customers

20 Communicating to customers about settlements involving complex land damage posed a particular challenge. EQC created detailed collateral and held multiple public meetings at critical stages of the settlement programme.

21 A specific process was developed for customer requests for information and challenges to complex land decisions. The purpose was to make the review of EQC decisions accessible without resorting to more formal dispute resolution.

22 EQC received relatively few requests for information or challenges concerning complex land settlement from individual customers. There has been very little litigation by customers on land settlements.

Time taken to settle complex land damage

23 EQC's response to the unique challenges of the land programme took significant time to achieve. A measured, planned approach was taken to ensure robust and enduring settlements. The trade-off was that customers experienced delay to receiving their full insurance entitlements.

24 In practice, that delay was likely only sustainable because:

a the most severely damaged land was, from the perspective of most customers in those areas, largely resolved by the government's determination of the residential red zones and the subsequent purchase offers; and

b in the residential green zone, the land damage did not in many cases impact the work required to repair or rebuild the building. However, the ongoing uncertainty with respect to the land claim and how this related to the building claim will have affected a significant number of customers.

Land and building insurance interaction

25 Issues concerning the interaction of the land and building insurance are disputed between EQC and private insurers (who provide building insurance but not land insurance).[1] This is the subject of ongoing litigation. One customer impact of this dispute is that, in a number of situations, customers had to assign their EQC land claim to insurers in order to receive a building claim settlement.

Lessons for the future

26 EQC's response to land damage arising from the 2010/2011 Canterbury earthquakes indicates that, for the future:

a there is significant value in co-ordination of the engineering response. This is to ensure consistent outcomes under EQC insurance and to facilitate the government's broader policy responses;

b enduring settlements can be achieved even in novel circumstances by taking a measured and planned approach to settlements. But that comes at the cost of delays to customers;

c there are limits to an insurance model for land to secure a building platform for residential buildings. The major issues with rebuilding on land in Christchurch were due to pre-existing vulnerability, not land damage. The impact of this pre-existing vulnerability had to be met by a separate insurance and government response;

d there is value in thinking beyond the individualised nature of EQC land insurance entitlements. In the response to the Canterbury earthquakes, effective area-wide solutions that were identified could not be pursued for various reasons. These impediments should be addressed; and

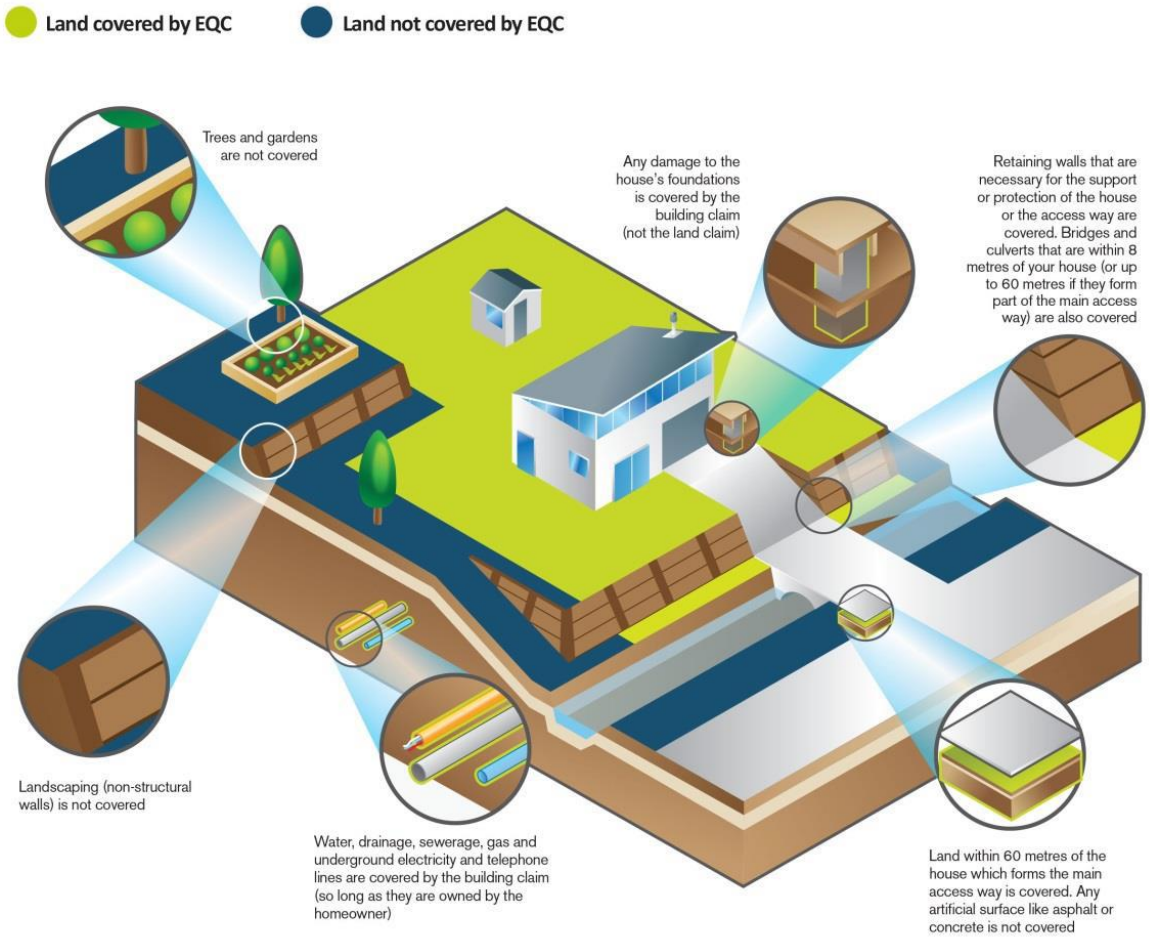
[1] Some private insurers do insure some land structures, e.g. retaining walls.

e if the insurance model is to be retained for land, the current legislative provisions are too complex (which in turn creates uncertainty and risks delay). These provisions could be simplified, including to clarify the interaction between land and building insurance.

Brief overview of EQC "residential land" cover

27 Insurance against natural disaster damage is available in respect of defined "residential land" under the Earthquake Commission Act 1993.[2] A diagram illustrating the scope of EQC land damage is given in **Figure 2** below.[3]

Figure 2: *Illustration of EQC land cover*



[2] See the definition of "residential land" in section 2(1), Earthquake Commission Act 1993.
[3] This diagram has been included to give a general indication of EQC land cover. For the detail of what is covered as residential land, see the definition of "residential land" in section 2(1), Earthquake Commission Act 1993.

Scope of EQC cover for residential land

28 The Earthquake Commission Act 1993 defines "residential land",[4] as follows:

> *"residential land" means, in relation to any residential building, the following property situated within the land holding on which the residential building is lawfully situated:*
>
> *(a) the land on which the building is situated; and*
>
> *(b) all land within 8 metres in a horizontal line of the building; and*
>
> *(c) that part of the land holding which –*
>
> *(i) is within 60 metres, in a horizontal line, of the building, and*
>
> *(ii) constitutes the main access way or part of the main access way to the building from the boundary of the land holding or is land supporting such access way or part; and*
>
> *(d) all bridges and culverts situated within any area specified in paragraphs (a) to (c); and*
>
> *(e) all retaining walls and their support systems within 60 metres, in a horizontal line, of the building which are necessary for the support or protection of the building or of any property referred to in any of paragraphs (a) to (c).*

29 Key features of this definition (highlighted above) include:

a the necessary relationship to a residential building;

b the limited areas included (i.e. it is not the whole of the land holding); and

c the inclusion of some infrastructure (the bridges, culverts and retaining walls).

30 The statutory insurance for residential land is created by section 19 of the Earthquake Commission Act 1993, which provides:

> *Subject to any regulations made under this Act and to Schedule 3, where a residential building is deemed to be insured under this Act against natural disaster damage, the residential land on which that building is situated shall, while that insurance of the residential building is in force, be deemed to be insured under this Act against natural disaster damage to the amount (exclusive of goods and service tax) which is the sum of, in the case of any particular damage, –*
>
> *(a) the value, at the site of the damage, of –*

[4] See section 2(1), Earthquake Commission Act 1993. See also section 21, Earthquake Commission Act 1993 – some items are expressly excluded from the term "residential land". These include trees, plants, lawns, paths and fences. For a full list of property not insured, see Schedule 2, Earthquake Commission Act 1993.

(i) if there is a district plan operative in respect of the residential land, an area of land equal to the minimum area allowable under the district plan for land used for the same purpose that the residential land was being used at the time of the damage; or

(ii) an area of land of 4000 square metres; or

(iii) the area of land that is actually lost or damaged –

whichever is the smallest; and

(b) the indemnity value of any property referred to in paragraphs (d) and (e) of the definition of the term residential land in section 2(1) that is lost or damaged.

31 Key features of the insurance of residential land against natural disaster damage provided by section 19 (highlighted above) include the following:

a the prerequisite that the residential building on the land must be insured for the residential land to be insured;

b the insurance is insurance against natural disaster damage. It is defined primarily as "*any **physical loss or damage to the property** occurring as the direct result of a natural disaster*".[5] It does not include financial loss to the property caused by natural disaster;

c the damage includes "*any **physical loss or damage to the property** that (in the opinion of the Commission) is **imminent** as the direct result of a natural disaster which has occurred*".[6] EQC assesses loss or damage as imminent if it considers that it is more likely than not to occur during 12 months from the date of the natural disaster;[7]

d the capping of the amount of the residential land insurance is by reference to "the value at the site of" areas of land, and to the indemnity value of damaged infrastructure (the value of the item immediately before loss or damage, taking into account its age and condition and therefore its likely remaining life). This residential land cap is different to the residential building cap (the latter is currently usually $100,000 plus GST), as it does not have a set value;

e there is no reference to "replacement value" (as found in sections 18 and 20, Earthquake Commission Act 1993). This omission indicates that the residential land insurance is for indemnity, not "replacement value".[8]

[5] See definition of "natural disaster damage" in section 2(1), Earthquake Commission Act 1993.
[6] See definition of "physical loss or damage" in section 2(1), Earthquake Commission Act 1993.
[7] See EQC fact sheet *Imminent damage resulting from a natural disaster*, https://www.eqc.govt.nz/sites/public_files/Imminent-damage.pdf
[8] The indemnity basis was confirmed in *Earthquake Commission v Insurance Council of New Zealand Incorporated and others* [2014] NZHC 3138, [2015] 2 NZLR 381.

EQC cover for residential land unique in the world

32 To EQC's knowledge, the cover for land damage provided by EQC is unique in the world.

33 This type of cover was added in the aftermath of the landslide that occurred in 1979 in the Dunedin suburb of Abbotsford, when 69 homes were destroyed. In the Abbotsford event, homeowners lost not only buildings but also complete use of their land. Land insurance administered by EQC was originally recommended in November 1980 by the Commission of Inquiry into the Abbotsford Landslip Disaster.[9]

34 The Earthquake and War Damage (Land Cover) Regulations 1984 provided wider cover than that proposed by the Commission of Inquiry. The Regulations provided that certain land should also be deemed to be insured for natural disaster damage. The Regulations defined that land in substantially the same terms as the current definition of "residential land" in the Earthquake Commission Act 1993.

35 There is no additional premium for the EQC land cover.

The consequences of the 2010/2011 Canterbury earthquakes for residential land

36 The 2010/2011 Canterbury earthquakes caused significant physical loss or damage to residential land in some locations.[10] Most of the land damage was caused by the four main earthquakes on 4 September 2010, 22 February 2011, 13 June 2011 and 23 December 2011.

37 The land damage included severe and widespread liquefaction-related land damage throughout the Christchurch area affecting more than 50,000 residential properties. The extent of this liquefaction damage was the most ever witnessed worldwide in an urban setting.

38 EQC dealt with approximately 142,000 residential land exposures arising out of the 2010/2011 Canterbury earthquakes. EQC assessed land damage on a property if any claim had been made under the Earthquake Commission Act 1993 for that property. This was irrespective of whether the customer had specifically identified damage to their land. EQC's assessment of damage to residential land was undertaken almost entirely proactively, rather than relying on customer information (although this was taken into account, if available).

[9] See *Report of The Commission of Inquiry into the Abbotsford Landslip Disaster* [1980] AJHR H7 at 160-165.
[10] See Tonkin + Taylor, *Increased Flood Vulnerability: Geological Processes Causing Increased Flood Vulnerability* (August 2014), Chapter 3, https://www.eqc.govt.nz/sites/public_files/file_attach/Geological%20Processes%20Causing%20Increased%20Flood%20Vulnerability%20August%202014%20Report.pdf.

39 Significant engineering, legal, and operational challenges for EQC were driven by:

a the scale of the number of properties and claims with potential land damage;

b the technical complexity of understanding the effects of changes to the residential land; and

c the novelty of the issues raised.

Physical damage to residential land

40 The physical changes to residential land caused by the earthquakes included:

a on the plains in affected areas of Christchurch and the Selwyn and Waimakariri districts (known colloquially as the "flat land" to distinguish these areas from the Port Hills):

i liquefaction-related damage. The term "liquefaction" is the process where earthquake shaking increases the water pressure in sandy and silty soil layers in the ground. This process results in a temporary loss of soil strength. Liquefaction can give rise to silt and sand ejecting from cracks in the ground to the ground surface. Over 500,000 tonnes of silt and sand were ejected and subsequently taken away from land as a result of the 2010/2011 Canterbury earthquakes;

ii ground cracking and undulations caused by lateral spreading. "Lateral spreading" refers to the horizontal movement of the ground either downslope or towards an open face (e.g. towards a road cutting, old river terrace or river bank); and

iii changes in ground elevation (either up or down). These changes are due in part to tectonic ground movements. The term "tectonic ground movement" refers to plate movements that may result in vertical tilting or horizontal movement. The changes in ground elevation were also caused in some cases by the ejection of liquefied soil, the consolidation of liquefied soil, and/or lateral spreading; and

b in areas in or around the Port Hills, rockfall and cliff collapse.

41 Where these physical changes to residential land resulted in a loss of value, this constituted natural disaster damage to residential land under the Earthquake Commission Act 1993.

Other consequences

42 The 2010/2011 Canterbury earthquakes had a number of other consequences that affected residential land, particularly relating to its use as a building platform. These included:

a *Increased knowledge and awareness of pre-existing vulnerability*: The severe damage caused by the 2010/2011 Canterbury earthquakes highlighted the pre-existing vulnerability of significant parts of Canterbury to land damage in earthquake events. In particular, it became more widely recognised that there was potential for:

i severe lateral spreading in some areas (see paragraph 40aii) above); and

ii rockfall and cliff collapse in other areas.

This potential for both lateral spreading and rockfall existed before the 2010/2011 Canterbury earthquakes and was not practically changed as a result of those earthquakes.[11] However, once this potential had been recognised, there was a significant hurdle for rebuilding of residential buildings in areas affected by severe lateral spreading vulnerability or risk of rockfall;

b *Increased vulnerability not caused by damage to residential land*: As a result of the 2010/2011 Canterbury earthquakes, the regional seismicity of Canterbury increased. This means that earthquakes with higher levels of shaking are likely to occur more often. Due to the increase in seismicity, the level of ground shaking at a particular return period (e.g. a 1 in 100 year earthquake) is greater than it was before the 2010/2011 Canterbury earthquakes. Accordingly, a property may now be more vulnerable to damage in a 1 in 100 year earthquake than it was. The change in seismicity is the result of remote regional changes. It is not the result of any physical change to residential land;[12]

[11] See Tonkin + Taylor, *Canterbury Earthquake Sequence: Increased Liquefaction Vulnerability Assessment Methodology* (October 2015), page 60-61, https://www.eqc.govt.nz/ILV-engineering-assessment-methodology; Independent Expert Panel, *Peer Review of the Increased Liquefaction Vulnerability Assessment Methodology* (October 2015), page 17, https://www.eqc.govt.nz/sites/public_files/images/ILV%20Expert%20Panel%20Report%20-%20Final_2.pdf; and Tonkin + Taylor and Aurecon, *Summary of Geotechnical Discussions (June to October 2017)* (October 2017), page 7.

[12] See Tonkin + Taylor, *Canterbury Earthquake Sequence: Increased Liquefaction Vulnerability Assessment Methodology* (October 2015), page 48, https://www.eqc.govt.nz/ILV-engineering-assessment-methodology, and Independent Expert Panel, *Peer Review of the Increased Liquefaction Vulnerability Assessment Methodology* (October 2015), page 16 https://www.eqc.govt.nz/sites/public_files/images/ILV%20Expert%20Panel%20Report%20-%20Final_2.pdf.

c *Changes in regulatory and building practice*: Following the 2010/2011 Canterbury earthquakes there were numerous changes in regulatory and building practices. In particular:

i the increased seismicity in the region and increased awareness of the vulnerability to liquefaction and severe lateral spreading damage led to changes in building regulations and practices.[13] More extensive geotechnical testing and more robust foundation designs were required in affected areas;

ii local authorities published new floor level requirements to mitigate the impact of flooding. This again, in some cases, required foundation designs in some areas that were different to the types of foundations that had been used before the 2010/2011 Canterbury earthquakes; and

iii the increase in seismicity together with the increased awareness of the risk of rockfall and cliff collapse led to some areas being unable to be lived in. Notices were issued by the Christchurch City Council and/or the Canterbury Earthquake Recovery Authority for such properties where there were life safety concerns (see paragraph 145 below).

43 The consequences set out above are outside the scope of the residential land insurance under the Earthquake Commission Act 1993. This is because they do not arise from physical loss or damage to residential land. Instead they arose from matters such as pre-existing vulnerabilities and remote regional changes. These matters in some cases caused loss to customers and impeded the rebuilding in certain areas of Christchurch. But to the extent they did so, these matters raised broader issues, which were outside the scope of EQC's statutory insurance mandate.

EQC not responsible for categorisation of land into zones and technical categories

44 EQC's mandate in relation to land damage was defined by the Earthquake Commission Act 1993. For example, EQC was not responsible for the categorisation of land in Christchurch into the residential red and green zones (see paragraphs 71 to 76 below). Nor was EQC responsible for the creation of technical categories in the residential green zone (TC1, TC2 and TC3).

[13] The changes in regulatory and building practice following the 2010/2011 Canterbury earthquakes are discussed further in the *Briefing to the Public Inquiry into the Earthquake Commission – Canterbury Home Repair Programme*.

45 The categorisation of land was undertaken by:

a the Canterbury Earthquake Recovery Authority (with the Christchurch City Council for areas in and around the Port Hills) – for the residential red and green zones; and

b the Department of Building and Housing (later the Ministry of Business, Innovation and Employment) – for the technical categories.

46 To inform their decisions about categorising land in the flat land areas, the Canterbury Earthquake Recovery Authority and the Department of Building and Housing relied heavily on EQC's information and data (see also paragraphs 49 and 50 below).

After September 2010: Initial assessment and identification of residential land damage

47 Following the 4 September 2010 earthquake, EQC engaged Tonkin + Taylor, an expert environmental and engineering consultancy, to provide advice on residential land damage. Tonkin + Taylor had provided expert advice to EQC in relation to residential land claims prior to September 2010.

Initial evidence gathering

48 Tonkin + Taylor initially undertook significant evidence gathering. The relationships and contracts EQC had in place with Tonkin + Taylor enabled quick deployment of resources to undertake these mass assessments. Tonkin + Taylor provided the overall leadership and coordination in this task. It subcontracted 26 other firms to do the assessments, along with its own staff.

49 The information gathering included:

a collecting information on areas of damaged land immediately following each of the four major earthquake events.[14] Information was obtained from preliminary mapping of land damage undertaken "street by street" after these events. This information was progressively added to with more detailed assessment techniques.[15] High resolution aerial photographs of the most affected areas of Christchurch and the Waimakariri and Selwyn districts were taken in the days following each of the main earthquakes;

b assessing visible land damage on individual properties when claims for land damage were received; and

[14] 4 September 2010, 22 February 2011, 13 June 2011 and 23 December 2011 (see paragraph 36 above).
[15] See Tonkin + Taylor, *Earthquake Commission: Canterbury Earthquakes 2010 and 2011 – Land report as at 29 February 2012* (July 2012), https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/land-reports/stage-3-land-report.

c identifying (in conjunction with other parties) changes in land levels on the flat land. To do this, Tonkin + Taylor used sophisticated airborne surveys, known as LiDAR (Light Detection and Ranging). These were commissioned by EQC and other government agencies following each of the major earthquakes. Aerial LiDAR technology surveys measure the height of the ground from the air. The LiDAR surveys were undertaken in September 2010, March 2011, May 2011, September 2011 and February 2012. They were carried out after the sand and silt from liquefaction had been removed (and, following the June 2011 earthquake, after the snowfall had gone).[16]

50 Much of this exercise was commissioned by EQC's research function, which has a broad purpose not limited to the administration of the EQC insurance cover.[17] This enabled data to be collected that could be used for multiple public purposes as part of the government's response to the earthquakes. These purposes included, but were not limited to, determining EQC's liability for natural disaster damage to residential land. For this reason, information was gathered about all residential areas materially affected by the earthquakes, and was not limited to properties where EQC claims had been made.

Completion of Tonkin + Taylor Stage 1 and Stage 2 Reports

51 EQC commissioned Tonkin + Taylor to prepare a series of geotechnical reports on the land damage.

52 Tonkin + Taylor provided land damage assessments of individual properties and advice to assist EQC in assessing insurance claims made under the Earthquake Commission Act 1993. Due to the scale and extent of land damage arising from the September 2010 earthquake, Tonkin + Taylor also undertook a broad geotechnical assessment on a community/suburb wide basis, so that the range of possible remedial options could be considered.

53 In October 2010 Tonkin + Taylor produced the Stage 1 Report[18] which set out damage categorisation, mapping methodology, information and results generated to 1 October 2010. Following the Stage 1 Report, EQC called and wrote to 1200 customers who had been most significantly affected by land damage in the September 2010 earthquake. EQC told these customers about the release of the report and provided them with a copy of it.

[16] See Tonkin + Taylor, *Earthquake Commission: Canterbury Earthquakes 2010 and 2011 – Land report as at 29 February 2012* (July 2012), page 11, https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/land-reports/stage-3-land-report.

[17] See section 5(1)(e), Earthquake Commission Act 1993.

[18] See Tonkin + Taylor, *Darfield Earthquake 4 September 2010 Geotechnical Land Damage Assessment & Reinstatement Report Stage 1 Report* (October 2010), https://www.eqc.govt.nz/sites/public_files/t-t-stage1.pdf.

54 The Tonkin + Taylor Stage 2 Report, completed in November 2010,[19] presented details and indicative maps on the land remediation options. The Stage 2 Report divided Christchurch into three recovery areas – Zones A, B and C.

55 In Zone C, it would not be possible to rebuild without carrying out significant works to reduce the potential for severe lateral spreading in future earthquakes. This vulnerability had existed prior to the earthquakes, but had become more apparent during the September 2010 earthquake. The work needed to address this pre-existing vulnerability was beyond repairing damage caused in the September earthquake. It was also therefore beyond the scope of EQC's land cover.

56 Full cross-agency and private insurer coordination was necessary in Zone C. Options were developed and presented in the report so that the appropriate recovery strategy could be considered. These options ranged from abandonment through to full scale area wide ground improvement.

57 Following the Stage 2 Report, EQC wrote to all customers who had made a claim following the September 2010 earthquake, telling them about the release of the report, and including information about the land damage in their area.

Plans for perimeter treatment works

58 The work in the Stage 1 and 2 Reports was the catalyst for the development of a range of land remediation concepts and options. Agencies involved in advising the government on the proposals included the Treasury, the New Zealand Transport Agency, and the Ministry of Economic Development and the Department of Building and Housing (both now part of the Ministry of Building, Innovation and Employment).

59 In late 2010, the government decided to progress plans for perimeter treatment works. These works were designed to mitigate the severe lateral spreading risk so that houses in Zone C could be safely and practically repaired or rebuilt.

60 The perimeter works were to have included a series of compacted gravel columns placed under the ground surface. They were to be located on both private and public land in certain areas around the banks of the Avon River and Kaiapoi River. Their purpose was to reduce the vulnerability of the land to severe lateral spreading.

[19] See Tonkin + Taylor, *Darfield Earthquake 4 September 2010 Geotechnical Land Damage Assessment & Reinstatement Report Stage 2 Report* (November 2010), https://www.eqc.govt.nz/sites/public_files/stage2-report.pdf.

61 As described above, this type of land remediation option was outside the scope of EQC's cover for damage to "residential land" as defined under the Earthquake Commission Act 1993. Accordingly, the government directed EQC to undertake the additional land remediation work under a Ministerial direction.[20] The work was to be funded separately by the government. The planned work required significant resources internal and external to EQC.[21]

Specific claims settlements (claims in Fendalton and Kaiapoi)

62 There were 16 properties in Zone C of the Stage 2 Report that fell outside the planned perimeter treatment areas. These properties needed a different response to address the severe lateral spreading vulnerability.

63 After more detailed investigations, the planned perimeter treatment works were able to be extended to cover five of these properties in Richmond. Another six properties in Spencerville were identified as a good location to undertake a trial of the perimeter treatment works. However, there remained five properties in Fendalton and Kaiapoi where it was not economic to undertake perimeter treatment works.[22]

64 In December 2010, land claim payments were made for these remaining five properties that were not usual EQC land settlement payments. These payments were not in accordance with the Earthquake Commission Act 1993. They were made by EQC against the backdrop of:

a the specific circumstances of those properties. This included that the properties did not fall within the areas where perimeter treatment works were then proposed by the government; and

b the specific decisions and approvals and a specific appropriation as detailed below.

65 On 14 December 2010, the Ad Hoc Cabinet Committee on Canterbury Earthquake Recovery[23] agreed that EQC could make payments to the very worst affected owners for the insured value of their land. The payments could be made in circumstances where the cost of (the then) proposed additional land remediation work was greater than the cost of levelling their land to return it to its pre-earthquake state.

[20] See the *Briefing to the Public Inquiry into the Earthquake Commission – Ministerial Directions since 1 January 1994* dated 13 March 2019, paragraphs 16 to 22.
[21] The impact of the Ministerial direction on land remediation in the context of the Canterbury Home Repair Programme is discussed further in the *Briefing to the Public Inquiry into the Earthquake Commission – Canterbury Home Repair Programme*.
[22] Richmond and Fendalton are suburbs of Christchurch, Spencerville is a settlement north of Christchurch, and Kaiapoi is a town in the Waimakariri district.
[23] The Ad Hoc Cabinet Committee was acting under a Power to Act which had been authorised by Cabinet. When a Power to Act is exercised, the decision of the Cabinet committee is final, and does not need to be ratified by Cabinet.

66 The Ad Hoc Cabinet Committee agreed that before the payments were made, EQC (in consultation with Treasury and the Department of the Prime Minister and Cabinet) had to provide advice to the Minister of Finance and the Minister of Canterbury Earthquake Recovery on the specific site investigations undertaken in respect of each affected property.

67 Following receipt of the site investigations, the Minister of Finance and the Minister for Canterbury Earthquake Recovery agreed that EQC could make payments to the five identified properties.[24]

68 A non-departmental other expense appropriation in Vote Finance was established to cover the payment to the identified properties and any other properties that emerged in that category as the engineering work progressed.

After February 2011 – further land damage and decisions regarding zones

69 The 22 February 2011 earthquake caused unprecedented damage to land and many buildings, including in the areas where perimeter treatment works were planned.

70 The government reconsidered some of its post-September 2010 decisions. It abandoned the area-wide additional land remediation proposals (i.e. the perimeter treatment works). The increase in seismicity meant that any land remediation works would have needed to be re-designed to be more extensive, both in terms of strength and geographic area to be covered.

71 Instead the decision was taken, as a social policy response, to declare certain areas of Christchurch "residential red zones". Crown offers would be made to property owners to purchase the land and residential building. Property owners who accepted the Crown offers could then avoid the complex issues in those areas, including the extensive pre-existing vulnerability of the land.

72 The residential red zones ultimately determined by the government included all areas where perimeter treatment works were originally proposed. Work at Spencerville did, however, proceed as a pilot of techniques to mitigate severe lateral spreading vulnerability (see paragraph 63 above). This work included the construction of underground stone columns forming an underground 'wall' adjacent to the Styx River next to, and on parts of, Nos 3 to 8 Riverside Lane.

[24] Department of the Prime Minister and Cabinet, Memorandum, dated 23 December 2010.

73 The government's determination of properties within the residential red zones:[25]

a did not prohibit building or the granting of building consents in the area for repair or rebuilding;

b did not prohibit residents from continuing to live in the residential red zones. That said, many of the houses in the Port Hills residential red zone were subject to notices issued by the Christchurch City Council and/or the Canterbury Earthquake Recovery Authority that prohibited residents from living in them due to life safety concerns from rockfall, discussed further in paragraphs 144 to 148 below; and

c did not require residents to demolish or repair their houses.

74 Instead, insured residential property owners with properties in the residential red zones were given the choice of either:

a a Crown offer (with the Crown acting by and through the Chief Executive of the Canterbury Earthquake Recovery Authority) to purchase the property (land and associated buildings). The purchase price was the 2007 rating valuation of the property.[26] The Crown took an assignment of all earthquake-related insurance claims. This offer was called "Option 1"; or

b a Crown offer to purchase the land at the 2007 rating valuation. Under this offer the Crown would take an assignment of the EQC land claim with the landowners being free to pursue their private insurance company for any other insurance claim they had. This offer was called "Option 2".

75 The Option 2 offers provided a "top up" right to the original owner. This meant that, if EQC paid to the Crown an amount in settlement of the land claims for the property greater than the purchase price, the difference between the purchase price and the settlement amount was to be paid to the original owner. The offers record that the Crown did not have a duty to seek any particular amount from EQC. The Crown also had an unfettered discretion as to how it would pursue the land claims against EQC.

76 Although most property owners elected to accept one of the Crown offers, property owners were not required to do so. A small number of property owners elected to retain their residential red zone property.

[25] *O'Loughlin v Tower Insurance Ltd* [2013] NZHC 670, [2013] 3 NZLR 275, [27].
[26] The 2007 rating valuation was used for properties in Christchurch, and the 2008 rating valuation was used for properties in the Waimakariri district.

77 Following the determination of the residential red zones, EQC and the Canterbury Earthquake Recovery Authority agreed that EQC would prioritise the identification and settlement of private claims, in particular in relation to:

a properties in residential green zone; and

b properties in the residential red zones that had not been sold to the Crown.

78 This decision to deprioritise settling claims with the Crown was taken in order to focus on settling private customers' claims. As a result, most private claims were settled prior to EQC settling claims with the Crown for the residential red zones.

Identifying categories of residential land damage

79 By February 2012, the EQC Board determined that in order to establish its liability in relation to any particular claim for land damage, EQC needed to address each of the following three key issues:[27]

Issue 1 – Is there insured "residential land"?

Issue 2 – Is the residential land "damaged" by earthquake (natural disaster)?

Issue 3 – How should EQC settle claims for that residential land damage having regard to the nature of the damage?

80 In response to the third issue, EQC drew on the different categories of damage that its advisers had identified. With the assistance of Tonkin + Taylor, these categories were identified through a process of field work, evidence gathering and analysis.

Overview of land damage categories

81 For the settlement of residential land exposures, EQC classified what it considered to be nine categories of damage to residential land arising from the 2010/2011 Canterbury earthquakes on the flat land.

VISIBLE DAMAGE ON THE FLAT LAND

82 Seven of these categories of land damage are observable on the surface of the land. To a greater or lesser extent, they impact in an immediate way on the ability to use the land. They are accordingly referred to as "visible damage".

[27] See EQC Board paper dated 14 February 2012 entitled *EQC Liability for Residential Land Damage – A proposal by Management for settlement of claims* (including Appendices 1-6) and the associated EQC Board Minutes.

83 The seven visible damage categories are:

a land cracking caused by lateral spreading;

b land cracking caused by oscillation movements;

c undulating land;

d local ponding;

e local settlement causing drainage issues;

f groundwater springs; and

g inundation by ejected sand and silt.

NON-VISIBLE DAMAGE ON THE FLAT LAND

84 In 2012, after extensive investigation, described below at paragraphs 88 to 98, the EQC Board determined that it would recognise two additional land damage categories on the flat land as natural disaster damage for the purposes of the Earthquake Commission Act 1993:

a Increased Flooding Vulnerability (IFV); and

b Increased Liquefaction Vulnerability (ILV).

85 These were categories of complex "non-visible" land damage, in that they could not be easily seen. They were later confirmed as forms of natural disaster damage by the High Court in the land declaratory judgment, discussed below in paragraphs 107 to 128.

86 In the residential green zone, 4,985 properties had Increased Flooding Vulnerability, 3,185 properties had Increased Liquefaction Vulnerability, and 787 had both. In the residential red zones, 1,278 properties had Increased Flooding Vulnerability, 1,563 properties had Increased Liquefaction Vulnerability, and 3,356 properties had both. **Figure 1** above shows the Increased Liquefaction Vulnerability and Increased Flooding Vulnerability qualification assessment results.

LAND DAMAGE IN THE PORT HILLS

87 In the Port Hills, the land damage mainly comprised major rockfall and cliff collapse, small scale land movement, and retaining wall failures.

Process of identifying non-visible damage – Increased Flooding Vulnerability and Increased Liquefaction Vulnerability

88 In 2011 and 2012, EQC commissioned Tonkin + Taylor to undertake several large scale studies that covered the extent, severity and effects of liquefaction-related land damage. These studies built on the Stage 1 and 2 Reports.

89 In collecting data using LiDAR surveys, Tonkin + Taylor coordinated with Land Information New Zealand and the Ministry of Civil Defence and Emergency Management. Tonkin + Taylor developed ground surface difference models based on the pre- and post-event LiDAR surveys in order to evaluate changes in ground levels caused by each earthquake event. This information was crucial to informing a whole of government response to the events, and were used multiple times for different purposes.

90 Comparison of LiDAR survey information taken before and after the 2010/2011 Canterbury earthquakes showed significant ground subsidence occurred. Of the 140,000 flat land residential properties in Christchurch, approximately 85% had subsided following the 2010/2011 Canterbury earthquakes.[28] Of the properties that had subsided, 60,000 subsided by more than 0.2 metres; 12,000 by more than 0.5 metres; and 500 by more than 1 metre.

91 Tonkin + Taylor also observed more frequent flooding events in low lying areas, which had not previously experienced flooding to that extent. In addition, residents in low lying suburbs where significant ground surface subsidence had occurred started reporting other changes. Their land was performing just as poorly or worse during smaller aftershocks than it had during the large earthquakes in September 2010 and February 2011. They were observing more cracking and surface liquefaction. EQC commissioned Tonkin + Taylor to investigate the causes of these observations.

92 Tonkin + Taylor's work identified two instances where a physical change to insured residential land (i.e. the subsidence of the land) had increased the risk to the land from future natural disasters. These occurred in areas where the land was susceptible to (1) liquefaction and (2) flooding, as detailed below.

INCREASED LIQUEFACTION VULNERABILITY

93 In some areas the land was susceptible to liquefaction. Liquefaction occurs where earthquake shaking increases the water pressure in sandy and silty soil layers in the ground. This process results in a temporary loss of soil strength. Liquefaction can give rise to significant damage – for example, where sediment ejects through cracks to the ground surface.

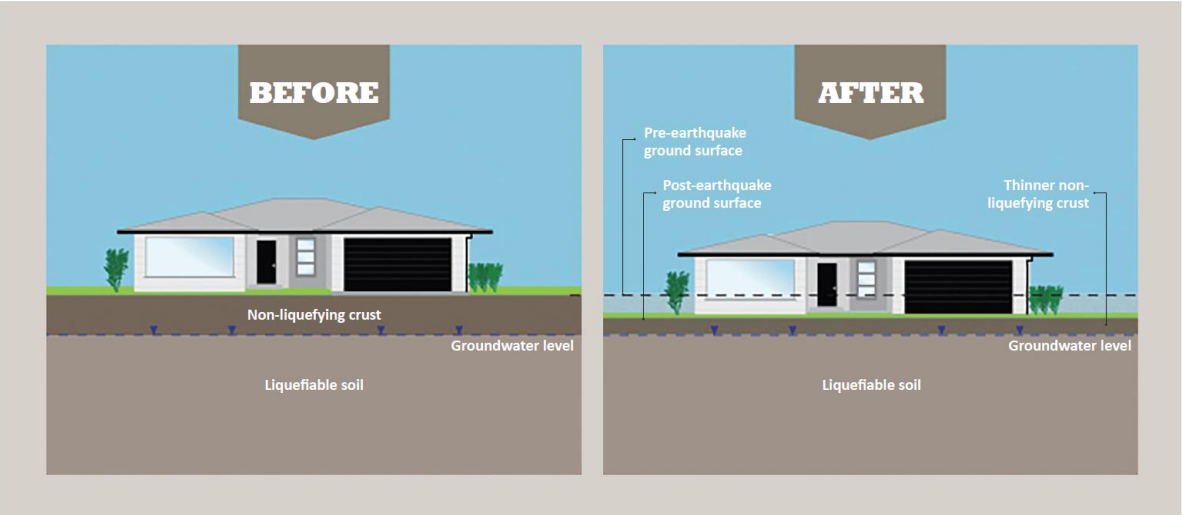
[28] N. Rogers, S. van Ballegooy, K. Williams and L. Johnson, *Considering post-disaster damage to residential building construction – is our modern building construction resilient?,* 6th International Conference on Earthquake Geotechnical Engineering, Christchurch (2015), https://secure.tcc.co.nz/ei/images/ICEGE15%20Papers/Rogers_693.00.pdf.

94 When an earthquake causes the land to subside, the non-liquefying crust of the land can become thinner. This thinner non-liquefying crust means that, in future earthquakes, the land may be more vulnerable to liquefaction damage than it was before the 2010/2011 Canterbury earthquakes.

95 Where this increase in vulnerability will have a material impact on the property, the land has Increased Liquefaction Vulnerability (ILV) damage. This was also sometimes referred to as Category 8 land damage or "crust-thinning".

96 **Figure 3** below shows how ground surface subsidence from the 2010/2011 Canterbury earthquakes made some properties more vulnerable to liquefaction.

***Figure 3**: Increased Liquefaction Vulnerability – how ground surface subsidence made some properties more vulnerable to liquefaction*

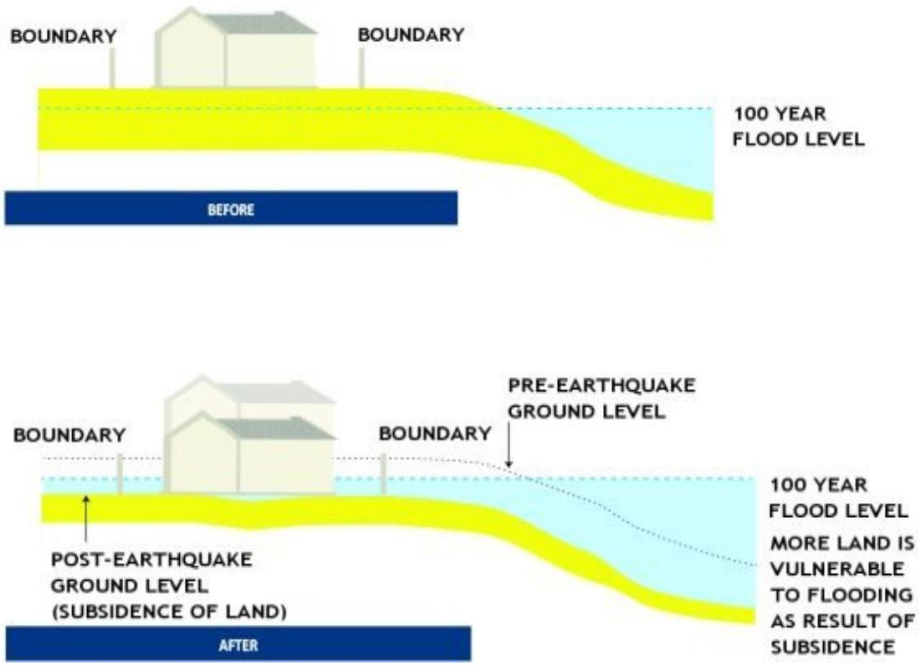


INCREASED FLOODING VULNERABILITY

97 In some parts of Christchurch, the ground surface subsidence had increased the flooding hazard. This flood hazard had increased in terms of depth, extent and frequency. This was sometimes referred to as Category 9 damage, or Increased Flooding Vulnerability (IFV).

98 **Figure 4** below shows how ground surface subsidence form the 2010/2011 Canterbury earthquakes made some properties more vulnerable to flooding.

Figure 4: *Increased Flooding Vulnerability – how ground surface subsidence made some properties more vulnerable to liquefaction*



DEVELOPING POLICIES AND METHODOLOGIES

99 Based on the analysis described above, the EQC Board accepted that Increased Liquefaction Vulnerability and Increased Flooding Vulnerability were forms of natural disaster damage to land for the purposes of the Earthquake Commission Act 1993.

100 The determination that Increased Flooding Vulnerability and Increased Liquefaction Vulnerability are forms of natural disaster damage was later confirmed by the High Court's decision in the land declaratory judgment, discussed below in paragraphs 107 to 128.

101 EQC undertook substantial work to develop policies and methodologies to identify and settle properties with Increased Flooding Vulnerability and/or Increased Liquefaction Vulnerability damage. Both forms of damage involved engineering and valuation assessments that had not previously been carried out in New Zealand or elsewhere in the world for insurance settlement purposes. Detailed engineering and valuation research was therefore carried out into both forms of damage, and submitted to international peer review.

102 Recognising and settling claims for Increased Flooding Vulnerability and Increased Liquefaction Vulnerability raised new legal and policy questions. These included:

a recognising that physical changes to the land that *increased the risk* of damage in future natural hazards was a form of natural disaster damage under the Earthquake Commission Act 1993; and

b the potential for some Increased Flooding Vulnerability and Increased Liquefaction Vulnerability claims to be cash settled for the diminution of value caused by the damage to the property.

103 EQC has historically assessed the amount necessary to indemnify a customer (so far as money is able to so do) against the financial loss suffered as a result of natural disaster land damage by reference to the cost of repairing that damage. Repairing the land removes any loss.

104 However, the nature of Increased Flooding Vulnerability in particular meant that a repair solution would often not be technically feasible or able to be lawfully undertaken in many cases.

105 In addition, the repairs to address Increased Flooding Vulnerability would in all likelihood not be undertaken given the high costs of, and practical difficulties associated with, undertaking the repairs. In particular, repairs would often require the removal of buildings that would not otherwise need to be removed.

106 In these circumstances, EQC considered that a customer's true financial loss may best be reflected in the reduction in value to the owner's property caused by the Increased Flooding Vulnerability (i.e. the diminution of value).

Land declaratory judgment

Reasons for seeking land declaratory judgment

107 The EQC Board decided to seek a declaratory judgment from the High Court to confirm the lawfulness of its proposed policy for settling Increased Flooding Vulnerability and Increased Liquefaction Vulnerability claims.

108 A declaratory judgment is a type of legal proceeding in which a person asks the High Court for a formal statement (a "declaration") on a legal question. That formal statement of the legal position then becomes binding on the person who has asked the question.

109 EQC decided to seek a declaratory judgment before starting to settle residential land claims because its proposed settlement policy involved recognising:

a new forms of land damage (that is, Increased Flooding Vulnerability and Increased Liquefaction Vulnerability); and

b new approaches to settling residential land claims (including the use of diminution of value in appropriate cases).

110 The proposed settlement policy carried legal uncertainty and risk. There were a significant number of properties and claims affected. EQC was concerned that, if it started to settle land claims but was subsequently successfully challenged on an issue of principle or policy that required other claims to be re-assessed, this could lead to considerable delay and cost.

111 This proactive use of the declaratory judgment procedure by a public body is very rare in New Zealand. EQC considered it was warranted, in the circumstances, to:

a resolve the significant legal uncertainty over recognising and settling claims involving increased vulnerability; and

b give customers confidence that settlements based on EQC's proposed settlement policy would be robust.

112 At the time EQC decided to seek a declaratory judgment, the policy, engineering and valuation work to support settlement of Increased Flooding Vulnerability claims was more advanced than the work to support settlement of Increased Liquefaction Vulnerability claims. The decision was made to seek declarations on Increased Flooding Vulnerability first, rather than waiting for the Increased Liquefaction Vulnerability work to be completed.

113 EQC commenced its proceeding seeking a declaratory judgment on 9 May 2014. To recognise the significance of the proceeding, and to limit the prospects of an appeal by any party, EQC requested a Full Court of the High Court (comprising three judges rather than the conventional single judge in the High Court) to hear the proceeding.

114 The proceeding was heard five months later in October 2014 in Christchurch. This relatively prompt hearing (for major civil litigation) was the result of both the High Court's recognition that the proceeding deserved urgency, and also the co-operation of all parties to achieve a timely hearing.

115 To ensure that EQC's proposed settlement policy was tested before the Court, the Insurance Council of New Zealand agreed to act as a defendant in the land declaratory proceedings at EQC's request.

116 Christchurch City Council and Southern Response Earthquake Services Limited also applied to be joined as defendants to test aspects of EQC's proposed approach. Two groups of customers affected by Increased Flooding Vulnerability (the Flockton Cluster Group and Ms Culf) also participated in the hearing and made submissions to the High Court.

117 In addition, two Queen's Counsel were appointed to assist the Court to:

a argue that Increased Flooding Vulnerability and Increased Liquefaction Vulnerability were not forms of natural disaster damage recognised by the Earthquake Commission Act 1993. It was necessary to have independent counsel to test this argument because both EQC and the Insurance Council of New Zealand submitted that Increased Flooding Vulnerability and Increased Liquefaction Vulnerability were natural disaster damage; and

b represent the interests of customers who may have Increased Flooding Vulnerability and Increased Liquefaction Vulnerability land damage. These customers would otherwise have been unrepresented in the proceeding.

118 The Insurance Council of New Zealand and EQC provided the Court with expert engineering and valuation evidence (including assessment and settlement methodologies) concerning the proposed approach to settling Increased Flooding Vulnerability claims. Evidence was also provided by the Christchurch City Council, Southern Response Earthquake Services Limited, and the counsel representing the interests of customers.

119 As a result of the engineering evidence received, EQC made a number of modifications to its proposed policy for the assessment of Increased Flooding Vulnerability.

120 The Insurance Council of New Zealand also sought:

a declarations that Increased Liquefaction Vulnerability was a form of land damage; and

b general declarations as to how EQC should settle claims for Increased Liquefaction Vulnerability damage.

121 EQC supported the claim for a declaration that Increased Liquefaction Vulnerability was a form of land damage. It also accepted that the principles that applied to settlement of Increased Flooding Vulnerability claims should also apply to Increased Liquefaction Vulnerability. However, EQC resisted detailed declarations concerning Increased Liquefaction Vulnerability. This was because at that stage the engineering and valuation work to support settlement of Increased Liquefaction Vulnerability claims remained under development.

Outcome of land declaratory judgment

122 The High Court delivered the land declaratory judgment on 10 December 2014.[29]

123 The High Court granted most of the declarations sought by EQC concerning its proposed policy for settling Increased Flooding Vulnerability claims. In particular, the Court confirmed that payments made in accordance with the policy would be lawful.

124 The judgment allowed EQC to proceed with the settlement of Increased Flooding Vulnerability claims with certainty and confidence. The Court emphasised that EQC was required to apply its policies in good faith and in a non-mechanical way to each individual property.

125 In more detail, the Court confirmed that:

a Increased Flooding Vulnerability **is** a form of natural disaster damage to residential **land** for the purposes of the Earthquake Commission Act 1993;

b Increased Flooding Vulnerability **is not** a form of natural disaster damage to residential **buildings** for the purposes of the Earthquake Commission Act 1993;

c the use of diminution of value as a measure of the amount of a settlement payment (in the way set out in EQC's policy), is lawful and proper;

d the costs of building work designed to mitigate the loss of utility associated with Increased Flooding Vulnerability **is not** an appropriate measure of the amount of a settlement payment (as the Insurance Council of New Zealand had argued). This is unless these costs are a proxy for diminution of value;

e EQC is entitled to adopt a policy setting out its approach to the settlement of claims involving Increased Flooding Vulnerability, so long as that policy:

i required EQC to act in good faith;

ii was not applied mechanically;

iii did not exclude consideration of factors relevant to any particular case; and

iv did not prevent customers challenging the decision in a court; and

f payment of claims out of the Natural Disaster Fund in accordance with the Increased Flooding Vulnerability policy and the Earthquake Commission Act 1993 is lawful.

[29] *Earthquake Commission v Insurance Council of New Zealand Inc* [2014] NZHC 3138, [2015] 2 NZLR 381.

126 The Court declined to grant a further declaration that the Increased Flooding Vulnerability policy was "appropriate and rational". The Court considered that, in the absence of cross-examination of expert witnesses, it was inappropriate for it to comment on this aspect. However, the judgment contained no criticism of EQC's proposed approach or its experts.

127 The Court also granted the Insurance Council of New Zealand's declarations that:

a Increased Liquefaction Vulnerability is a form of natural disaster damage to the land for the purposes of the Earthquake Commission Act 1993; and

b EQC was entitled to have a policy in relation to the settlement of claims involving Increased Liquefaction Vulnerability.

128 The land declaratory judgment was not appealed by any party. Following the judgment, EQC was able to:

a operationalise its Increased Flooding Vulnerability policy; and

b complete the engineering, valuation and legal work required to finalise its Increased Liquefaction Vulnerability policy.

Assessing and settling visible land damage on the flat land and in the Port Hills, including land structures

Overview of process

129 The process for a residential land claim with visible land damage only[30] (not Increased Flooding Vulnerability or Increased Liquefaction Vulnerability land damage) usually comprised EQC:

a establishing the "residential land" area;

b assessing the damage within the "residential land" area;

c assessing the cost to repair that damage; and

d settling by cash settlement (for an amount less than the residential land cap).[31]

[30] The categories of visible land damage (Categories 1-7) were: (1) land cracking caused by lateral spreading; (2) land cracking caused by oscillation movements; (3) undulating land; (4) local ponding; (5) local settlement causing drainage issues; (6) groundwater springs; and (7) inundation by ejected sand and silt. See paragraph 83.

[31] See Earthquake Commission, *Guide to Canterbury Land Claims – Visible Land Damage,* https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/guide-canty-land-claims (this brochure has been through various iterations, but its substantive provisions have broadly remained the same), and Earthquake Commission, *Guide to Settlement of Port Hills Land Claims,* https://www.eqc.govt.nz/sites/public_files/documents/6-Guide-to-Settlement-of-Canterbury-Land-Claims-Port-Hills-Land-Sample-%28Final%29.pdf.

Resources used

130 Tonkin + Taylor deployed a Land Damage Assessment Team to locate and record visible land damage on the insured residential land area of individual properties. The Team, comprising 474 geotechnical engineers and engineering geologists, carried out around 79,270 assessments.

131 The Land Damage Assessment Team assessed the types of land damage and location of that damage, the damage to the house and land structures had been affected. The resulting reports usually comprised a legend sheet (setting out the description of the damage)[32] and a land sketch (setting out the location of the land damage).[33] The Land Damage Assessment Team also undertook assessments on properties where EQC customers had notified EQC of land damage and requested that an engineering assessment be undertaken, but ultimately no land damage was identified by the Team.

Settlement of claims (including documentation)

132 The settlement of the seven categories of visible land damage, and the land damage in the Port Hills, involved:

a an assessment of the cost of the repair of the damage;

b calculation of the residential land cap; and

c payment of the lesser of the two (after deducting the excess amount).

133 The excess for a residential land claim is:[34]

> *$500 multiplied by the number of dwellings in the residential building which is situated on the land, or 10% of the amount payable under section 29 of the Earthquake Commission Act 1993, whichever is greater, to a maximum of $5,000.*

134 Each customer was sent a settlement pack[35] which included full details of the calculation.

[32] See Earthquake Commission, *Land Assessment – Legend Sheet*, https://www.eqc.govt.nz/sites/public_files/documents/Land-Legend-Flat-Land-Sample.pdf.
[33] See Earthquake Commission, *Assessor's sample land sketch*, https://www.eqc.govt.nz/sites/public_files/documents/Land-Sketch-Flat-Land-Sample_0.pdf.
[34] See Regulation 4, Earthquake Commission Regulations 1993.
[35] The EQC website contains samples of a flat land settlement pack (https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/understanding-your-land-settlement-pack/sample-flat-land-settlement-pack) and a Port Hills settlement pack (https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/understanding-your-land-settlement-pack/port-hills-land-settlement-pack).

Land structures

135 EQC provides cover for the following land structures (see **Figure 2** above):[36]

a bridges and culverts that are situated within eight metres of the residential building, or on land within 60 metres of the residential building that is part of, or supports, the main access way; and

b retaining walls and their support systems that are necessary for the support or protection of the residential building or insured land (including the main access way) if they are within 60 metres of the residential building.

136 The indemnity value of the bridges, culverts and retaining walls (sometimes referred to as "land structures") is critical for the purposes of calculating the residential land cap.[37] Indemnity value is a different thing from replacement value.[38] Indemnity value is the value of the item immediately before loss or damage, taking into account its age and condition and therefore its likely remaining life. Depreciation is a useful proxy for those factors.[39]

137 In calculating the residential land cap under section 19 of the Earthquake Commission Act 1993, EQC adds the value of the land (calculated under section 19(a)) to the indemnity value of the land structures (calculated under section 19(b)). The total amount (the cap) is then compared to the cost of repair for damage to the insured land (including the insured land structures). The settlement payment cannot exceed the cap (less the excess).

Boundary issues

138 Numerous issues have arisen regarding the extent of cover for residential land damage where, for example:

a a bridge or other land structure straddles the boundary of a land holding;

b a bridge is over an easement;[40] or

c land cover is affected by horizontal displacement of land.[41]

[36] See paragraphs (d) and (e) of the definition of "residential land", section 2(1), Earthquake Commission Act 1993. For more information, see https://www.eqc.govt.nz/sites/public_files/Land-structures-factsheet-s.pdf.
[37] See section 19, Earthquake Commission Act 1993.
[38] See *Michalik v Earthquake Commission* [2014] NZHC 2238 at [50].
[39] See *Michalik v Earthquake Commission* [2014] NZHC 2238 at [53].
[40] See *Earthquake Commission v Winch* (2008) 9 NZCPR 827.
[41] See the Canterbury Property Boundaries and Related Matters Act 2016, which addressed this issue.

139 More information can be provided on any of these specific issues, including issues arising on shared land. All of these issues relate to the detail of the definition of "residential land" under section 2(1) of the Earthquake Commission Act 1993.

Contaminated land

140 Some residential land in Canterbury was identified on the Hazardous Activities and Industries List (known as HAIL) on the Environment Canterbury Listed Land Use Register.

141 In May 2014, Environment Canterbury sent a mail-out to the owners of around 11,000 Christchurch properties. These were properties that may have had soil contaminated by chemicals or hazardous substances remaining in the ground from a previous land use (such as use of the land as an orchard, market garden or landfill).

142 Where one of the properties on the Hazardous Activities and Industries List had residential land damage, EQC funded certain contamination-related costs associated with an EQC land damage repair. For example, where land damage repair would require the removal of contaminated soil, EQC funded certain costs such as soil testing, and consenting-related costs associated with undertaking the repair. However, EQC was not responsible for addressing the effects of the contamination on the site itself.[42]

143 Accordingly, any costs related to the Hazardous Activities and Industries List are factored into the cost of repair of the visible land damage (Categories 1 to 7 as well as land structures) in assessing the settlement of the residential land exposure.

Risk of further rockfall

144 Following the February 2011 earthquake, a number of properties in the Port Hills were considered to be unsafe to live in due to the risk of further rockfall. The occupation of those houses was accordingly prohibited.

145 Occupation of these houses was prohibited under different legislation at different times. Initially, emergency powers under Part 5 of the Civil Defence Emergency Management Act 2002 were used. Later, occupation was prohibited through the Christchurch City Council issuing notices to prohibit access to buildings under section 124 of the Building Act 2004. This resulted in a number of houses in the Port Hills that were not able to be occupied but were otherwise repairable.

[42] See Earthquake Commission, *Annual Report 2014–15* (2015), page 31, https://www.eqc.govt.nz/sites/public_files/EQC%20Annual%20Report%202015%20WEB.pdf

146 The owners of one of the affected homes brought proceedings against EQC and their private insurer seeking the cost of rebuilding the house under the building insurance. They argued that the inability to live in their home was natural disaster damage. The house in that case was subject to a notice issued by the Christchurch City Council under section 124 of the Building Act 2004 prohibiting access because of the risk of rockfall. However, it was agreed that the physical damage to the house was repairable.

147 The High Court and Court of Appeal determined that loss of use of a house because of risk of rockfall was not "*physical loss or damage*" and was therefore not covered by the Earthquake Commission Act 1993.[43]

148 The property the subject of this case was in the Port Hills residential red zone. The owners therefore had the option of selling the property to the Crown. However, they deferred their decision on whether to sell the Crown until after they received the Court's decision on their insurance entitlement.

Overview of steps to settle Increased Flooding Vulnerability and Increased Liquefaction Vulnerability land damage

149 In general terms, the settlement of Increased Flooding Vulnerability and Increased Liquefaction Vulnerability followed parallel pathways. The steps involved included:

a development of a policy to determine when the form of land damage would be recognised, and how the damage would be settled (e.g. when a settlement would be based on cost of repair or diminution of value);

b development, and peer review of, an engineering methodology to assess whether land damage had occurred to a particular property;

c engineering assessments for individual properties in Canterbury in accordance with that engineering methodology;

d development, and peer review of, a valuation methodology to assess the diminution of value associated with any identified increased vulnerability; and

e valuation assessments for individual properties in Canterbury in accordance with that valuation methodology.

150 In addition, for properties with both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability, further valuation work was required to assess the diminution of value associated with both types of vulnerability together.

[43] *Kraal v Earthquake Commission & Allianz New Zealand Ltd* [2015] NZCA 13.

151 Initially, the work to settle Increased Flooding Vulnerability and Increased Liquefaction Vulnerability was progressed together. Both forms of damage posed significant challenges. But ultimately the Increased Liquefaction Vulnerability policies and methodologies took longer to develop. This was primarily because there was a better pre-existing understanding of flooding, both from an engineering and valuation perspective.

152 The Increased Flooding Vulnerability work had the benefit of existing flood models of Christchurch (although some new models were created). There was also existing research on the impact of flooding vulnerability on value.

153 By contrast, the Increased Liquefaction Vulnerability work required:

a the development of new engineering techniques to sensitively measure changes in liquefaction vulnerability to individual properties as a result of earthquake induced subsidence; and

b greater research into the impact of liquefaction vulnerability on value.

Assessing and settling Increased Flooding Vulnerability land damage

EQC's overall approach to assessing and settling Increased Flooding Vulnerability land damage

154 EQC approached the assessment and settlement of Increased Flooding Vulnerability on the basis that it was unlikely, although possible, that individual customers would be able to identify Increased Flooding Vulnerability on their property. This form of damage could not easily be seen and was therefore categorised as "non-visible" land damage.

155 Accordingly, EQC sought to develop policies and methodologies that emphasised:

a proactively gathering the information to identify Increased Flooding Vulnerability on an individual property basis;

b developing robust engineering and valuation methodologies based on the best available advice to assess and settle Increased Flooding Vulnerability; and

c communicating qualification and settlement decisions to customers in a clear and appropriate way. The communications would need to take into account the complexity of the engineering and valuation judgements required for the underlying Increased Flooding Vulnerability assessments.

EQC's Increased Flooding Vulnerability policy

156 As described above, EQC's policies and methodologies for assessing and settling Increased Flooding Vulnerability land damage were set out in its Increased Flooding Vulnerability policy, submitted to the Court in the land declaratory judgment proceedings (see paragraphs 107 to 128 above).

157 The Increased Flooding Vulnerability policy was later consolidated with the policy for settling Increased Liquefaction Vulnerability. The result was the *Increased Flooding Vulnerability (IFV) and Increased Liquefaction Vulnerability (ILV) Land Damage Consolidated Policy Statement*.[44] Consolidation was appropriate because a number of properties had both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability damage.

158 EQC's Increased Flooding Vulnerability policies covered:

a recognising Increased Flooding Vulnerability as a form of natural disaster land damage under the Earthquake Commission Act 1993;

b the thresholds for the assessment of potential Increased Flooding Vulnerability using flood modelling of the major river catchment areas in Canterbury;

c the thresholds determined by EQC for recognising Increased Flooding Vulnerability as natural disaster damage. The thresholds reflected a two stage assessment:

i an engineering assessment on whether physical changes to the insured land had caused an increase in vulnerability to flooding. This assessment took into account the limitations of the LiDAR and flood modelling evidence available to EQC; and

ii a valuation assessment as to whether the increased vulnerability to future flooding events could be expected to adversely affect the uses that would otherwise be associated with the land;

d how EQC would settle claims for damage to residential land that included Increased Flooding Vulnerability, and in particular:

i EQC's general preference for cash settlement of claims, rather than reinstatement;

[44] Earthquake Commission, *Increased Flooding Vulnerability (IFV) and/or Increased Liquefaction Vulnerability (ILV) Land Damage Consolidated Policy Statement* (September 2016) https://www.eqc.govt.nz/sites/public_files/file_attach/IFV%20and%20or%20ILV%20Land%20Damage%20Consolidated%20Policy%20Statement%20Sept%202016.pdf.

ii the policies that EQC would apply to determine how to assess the financial loss to the customer arising from Increased Flooding Vulnerability, either:

(1) the amount it would cost the customer to repair or reinstate the land; or

(2) the diminution of value suffered as a result of the Increased Flooding Vulnerability; and

iii how EQC would determine the diminution of value in circumstances where the settlement is based on the diminution of value figure. EQC relied on assessments of the diminution of value certified by independent valuation professionals.

Basis for Increased Flooding Vulnerability settlement – cost of repair vs diminution of value

159 The policies relating to the choice between settlement based on cost of repair and diminution of value were endorsed in the land declaratory judgment (see paragraphs 107 to 128 above). In summary:

a if the residential building was required to be removed in order to enable repairs to the land to address Increased Flooding Vulnerability, EQC would settle based on diminution of value;

b if resource consent was required under the Resource Management Act 1991 in order to enable repairs to the land to address the Increased Flooding Vulnerability, EQC would settle based on diminution of value. This was unless the customer demonstrated that they could obtain resource consent and would carry out the repairs;

c if the residential land had been sold by the customer after the earthquake event recognised as causing Increased Flooding Vulnerability, EQC would settle based on diminution of value; and

d in all other cases, EQC would pay the repair cost, unless that cost was disproportionate to diminution of value, having regard to the circumstances of the customer (including their stated intentions in relation to repair of the land).

Customer's right to review of EQC's Increased Flooding Vulnerability settlement decision

160 EQC expected that the policies set out in the Increased Flooding Vulnerability policy would provide a full and fair settlement of claims involving Increased Flooding Vulnerability. But any customer was entitled to provide:

a further information (or an alternative interpretation of existing information); and

b ask EQC to reconsider its Increased Flooding Vulnerability settlement decisions.

161 Further, the Increased Flooding Vulnerability policy expressly provided that any information provided to EQC by a customer would be taken into account by EQC in reaching a final settlement decision.

162 In the course of the land declaratory judgment proceedings, the Queen's Counsel representing customers also requested that EQC develop a process for reviewing Increased Flooding Vulnerability assessments at the request of a customer. EQC developed its process in September 2014.[45] The process emphasises that EQC would consider requests for re-assessment with an open mind.

Engineering work underpinning assessment for qualifying for Increased Flooding Vulnerability

163 Unlike the categories of visible land damage,[46] Increased Flooding Vulnerability could not be directly observed. The increased vulnerability of land could only be assessed with any accuracy by reference to:

a evidence of physical subsidence of land. This would be either through airborne LiDAR surveys of land levels or the direct observations of liquefaction that were made during the earthquake sequence; and

b analysis of predicted flood depths and extents using computerised flood models.

[45] Earthquake Commission, *Claims Review Framework for EQC's IFV Policy* (September 2014).

[46] The categories of visible land damage (Categories 1-7) were: (1) land cracking caused by lateral spreading; (2) land cracking caused by oscillation movements; (3) undulating land; (4) local ponding; (5) local settlement causing drainage issues; (6) groundwater springs; and (7) inundation by ejected sand and silt. See paragraph 83.

164 EQC instructed Tonkin + Taylor to:

a provide advice on a methodology to assess whether individual parcels of residential land had suffered Increased Flooding Vulnerability as a result of one or more of the 2010/2011 Canterbury earthquakes; and

b undertake engineering assessments to advise whether individual properties satisfied the engineering thresholds for potential Increased Flooding Vulnerability.

165 The methodology addressed two key questions:

a is the insured land vulnerable to flooding? and

b has the insured land become more vulnerable to flooding as a result of subsidence of that land caused by the 2010/2011 Canterbury earthquakes?

166 In overview, the methodology involved:

a adapting and developing computerised flood models. These models were able to predict flooding patterns to a resolution of 5 metres by 5 metres, based on pre- and post-Canterbury earthquake sequence ground levels;

b identifying areas based on those flood models that might have Increased Flooding Vulnerability based on automated thresholds. This also involved manually identifying properties that should be treated as exceptions to those thresholds;

c reviewing the results of the automated and manual processes, checking for spatial anomalies, and identifying further properties for site specific review;

d site visits to each property with potential Increased Flooding Vulnerability by qualified engineers to review projected flood mapping and identify any site specific anomalies with the flood modelling; and

e a final engineering assessment of the results of the site visits for potential Increased Flooding Vulnerability properties.

PEER REVIEW OF INCREASED FLOODING VULNERABILITY ENGINEERING ASSESSMENT WORK

167 To ensure the robustness of the methodology developed by Tonkin + Taylor, EQC instructed three independent engineering experts to peer review the work completed by Tonkin + Taylor (referred to as the Increased Flooding Vulnerability International Peer Review Panel).[47]

[47] The three independent engineering experts comprising the Increased Flooding Vulnerability International Peer Review Panel were: Professor Jeremy Benn, Dr Graeme Smart, and Bill Syme. See **Appendix 1** for a list of the panel's qualifications.

168 The Increased Flooding Vulnerability engineering assessment methodology was developed by Tonkin + Taylor, under the supervision of the Peer Review Panel, through a series of iterations.

169 In the course of development, Tonkin + Taylor received and took account of feedback from the Peer Review Panel. Tonkin + Taylor also:

a received and took account of feedback from experts assisting the Insurance Council of New Zealand and other parties in the land declaratory judgment; and

b refined the assessment approach as the methodology was implemented. This allowed Tonkin + Taylor to take advantage of the experience of applying the methodology, as well as address issues that arose in the implementation.

170 The general effect of these iterative developments of the methodology was to:

a review more properties for potential Increased Flooding Vulnerability;

b place less reliance on "thresholds" applied to calculated flood modelling data; and

c place greater weight on the results of a tiered process of manual review of properties by senior Tonkin + Taylor engineers.

DEVELOPMENT AND USE OF FLOOD MODELS

171 The engineering work to support the Increased Flooding Vulnerability assessment included the adaptation and development of flood models.

172 Some of these models were able to be adapted from models sourced from the Christchurch City Council. Other models (such as that to model flooding from rainfall rather than rising rivers) were developed by Tonkin + Taylor, with assistance from the Increased Flooding Vulnerability International Peer Review Panel.

173 The flood models were able to be calibrated using the flooding experienced in Christchurch in March 2014.

174 The new flood models used for the assessment of Increased Flooding Vulnerability, including the post-earthquake ground levels, were made available to Christchurch City Council and Waimakariri District Council to support their work to mitigate flood hazards in their respective areas.

DOCUMENTING THE INCREASED FLOODING VULNERABILITY ENGINEERING ASSESSMENT WORK

175 The Increased Flooding Vulnerability engineering assessment methodology is documented in the following Tonkin + Taylor reports:

a *Increased Flooding Vulnerability Assessment Methodology* (April 2014).[48] This report sets out the background and methodology for the engineering assessment of Increased Flooding Vulnerability;

b *Increased Flooding Vulnerability River Modelling and Coastal Extensions Report* (August 2014).[49] This report documents the modifications made to river and coastal flood models developed by the Christchurch City Council used in the Increased Flooding Vulnerability assessment;

c *Increased Flooding Vulnerability Overland Flow Model Build Report* (August 2014).[50] This report documents the development of a pluvial (rainfall) flood model by Tonkin + Taylor for use in the Increased Flooding Vulnerability assessment;

d *Increased Flood Vulnerability Geological Processes Causing Increased Flood Vulnerability* (August 2014).[51] This report provides an overview of the various geological processes that cause Increased Flooding Vulnerability;

e *Increased Flood Vulnerability: Response to Affidavits on Engineering Assessment Methodology for Increased Flood Vulnerability* (September 2014).[52] This report responded to evidence in the land declaratory judgment and provided some clarifications on the Increased Flooding Vulnerability assessment methodology;

[48] Tonkin + Taylor, *Increased Flooding Vulnerability Assessment Methodology* (April 2014), https://www.eqc.govt.nz/sites/public_files/file_attach/Canterbury%20Earthquake%20Sequence%20Increased%20Flooding%20Vulnerability%20Assessment%20Methodology%20April%202014%20Report.pdf.

[49] Tonkin + Taylor, *Increased Flooding Vulnerability River Modelling and Coastal Extensions Report* (August 2014), https://www.eqc.govt.nz/sites/public_files/file_attach/Canterbury%20Earthquake%20Sequence%20Increased%20Flooding%20Vulnerability%20River%20Modelling%20and%20Coastal%20Extensions%20August%202014%20Report.pdf.

[50] Tonkin + Taylor, *Increased Flooding Vulnerability: Overland Flow Model Build Report* (August 2014), https://www.eqc.govt.nz/sites/public_files/file_attach/Increased%20Flood%20Vulnerability%20Overland%20Flow%20Model%20Build%20August%202014%20Report.pdf.

[51] Tonkin + Taylor, *Increased Flood Vulnerability: Geological Processes Causing Increased Flood Vulnerability* (August 2014), https://www.eqc.govt.nz/sites/public_files/file_attach/Geological%20Processes%20Causing%20Increased%20Flood%20Vulnerability%20August%202014%20Report.pdf.

[52] Tonkin + Taylor, *Increased Flood Vulnerability: Response to Affidavits on Engineering Assessment Methodology for Increased Flood Vulnerability* (September 2014).

f *Increased Flooding Vulnerability: Observed Land Damage and Repair Methodology* (September 2014).[53] This report explained the process to collect observed land damage information following the 2010/2011 Canterbury earthquakes, and its relevance to Increased Flooding Vulnerability assessment. The report also sets out how Increased Flooding Vulnerability land damage could be repaired, and practical and legal constraints on undertaking repairs;

g *Increased Flooding Vulnerability (response to second affidavit of Dr Andrew McCowan)* (October 2014).[54] This report responded to further evidence given by an expert witness for the Insurance Council of New Zealand in the land declaratory judgment proceedings;

h *Increased Flooding Vulnerability: Properties with a greater increase in flooding vulnerability in higher frequency flooding events* (December 2015).[55] During the implementation of assessments it was observed that, in certain limited areas of Christchurch, the flooding hazard had increased in more frequent flood events, but not in less frequent but more severe flood events. This report sets out the methodology for the identification of these properties;

i *Increased Flooding Vulnerability Uplift Exceptions* (June 2016).[56] This report considers areas of Christchurch to ascertain whether localised subsidence may have caused Increased Flooding Vulnerability. This is despite the area generally having increased in height relative to sea level as a result of tectonic movements;

j *Increased Flood Vulnerability: Sumner Overland Flow Model and Assessment Report* (January 2015).[57] This report documents the flood models developed by Tonkin + Taylor for the assessment of properties for potential Increased Flooding Vulnerability in Sumner;

k *Increased Flood Vulnerability: Kaiapoi Overland Flow Model and Assessment Report* (March 2015).[58] This report documents the flood models developed by Tonkin + Taylor for the assessment of properties for potential Increased Flooding Vulnerability in Kaiapoi; and

[53] Tonkin + Taylor, *Increased Flood Vulnerability Observed Land Damage and Repair Methodology* (September 2014).
[54] Tonkin + Taylor, *Increased Flooding Vulnerability (response to second affidavit of Dr Andrew McCowan)* (October 2014).
[55] Tonkin + Taylor, *Increased Flooding Vulnerability: Properties with a greater increase in flooding vulnerability in higher frequency flooding events* (December 2015), https://www.eqc.govt.nz/sites/public_files/file_attach/2015%2012%2014%20mcnt%20Frequent%20flooding%20report%20no%20appendices_0.pdf.
[56] Tonkin + Taylor, *Increased Flooding Vulnerability Uplift Exceptions* (June 2016).
[57] Tonkin + Taylor, *Increased Flood Vulnerability: Sumner Overland Flow Model and Assessment Report* (January 2015).
[58] Tonkin + Taylor, *Increased Flood Vulnerability: Kaiapoi Overland Flow Model and Assessment Report* (March 2015).

l *Canterbury Earthquake Sequence Increased Flooding Vulnerability Assessment Implementation* (July 2018).[59] This report documents, after the completion of the Increased Flooding Vulnerability engineering assessments, the processes implemented to identify and manually assess properties to determine potential Increased Flooding Vulnerability properties.

176 In addition to these reports, the Increased Flooding Vulnerability International Peer Review Panel provided a report endorsing the Increased Flooding Vulnerability assessment methodology in April 2014.[60] The report documented a series of recommendations by the Peer Review Panel, which were taken into account by Tonkin + Taylor in the development and implementation of the Increased Flooding Vulnerability assessment methodology.

EQC considered settlement based on repair of Increased Flooding Vulnerability

177 In order to provide a basis for settling Increased Flooding Vulnerability based on repair costs, EQC instructed Tonkin + Taylor to provide advice about how Increased Flooding Vulnerability land damage could be repaired and any practical and legal issues associated with undertaking repairs.

178 Tonkin + Taylor advised that the only way Increased Flooding Vulnerability can be repaired on individual properties is by undertaking earthworks to raise the land.[61] The main issues noted were that raising the land:

a could often lead to geotechnical issues with the stability of the land;

b would have flow on effects for neighbouring properties, and the cumulative effects of raising land on many properties were potentially significant; and

c would often need resource consent, which the Christchurch City Council advised was unlikely to be granted in most cases.

179 In addition to these issues, where the Increased Flooding Vulnerability damage was under the house, but the house was not going to be demolished or removed, EQC considered that it would not be practicable to raise the land levels.

180 EQC considered whether the cost of repair was an appropriate settlement for properties with Increased Flooding Vulnerability. The issues set out above meant that all properties with Increased Flooding Vulnerability were ultimately settled based on diminution of value.

[59] Earthquake Commission, *Canterbury Earthquake Sequence: Increased Flooding Vulnerability Assessment Implementation* (July 2018).
[60] Increased Flooding Vulnerability International Peer Review Panel, *EQC Increased Flooding Vulnerability Damage Peer Review: Joint Report of the Expert Panel* (April/May 2014).
[61] See section 2, Tonkin + Taylor, *Increased Flood Vulnerability Observed Land Damage and Repair Methodology* (September 2014).

Developing the diminution of value methodologies for Increased Flooding Vulnerability (including peer review)

181 EQC instructed three professional valuers (the EQC valuers)[62] to have primary responsibility for the development of a methodology to assess, for properties that satisfied the engineering assessment for Increased Flooding Vulnerability:

a whether the identified increase in flooding vulnerability attributable to a physical change to the land had caused a loss of use and amenity to the property; and

b if so, the diminution of value to insured property arising from Increased Flooding Vulnerability.

182 To ensure the robustness of the diminution of value methodologies developed by the EQC valuers, EQC also invited the two major valuation professional associations in New Zealand, the Institute of Valuers and the Property Institute of New Zealand, to each nominate independent valuation experts to peer review the work completed by the EQC valuers. From these nominations, four independent valuation experts were selected. Together, these experts were referred to as the Diminution of Value Expert Valuation Panel.[63]

183 The first diminution of value methodology report for Increased Flooding Vulnerability was provided by the EQC valuers in April 2014.[64] This methodology assessed diminution of value in circumstances where the pre-earthquake building on the residential land remained in place. This report was known as the "In Situ Diminution of Value Methodology for Increased Flooding Vulnerability". The report described:

a a methodology by which professional valuers can determine what, if any, reduction or diminution of value of residential property has resulted from Increased Flooding Vulnerability caused by the 2010/2011 Canterbury earthquakes; and

b the basis for that methodology. This included the evidence collated by the EQC valuers from studies of flooding impacts on property value in Canterbury and in international literature.

184 The methodology was tested and refined through a pilot project undertaken in 2013.

[62] The EQC valuers were Dave Townsend, Ken Blucher and Chris Bridges. See **Appendix 1** for a list of the panel's qualifications.
[63] The Expert Valuation Panel comprised Nicola Bilbrough, Dr Sandy Bond, Ian McGowan, and Gary Sellars. See **Appendix 1** for a list of the panel's qualifications.
[64] Earthquake Commission, *Diminution of Value Methodology for Increased Flooding Vulnerability* (April 2014) (updated with guidance notes and minor amendments as at March 2015), https://www.eqc.govt.nz/sites/public_files/IFV%20DOV%20methodology%20report%20-%20March%202015_1.pdf.

185 In April 2014, the members of the Diminution of Value Expert Valuation Panel endorsed the methodology described in the *Diminution of Value Methodology for Increased Flooding Vulnerability* report. They considered it to be an appropriate methodology for assessing the diminution of value caused by Increased Flooding Vulnerability due to the 2010/2011 Canterbury earthquakes. They found that it accorded with accepted valuation standards and practice.[65]

186 The EQC valuers subsequently developed variations on the *Diminution of Value Methodology for Increased Flooding Vulnerability* to apply in other relevant circumstances. These were:

a a methodology to assess diminution of value in circumstances where the pre-earthquake building on the residential land had been or would be rebuilt. This was known as the "Cleared Site Diminution of Value Methodology for Increased Flooding Vulnerability";[66] and

b a methodology to assess diminution of value attributable to both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability. This methodology covered circumstances where the pre-earthquake building on the residential land remained, or had been or would be rebuilt. This was known as the "Diminution of Value Methodology for Increased Flooding Vulnerability and Increased Liquefaction Vulnerability".

187 Each of these methodologies was reviewed and approved by the Diminution of Value Expert Valuation Panel.[67]

Implementing the diminution of value methodologies for Increased Flooding Vulnerability

188 In the case of each property with potential Increased Flooding Vulnerability, a valuation assessment was carried out in accordance with the appropriate methodology by a registered valuer, under the supervision of the EQC valuers. The team of registered valuers used to assess diminution of value attributable to Increased Flooding Vulnerability were assembled primarily from local Canterbury valuation firms. Valuation results were peer reviewed by the EQC valuers.

[65] Diminution of Value Expert Valuation Panel, *Expert Valuation Panel Statement* (April 2014).
[66] Earthquake Commission, *Diminution of Value Methodology for Increased Flooding Vulnerability (for where the residential building has been or will be rebuilt)* (October 2016), https://www.eqc.govt.nz/sites/public_files/IFV%20DOV%20methodology%20report%20-%20March%202015_1.pdf.
[67] Diminution of Value Expert Valuation Panel, *Expert Valuation Panel Statement – IFV (Cleared Site) DOV Methodology* (October 2016) and Diminution of Value Expert Valuation Panel, *Expert Valuation Panel Statement – ILV and IFV DOV Methodology* (February 2017).

189 The valuation process involved three steps:

a establishing the pre-earthquake value of the property as at 3 September 2010, using recognised valuation techniques. As part of this, a road side inspection of each property was undertaken by the valuer;

b determining the amount of the reduction in the property's market value because it had Increased Flooding Vulnerability land damage in accordance with the applicable diminution of value methodology. This assessment was undertaken using flood maps produced by Tonkin + Taylor showing flood depths and change in flood depth pre- and post- the 2010/2011 Canterbury earthquakes on the property. These were assessed against property features by the valuer during the site visit; and

c exercising valuation judgement as to the resulting diminution of value.

190 In the course of implementing the assessments of diminution of value for Increased Flooding Vulnerability, a number of practice notes to guide the exercise of valuation judgement were developed by the EQC valuers. These include a practice note on how to modify the methodologies to deal with properties with significant impacts in more frequent flooding events.[68]

Apportionment of Increased Flooding Vulnerability settlements

191 Cover under the Earthquake Commission Act 1993 begins afresh after each occurrence of natural disaster damage.[69]

192 Because of the nature of the engineering and valuation assessments involved, Increased Flooding Vulnerability was assessed in relation to the effects of the 2010/2011 Canterbury earthquakes as a whole. EQC therefore needed to apportion the diminution of value amount assessed for each property to one or more of the earthquakes in order to calculate the final settlement amount. EQC instructed Tonkin + Taylor to provide it with advice on this issue.

[68] Earthquake Commission, *IFV DOV: Frequency Focus Areas: Guidance Note* (updated January 2017) https://www.eqc.govt.nz/sites/public_files/file_attach/WGNDOC01-%232454274-v11-MS_EQC_IFV_frequency_guidance_note.pdf.

[69] In *Re Earthquake Commission* [2011] 3 NZLR 695 (HC), the High Court confirmed that the insurance under sections 18 and 20 of the Earthquake Commission Act 1993 is a continuing cover and therefore the amount of insurance available under these two sections is for each occurrence of natural disaster damage during the period of insurance.

193 For each property, Tonkin + Taylor allocated the Increased Flooding Vulnerability damage to one or more earthquakes that were assessed as having caused Increased Flooding Vulnerability. When Increased Flooding Vulnerability damage was allocated to more than one earthquake, Tonkin + Taylor estimated the percentage that each separate earthquake contributed to the Increased Flooding Vulnerability damage.[70]

194 To make this estimate, Tonkin + Taylor used available information about the extent of land damage in each event, and engineering judgement. EQC then apportioned the diminution of value amount for each property using the percentages provided by Tonkin + Taylor.

195 Where part of the settlement was apportioned to an event for which no claim was made, the settlement was still paid to the customer. The payment was made where the customer had made a claim for at least one of the 2010/2011 Canterbury earthquakes. Settlement amounts apportioned to unclaimed-for events were made under a Ministerial direction.[71]

Increased Flooding Vulnerability settlements – communications

196 EQC communicated with customers regarding Increased Flooding Vulnerability on several occasions. In particular, customers were informed of:

a their property's potential Increased Flooding Vulnerability status;

b after the assessments were completed, the decision on whether or not their property qualified for Increased Flooding Vulnerability status, and the decision on settlement; and

c payment of the claim.

197 Customers were sent an Increased Flooding Vulnerability settlement pack. Different settlement packs were provided depending on the circumstances, such as whether or not the property qualified, and whether or not the house on the property before the 2010/2011 Canterbury earthquakes had been, or was to be, rebuilt. Sample settlement packs sent to customers for properties in different circumstances, including those that did not qualify for Increased Flooding Vulnerability, are available on EQC's website.[72]

[70] See Tonkin + Taylor, *Canterbury Earthquake Sequence Increased Flooding Vulnerability Allocation Methodology Report* (December 2016).
[71] See *Briefing to the Public Inquiry into the Earthquake Commission – Ministerial Directions since 1 January 1994* dated 13 March 2019, paragraphs 34 to 36.
[72] The EQC website contains sample Increased Flooding Vulnerability settlement packs at: https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/complex-land-claims/increased-risk-of-flooding/#Understanding your settlement pack.

198 For example, a customer with a property that qualified for Increased Flooding Vulnerability land damage where the house remained in place and was not to be rebuilt would be sent a settlement pack containing the following information:

a a cover letter that outlined EQC's settlement decision for the property and key information explaining that decision;[73]

b a land settlement summary showing the settlement amount and related information for each land claim on the property;[74]

c a report by one of EQC's valuers outlining the valuation assessment for the property;[75]

d a fact sheet on diminution of value due to Increased Flooding Vulnerability land damage;[76]

e a report by EQC's engineers, Tonkin + Taylor, outlining the engineering assessment process and results for the property;[77] and

f a fact sheet on Increased Flooding Vulnerability land damage.[78]

199 EQC staff were provided with training so that they could answer questions from customers on Increased Flooding Vulnerability and diminution of value.

Increased Flooding Vulnerability settlements – summary of outcome

200 A total of 9,744 properties were assessed as qualifying for Increased Flooding Vulnerability. Of these, 5,772 were in the residential green zone and 3,972 were in the residential red zones.[79]

[73] Earthquake Commission, *Sample cover letter for Increased Flooding Vulnerability settlement*, https://www.eqc.govt.nz/sites/public_files/images/FINAL%20DF04%20YES%20IFV%20DOV_cover_letter_20160210.pdf.
[74] Earthquake Commission, *Sample land settlement summary for Increased Flooding Vulnerability*, https://www.eqc.govt.nz/sites/public_files/images/IFV%20YES%20LSS.pdf.
[75] Earthquake Commission, *Sample valuation assessment for Increased Flooding Vulnerability*, https://www.eqc.govt.nz/sites/public_files/images/IFV%20YES%20DOV%20VR.pdf
[76] Earthquake Commission, *Diminution of Value (DOV) due to Increased Flooding Vulnerability (IFV) land damage (for where the house is still in place) Fact Sheet* (November 2016), https://www.eqc.govt.nz/sites/public_files/images/FINAL_Updated_%20DOV-IFV%20Insitu%20Fact%20Sheet%20Nov-2016_20161124_0.pdf
[77] Earthquake Commission, *Sample Increased Flooding Vulnerability (IFV) Engineering Assessment*, https://www.eqc.govt.nz/sites/public_files/images/IFV%20YES%20DOV%20ES%20reduced.pdf
[78] Earthquake Commission, *Increased Flooding Vulnerability (IFV) Fact Sheet* (November 2016), https://www.eqc.govt.nz/sites/public_files/images/FINAL_Updated_IFV_qualification_fact_sheet_November%202016_0.pdf
[79] Properties in the residential red zones that were not sold to the Crown are included in the numbers for the residential green zone.

201 EQC started assessing properties for Increased Flooding Vulnerability following the development of the engineering and valuation methodologies, discussed above in paragraphs 163 to 190, and the decision in the land declaratory judgment in December 2014, discussed above in paragraphs 107 to 128.

202 The first settlements for Increased Flooding Vulnerability land damage were made in March 2015. The majority of Increased Flooding Vulnerability settlements were completed by July 2017.

203 There remain approximately 70 properties that have both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability damage and have been on hold due to claims made by the private insurers in relation to Increased Liquefaction Vulnerability. However, many of these claims are now also being progressed.

204 All Increased Flooding Vulnerability settlements were based on diminution of value. The average (mean) Increased Flooding Vulnerability settlement in the residential green zone was:

a $20,809 for properties where the residential building remained in place; and

b $20,705 where the residential building has been or will be rebuilt.

Assessing and settling Increased Liquefaction Vulnerability land damage

EQC's overall approach to assessing and settling Increased Liquefaction Vulnerability land damage

205 As for Increased Flooding Vulnerability land damage, EQC approached the assessment and settlement of Increased Liquefaction Vulnerability on the basis that it was unlikely, although possible, that individual customers would be able to identify Increased Liquefaction Vulnerability on their property. This form of damage could not easily be seen and was therefore categorised as "non-visible" land damage.

206 Accordingly, EQC sought to develop policies and methodologies that emphasised:

a proactively gathering the information to identify Increased Liquefaction Vulnerability on an individual property basis;

b developing robust engineering and valuation methodologies based on the best available advice to assess and settle Increased Liquefaction Vulnerability; and

c communicating qualification and settlement decisions to customers in a clear and appropriate way. The communications would need to take into account the complexity of the engineering and valuation judgements required for the underlying Increased Liquefaction Vulnerability assessments.

207 The Increased Liquefaction Vulnerability policies and methodologies were more complex than for Increased Flooding Vulnerability and took longer to develop.

EQC's Increased Liquefaction Vulnerability policy

208 EQC's policies and methodologies for assessing and settling Increased Liquefaction Vulnerability land damage were set out in its Increased Liquefaction Vulnerability policy in October 2015. This policy was later consolidated with the Increased Flooding Vulnerability policy. The result was the *Increased Flooding Vulnerability (IFV) and Increased Liquefaction Vulnerability (ILV) Land Damage Consolidated Policy Statement*.[80] As mentioned above, consolidation was appropriate because a number of properties had both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability damage.

209 EQC's Increased Liquefaction Vulnerability policies covered:

a recognising Increased Liquefaction Vulnerability as a form of natural disaster land damage under the Earthquake Commission Act 1993;

b the three criteria determined by EQC for recognising Increased Liquefaction Vulnerability as natural disaster damage. These criteria were that the property had to have:

i an engineering assessment that the insured land has a material vulnerability to liquefaction damage (assessed at 100 year return period levels of earthquake shaking);

ii an engineering assessment that subsidence of the insured land caused by the 2010/2011 Canterbury earthquakes resulted in a materially increased vulnerability to liquefaction damage (assessed at up to 100 year return period levels of earthquake shaking); and

iii a valuation assessment that the increase in vulnerability to liquefaction damage of the residential land reduced the market value of the property;

c how EQC would settle claims for damage to residential land that included Increased Liquefaction Vulnerability, and in particular:

i EQC's general preference for cash settlement of claims, rather than reinstatement;

[80] Earthquake Commission, *Increased Flooding Vulnerability (IFV) and/or Increased Liquefaction Vulnerability (ILV) Land Damage Consolidated Policy Statement* (September 2016), https://www.eqc.govt.nz/sites/public_files/file_attach/IFV%20and%20or%20ILV%20Land%20Damage%20Consolidated%20Policy%20Statement%20Sept%202016.pdf.

ii the policies that EQC would apply to determine how to assess the financial loss to the customer arising from Increased Liquefaction Vulnerability, either:

(1) the amount it would cost the customer to repair or reinstate the land; or

(2) the diminution of value suffered as a result of the Increased Liquefaction Vulnerability; and

iii how EQC would determine the diminution of value in circumstances where the settlement is based on the diminution of value figure. EQC relied on assessments of the diminution of value certified by independent valuation professionals.

Basis for Increased Liquefaction Vulnerability settlement – cost of repair vs diminution of value

210 The policies relating to the choice between settlement based on cost of repair and diminution of value were based on those endorsed in the land declaratory judgment (see paragraphs 107 to 128 above). In summary, EQC will settle based on diminution of value unless:

a there is a legally and practically available repair methodology for the repair of Increased Liquefaction Vulnerability on the property;

b the customer intends to undertake the repair of the land within a reasonable period of time using that methodology;

c the residential land has been sold by the customer; or

d the repair cost is not disproportionate to the diminution of value of the property, having regard to the particular circumstances of the customer (including his or her stated intentions in relation to repair of the land).

Customer's right to review of EQC's Increased Liquefaction Vulnerability settlement decision

211 EQC expected that the policies set out in the Increased Liquefaction Vulnerability policy would provide a full and fair settlement of claims involving Increased Liquefaction Vulnerability. But any customer was entitled to provide:

a further information (or an alternative interpretation of existing information); and

b ask EQC to reconsider its Increased Liquefaction Vulnerability settlement decisions.

212 Further, the Increased Liquefaction Vulnerability policy expressly provided that any information provided to EQC by a customer would be taken into account by EQC in reaching a final settlement decision.

213 As for Increased Flooding Vulnerability, EQC also developed a process for reviewing Increased Liquefaction Vulnerability assessments at the request of a customer (see paragraph 162 above). The process emphasises that EQC would consider requests for re-assessment with an open mind.

Engineering work underpinning assessment for qualifying for Increased Liquefaction Vulnerability

214 Unlike the categories of visible land damage,[81] and as is the case for Increased Flooding Vulnerability, Increased Liquefaction Vulnerability could not be directly observed. The increased vulnerability of land to liquefaction damage could only be assessed with any accuracy by reference to:

a evidence of physical subsidence of land, either through airborne LiDAR surveys of land levels or the direct observations of liquefaction that were made during the earthquake sequence;

b observed land damage experienced in each of the 2010/2011 Canterbury earthquakes relative to the estimated levels of shaking experienced;

c extensive geotechnical investigations and groundwater levels; and

d modelling of liquefaction vulnerability based on geotechnical investigations and depth to groundwater.

215 EQC instructed Tonkin + Taylor to:

a provide advice on a methodology to assess whether individual parcels of residential land met the engineering criteria for Increased Liquefaction Vulnerability as a result of one or more of the 2010/2011 Canterbury earthquakes; and

b undertake engineering assessments to advise whether individual properties satisfied the engineering criteria for potential Increased Liquefaction Vulnerability.

[81] The categories of visible land damage (Categories 1-7) were: (1) land cracking caused by lateral spreading; (2) land cracking caused by oscillation movements; (3) undulating land; (4) local ponding; (5) local settlement causing drainage issues; (6) groundwater springs; and (7) inundation by ejected sand and silt. See paragraph 83.

216 This work involved first reviewing the existing liquefaction vulnerability assessment tools in the context of the available geotechnical information. It was found that none of these tools was appropriate for the assessment of Increased Liquefaction Vulnerability in Canterbury. Tonkin + Taylor therefore developed a new tool, called the Liquefaction Severity Number, for the assessment of Increased Liquefaction Vulnerability.

217 The methodology addressed two key questions:

a is the insured land materially vulnerable to liquefaction damage? and

b has the insured land become materially more vulnerable to liquefaction damage as a result of subsidence of that land caused by the 2010/2011 Canterbury earthquakes?

218 The material vulnerability, and the material increase in vulnerability, were measured at up to 1 in 100 year level of earthquake shaking.

219 The methodology involved using:

a modelling of the Liquefaction Severity Number;

b other information about the nature of the land and its performance during the earthquakes; and

c the application of engineering judgement.

PEER REVIEW OF INCREASED LIQUEFACTION VULNERABILITY ENGINEERING ASSESSMENT WORK

220 To ensure the robustness of the methodology developed by Tonkin + Taylor, EQC instructed four independent engineering experts from the United States and New Zealand to peer review the work completed by Tonkin + Taylor (referred to as the Increased Liquefaction Vulnerability International Peer Review Panel).[82]

221 The Increased Liquefaction Vulnerability engineering assessment methodology was developed by Tonkin + Taylor, under the supervision of the International Peer Review Panel, through a series of iterations. An iterative process was necessary because of the novelty and complexity of the engineering work involved.

[82] The four independent engineering experts comprising the Increased Liquefaction Vulnerability International Peer Review Panel were: Professor Ross Boulanger, Professor Jonathan Bray, Professor Misko Cubrinovski, and Professor Thomas O'Rourke. See **Appendix 1** for a list of the panel's qualifications.

222 Liquefaction vulnerability was generally understood and recognised prior to the 2010/2011 Canterbury earthquakes. But the idea that liquefaction vulnerability could increase as a result of an earthquake was new. Further, as noted above, Tonkin + Taylor developed a new tool to assess liquefaction vulnerability, which also needed to be worked through and tested with the peer reviewers.

223 In the course of developing the assessment approach, Tonkin + Taylor:

a received and took account of feedback from the Peer Review Panel and the guidance provided in the land declaratory judgment;[83] and

b refined the assessment approach as assessments were undertaken and understanding of Increased Liquefaction Vulnerability increased, and as new information became available. The Increased Liquefaction Vulnerability assessment methodology was revised following an update of the liquefaction evaluation procedures in 2014.[84] Assessments of particular properties were reviewed in light of the additional information obtained from land damage observations from the 14 February 2016 earthquake in Christchurch.

224 Refining the assessment approach allowed Tonkin + Taylor to take advantage of the experience of applying the methodology, as well as address issues that arose in the implementation. Where the assessment was refined, all properties previously assessed were reviewed to ensure consistency.

225 The general effect of these iterative developments was to place less reliance on automated results based on liquefaction vulnerability modelling, and place greater weight on manual assessment of properties.

INFORMATION GATHERED FOR INCREASED LIQUEFACTION VULNERABILITY ENGINEERING ASSESSMENTS

226 The Increased Liquefaction Vulnerability engineering assessment methodology used relevant information available to EQC, including information proactively collected by EQC. The sources of information used in the methodology include:

a ground surface levels derived from LiDAR (aerial surveys);

b groundwater levels throughout Canterbury. Approximately 1,000 shallow groundwater monitoring wells were used for this purpose;

c aerial photographs taken after each of the four main 2010/2011 Canterbury earthquakes;[85]

[83] As discussed above at paragraphs 107 to 128.
[84] R.W. Boulanger and I. M. Idriss, *CPT and SPT based liquefaction triggering procedures*, Report No. UCD/CGM-14/01, Center for Geotechnical Modeling, Department of Civil and Environmental Engineering, University of California (2014).
[85] 4 September 2010, 22 February 2011, 13 June 2011 and 23 December 2011 (see paragraph 36 above).

d observed land performance, based on data collected following each of the major earthquakes (see paragraph 49 above), relative to the estimated levels of shaking in each of the earthquakes;

e peak ground acceleration models based on recorded earthquake shaking intensity for each of the four main 2010/2011 Canterbury earthquakes; and

f soil characteristics data obtained from extensive geotechnical investigations, both from private insurers and from EQC's own extensive drilling programme.[86] This includes data from approximately 18,000 Cone Penetrometer Tests (often known as CPTs), 4,000 boreholes, and 6,000 laboratory tests.

227 Data gathered by EQC was uploaded to the Canterbury Geotechnical Database. This online database was designed by Tonkin + Taylor and IT developers with the collaboration of EQC, the Canterbury Earthquake Recovery Authority, and the Department of Building and Housing (now Ministry of Business, Innovation and Employment).

228 The Canterbury Geotechnical Database was established in May 2012 and has been used since as a collaborative tool for professionals to share geotechnical data.[87] It has since been expanded to cover geotechnical information throughout New Zealand as the New Zealand Geotechnical Database.

DOCUMENTING THE INCREASED LIQUEFACTION VULNERABILITY ENGINEERING ASSESSMENT WORK

229 The Increased Liquefaction Vulnerability engineering assessment methodology is documented in the Tonkin + Taylor report, *Canterbury Earthquake Sequence: Increased Liquefaction Vulnerability Assessment Methodology*.[88] The Increased Liquefaction Vulnerability International Peer Review Panel provided a report endorsing the assessment methodology.[89]

[86] See Earthquake Commission, *Technical Category 3 (TC3) EQC geotechnical investigations and assessments* (September 2012), https://www.eqc.govt.nz/sites/public_files/documents/Canterbury/TC3-factsheet-Sept2012.pdf. Drilling was completed on 21 December 2012, which was earlier than expected.
[87] See Tonkin + Taylor, *Sketch on cardboard box results in world first and gold award* (6 September 2016), https://www.tonkintaylor.co.nz/news/2016/9/cardboard-box-sketch-results-in-world-first-and-gold-award/.
[88] Tonkin + Taylor, *Canterbury Earthquake Sequence: Increased Liquefaction Vulnerability Assessment Methodology* (October 2015), https://www.eqc.govt.nz/sites/public_files/2015%2010%2016%20CES%20Increased%20Liquefaction%20Vulnerability%20Assessment%20Methodology_T%2BT%20Report_FINAL_Part%201.pdf
[89] Independent Increased Liquefaction Vulnerability Expert Panel, *Peer Review of the Increased Liquefaction Vulnerability Assessment Methodology* (October 2015), https://www.eqc.govt.nz/sites/public_files/images/ILV%20Expert%20Panel%20Report%20-%20Final_2.pdf

Development of Increased Liquefaction Vulnerability repair methodologies

230 In 2013, EQC commenced a research project to inform appropriate solutions for ground improvement of land vulnerable to liquefaction, which would also repair any Increased Liquefaction Vulnerability damage to the land. The project (known as the Ground Improvement Programme) was coordinated by EQC's engineers, Tonkin + Taylor, and involved leading experts from New Zealand and around the world.

231 The land repair techniques were piloted on 31 different residential properties. The aim was to ensure that the actual costs and complexities of the land repair could be understood by property owners, engineers, builders, private insurers, local authorities and central government agencies. This was in the context of building or rebuilding of houses on land vulnerable to liquefaction.[90]

232 Results from the Ground Improvement Programme made a key contribution to updated guidance for repairing and rebuilding houses on TC3 land in Canterbury issued by the Ministry of Business, Innovation and Employment in 2015.[91] This guidance included some of the ground improvement techniques developed in the Ground Improvement Programme.

233 Based on the work undertaken in the Ground Improvement Programme, and the 2015 update to the guidance, EQC was able to settle Increased Liquefaction Vulnerability damage for customers in appropriate circumstances by paying for the cost of designing and undertaking ground improvement. That ground improvement could be designed to repair the Increased Liquefaction Vulnerability damage.

Developing the diminution of value methodologies for Increased Liquefaction Vulnerability (including peer review)

234 EQC instructed the EQC valuers who developed the diminution of value methodologies for Increased Flooding Vulnerability (see paragraph 181 above) to have primary responsibility for the development of a methodology to assess, for properties that satisfied the engineering assessment for Increased Liquefaction Vulnerability:

a whether the identified increase in liquefaction vulnerability attributable to a physical change to the land had caused a loss of use and amenity to the property; and

b if so, the diminution of value to insured property arising from Increased Liquefaction Vulnerability.

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[90] Earthquake Commission, *Residential Ground Improvement – Findings from trials to manage liquefaction vulnerability* (2015), https://www.eqc.govt.nz/sites/public_files/1.%20Residential%20Ground%20Improvement%20report%20EQC.pdf.

[91] Ministry of Business, Innovation and Employment, *Guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence* (2012, as updated April 2015), https://www.building.govt.nz/building-code-compliance/canterbury-rebuild/repairing-and-rebuilding-houses-affected-by-the-canterbury-earthquakes/.

235 To ensure the robustness of the diminution of value methodologies developed by the EQC valuers, EQC engaged the same Diminution of Value Expert Valuation Panel who advised on the diminution of value methodologies for Increased Flooding Vulnerability (see paragraph 182 above). The Panel peer reviewed the work completed by the EQC valuers in relation to Increased Liquefaction Vulnerability.

236 The EQC valuers advised EQC in October 2015 that all properties that were assessed by Tonkin + Taylor as meeting the engineering criteria for Increased Liquefaction Vulnerability damage would also meet the valuation criteria, and this meant they would all therefore have Increased Liquefaction Vulnerability damage.[92] There was an exception to this for properties where only part of the insured land, away from the residential building, met the engineering criteria for Increased Liquefaction Vulnerability damage. The EQC valuers advised that in such cases, the property would not have experienced a loss in value due to the increase in vulnerability to that part of the land.[93]

237 EQC instructed Tonkin + Taylor to provide advice about the practical implications of Increased Liquefaction Vulnerability for residential properties for the EQC valuers to consider in developing the diminution of value methodologies for Increased Liquefaction Vulnerability.

238 This advice is contained in the Tonkin + Taylor report, *Practical Implications of Increased Liquefaction Vulnerability* (November 2016).[94] This report:

a provides classifications (undertaken at both 25 year and 100 year return period levels of earthquake shaking) for properties with Increased Liquefaction Vulnerability damage of:

i the severity of liquefaction vulnerability before and after the 2010/2011 Canterbury earthquakes; and

ii the extent of change of liquefaction severity across the 2010/2011 Canterbury earthquakes; and

b explains the practical implications of Increased Liquefaction Vulnerability damage by reference to these classifications. Those implications are primarily an increased likelihood of land and building damage in future earthquakes, and a potential increase in foundation requirements when building a new house.

[92] Letter from EQC's valuers to Ian Simpson (Chief Executive of EQC) regarding Criterion 3 for Increased Liquefaction Vulnerability damage - Valuation (16 October 2015).
[93] Letter from EQC's valuers to Ian Simpson (Chief Executive of EQC) regarding Criterion 3 for Increased Liquefaction Vulnerability damage – Valuation for Long Access Ways (16 October 2015).
[94] Tonkin + Taylor, *Practical Implications of Increased Liquefaction Vulnerability* (November 2016), https://www.eqc.govt.nz/sites/public_files/images/Main%20Report_Optimized.pdf.

239 The first diminution of value methodology report for Increased Liquefaction Vulnerability was provided by the EQC valuers to EQC in June 2016.[95] This methodology assessed diminution of value in circumstances where the pre-earthquake building on the residential land remained in place. This report is known as the "In Situ Diminution of Value Methodology for Increased Liquefaction Vulnerability". The report described:

a a methodology by which professional valuers can determine what reduction or diminution of value of residential property has resulted from Increased Liquefaction Vulnerability caused by the 2010/2011 Canterbury earthquakes; and

b the basis for that methodology, including a statistical analysis of residential property sales in Christchurch commissioned by EQC from Professor Basil Sharp (University of Auckland).[96]

240 The In Situ Diminution of Value Methodology for Increased Liquefaction Vulnerability was tested and refined through an iterative process. The process involved reviewing the diminution of value results, considering any anomalies in these results in consultation with Tonkin + Taylor, and engaging with the Diminution of Value Expert Valuation Panel.

241 In June 2016, the members of the Diminution of Value Expert Valuation Panel endorsed the methodology described in the Diminution of Value Methodology for Increased Liquefaction Vulnerability Report as an appropriate methodology for assessing the diminution of value caused by Increased Liquefaction Vulnerability due to the 2010/2011 Canterbury earthquakes. They found that it accorded with accepted valuation standards and practice.[97]

242 The EQC valuers subsequently developed variations on the In Situ Diminution of Value Methodology for Increased Liquefaction Vulnerability to apply in other relevant circumstances. These were:

a a methodology to assess diminution of value in circumstances where the pre-earthquake building on the residential land had been or would been rebuilt (Cleared Site Diminution of Value Methodology for Increased Liquefaction Vulnerability).[98] This methodology:

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[95] Earthquake Commission, *Diminution of Value Methodology for Increased Liquefaction Vulnerability (for Properties with Residential Building in Place)* (June 2016), https://www.eqc.govt.nz/sites/public_files/EQC%20ILV%20DoV%20Methodology%20%28For%20Properties%20with%20the%20CES-Building%20In%20Place%29%20FINAL_June2016.pdf.

[96] W. Yang and B. Sharp, *Impact of Liquefaction Vulnerability on Residential Property Prices* (November 2015).

[97] Expert Valuation Panel, *Expert Valuation Panel Statement – ILV DOV Methodology* (June 2016).

[98] Earthquake Commission, *Diminution of Value Methodology for Increased Liquefaction Vulnerability (for where the residential building has been or will be rebuilt)* (November 2016), https://www.eqc.govt.nz/sites/public_files/images/Diminution%20of%20Value%20Methodology%20for%20Increased%20Liquefaction%20Vulnerability%20%28for%20where%20the%20residential%20building%20has%20been%20or%20will%20be%20rebuilt%29_November%202016.pdf.

i reflected the reduced implications of Increased Liquefaction Vulnerability for houses that are rebuilt with foundations in accordance with the Ministry of Business, Innovation and Employment guidance;[99] and

ii included a methodology for properties where part of the land under and around the building platform was repaired, to assess the diminution of value resulting from Increased Liquefaction Vulnerability to un-remediated areas of insured land; and

b a methodology to assess diminution of value attributable to both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability, both in circumstances where the pre-earthquake building on the residential land remained, or had been or would be rebuilt (Diminution of Value Methodology for Increased Flooding Vulnerability and Increased Liquefaction Vulnerability).

243 Each of these methodologies was reviewed and approved by the diminution of value Expert Valuation Panel.[100]

Implementing diminution of value methodologies for Increased Liquefaction Vulnerability

244 In the case of each property with Increased Liquefaction Vulnerability, a valuation assessment was carried out in accordance with the appropriate methodology by the EQC valuers.

245 The valuation process involved three steps:

a establishing the pre-earthquake value of the property as at 3 September 2010, using recognised valuation techniques;

b determining the amount of the reduction in the property's market value because it had Increased Liquefaction Vulnerability land damage in accordance with the applicable diminution of value methodology. This assessment was undertaken based on the liquefaction severity classifications of the property before and after the 2010/2011 Canterbury earthquakes, and the extent of change in liquefaction severity provided by Tonkin + Taylor; and

c exercising valuation judgement as to the resulting diminution of value.

[99] Ministry of Business, Innovation and Employment, *Guidance on repairing and rebuilding houses affected by the Canterbury earthquake sequence* (2012, as updated April 2015), https://www.building.govt.nz/building-code-compliance/canterbury-rebuild/repairing-and-rebuilding-houses-affected-by-the-canterbury-earthquakes/.

[100] Diminution of Value Expert Valuation Panel, *Expert Valuation Panel Statement – ILV (Cleared Site) DOV Methodology* (November 2016) and Diminution of Value Expert Valuation Panel, *Expert Valuation Panel Statement – ILV and IFV DOV Methodology* (February 2017).

246 The first step, assessing pre-earthquake values, was undertaken using mass appraisal techniques. This work was carried out by Quotable Value (QV) for properties where the house remained in place, and by Northland Valuers Limited for properties where the house had been or would be rebuilt. The EQC valuers relied on these pre-earthquake values in undertaking the other two steps.

Apportionment of Increased Liquefaction Vulnerability settlements

247 Because of the nature of the engineering and valuation assessments involved, Increased Liquefaction Vulnerability was assessed in relation to the effects of the 2010/2011 Canterbury earthquakes as a whole. EQC therefore needed to apportion the diminution of value or repair costs assessed for each property to one or more of the earthquakes in order to calculate the final settlement amount. EQC instructed Tonkin + Taylor to provide it with advice on this issue.

248 For each property, Tonkin + Taylor allocated the Increased Liquefaction Vulnerability damage to one or more earthquakes that were assessed as having caused Increased Liquefaction Vulnerability. When Increased Liquefaction Vulnerability damage was allocated to more than one earthquake, Tonkin + Taylor estimated the percentage that each separate earthquake contributed to the Increased Liquefaction Vulnerability damage.[101]

249 Where the settlement was based on diminution of value, EQC then apportioned the diminution of value amount for each property using the percentages provided by Tonkin + Taylor. Where the settlement was based on the cost of repairing Increased Liquefaction Vulnerability, the repair costs were apportioned to the first earthquake to which Tonkin + Taylor had allocated Increased Liquefaction Vulnerability.

250 Where part of the settlement was apportioned to an event for which no claim was made, the settlement was still paid to the customer in accordance with the Ministerial direction.[102]

Increased Liquefaction Vulnerability settlements – communications

251 EQC communicated with customers regarding Increased Liquefaction Vulnerability on several occasions. In particular, customers were informed of:

a their property's potential to qualify for Increased Liquefaction Vulnerability status;

b after engineering assessments were completed, the decision on whether or not their property qualified for Increased Liquefaction Vulnerability status; and

[101] The methodology developed by Tonkin + Taylor for the allocation of Increased Liquefaction Vulnerability is set out in its report, *Canterbury Earthquake Sequence: Increased Liquefaction Vulnerability: Allocation Methodology Report* (March 2019).

[102] See *Briefing to the Public Inquiry into the Earthquake Commission – Ministerial Directions since 1 January 1994* dated 13 March 2019, paragraphs 34 to 36.

c after the valuation assessment (or process regarding Increased Liquefaction Vulnerability repair) was completed, the decision on settlement and payment.

252 Once qualification decisions were made, customers were sent an Increased Liquefaction Vulnerability qualification pack. Different qualification packs were provided depending on whether or not the property qualified.[103]

253 For example, a customer with a property that qualified for Increased Liquefaction land damage would be sent a qualification pack containing the following information:

a a cover letter that outlined EQC's qualification decision for the property and key information explaining that decision;[104]

b a report by EQC's engineers, Tonkin + Taylor, outlining the engineering assessment process and results for the property;[105] and

c a fact sheet on Increased Liquefaction Vulnerability land damage.[106]

254 Once settlement decisions were made, customers were sent an Increased Liquefaction Vulnerability settlement pack. Different settlement packs were provided depending on the circumstances, such as whether or not the house on the property before the 2010/2011 Canterbury earthquakes had been, or was to be, rebuilt.[107]

255 For example, a customer with a property that qualified for settlement of Increased Liquefaction Vulnerability land damage where the house remained in place and was not to be rebuilt would be sent a settlement pack containing the following information:

a a cover letter that outlined EQC's settlement decision for the property and key information explaining that decision;[108]

[103] Sample qualification packs for Increased Liquefaction Vulnerability are on the EQC website: https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/flat-land/increased-risk-of-liquefaction#Qual_pack.
[104] Earthquake Commission, *Sample cover letter for Increased Liquefaction Vulnerability qualification*, https://www.eqc.govt.nz/sites/public_files/images/FINAL_ILV_YES_letter_20160209_0.pdf.
[105] Earthquake Commission, *Sample Increased Liquefaction Vulnerability (ILV) Engineering Assessment*, https://www.eqc.govt.nz/sites/public_files/images/ILV%20Engineering%20Report%20YES%20Sample%2020151021.pdf.
[106] Earthquake Commission, *Increased Liquefaction Vulnerability (IFV) Fact Sheet* (October 2015), https://www.eqc.govt.nz/sites/public_files/images/ILV%20Fact%20Sheet%20October.pdf.
[107] Sample settlement packs for Increased Liquefaction Vulnerability are on the EQC website: https://www.eqc.govt.nz/canterbury-earthquakes/land-claims/flat-land/increased-risk-of-liquefaction/#Understanding your settlement pack.
[108] Earthquake Commission, *Sample cover letter for Increased Liquefaction Vulnerability settlement*, https://www.eqc.govt.nz/sites/public_files/images/FINAL%20ILV%20DOV%20Only%20settlement%20pack%2020160615.pdf.

b a land settlement summary showing a breakdown of the land settlement amount (if a customer had more than one land claim they also received a land settlement summary for each land claim and a land settlement summary for all land claims);[109]

c a report outlining the valuation assessment for the property;[110] and

d a fact sheet on diminution of value due to Increased Liquefaction Vulnerability land damage.[111]

256 EQC staff were provided with training so that they could answer questions from customers on Increased Liquefaction Vulnerability and diminution of value.

Increased Liquefaction Vulnerability settlements – summary of outcome

257 A total of 9,553 properties were assessed as qualifying for Increased Liquefaction Vulnerability. Of these, 4,634 were in the residential green zone and 4,919 were in the residential red zones.[112] These figures include properties with increased vulnerability to liquefaction due to compromised crust (see paragraphs 276 to 284 below).

258 EQC started advising customers about whether their property qualified for Increased Liquefaction Vulnerability damage in October 2015.

259 EQC started making settlements for Increased Liquefaction Vulnerability damage in mid-2016. Most settlements had been completed by July 2017.

260 The significant majority of properties with Increased Liquefaction Vulnerability were settled based on diminution of value, with only a small number of properties being settled based on cost of repair. This included 31 properties repaired by EQC as part of its Ground Improvement Programme.

261 The average (mean) Increased Liquefaction Vulnerability settlement based on diminution of value in the residential green zone was:

a $21,238 for properties where the residential building remained in place; and

b $11,584 where the residential building has been or will be rebuilt.

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[109] Earthquake Commission, *Sample land settlement summary for Increased Liquefaction Vulnerability*, https://www.eqc.govt.nz/sites/public_files/DOV%20land%20summary.pdf.
[110] Earthquake Commission, *Sample valuation assessment for Increased Liquefaction Vulnerability*, https://www.eqc.govt.nz/sites/public_files/DOV%20visible%20valuation.pdf.
[111] Earthquake Commission, *Diminution of Value (DOV) due to Increased Liquefaction Vulnerability (ILV) land damage (where the house is still in place) Fact Sheet* (June 2016), https://www.eqc.govt.nz/sites/public_files/FINAL_ILV-DOV%20Fact%20Sheet%20-%20June%202016.pdf.
[112] Properties in the residential red zones that were not sold to the Crown are included in the numbers for the residential green zone.

Claims against EQC by private insurers

262 On 20 January 2017, IAG New Zealand Limited and Tower Insurance Limited commenced High Court proceedings against EQC in respect of EQC's policy for settling Increased Liquefaction Vulnerability land damage. Since the proceedings were commenced, IAG and Tower have amended their claims several times. The current proceedings raise claims that, amongst other things:

a EQC has not identified all properties with Increased Liquefaction Vulnerability land damage and some forms of visible land damage;

b EQC should have settled claims based on payment of either the costs of undertaking a ground improvement or enhanced foundation that would enable the residential building to be rebuilt using less expensive foundations; and

c EQC has underestimated the diminution of value attributable to residential land damage.

263 These proceedings are ongoing. There remain approximately 70 land claims that have been on hold due to this litigation, though many of these claims are now being progressed.

264 EQC has denied the claims. EQC has based its settlement decisions on expert advice that contradicts the claims made by IAG and Tower. In addition, a number of the arguments made by IAG and Tower in the proceedings are in conflict with EQC's policies for settling Increased Liquefaction Vulnerability (and Increased Flooding Vulnerability) damage for customers, and with the principles in the land declaratory judgment (see paragraphs 107 to 128 above).

265 Other private insurers have indicated they have similar claims against EQC, but have not yet issued proceedings.

Properties with both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability land damage

266 In total 4,143 properties have been assessed as having both Increased Liquefaction Vulnerability and Increased Flooding Vulnerability. Of these, 787 are in the residential green zone and 3,356 are in the residential red zones.[113] These figures include properties with increased vulnerability to liquefaction due to compromised crust (see paragraphs 270 to 284 below).

267 Qualification for each of Increased Flooding Vulnerability and Increased Liquefaction Vulnerability is assessed separately in accordance with the processes and methodologies discussed above.

[113] Properties in the residential red zones that were not sold to the Crown are included in the numbers for the residential green zone.

268 Tonkin + Taylor confirmed that Increased Flooding Vulnerability and Increased Liquefaction Vulnerability are independent from an engineering perspective. Therefore where a property has both forms of damage, it is still possible to repair either or both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability damage.[114] Accordingly, both cost of repair and diminution of value are available settlement options for Increased Flooding Vulnerability and Increased Liquefaction Vulnerability on these properties.

269 Where both forms of damage are settled based on diminution of value, the EQC valuers have developed a diminution of value methodology to assess the loss in value resulting from both forms of damage together.[115] A summary of the diminution of value methodology is given in the EQC fact sheets.[116]

Settling claims in the residential red zones

Approach to assessing and settling land damage in the residential red zones

270 Most land claims in the residential red zones were assigned to the Crown following the Crown offers to purchase properties in the residential red zones (see paragraphs 69 to 78 above).

271 EQC made payments to Land Information New Zealand, on behalf of the Crown, for settlement of land claims for residential red zone properties in April and December 2017, and March 2018. The background to and reasons for the settlement are set out in the following documents:

a *Explanatory notes for EQC residential land settlement for residential red zones – Flat Land (Excluding Known Severe Lateral Spreading Areas)*;[117]

b *Explanatory notes for EQC residential land settlement for residential red zones – Flat Land (Known Severe Lateral Spreading Areas)*;[118] and

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[114] Letter from Tonkin + Taylor to Chapman Tripp regarding the implications of Increased Flooding Vulnerability for properties that also have Increased Liquefaction Vulnerability (8 July 2016) and Tonkin + Taylor, *Practical Implications of Increased Liquefaction Vulnerability* (November 2016), https://www.eqc.govt.nz/sites/public_files/images/Main%20Report_Optimized.pdf.

[115] Earthquake Commission, *Diminution of value methodology for properties with both Increased Flooding Vulnerability and Increased Liquefaction Vulnerability* (November 2016), https://www.eqc.govt.nz/sites/public_files/images/FINAL_WGNDOC01-%232852270-v3-M_EQC_DoV_methodology_ILV_and_IFV_%28including_cleared_sites%29_Nov%202016_0.pdf.

[116] Earthquake Commission, *Diminution of Value due to both IFV and ILV land damage (where the house is still in place) fact sheet* (September 2016), https://www.eqc.govt.nz/sites/public_files/file_attach/ILV-IFV%20DOV%20Fact%20sheet%20Sept%2016.pdf, and Earthquake Commission, *Diminution of Value due to both IFV and ILV land damage (where the house has been or will be rebuilt)* fact sheet (December 2016), https://www.eqc.govt.nz/sites/public_files/file_attach/FINAL_%20IFV-ILV%20Crossover%20Cleared%20Sites%20DOV%20Fact%20Sheet_2016%2012%2008.pdf.

[117] Earthquake Commission, *Explanatory notes for EQC residential land settlement for residential red zones (excluding Known Severe Lateral Spreading Areas)* (December 2017).

[118] Earthquake Commission, *Explanatory notes for EQC residential land settlement for residential red zones – Flat Land (Known Severe Lateral Spreading Areas)* (February 2018),

c *Explanatory notes for EQC residential land settlement for residential red zones – Port Hills*.[119]

272 In total, EQC has paid approximately $137.6 million in settlement of land damage in relation to the approximately 7,100 residential red zone properties where EQC claims were assigned to the Crown. This amount includes settlements for properties in the Port Hills and on the flat land. The amount is in addition to some settlements for land damage that were paid directly to customers before residential red zone properties were sold to the Crown.

273 EQC's assessment of its liability to the Crown for land damage was consistent with the principles, policies and methodologies applied to settle land claims in the residential green zone where applicable. However, some aspects of the assessment were different, reflecting the following matters:

a there was more limited information generally available about land damage in the residential red zones. The information was more limited because:

i less geotechnical information was obtained following the government decision to categorise the residential red zones;

ii fewer foundation repairs and rebuilds were undertaken in the residential red zones; and

iii property specific land damage assessments were not undertaken on Crown-owned properties in the residential red zones before the Crown's programme to clear the land;

b EQC gave the Canterbury Earthquake Recovery Authority an undertaking that, in settling claims, it would not have regard to demolitions undertaken by the Canterbury Earthquake Authority or Land Information New Zealand to clear the land for public safety reasons.

274 Further, EQC took a settlement approach that was proportionate to the level of detail required to implement lawful and accurate settlement payments. EQC, in appropriate cases, utilised mass appraisal techniques to assess its liability to the Crown. This was in recognition of:

a the Crown to Crown nature of the transaction (from EQC to Land Information New Zealand); and

https://www.eqc.govt.nz/sites/public_files/file_attach/Explanatory%20notes%20for%20EQC%20residential%20land%20settlement%20for%20Residential%20R....pdf.

[119] Earthquake Commission, *Explanatory notes for EQC residential land settlement for residential red zones – Port Hills* (March 2018).

b the limited potential for "top up" payments to former property owners. Only a small proportion of the claims had the potential to involve an EQC settlement above the Crown offer for the land (which could raise a liability on the Crown to pay a "top up" to the former property owner).

275 In assessing the settlement for the Crown, EQC engaged with Land Information New Zealand on the principles to be applied in assessing the claims. EQC also engaged with Land Information New Zealand and its advisors, both before and after the settlement was made, to explain the engineering and valuation methodologies involved and discuss issues raised by Land Information New Zealand.

Additional form of land damage – Increased Vulnerability to Liquefaction due to Compromised Crust

276 The different types of land damage observed on the flat land in the residential green zone were also observed in the residential red zones. However, in many cases the damage was more severe.

277 In addition, a new form of damage was identified in the residential red zones. This form of damage is Increased Vulnerability to Liquefaction due to Compromised Crust (ILVCC). EQC instructed Tonkin + Taylor and the EQC valuers to develop methodologies to assess qualification and diminution of value for this form of damage.

278 Tonkin + Taylor's report on Increased Vulnerability to Liquefaction due to Compromised Crust defined this form of damage as:

> "*a physical change to residential land as a result of extensive stretching and ground cracking in the CES [the 2010/2011 Canterbury earthquakes], such that existing individual crack repair methodologies are insufficient to reinstate the crust to pre-CES conditions, adversely affecting the use and amenity that would otherwise be associated with the land by materially increasing the vulnerability of that land to liquefaction damage in future earthquakes*".[120]

279 Increased Vulnerability to Liquefaction due to Compromised Crust occurred on certain residential red zones properties where the land was already vulnerable to severe stretching and cracking before the 2010/2011 Canterbury earthquakes occurred. The vulnerability to severe stretching and cracking has not become any worse as a result of the 2010/2011 Canterbury earthquakes.

[120] Letter from Tonkin + Taylor to Tim Smith (Chapman Tripp) regarding the assessment methodology and practical implications of Increased Liquefaction Vulnerability due to Compromised Crust from the Canterbury earthquake sequence (20 December 2017).

280 The Tonkin + Taylor report:

a explained the methodology that was used to identify areas with Increased Vulnerability to Liquefaction damage due to Compromised Crust;

b described the liquefaction vulnerability severity and change in severity classifications for properties with Increased Vulnerability to Liquefaction due to Compromised Crust (including the impact of any Increased Liquefaction Vulnerability); and

c explained the practical implications of Increased Vulnerability to Liquefaction damage due to Compromised Crust.

281 The EQC valuers developed a methodology to assess the diminution of value resulting from Increased Vulnerability to Liquefaction due to Compromised Crust based on the advice from Tonkin + Taylor about its practical implications.[121] That methodology is based on Increased Liquefaction Vulnerability diminution of value methodologies, with changes as needed to reflect the characteristics of land with Increased Vulnerability to Liquefaction damage due to Compromised Crust.

282 The diminution of value methodology for Increased Vulnerability to Liquefaction due to Compromised Crust follows a similar process as the other diminution of value methodologies. The diminution of value is assessed by:

a assessing the pre-earthquake value of the properties. For properties with Increased Vulnerability to Liquefaction damage due to Compromised Crust, this pre-earthquake value is reduced to reflect the pre-existing severe vulnerability to lateral spreading on these properties;

b determining the reduction in value due to Increased Vulnerability to Liquefaction damage due to Compromised Crust. This is based on the liquefaction vulnerability severity and change in severity classifications provided by Tonkin + Taylor; and

c exercising valuation judgment to confirm that the resulting diminution of value is appropriate.

283 Most land claims for properties with Increased Vulnerability to Liquefaction due to Compromised Crust were assigned to the Crown, and EQC's settlement for these properties was included in its settlement to the Crown for land damage in the residential red zones.

[121] Earthquake Commission, *Diminution of Value Methodologies for Increased Flooding Vulnerability, Increased Liquefaction Vulnerability, and Increased Liquefaction Vulnerability (Compromised Crust) for Crown-owned Properties in the residential red zones (with Known Severe Lateral Spreading Vulnerability)* (February 2018), https://www.eqc.govt.nz/sites/public_files/documents/publications/A4%20Diminution%20of%20Value%20Methodologies%20for%20IFV%2C%20ILV%20and%20ILVcc%20for%20Crown-ow....pdf.

284 There were six properties in the residential red zones with Increased Vulnerability to Liquefaction due to Compromised Crust that were not sold to the Crown. EQC has settled the Increased Vulnerability to Liquefaction due to Compromised Crust for these properties following its usual settlement processes.

Engagement with customers on land damage

285 Among the most challenging of EQC's communications to customers arising from the 2010/2011 Canterbury earthquakes were those related to Increased Flooding Vulnerability and Increased Liquefaction Vulnerability land damage. The challenges were due to the complexity of the subject matter, in particular the engineering and valuation methodologies that underpinned the assessment, and settlement of these land damage types.

286 EQC undertook considerable community engagement in 2015 and 2016 on Increased Flooding Vulnerability and Increased Liquefaction Vulnerability land damage claims. For example, in 2015, EQC participated in and/or presented at over 80 meetings across customers and advocacy groups.

Increased Flooding Vulnerability land communications

287 In the lead up to the decision in the land declaratory judgment (delivered in December 2014), EQC advised 9,600 homeowners that their properties potentially qualified for an Increased Flooding Vulnerability settlement, because their land was more likely to flood as a result of the 2010/2011 Canterbury earthquakes.

288 In March 2015, EQC sent the first settlement packs telling customers whether their property had Increased Flooding Vulnerability land damage and (if it did) their settlement amount (see paragraph 197 above). The packs included engineering and valuation reports where applicable. These settlement packs were reviewed by the Customer Advisory Group prior to being sent out.

289 EQC aimed to call each affected customer within three days of sending out their Increased Flooding Vulnerability pack. The call was intended to give the customer the chance to talk through EQC's settlement decision related to their property and ask questions about how it was reached.

290 Prior to the settlement packs being sent out, the Increased Flooding Vulnerability page on the EQC website was updated with detailed information, including questions and answers.

291 From around April 2015, EQC personnel, engineers from Tonkin + Taylor and the EQC valuers made a series of presentations on Increased Flooding Vulnerability at the "In the Know" Hub. The Hub was initially set up in October 2014 as a public education space where residents could get information on changes to land across Christchurch, and was expanded in 2015 into a one-stop shop for residents with earthquake-related enquiries.[122]

292 One purpose of the "In The Know" land hub was to provide information to residents on the different roles played by agencies and how they were working together on land issues (e.g. regarding Increased Flooding Vulnerability damage covered by EQC; and Christchurch City Council flood management and local flood protection measures).

293 EQC, Tonkin + Taylor and the EQC valuers also made presentations at community meetings with area-specific flooding issues (for example, the meeting with Flockton residents in July 2015).

Increased Liquefaction Vulnerability land communications

294 At community meetings in late 2015 and in January 2016, EQC advised customers that the first payments for Increased Liquefaction Vulnerability land damage would happen in early 2016. Due to more work being required than originally anticipated, the timeline for first payments was moved to mid-2016. The new timeline was communicated to customers in mid-March 2016 via press advertising (EQC Update) and EQConnects e-newsletters.

295 Another general land settlements update was delivered in mid-May 2016 via paid media (EQC Update in The Press and weekly community newspapers) and a video in the EQConnects e-newsletter.

296 By June 2016, EQC had sent qualification packs to around 4,400 customers advising them that their property had Increased Liquefaction Vulnerability land damage (see paragraph 252 above). Once settlement decisions were made, EQC sent settlement packs advising customers of their settlement amount for Increased Liquefaction Vulnerability diminution of value (see paragraph 254 above). These settlement packs were reviewed by the Customer Advisory Group prior to being sent out.

297 Prior to the settlement packs being sent out, the Increased Liquefaction Vulnerability page on the EQC website was updated with detailed information, including and questions and answers.

[122] See Earthquake Commission, *What's happening to the land under Christchurch?* (3 October 2014), https://www.eqc.govt.nz/news/what%E2%80%99s-happening-to-the-land-under-christchurch on the original land-focused hub, and see Earthquake Commission, *Winning hard yards with community advocates* (17 November 2015), https://www.eqc.govt.nz/news/winning-hard-yards-with-community-advocates on the more permanent centre set up under the "In The Know Hub" brand at the Eastgate Shopping Centre in April 2015.

298 Between July and November 2016, customers who received Increased Liquefaction Vulnerability diminution of value settlement packs were invited to attend community meetings about how settlement decisions were made. Around five such meetings were planned.

299 Typically, these meetings included a presentation by key speakers (EQC's Head of Land, a Tonkin + Taylor engineer and an EQC valuer), followed by a question and answer session. Also present at these meetings were support services such as the Earthquake Support Coordinators and the Residential Advisory Service. There was an opportunity for customers to leave their personal details with EQC staff on site if they wished EQC to contact them and discuss their specific Increased Liquefaction Vulnerability claim after the meeting.

300 EQC also engaged with key stakeholders and customer support groups, such as customer advocate groups and community boards, to ensure they were well informed about Increased Liquefaction Vulnerability. This helped them be in a better position should any EQC customers contact them for support.

301 For any customers whose Increased Liquefaction Vulnerability settlement might be based on repair cost, EQC followed a case management approach. This was because before the payment could be made, EQC needed more information from customers to better understand what their property's then current situation was and to confirm the appropriate settlement approach.

The Land Review Team: responding to customer queries

302 In late 2013, EQC set up the Land Review Team, which was responsible for responding to customer queries in relation to their EQC land settlements. Most customer queries were addressed by providing the customer with more information about the nature and scope of EQC land cover, and on how land settlement decisions were made.

303 The Land Review Team was also responsible for managing reviews of Increased Flooding Vulnerability and Increased Liquefaction Vulnerability settlement decisions under the Increased Flooding Vulnerability and Increased Liquefaction Vulnerability claim review frameworks (See paragraphs 160-162 and 211-213). The form of engagement with the customer on reviews of their settlements could include letters, phone calls or facilitating meetings with the customer and relevant experts.

304 The steps taken by the Land Review Team included:

a carrying out a detailed review of the customer's land settlement, and all available information, including any further information provided by the customer;

b seeking any input required from relevant experts, including engineers and valuers; and

c amending the customer's land settlement where appropriate.

305 From its establishment in 2013 until March 2017, the Land Review Team dealt with customer queries or reviews regarding approximately 7,000 properties. The majority of queries and reviews related to properties with visible land damage or properties in the Port Hills. A total of 1,300 customer queries or reviews concerned Increased Flooding Vulnerability and Increased Liquefaction Vulnerability. Most customer reviews were resolved by the Land Review Team. There have been few instances of customer litigation concerning land settlements.

Some thoughts on the future of EQC residential land insurance

306 Set out below are some thoughts regarding the future of EQC residential land insurance.

Consider how engineering resources should be organised

307 As discussed above, Tonkin + Taylor carried out considerable geotechnical work resulting in the identification and assessment of new forms of land damage (Increased Flooding Vulnerability and Increased Liquefaction Vulnerability) on the flat land arising from the 2010/2011 Canterbury earthquakes. Much of this work was commissioned by EQC's research function.

308 The investigation work carried out by Tonkin + Taylor for EQC regarding land damage led to data sets that underpinned the work of other government agencies (including the determination of the residential red zones by the Canterbury Earthquake Recovery Authority; and determination of technical categories (TC1, TC2 and TC3) by the Department of Building and Housing). The data sets and techniques developed will also be valuable to EQC and other government agencies in the future.

309 The coordinated nature of the engineering response to the 2010/2011 Canterbury earthquakes enabled useful area-wide data to be collected and analysed in a way that transcended particular agency remits and incentives and informed a broader Crown response to the events.

310 There is a risk that a failure to co-ordinate the engineering response in any future event could lead to:

a an incomplete and fragmented view of the area-wide issues, which need to be fully understood to accurately identify and assess land damage; and

b in the particular case of EQC, an inconsistent approach to the land assessment task by a range of engineers, resulting in inequities in EQC customer land damage settlements.

311 If an agency model were used following a future event (along the lines of the model adopted under the Memorandum of Understanding for the Kaikōura earthquake, in which insurers would be acting as EQC's agents), the assessment of land damage might be carried out by engineers who are instructed by multiple private insurers.

312 In reflecting on lessons learned from the 2010/2011 Canterbury earthquakes, it is timely to ask whether, for example, a range of engineers contracted to multiple insurers under an agency model would have:

a picked up on the occurrence of more frequent flooding events in low lying areas (which in turn led to the investigations into Increased Flooding Vulnerability) or the issues concerning liquefaction which led to the investigations into Increased Liquefaction Vulnerability; and

b compiled a consistent data set that could have later informed the decisions regarding residential red zones and technical categories (TC1, TC2 andTC3).

313 No two major events are going to be the same. In a future event there may be no recognised Increased Flooding Vulnerability or Increased Liquefaction Vulnerability land damage. But other forms of land damage or issues assessing such damage may arise.

314 A major event will involve perhaps hundreds of engineers in land damage assessment work. For EQC, the Canterbury response involved a team comprising 474 geotechnical engineers and engineering geologists, but with the benefit of strong central co-ordination.

315 Central co-ordination would need to be a feature of any agency-type model used for the assessment and settlement of land damage. The question is whether (and if so, how) in practice such central co-ordination could be successfully achieved under that model in the context of a major event.

Consider the insurance model for residential land

316 A feature of the response to the 2010/2011 Canterbury earthquakes was that a broader government response to land use issues arising from the earthquakes was needed than could be provided by land insurance under the Earthquake Commission Act 1993.

317 As described above, the land insurance responded to natural disaster damage to residential land. A broader social policy response was required to address pre-existing vulnerability of land. Initially, this was through the proposed area-wide land remediation programme, and later through the determination of residential red zones. In this sense, the insurance of residential land against natural disaster damage alone was not sufficient to address all the loss to customers arising from the earthquakes. This was because much of the loss was outside of the scope of the defined insurance.

318 This is relevant both to the design of a response to a natural disaster event, but also to preparedness. Public awareness of vulnerability of land to natural hazards, and the role of insurance as a driver of behaviour, could be considered in more detail. There are undoubtedly lessons and information from the effects of and response to the Canterbury earthquake sequence that are relevant to land use planning. Ensuring this information is used requires a strong relationship between EQC's research function, GNS Science, territorial authorities, the Ministry of Business, Innovation and Employment, and the Ministry for the Environment.

Potential for Global Settlements?

319 Even in the case of loss caused by natural disaster damage to residential land, the individualised nature of insurance (in which each customer has an individual entitlement to be indemnified against the loss suffered) may not lead to optimal outcomes.

320 For example, in 2014, EQC worked with the Department of the Prime Minister and Cabinet, the Canterbury Earthquake Recovery Authority and the Christchurch City Council on a proposal for EQC land settlement funds from Increased Flooding Vulnerability land damage to be applied to some Christchurch City Council led area-wide flood mitigation works. These works had been aimed at reducing the future risk of flooding in particular areas of Christchurch (e.g. Flockton Basin).

321 At the time, that proposal was seen as an alternative form of land settlement that would not only extinguish the EQC land liability, but also mitigate the flooding risk for a property and help to protect the future insurability for flood risk of some parts of Christchurch. Although the proposal did not go ahead, it is useful to note the potential benefits and challenges that were considered at the time.

322 The potential benefits of the proposal included:

a mitigating the risk of further damage;

b improving insurability of the relevant properties; and

c the likely community receptiveness.

323 However, under the Earthquake Commission Act 1993, the proposal had several potential legal challenges and risks. These included:

a determining how best to give effect to the settlement – under the Earthquake Commission Act 1993 or through some broader form of Crown engagement;

b ensuring any settlement fully extinguished EQC's liability to its customers, particularly given the potential need to obtain consent from all affected customers;

c managing any impact on EQC's reinsurance programme; and

d mitigating any future liability for EQC and the Crown from the flood mitigation works.

324 The Earthquake Commission Act 1993 could be amended to include a new power which clearly enables EQC to make global settlements to large groups of customers. Under this power EQC could for instance, apply pooled claim settlement funds (by way of cash settlement or otherwise) for the purpose of area-wide flood mitigation, instead of paying out customers individually.

325 When not responding to a significant natural disaster, EQC and other government agencies have a better opportunity to consider carefully how such a proposal might be put in place in the future as a more proactive and coordinated approach to the mitigation of natural hazard risk across New Zealand.

Amend the Earthquake Commission Act 1993 to simplify the key provisions governing residential land cover

326 If an insurance model for residential land is retained, there is scope to simplify and remove the ambiguity from the key provisions in the Earthquake Commission Act 1993 governing land cover, including how the land cover interacts with building cover. Doing so could reduce:

a the time required to investigate and determine settlement outcomes for customers;

b the costs of administering these provisions; and

c the potential for disputes that arise between EQC and customers, and between EQC and private insurers, about how these provisions interact.

327 For example, changes to the Earthquake Commission Act 1993 could include:

a simplifying the description of:

i "residential land"; and

ii the liability cap relating to land damage; and

b expressly providing for how the land and building insurances interact.

328 Consideration could also be given to whether a more fundamental reform of the land insurance is appropriate. This would involve taking a first principles approach to determine the policy underpinning of separate land insurance, and what form of insurance is best suited to meet that policy objective.[123]

[123] See David Middleton, *Habitability of Homes after a Disaster* (2008), http://www.irbnet.de/daten/iconda/CIB11569.pdf.

329 This exercise could lead to a consideration of whether the current general and separate insurance of residential land against natural disaster damage is the optimal form of insurance. For example, it could be considered whether a narrower approach to land insurance is appropriate. This could focus on the case of total loss of the residential land due to natural disaster damage, where it is impracticable to rebuild, as was the recommendation of the Abbotsford Commission of Inquiry (see paragraph 33).

PROPOSAL REGARDING "SITEWORKS"

330 In July 2015, the government released a discussion document[124] setting out a proposal that the EQC building cover would expressly include additional siteworks associated with repair or reinstatement of the building and access to it. The siteworks would involve land works, including tasks such as testing the soil and geotechnical engineering assessments, levelling, cutting and filling the land and installing retaining walls needed to support or protect the building.

331 This proposal was intended to better align with private insurer practice in commercial claims. As some of these siteworks may currently fall within EQC land cover, the discussion document contemplated that the proposal would remove the problematic overlap between EQC residential land and residential building cover. EQC supported this proposal.

332 In submissions on the discussion document, private insurers opposed the proposal.[125] Insurers raised concerns that, in the event that significant costs were incurred in re-establishing a building platform or foundation, customers might be significantly under insured in a sum-insured policy environment. These concerns are linked to private insurers' views on the extent of EQC's land coverage, which is the subject of the current proceedings by IAG and Tower against EQC (see paragraphs 262-265 above).

333 In 2018, the government decided to proceed with only a subset of the proposed changes set out in the discussion document ahead of the findings of the Public Inquiry into EQC. The proposal regarding siteworks was not one of the changes that have now been effected by the Earthquake Commission Amendment Act 2019.

[124] New Zealand Government, *New Zealand's Future Natural Disaster Insurance Scheme – Proposed changes to the Earthquake Commission Act 1993 – Discussion Document* (July 2015), pages 9 and 11, https://treasury.govt.nz/sites/default/files/2012-09/eqc-rev-discussion-doc.pdf.

[125] Submissions received in response to the discussion document are on the Treasury's website: https://treasury.govt.nz/news-and-events/reviews-consultation/earthquake-commission-act-1993/earthquake-commission-act-submissions-received.

Appendix 1: Members of panels

Panel	Members
Increased Flooding Vulnerability International Peer Review Panel	• Professor Jeremy Benn, FREng MA MSc CEng CWEM FICE FCIWEM MASCE MIEI, based in the United Kingdom (Chair) • Dr Graeme Smart, FIPENZ, PhD, BSc, BE(Hons), MIAHR, based in New Zealand • Bill Syme, MEngSc, BE, based in Australia
EQC valuers	• Dave Townsend FNZIV, FPINZ, based in New Zealand • Ken Blucher FNZIV, FPINZ, SPINZ, based in New Zealand • Chris Bridges ANZIV, SPINZ, based in New Zealand
Diminution of Value Expert Valuation Panel	• Nicola Bilbrough FNZIV, FPINZ, based in New Zealand • Dr Sandy Bond SPINZ, ANZIV, based in the United States • Ian McGowan FNZIV, FPINZ, based in New Zealand • Gary Sellars FNZIV, FPINZ, based in New Zealand
Increased Liquefaction Vulnerability International Peer Review Panel	• Professor Ross Boulanger, PhD, PE, based in the United States • Professor Jonathan Bray, PhD, PE, NAE, based in the United States • Professor Misko Cubrinovski, PhD, based in New Zealand • Professor Thomas O'Rourke, PhD, Dist.M.ASCE, NAE, FREng, based in the United States.