Earthquake Commission

21 March 2017

Insurance Liability Valuation as at 31 December 2016

Final Report

MELVILLE JESSUP WEAVER

Willis Towers Watson Alliance Partner

Contents

Appendices

1 Executive Summary

1.1 Valuation results

1.1.1 Canterbury earthquake claims

The gross estimated ultimate claims costs from the Canterbury earthquake events are $11,181 million. This is a reduction of $98 million since 30 June 2016.

Canterbury earthquakes only
Ultimate claims costs, central estimate, undiscounted, including CHE - 31 December 2016 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Claims paid to date*	2,409	5,118	409	117	191	8,243
Case estimates	(122)	(439)	53	3	17	(487)
Actuarial determination	519	1,317	89	6	(8)	1,924
Gross estimated ultimate incurred claims	2,806	5,996	551	126	200	9,680
Claims handling expenses (CHE)						
Paid to date	468	773	113	37	50	1,441
Estimated future	15	31	11	2	1	59
Total	483	803	124	39	51	1,500
Gross ultimate incurred claims including CHE	3,290	6,800	675	165	251	11,181
Reinsurance recoveries	(1,762)	(2,478)	(0)	(0)	(0)	(4,239)
Net ultimate incurred claims including CHE	1,528	4,322	675	165	251	6,942
30 June 2016 comparatives						
Gross ult incurred claims including CHE	3,362	6,749	712	196	259	11,279
Net ult incurred claims including CHE	1,541	4,272	712	196	259	6,981
30 June 2015 comparatives						
Gross ult incurred claims including CHE	3,341	6,675	790	199	244	11,249
Net ult incurred claims including CHE	1,520	4,197	790	199	244	6,950

*Includes Fletcher PMO direct costs of repair (excludes margin and infrastructure costs - included in CHE)

1.1.2 Kaikoura earthquake claims

The gross estimated ultimate claims costs from the Kaikoura earthquake events are $564 million. It should be stressed how uncertain this result is and that it will change as new information develops. The Kaikoura event does not include the storm damage that occurred on 15 November 2016.

Kaikoura earthquakes only
Estimated ultimate claims costs (undiscounted) - 31 Dec 2016

	KEQ $m
Claims costs paid to date	
Land	-
Building	8
Contents	0
CHE	-
Total	8
Estimated future	
Land	13
Building	439
Contents	17
CHE	86
Total	555
Gross ultimate incurred claims cost - central estimate	
Land	13
Building	447
Contents	17
CHE	86
Total	564

1.1.3 All EQC claims

The table below shows the gross ultimate claims costs (Canterbury earthquake and Kaikoura events) and how the net outstanding claims liabilities (all EQC claims) are derived.

All EQC claims
Gross ultimate claims costs to net outstanding claims liabilities - 31 December 2016 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	BAU $m	KEQ $m	Total $m
Gross ultimate claims excl CHE, undisc - central est	2,806	5,996	551	126	200		477	10,157
Claims handling expenses (CHE)	483	803	124	39	51		86	1,587
Gross ult claims incl CHE, undisc - central est	3,290	6,800	675	165	251	n.a.	564	11,744
Reinsurance recoveries, undiscounted - central estimate	(1,762)	(2,478)	(0)	(0)	0	-	0	(4,239)
Net ult inc claims incl CHE, undisc - central est	1,528	4,322	675	165	251	n.a.	564	7,505
Net claims costs paid to date	(1,053)	(2,640)	(409)	(117)	(191)		(8)	(4,419)
CHE paid to date	(468)	(773)	(113)	(37)	(50)		-	(1,441)
Discounting	(0)	(9)	(1)	(0)	(0)		(5)	(16)
Net OS including CHE, disc - central est	7	900	152	11	10	34	550	1,664
Net risk margin, diversified, 85% PoA	1	161	27	2	2	7	97	297
Net OS including CHE, disc - 85% PoA	8	1,061	179	13	12	42	647	1,961

The table above shows the Kaikoura event (‘KEQ’) with a gross ultimate claims costs of $564 million. The diversified risk margin (85% PoA) for this event is $97 million.

1.2 Current insurance activities

1.2.1 Canterbury earthquake building claims

EQC has largely completed *resolving* all Canterbury earthquake building claims. The term, Resolved, is an internal EQC descriptor that refers to whether the building damage has been reinstated either by way of cash payment or managed repair (see Glossary). This does not preclude the ability of the insured to request that the resolution be reviewed.

Consequently, future insurance activities in respect of building claims will revolve around addressing reopened claim issues.

1.2.2 Canterbury earthquake land clams

EQC is continuing to settle its land claims. In respect of Green Zone properties, there are some 2,648 properties to settle.

Settlement of these claims is also affected by the impact of land litigation cases from private insurers in respect of EQC's ILV settlement policies. 9(2)(h) [redacted]

1.2.3 Kaikoura earthquake event

The 2016 Kaikoura earthquake was a magnitude 7.8 earthquake in the South Island of New Zealand that occurred two minutes after midnight on 14 November 2016.

Memorandum of Understanding

In order to facilitate the efficient management of claims, a Memorandum of Understanding (MoU) has been signed between EQC and eight private insurers. In summary, almost all building and contents claims will be managed by the relevant private insurer, who will then invoice EQC for their share of claims costs and claims handling expenses.

1.2.4 Other

Over the past several months, EQC has continued settling the claims that arose from the 14 February 2016 earthquake. To date, EQC has paid $42 million in claims costs.

As at 30 June 2016, we had estimated that the ultimate incurred costs from this event would be of the order of $76m. This has been revised down to $51 million for this valuation.

1.3 Developments since prior valuation

The following developments have occurred since 30 June 2016:

- Land payments and policies
- Legal challenges
  - Insurer
  - Individual
- Building financial close – insurers
- Building - reopened
- Kaikoura earthquake

Below is a brief note on these developments and what has been done as a consequence. A more detailed discussion can be found in Section 3.

1.3.1 Land payments and policies

Settlement of ILV affected land claims began shortly before 30 June 2016. Diminution of Value ('DoV') policies have now been finalised on all land settlement possibilities (including ILV/IFV crossover properties) and these policies are now being used to determine land settlement amounts.

The valuation model has been adjusted to take into account these actual ILV settlements, along with any other settlements (e.g. IFV) that have been paid over the past six months. The model has also been updated to reflect the recently approved land DoV settlement policies (IFV cleared site, ILV cleared site and IFV/ILV crossovers (for both in situ and cleared sites).

In addition to the above, we now have more accurate information as to the building footprint, which affects the modelled settlement amount for land repair costs.

These changes have resulted in a reduction of the estimated ultimate land claims costs of $196 million.

1.3.2 Legal challenge - insurer

EQC has been recently notified of legal challenges by private insurers in respect of its proposed land settlement of ILV affected properties where private insurers have carried out or paid for ground improvement or surface foundation works as part of the settlement of building claims.

The valuation approach that was adopted at the previous valuation allowed for the risk of legal challenge. Whilst it is still considered appropriate to maintain a provision for this risk, it has been modelled separately for this valuation. See Sections 3.2.5 and 3.2.7 for details.

1.3.3 Legal challenge - individual

There is a growing number of legal challenges in respect of individual properties. These involve building and land settlements.

9(2)(h) [redacted]

The expected legal costs have been incorporated in the additional CHE costs, see below. Section 1.3.6 summarises the provisions made in respect of all reopened claims costs.

1.3.4 Canterbury CHE

9(2)(h) [redacted]

1.3.5 *Building financial close - insurers*

9(2)(j) [redacted]

1.3.6 *Building reopened claims*

EQC has largely completed *resolving* all Canterbury earthquake building claims. However, there are a number of residual issues which may be generally referred to as reopened claims. These reopened claims fall into one of the following categories:

- Remedial and warranty work carried out as a result of the EQR programme. This can be further broken down into:
  - CEDAR. Properties that require remediation as a result of the CEDAR review.
  - General remediation. Other properties.
- Drainage claims.
- Complaints. Challenges on previously cash settled amounts as to their adequacy.
- Individual legal challenges – mentioned above
- Financial close – insurers – mentioned above.
- Unreported remedial and secondary repair issues. In addition to the identified issues above, it is expected there will be further reported remedial and secondary repair work to undertake.

As at 30 June 2016, we held provisions in respect of open claims (tail deterioration) and a number of reopened categories. The table below summarises the provisions held in respect of the various categories as at 30 June 2016 and those held for this valuation.

Building claims liability

	30 Jun 16 $m	31 Dec 16 $m
Open claims / unreported *	9(2)(j) [redacted]	9(2)(j) [redacted]
CEDAR		
Remedials		
Drainage		
Complaints / Disputes		
Individual litigation		
Financial close - insurer		
Total	614	485

The Open claims / unreported component was previously determined by reference to historical experience and the pool of open claims. This has been modified for this valuation to be determined more directly from estimated remedial and secondary repair issues.

Since 30 June 2016, EQC has made buildings payments of $196 million. As the provisions above have been reduced by only $129 million, the expected ultimate claims costs for building has increased by $67 million.

Further detail on these provisions is provided in Section 3.3.

1.3.7 Kaikoura earthquake

The 2016 Kaikoura earthquake was a magnitude 7.8 earthquake in the South Island of New Zealand that occurred two minutes after midnight on 14 November 2016.

Given the immediacy of the event there is little information from which to draw a firm estimate of the ultimate costs. We have therefore used a variety of approaches to determine our estimate. It should be noted that this will change as information develops.

It is estimated that the ultimate gross claims costs arising from this event are $564 million including CHE costs.

Memorandum of Understanding

In order to facilitate the efficient management of claims, a Memorandum of Understanding (MoU) has been signed between EQC and eight private insurers. In summary, almost all building and contents claims will be managed by the relevant private insurer, who will then invoice EQC for their share of claims costs and claims handling expenses.

Building and contents claims that will be managed by EQC include:

- Claims where there is still an open prior EQC claim.
- Claims where the private insurer is not party to the MoU.

EQC will also be managing all land claims.

Implications of the MoU

It is intended that the MoU will lead to a more effective claims experience for homeowners affected by the Kaikoura earthquake.

There are some challenges that arise from the MoU and these include the fact that third parties will be managing EQC's claims on its behalf. In addition, the timeliness and quality of claims information may be slower than would otherwise be experienced as EQC will be waiting for the insurers to submit supporting claim documentation. Lastly it is noted that EQC will need to connect with eight different insurers (with eight different ways of operating) in a detailed manner.

1.4 Key areas of judgement

In undertaking the valuation there are some areas of judgement required that materially affect the results. These are briefly discussed below.

1.4.1 Canterbury building claims

EQC has materially resolved all of their building claims. However, there is a large number of reopened claims with more being reopened.

A key area of judgement in the provision is understanding how claims are being reopened, the expected quantum per claims and how systemic this might be.

Another area of judgement is estimating the provision for Financial close - insurer as there has been limited communication with the three main commercial insurers

1.4.2 *Canterbury land claims*

9(2)(h)

[redacted]

1.4.3 *Kaikoura claims costs*

The Kaikoura earthquakes struck on 14 November 2016. At the time of determining a provision, there was very little information to inform a view as to the ultimate claims costs.

While we have attempted to reconcile the result produced for this valuation with external sources, it cannot be overemphasised how uncertain the ultimate claims costs will be.

1.5 Key assumptions

1.5.1 *Canterbury building claims*

In this subsection we discuss the reasoning and judgement involved in the selection of assumptions for building claims from the Canterbury earthquakes. As EQC has materially completed resolving all properties, the provisions below relate to reopened claims. The building claim components are noted in Section 1.3.6 and are addressed in the same order below.

Remedial – CEDAR

Remedial – CEDAR refers to properties with issues predominantly relating to the sub floor area. As at the valuation date, there are 1,600 properties in this group. They have been triaged by EQC staff into the following groups:

9(2)(j)

[redacted]

These estimates will be based on what is known in respect of each property and clearly cannot allow for any issues which have not yet been raised. Also, given the history of estimated undercap properties going overcap, it is anticipated that some cost escalation will occur.

9(2)(j)

[redacted]

9(2)(j) [redacted]

The table below summarises the calculation for CEDAR remediation.

9(2)(j) [redacted]

Remedial - general

9(2)(j) [redacted]

Drainage claims

9(2)(j) [redacted]

Complaints

9(2)(j) [redacted]

Individual legal challenges

9(2)(h) [redacted]

9(2)(h) [redacted]

Financial close – insurers

9(2)(j) [redacted]

In addition, there have been some public statements from an insurer as to their expected recoveries from EQC.

Our modelling of this component's provision is based on the following:

9(2)(j) [redacted]

Unreported remedial and secondary repair issues

In addition to the reported issues above, it is expected there will be further remedial and secondary repair work to undertake. These are unreported as the valuation date. Given the uniqueness of the Canterbury earthquake event it is difficult to assess how many more claims will be reopened.

9(2)(ba)(i) [redacted]

We have also considered the RBNZ reports on the overall industry increases in Canterbury earthquake claims costs which show that ultimate claims costs tend to be considerably higher than initial estimates. EQC will be partially immune to this effect as its exposure will be limited to $100k.

9(2)(ba)(i) [redacted]

9(2)(h)

[redacted]

1.5.2 *Canterbury land claims*

In this subsection we discuss the reasoning and judgement involved in the selection of assumptions for land claims from the Canterbury earthquakes, as well as some sense checks around implied costs per property. Details of the actual assumptions and methodology are provided in Appendix K.

Cost calculation assumptions

Cost calculation assumptions are those which relate to the cost of various elements of the settlement process, for example, the cost per square metre for repairing ILV damaged land. These are generally based on advice from T+T. The impact of this is illustrated in the Sense checks section below.

Implementation assumptions

Implementation assumptions are those which relate to the likelihood that EQC will successfully implement their policy. The area we have identified as having the highest implementation risk is ILV settlements. The high risk is due to:

- The significant difference between settlement amounts for diminution of value ('DoV') and repair cost.
- The lack of historical precedent in remediating/compensating for ILV.
- The costs borne by private insurers in respect of enhanced foundations which they consider are in lieu of land remediation.
- The recent litigation action by insurers and potential future litigation
- The systemic nature of the outcome of any litigation i.e. the outcome of a particular property could have implications for many other properties.

EQC's policy is to settle ILV claims by DoV rather than repair unless certain criteria are met, namely:

- the property has not been sold since the 2010-2011 Canterbury earthquakes;
- there is a repair methodology for the repair of the ILV land damage on the property;
- the customer intends to undertake the repair of the ILV land damage using the repair methodology within a reasonable period of time; and
- the repair cost is not disproportionate to the DOV of the property, determined on a case by case basis.

We do not have reliable information in regard to whether or not properties have been sold, and so have not attempted to incorporate the sale criteria into our estimate of which properties will be settled via DoV vs. repair. Effectively, we have treated all properties as meeting the 'not sold' criteria.

Similarly we do not have reliable information in regard to whether or not a customer intends to undertake repair of the damaged land. We have assumed that, if a property meets the other criteria to be settled via repair then the customer will indeed undertake a repair.

The existence and cost of a repair methodology is largely a function of whether or not the property is (or will be) a cleared site – as is the case for a complete rebuild – or is a house in situ – for example where there is a partial repair. We have used information from T+T and other historical information in regard to the repair/rebuild status as well as the relevant zone for each ILV qualifying property to estimate whether it is a cleared site or house in situ. We have treated cleared sites as likely be settled via repair and house in situ sites as being settled via DoV (but see below).

DoV vs. repair cost

The cost of repairing ILV damaged land is generally significantly more than the cost to EQC of settling that same claim on a DoV basis. Therefore, where the criteria for settling a ILV claim via repair are met, we would not expect an insured (or their insurer) to challenge EQC's policy and request a DoV payment instead.

9(2)(h) [redacted]

9(2)(h) [redacted]

Sense checks

In order to sense-check the assumptions used for the land model we have used the aggregate results from the model to calculate the implied ultimate average costs per property and compare these to the experience to date. The table below summarises these results.

9(2)(j) [redacted]

NB: All figures are uncapped and gross of excess
Ultimates include inflation and demand surge where applicable

For each of the three types of land damage the assumed average cost per property for future settlements is greater than that for settlements to date. This is because the actual settlements will incorporate sale and intent to repair information in the settlement and is likely to favour a DoV payment. The modelled future settlements do not have this information and so will allow for more land repair payments. In the case of both ILV and IFV around half of the Green Zone qualifying properties have been settled to date.

The significant difference in average cost for ILV properties between those settled to date and future settlements is largely a function of the difference between DoV and repair cost. We understand that few of the ILV settlements to date have been on the basis of repair cost. Similarly, for IFV settlements, the properties settled to date have, on average, much lower EFC percentages (see Appendix K) than those which have not yet been settled.

The aggregate costs above are before the application of caps and excesses. As such, they should be taken as raw indicative figures rather than what would be paid under each scenario.

9(2)(h) [redacted]

1.5.3 Kaikoura claims

The key elements of the methodology and assumptions used to estimate the cost of the Kaikoura earthquakes are discussed below. Further details are provided in Appendix D.

The methodology and assumptions used for the actuarial valuation drew upon a model supplied to us by T+T to estimate the cost of building claims in the worst medium – high damage areas.

Zone classification

In order to model the cost of claims from the Kaikoura earthquakes we have divided the damage zones according to the nature of the land movement and/or damage in the different areas affected. The zones are:

- The Land Damage Likely ('LDL') zones:
  - Fault rupture: LDL-F
  - Slope instability: LDL-S
  - Both fault rupture and slope instability: LDL-FS
  - Liquefaction: LDL-L
- The Land Damage Unlikely ('LDU') zones:
  - High shaking: LDU-H
  - Moderate shaking: LDU-M
  - Low shaking: LDU-L
- Apartments in the Wellington region: WGN-A

Modelling approach

For building claims we have modelled the cost to EQC as being a function of four elements:

- The number of dwellings exposed to potential damage
- The probability that each of these which will report a claim (where a claim has not already been reported for that dwelling)
- The probability that a reported claim will result in some non-zero cost to EQC
- The distribution of the cost of each non-zero claim to EQC. This is specified as:

The methodology is applied in a stochastic manner. That is, each element is simulated as a random process and the distribution of results is analysed.

For land and contents claims we used a similar methodology though with some exceptions. The building claims are by far the most significant component of the cost; these are discussed in this Executive Summary. The land and contents claims are discussed in Appendix D.

Exposure base

We obtained a dataset of housing stock based on that used for the Minerva model. The number of dwellings in each zone are given below.

Number of dwelling exposures

Zone	Number of dwellings
LDL-FS	140
LDL-F	13
LDL-S	1,006
LDL-L	2,800
LDU-H	3,179
LDU-M	18,086
LDU-L	rest of the country
WGN-A	8,144

Reporting percentage

For the valuation model we allowed for those properties in each zone where there was already a claim associated with that dwelling and then applied probabilities that the remaining dwellings would lodge a claim. The table below summarises the assumptions.

Reporting percentage assumptions - building claims

Zone	Proportion having already notified a claim	Assumed probability of future notification	Implied ultimate proportion notified
LDL-FS	20.4%	95.0%	96.0%
LDL-F	85.7%	95.0%	99.3%
LDL-S	37.9%	93.5%	96.0%
LDL-L	18.3%	45.0%	55.1%
LDU-H	43.3%	60.0%	77.3%
LDU-M	10.0%	7.5%	16.7%
LDU-L	n.a.	n.a.	n.a.
WGN-A	4.5%	47.5%	49.9%

n.a. - not applicable

For the WGN-A zone, which was not addressed in the T+T model, we conducted some random sampling to test whether those dwellings in the exposure data labelled as apartments were genuinely mid-high rise apartments (as opposed to townhouses or 1-2 level terraced housing which might possibly be referred to as apartments). Our sampling found that the majority were genuine mid-high rise apartments, and we understand that these were fairly susceptible to the long, slow rocking of the Kaikoura event. We used a reporting percentage for new claims of 47.5% which implies an ultimate reporting rate of 50% for Wellington apartments.

For the LDU-L zone, which was also not addressed in the T+T model, we identified 11,068 claims notified to date where the QPID was matched to a property in the LDU-L zone. There were an additional 1,343 claims which were not matched to a QPID but for which T+T have estimated that they are located in the LDU-L zone. We have assumed there will be another 5,000 +/- 3,500 claims notified in the LDU-L zone.

Non-zero percentage

High level analysis of other events suggests that around 70% of building claims reported will result in some non-zero cost to EQC. The other 30% are closed without cost to EQC. This however is likely to vary by zone i.e. the more damaged zones will have fewer zero claims. The table below shows the assumptions we have used.

Non-zero probability assumptions - building claims

Zone	Assumed probability that a nofication will result in a non-zero cost
LDL-FS	99%
LDL-F	99%
LDL-S	99%
LDL-L	95%
LDU-H	90%
LDU-M	90%
LDU-L	60%
WGN-A	70%

Taking the weighted average non-zero percentage over all zones results in an overall non-zero percentage for the Kaikoura event of around 70%.

Combining our reporting and non-zero assumptions gives implied proportions of exposures resulting in non-zero damage by zone. These implied figures are reasonably consistent with the T+T assumptions.

Claim size

In the valuation model we have used a lognormal distribution to model Building Damage Ratios ('BDRs') for each zone and capped the results at 100%. The lognormal distributions are scaled to achieve the intended mean and proportion capping at 100% based on our discussions with T+T. The assumptions are:

BDR distribution assumptions

Zone	Lognormal parameter mu	Lognormal parameter sigma	Implied proportion of non-zero claims with 100% BDR	Average non-zero BDR where <100%
LDL-FS	0.3958	1.4075	61%	47%
LDL-F	0.3958	1.4075	61%	47%
LDL-S	-1.5013	1.4075	14%	26%
LDL-L	-1.4213	1.4075	16%	27%
LDU-H	-1.6032	1.2686	10%	25%
LDU-M	-1.9560	0.8326	1%	19%
LDU-L	n.a.	n.a.	n.a.	n.a.
WGN-A	n.a.	n.a.	n.a.	n.a.

n.a. - not applicable

For the LDU-L and WGN-A zones we have used a lognormal distribution to model the actual damage amount in dollar terms (rather than the BDR). The parameters of the lognormal distributions are such that:

- In the LDU-L zone the average building damage is $1,000 and the CoV[1] is 250%
- In the WGN-A zone the average building damage is $25,000 and the CoV[1] is 200%

[1]CoV – coefficient of variation i.e. the mean of a distribution divided by the standard deviation of that distribution.

Claims handling expenses

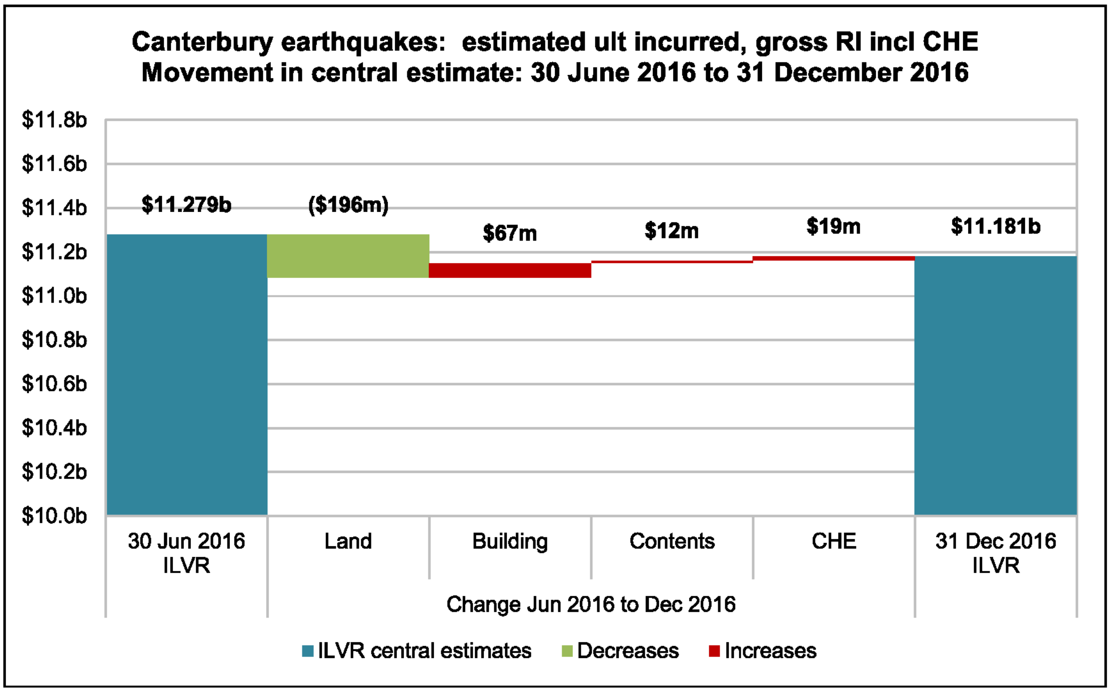
A range of potential claims handling expenses was estimated by EQC as a function of the likely number of claims involved and categorised according to the various cost elements.

We reviewed the calculation in the context of the claims management agreements with insurers and also the experience of the Canterbury earthquakes. We selected a figure within the range that we believe represents a reasonable central estimate of CHE costs and included an allowance for potential cost inflation.

For the Kaikoura event the CHE as a percentage of ultimate cost (including CHE) is around 15%. As a sense check we compared this with the CHE percentages for Canterbury earthquake events. These range from around 12% for EQ2 to 23% for EQ4. One would generally expect a higher CHE percentage for a smaller event (as indirect costs are spread over a smaller volume of claims), although it should be noted that the Canterbury CHE costs include significant PMO fees which aren't part of the Kaikoura CHE costs under the MoU. As such the 15% CHE for Kaikoura appears reasonable in the context of the Canterbury events.

1.6 Estimated ultimate claims costs – movement since 30 June 2016 – Canterbury only

The estimated ultimate gross claims cost for Canterbury earthquake events has moved from $11.279b as at 30 June 2016 to $11.181b as at 31 December 2016. Shown below is a graphical representation of the change in estimated ultimate incurred liabilities.



1.7 Implications of above

In respect of Canterbury Earthquake claims only, the implications of the above are that the building provision has been strengthened whilst the land provision was considered to be more than adequate and reduced.

In respect of all claims, the net outstanding claims liabilities have increased as a result of the Kaikoura earthquake event.

1.8 Limitations

In this report, we provide the results of our investigations together with an outline of the matters considered and the methods and assumptions applied to obtain these results. Opinions and estimates contained in this report constitute our judgement as at the date of the report.

There is considerable uncertainty regarding the estimate for the Kaikoura earthquake. Care should be taken in relying on this estimate at this stage.

This report must be read in its entirety. Individual sections of the report, including the Executive Summary, could be misleading if considered in isolation from each other.

1.9 Key recommendations

1.9.1 Progress against previous recommendations

Several recommendations were set out in the previous ILVR. The progress against these recommendations is as follows:

- In respect of settling the remaining land claims
  - Record the properties that have been sold. *Ongoing*
  - Improve the quality of the link between properties in the land model and properties in the ADE. *Stage 1 complete*

1.9.2 Current Recommendations

The key recommendations, from an actuarial estimate perspective, arising from this investigation is:

- In respect of settling the remaining Canterbury earthquake land claims
  - Record the properties that have been sold.
  - Improve the quality of the link between properties in the land model and properties in the ADE.
- Collect timely and accurate information in respect of the Kaikoura earthquake claims managed under the MoU.

1.10 Authors

Craig Lough

Fellow of the NZ Society of Actuaries

Jeremy Holmes

Fellow of the NZ Society of Actuaries

2 Report description

2.1 Addressee

This report is addressed to Sid Miller, Chief Executive of the Earthquake Commission ('EQC').

2.2 Report commissioned by

This report was commissioned by Hugh Cowan, EQC's GM Reinsurance, Research and Education.

2.3 Purpose

This report was commissioned to provide information with regards to:

- EQC's insurance liabilities and reinsurance recoveries for use in the financial statements as at 31 December 2016.
- The development of EQC's Canterbury earthquakes claims costs since 30 June 2016.
- An estimate of the claims costs arising from the Kaikoura earthquake.

2.4 Scope

2.4.1 Insurance liabilities components

The insurance liabilities include:

- Outstanding (OS) claims liabilities – which relate to the future direct and indirect claims costs and reinsurance recoveries for claims incurred up to 31 December 2016.
- Premium liabilities – which relate to the future net claims costs and administration and reinsurance expenses for future claims arising from unexpired risks as at 31 December 2016.

The liabilities calculated include a risk margin and are discounted for the time value of money.

Premium liabilities are not included directly on the balance sheet but are used for the Liability Adequacy Test of the unearned premium liability provision.

A more detailed description of the nature and components of the insurance liabilities is set out in Section 4.

2.5 Effective valuation date

The effective date of the valuation is 31 December 2016.

2.6 This report

Although this report includes considerable detail on all aspects of the actuarial investigations, in order to keep it to a manageable size a lot of the information has been summarised. Further details regarding the data, methods, assumptions, calculations and results underlying this report are available from the authors on request.

Unless otherwise indicated, all amounts in this report are stated in New Zealand dollars and are net of GST (i.e. they exclude GST).

2.7 Previous valuations

Melville Jessup Weaver ('MJW') has prepared valuations for EQC at six monthly intervals since 2010, when the Canterbury Earthquake Sequence began.

The most recent valuation for EQC, which is referenced in this report, is the Insurance Liability Valuation Report ('ILVR') as at 30 June 2016 (dated 15 August 2016).

2.8 Definitions of technical terms

Whilst we have tried to avoid unnecessary insurance jargon where possible, to help understand the technical terms which were used in this report we have included a glossary in Appendix P.

2.9 Event groups

2.9.1 Canterbury earthquake claim events

A series of damaging earthquakes has affected the Canterbury region in general, and the city of Christchurch in particular, since the first event on 4 September 2010. These earthquakes have resulted in injury, loss of life, and billions of dollars of damage to infrastructure, commercial property and residential buildings.

Details of the Canterbury earthquake events are set out in Appendix B.

For the purposes of valuing the outstanding claims, the Canterbury earthquake claims have been split into the following event groups:

- EQ1 – 4 September 2010 event
- EQ2 – 22 February 2011 event
- EQ3 – 13 June 2011 event (including 21 June 2011 event)*
- EQ4 – 23 December 2011 event
- Aftershocks ('AS') – the ten other events shown on the Business Information Unit ('BIU') Daily Report as well as 'Other Canterbury claims' included in the Daily Report totals. The logic used to identify these claims is based on the claim's Territorial Local Authority and loss cause and is consistent with the BIU's definition.

*EQC's reinsurance programme covers all incurred losses arising within 720 hours from an event. Consequently, losses arising from the 21 June 2011 aftershock are included in the EQ3 event definition.

2.9.2 *Kaikoura earthquake claim events*

At 12:02am on 14 November 2016, an earthquake occurred near Culverden (approximately 100km north of Christchurch). This caused other faults to rupture in a domino effect, and other earthquakes occurred in a North-East direction towards Seddon. This earthquake event group has been named the Kaikoura earthquake. For the purposes of this report, it has the three-letter code KEQ.

2.9.3 *Other claim events*

Other outstanding EQC claims, including those arising from landslips, hydrothermal events, and from earthquakes outside Canterbury are categorised as 'BAU' (Business As Usual) claims.

2.9.4 *Components of premium liabilities*

For the purposes of valuing the premium liabilities, the following event categories were used:

- Business as Usual ('BAU') claims.
- Minerva claims - catastrophe event claims arising from earthquakes in NZ outside Canterbury.
- Enhanced seismicity in respect of Canterbury earthquake claims and Kaikoura earthquake claims.

2.10 Professional standards

This report has been written to comply with Professional Standard No. 30 (Valuations of General Insurance Claims) of the New Zealand Society of Actuaries.

2.11 MJW staff involved in the investigation

The following MJW staff members were involved in some capacity during the course of the investigation:

- Craig Lough — Principal
- Jeremy Holmes — Principal
- 9(2)(a) [redacted] — Analyst
- [redacted] — Analyst
- [redacted] — Actuary (Peer review)

3 Developments since prior valuation

There have been a number of developments that have occurred over the six months from 30 June 2016 that have affected the estimation of EQC's claims costs. These relate to:

- Canterbury earthquake claims
  - Land model
    - Land payment and policies
    - Updated land information
    - Legal challenge
    - Port Hills
  - Building model
    - Resolved and reopened claims
- New events (Kaikoura)
- BAU – 14 February 2016 event
- Claims Handling Expenses (CHE)

A description of these developments is shown in Sections 3.2 to 3.6 below with detail on how each of these has affected the valuation.

3.1.1 Valuation vs operational approach

The valuation methodology is intended to model the operational manner in which EQC is settling claims.

In many areas, the settlement process may utilise information which is not readily available for valuation purposes and so the valuation methodology must take a pragmatic approach. In some cases, the operational process has not been put into effect or is in its early stage and in these cases, we model a range of potential outcomes.

For these reasons the valuation approach may not mirror the intended operational process and this should be borne in mind when reading the following sections.

3.2 Canterbury earthquakes: land

3.2.1 Land payments and policies

The settlement of ILV affected land claims began shortly before 30 June 2016. With the continuation of the settlement of IFV affected properties, there are currently some 2,648 green zone properties to finish (ILV, IFV, crossover and other). This includes 1,167 properties with ILV damage only, 760 properties with IFV damage only and 558 properties with both ILV and IFV damage (crossover properties). There are a further 163 Other properties to settle (other flat land and Port Hills).

There has been little challenge to date in respect of qualification or amount of ILV or IFV settlement from individual homeowners. EQC has received recent notification of legal challenge from insurers however and this is discussed in Section 3.2.3.

Internal policies have now been finalised on all major DoV settlement combinations and these are being used as a basis to determine settlement amounts. This includes all combinations of:

- IFV / ILV.
- Single / crossover.
- Cleared site / in situ.

In respect of the valuation model, actual land settlement amounts (ILV and/or IFV) have been included in the land model. In addition, the DoV policies above have been considered as well. The estimated impact from this is to reduce the expected ultimate claims costs by $90 million.

3.2.2 *Updated land information*

A key factor in the land model is the building footprint for each property as it is used to determine the area of land that must be repaired under a repair cost settlement path.

This information was originally sourced from council data and was approximate in its nature. It is now being based directly off the data being used by valuers to settle each property.

In addition, the new data has identified properties where some the areas were overstated. For example, a property with a footprint of 150m2 may have had three buildings. Under the council data, each may have been assigned the 150m2 footprint. Now the footprint would be 50m2 each.

This has led to a reduction in the overall building footprint and a consequential reduction in the estimated ultimate claims costs of some $97 million.

3.2.3 *Legal challenge - insurer*

EQC has been recently notified of legal challenges by private insurers in respect of its proposed settlement of ILV affected properties where private insurers have carried out or paid for ground improvement or surface foundation works as part of the settlement of building claims. The broad thrust of the challenge revolves around the ILV settlement options with the proposal being that there should be three paths:

- Land repair cost
- DoV
- Costs incurred in surface foundations.

9(2)(h) [redacted]

9(2)(j) [redacted]

3.2.4 *Port Hills*

Green Zone properties in the Port Hills are almost fully settled. Settlement amounts have been at a lower rate than that previously assumed and this has led to a reduction in the estimated ultimate claims costs of $16 million.

3.2.5 *Valuation developments*

In respect of the valuation model, we have made the following allowances for the land issues raised above:

- The actual settlement amounts paid have been incorporated into the valuation model and replaced the previously estimated settlement amounts.
- DoV policies formalised over the past six months are now factored into the land model. This predominantly affects crossover properties where the total DoV amount paid is less than the sum of the ILV and IFV DoV amounts separately.
- The building footprint information has been updated.
- The valuation methodology now models EQC's intended settlement approach for each property and has an explicit allowance for the risk of successfully legal challenge.

Risk of successful legal challenge

9(2)(h) [redacted]

3.2.6 *Areas of judgement*

The principal area of judgement for this valuation will revolve around whether a sufficient provision has been made for the risk of insurer legal challenge. There is considerable uncertainty in this.

It will take some time for the likely outcome of these legal challenges to evolve.

3.2.7 *Key results*

The impact of the changes noted above is to reduce the expected ultimate land claims cost by some $196 million. Note that the movements shown below relate to ultimate claims costs, rather than future provisions.

Undisc gross central estimate ultimate claims

	Movement $000s	Total $000s
As at 30 June 2016		1,461,374
Building footprints	9(2)(j) [redacted]	
ILV actual settlements	[redacted]	
Port Hills	[redacted]	
Other	[redacted]	
Subtotal		(195,998)
As at 31 December 2016		1,265,376

The estimated ultimate land claims costs have been split into that element which would be paid according to EQC's land settlement policies and an element for the risk of successful legal challenge.

Estimated EQC Gross Liability for Land Claims - Canterbury earthquakes only

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Gross central estimate ultimate (undiscounted, excl CHE)						
9(2)(h) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Allowance for potential litigation	9(2)(h) [redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total including litigation allowance	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

9(2)(h) [redacted]

3.2.8 Drivers of results

The key drivers of the result are how the actual settlements proceed and how the DoV policy is implemented, especially against the backdrop of the legal challenge.

3.2.9 Implications of results

The implication of these issues is that the land provision has been reduced as it is considered that it was more than sufficient provide for the Canterbury earthquake land claims.

3.3 Canterbury earthquakes: building model

3.3.1 Building reopened claims

Reopened claims issues may be categorised as follows:

- Remedial or warranty work carried out as a result of the EQR programme. This can be further broken down into:

- CEDAR. Properties that require remediation as a result of the CEDAR review.
- General remediation. Other properties.

- Drainage claims.
- Complaints. Challenges on previously resolved amounts.
- Individual legal challenges.
- Unreported remedial and secondary repair issues. The remedial work identified above is only in respect of reported issues. It is expected that there will be remedial and secondary repair work on future reported issues.
- Financial close – insurers.

Remediation - CEDAR

9(2)(j) [redacted]

Remediation – general

9(2)(j) [redacted]

Drainage

9(2)(j) [redacted]

Complaints

9(2)(j) [redacted]

Legal challenges – individual

There are a growing number of legal challenges in respect of individual properties. These involve building and some land settlements.

9(2)(h) [redacted]

Unreported remedial and secondary repair issues

9(2)(h) [redacted]

3.3.2 *Building financial close - insurers*

9(2)(j) [redacted]

9(2)(j) [redacted]

3.3.3 *Valuation developments*

The estimated provisions have been revised. As EQC has materially resolved all claims, the provisions in respect of open claims have been replaced by a variety of provisions in respect of reopened claims. These are explicitly modelled along with a provision for other remedial and secondary repair issues.

3.3.4 *Areas of judgement*

The key area of judgement in the provision is understanding how claims are being reopened, the expected quantum per claims and how systemic this might be.

Another area of judgement is estimating the provision for Financial close - insurer as there has been limited communication with the three main commercial insurers.

3.3.5 *Key results*

The result of the changes in the provisions together with the building claim payments over the past six months has resulted in an increase to the expected ultimate building claims costs of $67 million. This is shown in the table below.

Movement in undisc gross central estimate ultimate claims

	Movement $000s	Total $000s
As at 30 June 2016		7,861,677
Movements		
Payments	9(2)(j) [redacted]	
Open claims / warranty*		
CEDAR		
Remedials		
Drainage		
Individual litigation		
Subtotal		66,819
As at 31 December 2016		7,928,496

Note that the movements shown above relate to future provisions, rather than ultimate claims costs.

3.3.6 *Drivers of results*

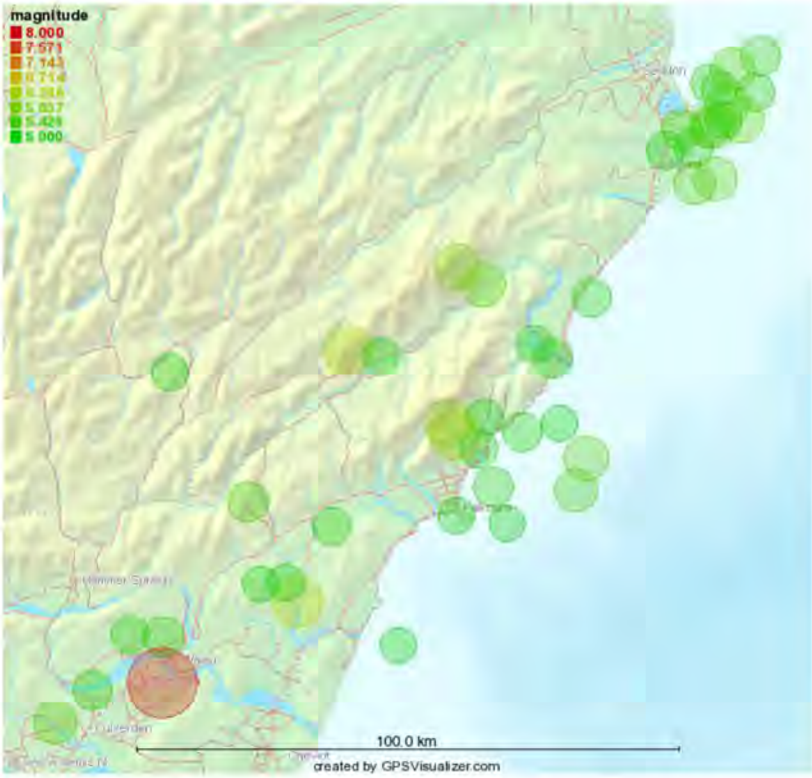
The key driver of the result is the extent to which reopened claims will put pressure on the provisions in the accounts.

3.4 Kaikoura earthquake

The 2016 Kaikoura earthquake was a magnitude 7.8 earthquake in the South Island of New Zealand that occurred two minutes after midnight on 14 November 2016. The earthquake started at about 15 kilometres north-east of Culverden and 60 kilometres south-west of the tourist town of Kaikoura and at a depth of approximately 15 kilometres. Ruptures occurred on multiple fault lines in a complex sequence that lasted for about two minutes. The cumulative magnitude of the ruptures was 7.8, with the largest amount of that energy released far to the north of the epicentre.

The shaking caused significant damage for areas immediately around the fault lines that ruptured, including a number of very large land slips. It also caused significant shaking in Wellington although this most affected medium rise buildings which had natural shaking frequencies similar to that produced by the earthquake.

The chart below illustrates the quakes greater than magnitude 5.0 that occurred on 14 November 2016. The size and colour of the circles represent the magnitude of the quakes.



Source: GeoNet project, sponsored by EQC, GNS Science and LINZ

3.4.1 *Valuation developments*

Given the immediacy of the event there is little information from which to draw a firm estimate of the ultimate costs. As a consequence, we have used an exposure based approach to determine our estimate. It should be noted that this will almost certainly change as information develops.

The approach that we have used combines:

- An exposure / damage ratio model. It may be referred to as a simplified catastrophe model although it is only in respect of one event and the damage ratios are applied in a fairly broad fashion.
- An average cost per claims model. This is the traditional method for estimating BAU events and was used to help inform the exposure model.

Both of these approaches have their shortcomings, especially as there is little information as to what might be reasonable damage ratios, the claims notification period will not expire until 14 February 2017 and the heterogeneity of buildings (mix of rural residential buildings and urban apartments) make damage ratios or average cost per claim hard to estimate.

3.4.2 *Modelling approach*

For the purposes of modelling the expected claims costs, properties were grouped into; prevalence of land damage, type of shaking / land damage, and whether the property was a medium rise apartment in Wellington.

- Likely land damage

- Fault rupture
- Slope stability
- Liquefaction

- Unlikely land damage
  - High shaking zone
  - Medium shaking zone
  - Low shaking zone
- Medium rise apartments in Wellington

Scope

There were a number of aftershock events, the most significant occurring on 22 November 2016. All costs arising from earthquake events within 720 hours of the first event are included in the Kaikoura event.

The damage from the storm event which occurred on 15 November 2016 is not included in the Kaikoura event.

3.4.3 Areas of judgement

The estimation of the losses arising from the Kaikoura event is clearly the area with the most judgement. We have taken the view for this valuation that the use of a simplified model will enable us to create an estimate for the valuation while also conveying the inherent uncertainty in it.

3.4.4 Key results

The results from our simplified model are shown below. Note that not all dwellings will make a claim, and of those that do, not all will result in a valid claim.

Central estimate ultimate cost of Kaikoura claims

Land damage grouping	Number of dwellings	Land $m	Building $m	Contents $m	Total $m
Land damage likely					
fault rupture and slope instability	140	1.7	11.4	0.2	13.3
fault rupture	13	0.1	1.0	0.0	1.2
slope instability	1,006	6.0	51.8	1.4	59.2
liquefaction	2,800	4.6	83.5	3.1	91.2
Land damage unlikely					
high shaking	3,179	0.2	115.8	3.6	119.6
moderate shaking	18,086	0.1	117.5	1.5	119.1
low shaking	n.a.	-	8.8	2.4	11.3
Wellington apartments	8,144	0.2	56.6	5.1	62.0
	0	-	-	-	-
Total	33,368	12.9	446.6	17.4	476.8

In addition to the above there are assumed CHE costs of $86 million.

The most significant cost is assumed to relate to building claims. The table below details some key parameters of the Kaikoura building cost.

Components of Kaikoura building claim costs

	Number of dwellings exposed	Number of claims* notified	Number of non-nil claims*	Total cost to EQC	Average cost per claim*
Land damage likely				[redacted] 9(2)(i)	
fault rupture and slope instability	140	135	133		
fault rupture	13	13	13		
slope instability	1,006	966	956		
liquefaction	2,800	1,541	1,464		
Land damage unlikely					
high shaking	3,179	2,468	2,221		
moderate shaking	18,086	3,058	2,753		
low shaking	n.a.	17,411	10,447		
Wellington apartments	8,144	4,126	2,888		
Total	**33,368**	**29,719**	**20,875**		

* each dwelling is counted as a separate claim

From the table above, it can be seen that of the 140 dwellings that resided on a fault rupture & slope instability zone, we have assumed that 135 result in a claim with 133 receiving a non-nil payment. The average payment for these dwellings is [redacted] 9(2)(i) (note that some dwellings have building values less than $100k).

3.4.5 *Drivers of results*

Key drivers of the result are:

- The number and severity of damaged buildings in rural areas in the South Island
- The extent of damage in South Island towns, especially Kaikoura, Waiau and Culverden.
- The extent of damage in apartment blocks in Wellington.

3.4.6 *Implications of results*

The most material implication of the Kaikoura event is that there will be significant costs for EQC.

3.5 BAU model

As at 30 June 2016 it was estimated that the 14 February 2016 earthquake would ultimately incur claims costs of $76m (including CHE).

As at 31 December 2016, the claim payments for this event totalled $42 million including CHE costs incurred for this event.

The provision for the 14 February 2016 has been reduced to $51 million, with $9 million being outstanding.

The BAU model also includes the claims costs from the Wellington storm event.

3.6 Claims handling expenses (CHE)

3.6.1 Canterbury earthquakes

The claims handling expenses for Canterbury have been increased by $19 million in recognition of the legal costs that will be incurred in settling the open legal disputes.

3.6.2 Kaikoura earthquakes

In respect of the Kaikoura earthquake, a range of potential claims handling expenses was estimated by EQC as a function of the likely number of claims involved and categorised according to the various cost elements.

We reviewed the calculation in the context of the claims management agreements with insurers and also the experience of the Canterbury earthquakes. We selected a figure within the range that we believe represents a reasonable central estimate of CHE costs and included an allowance for potential cost inflation.

3.6.3 CHE rates

The tables below illustrate the estimated ultimate CHE for the Canterbury earthquakes and Kaikoura earthquake and also illustrates this as a percent of the gross ultimate claims costs.

Canterbury earthquakes only
CHE - 31 December 2016 valuation

	EQ1	EQ2	EQ3	EQ4	AS	Total
Total CHE $m	483.5	803.5	123.8	38.7	51.0	1,500.4
CHE % of gross ultimate	14.7%	11.8%	18.3%	23.4%	20.3%	13.4%

Kaikoura earthquakes only
CHE - 31 December 2016 valuation

	KEQ
Total CHE $	86.4
CHE % of gross ultimate	15.3%

4 Overall results

4.1 Claims incurred

The gross incurred claims costs for all Canterbury and Kaikoura EQ events, incurred to 31 December 2016, include:

- Claims costs paid to date
- Claims costs expected to be paid in future (the OS claims liability).

Claims costs paid to date are known, but those to be paid in the future are unknown and so must be estimated. The approach that we have taken is to estimate the ultimate incurred claims costs and then deduct payments made to 31 December 2016 in order to determine the estimated OS claims liability.

The ultimate incurred claims costs are calculated in respect of Canterbury and Kaikoura earthquake events only.

It is not useful (or practical) to include ultimate incurred claims costs from BAU events as this would include a vast number of smaller events which may have been materially settled. This makes comparisons of BAU claims costs between valuations meaningless.

No risk margins have been calculated and no discounting has been applied to the estimated ultimate incurred claims costs.

The outstanding claims liabilities are in respect of all outstanding EQC claims (Canterbury and Kaikoura earthquakes plus BAU) and are discounted for the time value of money and include risk margins at the 85th percentile.

4.2 Canterbury earthquakes

4.2.1 Estimated ultimate claims costs – Canterbury earthquakes only

The table below summarises the main components involved in estimating the ultimate cost of claims to EQC arising from the Canterbury earthquakes only as at 31 December 2016. A more detailed version of this table, including comparatives with the 30 June 2016 ILVR, is given in Appendix N.

The estimated ultimate claims cost is built up from the following components:

- Claims costs paid to date
- Case estimates
- Actuarial determination
- Claims handling expenses (CHE).

Canterbury earthquakes only
Ultimate claims costs, central estimate, undiscounted, including CHE - 31 December 2016 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Claims paid to date*	2,409	5,118	409	117	191	8,243
Case estimates	(122)	(439)	53	3	17	(487)
Actuarial determination	519	1,317	89	6	(8)	1,924
Gross estimated ultimate incurred claims	2,806	5,996	551	126	200	9,680
Claims handling expenses (CHE)						
Paid to date	468	773	113	37	50	1,441
Estimated future	15	31	11	2	1	59
Total	483	803	124	39	51	1,500
Gross ultimate incurred claims including CHE	3,290	6,800	675	165	251	11,181
Reinsurance recoveries	(1,762)	(2,478)	(0)	(0)	(0)	(4,239)
Net ultimate incurred claims including CHE	1,528	4,322	675	165	251	6,942
30 June 2016 comparatives						
Gross ult incurred claims including CHE	3,362	6,749	712	196	259	11,279
Net ult incurred claims including CHE	1,541	4,272	712	196	259	6,981
30 June 2015 comparatives						
Gross ult incurred claims including CHE	3,341	6,675	790	199	244	11,249
Net ult incurred claims including CHE	1,520	4,197	790	199	244	6,950

*Includes Fletcher PMO direct costs of repair (excludes margin and infrastructure costs - included in CHE)

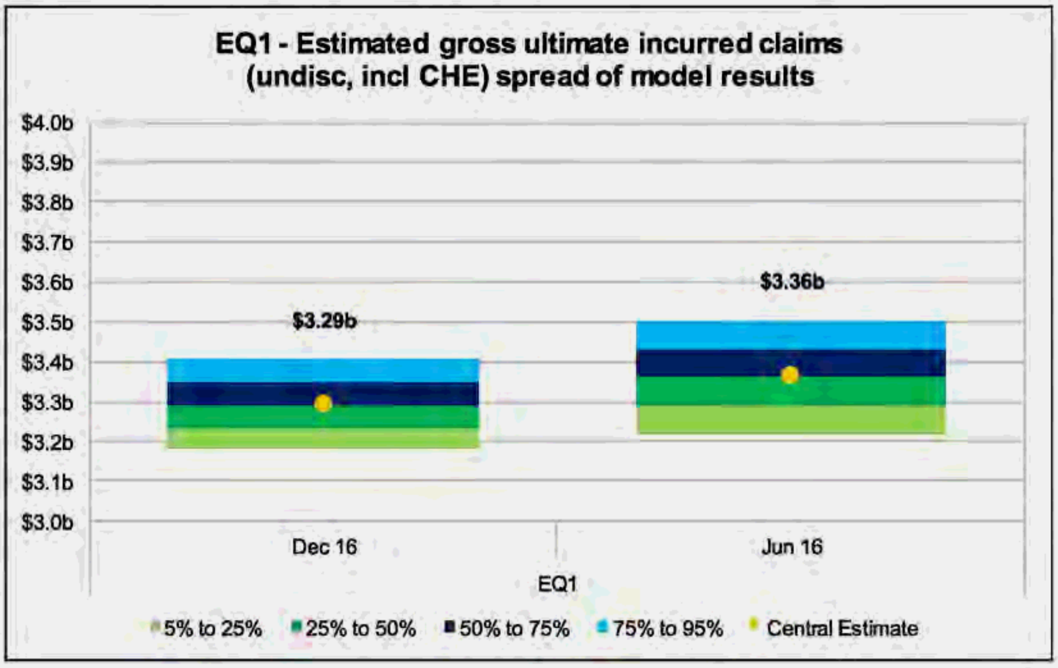
Fletcher Earthquake Recovery (EQR) direct claim costs are included in the claims costs paid to date. Fletcher PMO margin and infrastructure costs are included in CHE.

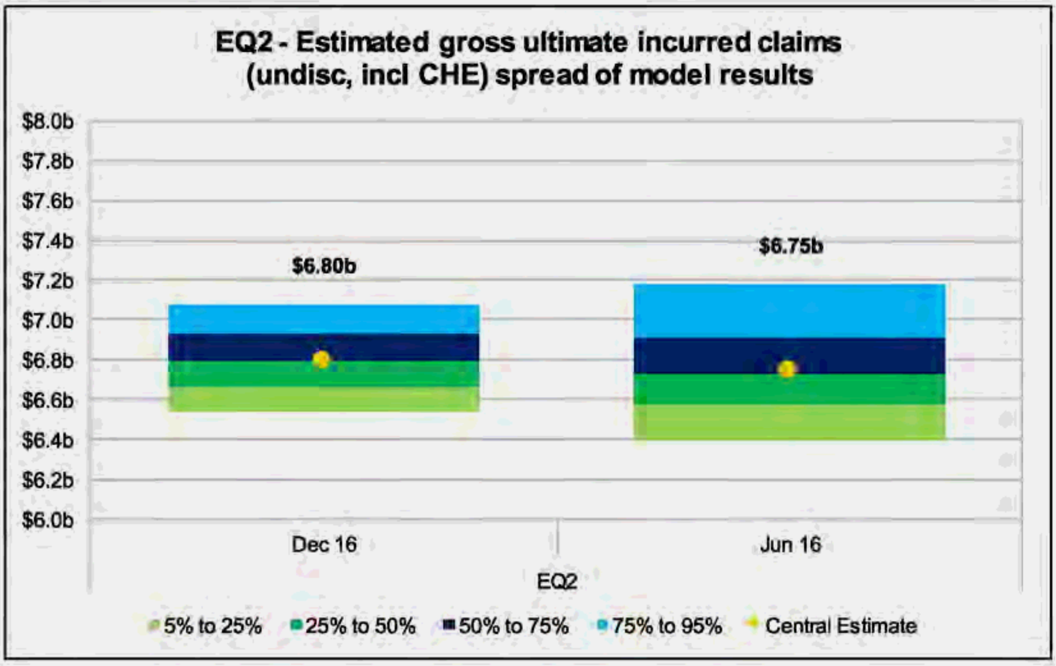
4.2.2 Estimated ultimate claims costs – variability in modelled results

The actual ultimate incurred claim costs arising from the Canterbury earthquake events will not be known until the last claim is settled. The figures shown in Section 4.2 are the central estimate (mean) of a distribution of modelled outcomes.

The charts below illustrate the variability in the ultimate claims liabilities for EQ1 and EQ2 according to our valuation model, split by Canterbury earthquake event. The numbers shown correspond to the central estimates. The corresponding table can be found in Appendix N.2.

Canterbury Earthquakes only

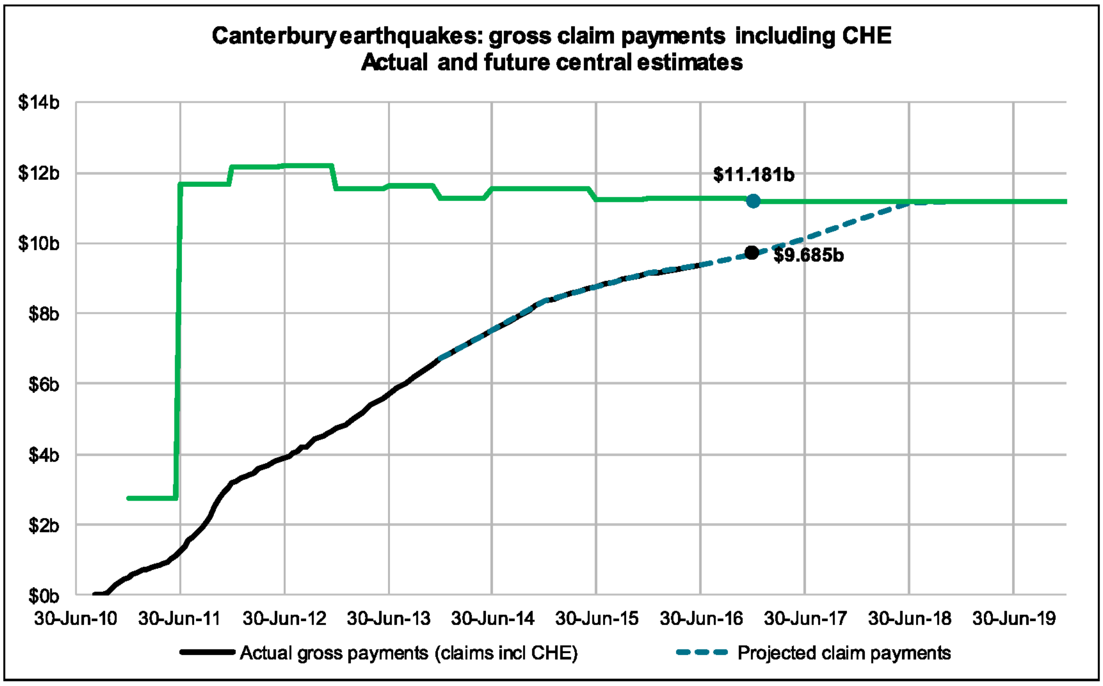




4.2.3 Gross claim payments – comparison to previous estimates

The following chart shows actual gross claim payments for Canterbury earthquakes to 31 December 2016 (including EQR payments and CHE) as the solid black line. Projected payments are shown as the blue broken line.

Future cashflow estimates underlying this chart can be found in Appendix N, including a split by event.



The valuation reflects our understanding of anticipated future cashflows. CHE payments are assumed to continue until 30 June 2019. The final two years of CHE payments are assumed to be small and will be required for a variety of tail issues including managing warranty / rework and litigation.

4.2.4 Movement in Canterbury earthquake claims costs

Movement in ultimate incurred claims costs

	Building $m	Contents $m	Land $m	CHE $m	Total $m
30 June 2016 ILVR					
Paid to date	7,248	472	257	1,383	9,360
Estimated future payments	614	3	1,204	98	1,919
Gross ultimate incurred claims	7,862	475	1,461	1,481	11,279
Movements over period					
Payments	196	2	68	58	325
Estimated future payments	(129)	10	(264)	(39)	(423)
Gross ultimate incurred claims	67	12	(196)	19	(98)
31 December 2016 ILVR					
Payments	7,444	474	326	1,441	9,685
Estimated future payments	485	13	940	59	1,496
Gross ultimate incurred claims	7,928	486	1,265	1,500	11,181

Canterbury earthquakes only
Comparison to 30 June 2016 ILVR Results

	EQ1			EQ2			EQ3			EQ4			AS			Total		
	Dec 16 $m	Jun 16 $m	Change $m	Dec 16 $m	Jun 16 $m	Change $m	Dec 16 $m	Jun 16 $m	Change $m	Dec 16 $m	Jun 16 $m	Change $m	Dec 16 $m	Jun 16 $m	Change $m	Dec 16 $m	Jun 16 $m	Change $m
Gross ultimate claims excl CHE, undiscounted - central estimate																		
Land	265	288	-23	868	1,037	-169	127	130	-3	5	6	-1	1	1	+0	1,265	1,461	-196
Building	2,412	2,473	-61	4,822	4,616	+206	394	431	-37	109	140	-31	191	201	-10	7,928	7,862	+67
Contents	129	126	+3	306	300	+6	30	29	+1	13	12	+0	8	8	+1	486	475	+12
Total	2,806	2,887	-81	5,996	5,954	+43	551	590	-39	126	158	-31	200	210	-9	9,680	9,798	-117
Claims handling expenses (CHE)																		
Paid	468	450	+19	773	741	+31	113	108	+5	37	36	+1	50	48	+2	1,441	1,383	+58
Future	15	25	-10	31	54	-24	11	15	-4	2	2	-1	1	2	-1	59	98	-39
Total	483	475	+9	803	796	+8	124	123	+1	39	38	+0	51	50	+1	1,500	1,481	+19
Gross ult claims incl CHE, undisc - central est	3,290	3,362	-72	6,800	6,749	+50	675	712	-38	165	196	-31	251	259	-8	11,181	11,279	-98
Reconciliation to gross outstanding (OS)																		
Gross ult cost incl CHE, undisc - central est	3,290	3,362	-72	6,800	6,749	+50	675	712	-38	165	196	-31	251	259	-8	11,181	11,279	-98
Paid claims costs excl CHE	(2,409)	(2,399)	-10	(5,118)	(4,833)	-284	(409)	(420)	+11	(117)	(137)	+20	(191)	(188)	-3	(8,243)	(7,977)	-266
Paid CHE	(468)	(450)	-19	(773)	(741)	-31	(113)	(108)	-5	(37)	(36)	-1	(50)	(48)	-2	(1,441)	(1,383)	-58
Gross OS incl CHE, undisc - central est	413	514	-101	909	1,174	-265	153	185	-32	11	23	-12	10	23	-13	1,496	1,919	-423
Reinsurance recoveries, undiscounted - central estimate																		
Past payments recoveries	(1,355)	(1,329)	-27	(2,478)	(2,478)	+0	-	-	-	-	-	-	-	-	-	(3,833)	(3,806)	-27
Future payments recoveries	(406)	(492)	+86	(0)	0	-0	(0)	0	-0	(0)	0	(0)	-	-	-	(406)	(492)	+86
Total expected recoveries	(1,762)	(1,821)	+59	(2,478)	(2,477)	-0	(0)	0	-0	(0)	0	(0)	-	-	-	(4,239)	(4,298)	+59
Net ult inc claims incl CHE, undisc - central est	1,528	1,541	-13	4,322	4,272	+50	675	712	-38	165	196	-31	251	259	-8	6,942	6,981	-39
Reconciliation to net outstanding																		
Gross OS incl CHE, undisc - central est	413	514	-101	909	1,174	-265	153	185	-32	11	23	-12	10	23	-13	1,496	1,919	-423
Future payments recoveries	(406)	(492)	+86	(0)	0	-0	(0)	0	-0	(0)	0	-0	-	-	+0	(406)	(492)	+86
Net OS including CHE, undisc - central est	7	21	-15	909	1,174	-265	153	185	-32	11	23	-12	10	23	-13	1,090	1,427	-337
Discounting	(0)	(0)	+0	(9)	(12)	+3	(1)	(2)	+1	(0)	(0)	+0	(0)	(0)	+0	(11)	(15)	+4
Net OS including CHE, disc - central est	7	21	-15	900	1,162	-262	152	183	-31	11	23	-12	10	23	-13	1,079	1,412	-333
Net risk margin, diversified, 85% PoA	1	2	-1	161	229	-68	27	36	-9	2	4	-3	2	5	-3	193	278	-86
Net OS including CHE, disc - 85% PoA	8	23	-16	1,061	1,391	-330	179	219	-40	13	27	-15	12	28	-16	1,272	1,691	-419

4.3 Kaikoura claims

4.3.1 Estimated ultimate claims costs – Kaikoura earthquakes only

The table below summarises the main components involved in estimating the ultimate cost of claims to EQC arising from the Kaikoura earthquakes only as at 31 December 2016.

Kaikoura earthquakes only
Estimated ultimate claims costs (undiscounted) - 31 Dec 2016

	KEQ $m
Claims costs paid to date	
Land	-
Building	8
Contents	0
CHE	-
Total	8
Estimated future	
Land	13
Building	439
Contents	17
CHE	86
Total	555
Gross ultimate incurred claims cost - central estimate	
Land	13
Building	447
Contents	17
CHE	86
Total	564

4.4 All claims

4.4.1 Ultimate and outstanding claims liabilities – all claims

The table below summarises the key components of the gross ultimate claims costs and the derivation of the outstanding claims liabilities ('OSCL') as at 31 December 2016. A more detailed breakdown is set out in Appendix N.

The net discounted OSCL at a probability of adequacy of 85% is $1.961b. The largest component of the liabilities is in respect of EQ2.

All EQC claims
Gross ultimate claims costs to net outstanding claims liabilities - 31 December 2016 valuation

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	BAU $m	KEQ $m	Total $m
Gross ultimate claims excl CHE, undisc - central est	2,806	5,996	551	126	200		477	10,157
Claims handling expenses (CHE)	483	803	124	39	51		86	1,587
Gross ult claims incl CHE, undisc - central est	3,290	6,800	675	165	251	n.a.	564	11,744
Reinsurance recoveries, undiscounted - central estimate	(1,762)	(2,478)	(0)	(0)	0	-	0	(4,239)
Net ult inc claims incl CHE, undisc - central est	1,528	4,322	675	165	251	n.a.	564	7,505
Net claims costs paid to date	(1,053)	(2,640)	(409)	(117)	(191)		(8)	(4,419)
CHE paid to date	(468)	(773)	(113)	(37)	(50)		-	(1,441)
Discounting	(0)	(9)	(1)	(0)	(0)		(5)	(16)
Net OS including CHE, disc - central est	7	900	152	11	10	34	550	1,664
Net risk margin, diversified, 85% PoA	1	161	27	2	2	7	97	297
Net OS including CHE, disc - 85% PoA	8	1,061	179	13	12	42	647	1,961

14 February 2016 earthquake

Within the BAU estimate from 30 June 2016 was a provision for claims costs arising from the 14 February 2016 earthquake of $76m. This included a CHE provision.

As at 31 December 2016, claims costs paid to date including CHE sum to $42 million.

4.4.2 Movement in net outstanding claims liabilities – all claims

The table below shows the movement in the net outstanding claims liabilities since 30 June 2016. The increase of $160 million is a result of the new Kaikoura earthquake claims exceeding the payment of past claims.

All EQC claims
Reconciliation of change in outstanding claims liability from 30 June 2016 ILVR

	Prior Periods (to 31 December 2015)							Current		All Periods			
	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	BAU $m	Subtotal $m	KEQ	BAU $m	CEQ $m	KEQ	BAU $m	Total $m
Net OSCL (85% PoA, discounted) as at 30 June 2016	26	1,391	219	27	28	9	n.a	-	101	1,691	-	110	1,801
Remove net risk margin (85% PoA)	(4)	(229)	(36)	(4)	(5)	(2)	n.a	-	(17)	(278)	-	(18)	(297)
Net OSCL (central estimate, discounted) as at 30 June 2016	21	1,162	183	23	23	8	1,420	-	84	1,412	-	92	1,504
Remove discounting	0	12	2	0	0	0	15	-	1	15	-	1	16
Net OSCL (central estimate, undiscounted) as at 30 June 2016	21	1,174	185	23	23	8	1,435	-	85	1,427	-	93	1,520
Estimated net paid over period	(2)	(315)	6	19	(5)	(1)	(299)	(8)	(49)	(298)	(8)	(50)	(356)
Change in net actuarial determination	(13)	50	(38)	(31)	(8)	1	(38)	564	(10)	(39)	564	(9)	516
Net OSCL (central estimate, undiscounted) as at 31 Dec 2016	7	909	153	11	10	8	1,098	555	27	1,090	555	35	1,680
Add discounting	(0)	(9)	(1)	(0)	(0)	(0)	(11)	(5)	(0)	(11)	(5)	(0)	(16)
Net OSCL (central estimate, discounted) as at 31 December 2016	7	900	152	11	10	8	1,087	550	27	1,079	550	34	1,664
Net diversified risk margin (85% PoA, discounted)	1	161	27	2	2	1	n.a	97	6	193	97	7	297
Net OSCL (85% PoA, discounted) as at 31 December 2016	8	1,061	179	13	12	9	n.a	647	33	1,272	647	42	1,961

4.5 Key results – premium liabilities

4.5.1 Premium liabilities

The table below summarises the key results of the estimation of EQC's premium liabilities as at 31 December 2016. The premium liabilities will be used in the liability adequacy test.

The total value at 75% probability of adequacy is $251 million. This is greater than the $148 million unearned premium reserve. This means that an additional unexpired risk reserve will be required in the accounts as at 31 December 2016.

The largest component ($102 million, as compared to $96 million as at 30 June 2016) relates to projected costs of future claims arising from major events (other than those related to Canterbury earthquakes) during the period of the runoff of risks on the books as at 31 December 2016. These claims are modelled by Minerva.

The next largest component ($88 million, as compared to $90 million as at 30 June 2016) relates to projected costs of future claims arising from Canterbury earthquakes during the period of the runoff of existing risks as at 31 December 2016. This decreased slightly as a result of decreased probabilities of seismic activity as reported by GeoNet.

There is a new component relating to the enhanced seismicity relating to the Kaikoura earthquakes. Although more recent, it is expected that the future costs will be smaller than the Canterbury component due to the relative lack of exposure around Kaikoura.

The other claims costs relate to future BAU (small) claims and the associated reinsurance and administration expenses.

The cost to EQC of reinsurance has increased considerably for cover negotiated since the Canterbury events. The future reinsurance costs for unexpired risks are $82 million.

Estimated Premium Liabilities - 31 December 2016

	BAU $m	Minerva $m	Cant EQ $m	KEQ $m	Total $m
Unearned premium reserve					148
Cost of future claims from unexpired risks					
Gross claims, undiscounted - central estimate	17	47	68	31	162
Administration and reinsurance costs for unexpired risks					
Claims administration expenses	3	5	7	3	17
Policy (non-claims) admin expenses for unexpired risks	5	0	0	0	5
Future reinsurance costs for unexpired risks	0	62	17	2	82
Reinsurance recoveries					
Reinsurance recoveries, undiscounted	0	(10)	(3)	(0)	(14)
Net premium liabilties, undiscounted - central estimate	25	103	89	36	253
Discounting	(0)	(1)	(1)	(0)	(2)
Net premium liabilties, discounted - central estimate	25	102	88	35	251
Diversified risk margin, discounted - 75% PoA					0
Net premium liabilities, discounted - 75% PoA					251

Note that the reason that the risk margin is $0 is because the distribution of potential claims is very skewed. The central estimate is the average of all possible outcomes; this includes some very low probability but high severity events. As a consequence, the central estimate (mean) outcome is greater than the 75th percentile.

The outcome of the liability adequacy test is often taken as a proxy for the adequacy of the levies (premium rates) that are charged. Consequently, the outcome above suggests that the current levy rates are less than sufficient to cover the expected costs of claims. However:

- The expected claims costs are currently inflated due to the heightened seismic conditions in Canterbury.
- The central estimate claims costs may not be the best decision making tool for setting levy rates for such a highly-skewed distribution.
- EQC's considerations differ from private insurers and will include such factors as the Crown's appetite for managing earthquake risk including pre and post-funding.

5 Background

5.1 EQC structure and role

EQC is a NZ Government-owned Crown entity whose origins stretch back to 1945 and is currently established under the Earthquake Commission Act 1993 ('the Act') and associated schedules and regulations.

EQC's role may be summarised as follows:

- To provide insurance against insured perils (see Appendix A.2).
- To administer the Natural Disaster Fund (NDF), including investments, and obtain reinsurance.
- To facilitate research and education about matters relevant to natural disaster damage and its mitigation.
- To undertake other functions as required by the Minister of Finance or the Minister of EQ Recovery and EQC.

A Government Guarantee ensures that EQC will be able to meet its financial obligations in all circumstances.

More detail on EQC and its operations is given in Appendix A and E.

5.2 New Zealand economic environment

5.2.1 Economic growth

GDP increased 1.1% in the September 2016 quarter with annual growth of 3.3%.

5.2.2 Inflation

Inflation has been very low with the December 2016 Consumer Price Index at 1.3% for the year. The CPI rose 0.4% for the December 2016 quarter.

5.2.3 Interest rates

The Reserve Bank has recently decreased the OCR so that it is now 1.75% p.a.

The five-year government stock rate was 2.69% pa as at 31 December 2016 (2.02% as at 30 June 2016).

6 Data and Information

6.1 Sources of data – Canterbury earthquake claims

The most important sources of data for the Canterbury earthquake investigations were:

- Actuarial Data Extracts from the Claim Centre Claims Information Management System ('ADE').
  - Data as at 31 December 2016 was used to inform the ultimate incurred claims costs and net outstanding claims liabilities.
- ACE apportionment data from the Business Intelligence Unit ('BIU') – see below.
- Small PAT results - see below.
- EQR paid data.
- Claim-to-address mapping data from the BIU.
- Land cost calculations from EQC & T+T.
- Fletcher Construction completion cost data.
- Trial Balances as at 31 December 2016.
- A Minerva model run generated in January 2011.
- Discussions with EQC employees and contractors.

6.1.1 ACE & Small PAT

Properties with building damage are managed either by EQC or by the relevant private insurer. Generally, all properties with building damage less than the EQC cap ($100,000 +GST) per claim will be managed by EQC with the remainder ('overcap properties') managed by the private insurer.

To assess whether a property is overcap, a manual Apportioned Cost Estimates ('ACE') process is carried out. This will indicate whether any claim has expected damage of more than the cap and therefore whether it should be handed over to the insurer. All overcap properties, and some undercap properties, will have ACE data.

Undercap properties were not, as a rule, manually apportioned. For the purposes of the valuation and for reinsurance, undercap properties have been apportioned using a statistical model, developed by the statistician, Dr David Baird. The statistical apportionment method is referred to as Small PAT (Proxy Apportionment Tool).

6.1.2 Actuarial Data Extract from ClaimCentre

Weekly Actuarial Data Extracts (ADE) were taken from ClaimCentre and the key extracts used were dated 31 December 2016 (for the Canterbury earthquake claims costs) and 9 January 2016 (for the Kaikoura earthquake claims costs).

The extract is structured as a single database table. Each record relates to a single claim (itself relating to up to three sub-claims) with many fields describing the claim's details.

More information on the ADE can be found in Appendix F.1.

6.1.3 ACE damage data

The ACE damage data (as at 31 December 2016) consisted of a table, provided by the BIU, showing apportioned damage estimates for a number of Christchurch properties. There were approximately 130,000 properties in the table although many of these had yet to be populated with apportionment information. There were 49,848 approved properties from this data set that were used in the building model. The table below details how the usable properties were derived from the total data set. It is in respect of all review statuses.

ACE data cleaning process

		Sum of Raw ACE Estimates					
	Number of Properties	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Raw ACE Data	129,094	1,627	4,986	237	29	48	6,927
Remove:							
NAs	(75,879)	-	-	-	-	-	-
Duplicates	(50)	-	-	-	-	-	-
Property ID errors & non-approved	(3,317)	(92)	(200)	(9)	(1)	(4)	(306)
Extremely large estimates (>$100m)	0	-	-	-	-	-	-
Data used in model	49,848	1,535	4,786	228	27	44	6,621

6.1.4 EQR paid data

The EQR paid data (as at 31 December 2016) consisted of a table, provided by the BIU, showing the amounts paid to substantively completed properties. There were 68,000 properties from this data set used in the model.

6.1.5 Tonkin + Taylor land data and assumptions

The land valuation model has been constructed using information from T+T and supplemented with information from EQC and their advisors.

6.1.6 Output from the Minerva loss model

Output from the Minerva model was the same as that used for the 30 June 2012 valuation. This output was provided by EQC in July 2011. No more recent outputs have been provided as there has been no input of revised parameters following the Christchurch events.

Details on the Minerva model are given in Appendix F.2.

6.2 Sources of data – Kaikoura earthquake claims

In addition to the data above, to assist in assessing the ultimate claims costs from the Kaikoura event we have also received:

- Exposure data from the Minerva model
- List of properties grouped by land movement information from T+T.

6.3 Sources of information

The additional sources of information used for the investigation were:

- Draft accounts for the period ending 31 December 2016.

- Trial balance for the period ending 31 December 2016.
- Small PAT results.
- CHE Forecast 31 December 2016.
- Daily reports supplied by the BIU.
- Reports supplied by the Fletcher Construction EQR.
- T+T land claims cost model.
- Information from the Treasury website.
- Discussions and correspondence with various relevant EQC staff, contractors and advisors (more details are set out in Appendix F.3).

6.4 Validation of data

6.4.1 Actuarial data extract

The first table in Appendix G illustrates a reconciliation of the 31 December 2016 Actuarial Data Extract system against the BIU's Daily Report for 31 December 2016.

Note that for BAU claims the information from the data extract is calculated on a loss date basis and so does not agree exactly with the accounting data. Overall the level of agreement is satisfactory for our purposes.

Further validation is provided via the claims analyses set out in Appendix G.

6.4.2 Other data

The other data sources were not able to be reconciled against the accounts but were reconciled against other sources where relevant and possible.

6.5 Reliances

The key data and information upon which we have placed reliance are described in Sections 6.1 to 6.3 above.

6.6 Concerns and qualifications

6.6.1 General comments regarding the data held by EQC

The main areas of concern with respect to the use of the data for actuarial purposes is that the Minerva model requires recalibration for new exposure, risk and damage levels, particularly land damage information and changes to building standards (e.g. enhanced foundations).

6.7 Recommendations

6.7.1 Progress against previous recommendations

Several data-related recommendations were set out in Section 3.6 of the 30 June 2016 report. The progress against these recommendations is as follows:

- Minerva:
  - Review the model in the light of the recent events. *Ongoing*
  - Consider whether other catastrophe events besides earthquakes should be included. *Ongoing*

6.7.2 *Current Recommendations*

The recommendations that were noted in the previous ILVR are outstanding although we note that EQC are planning to address these in the near future.

We recognise that our recommendations relate to actuarial data only. We also recognise the unique operational challenges EQC is facing and the need for EQC to prioritise process and systems changes according to the areas of greatest need.

As a consequence, we have no additional recommendations to those noted above.

6.8 Adequacy and Appropriateness

The quality of the results in this report relies on the accuracy and completeness of the data and information supplied. Overall, and subject to the significant but unavoidable issues identified in Sections 6.6 and 6.7, we consider that the information provided to us was adequate and appropriate for the purposes of this valuation.

7 Outstanding Claims Liabilities – Valuation Methodologies

7.1 Liability components

EQC's outstanding (OS) claims liabilities to be included in its accounts for 31 December 2016 are, in summary, an estimate of the total value of liabilities arising from all claims incurred up to the valuation date of 31 December 2016.

Claims incurred will include both reported and unreported claims as at the valuation date. Liabilities are calculated both net and gross of reinsurance.

The OS claims liabilities include both claim payments that will be made after the valuation date and the associated claims handling expenses.

The direct claims payments have been calculated to include the valid claims costs payable to insureds, as defined by the Earthquake Commission Act 1993 ('the Act'). The claims handling costs include the administration costs and allocated overheads associated with the management of those claims.

Insurance accounting standards also require the OS claims liabilities to be discounted for the time value of money and to include the addition of a risk margin to increase the probability of adequacy of the provision.

Based on the comments above the key liability components are:

- Direct claims costs of reported, open claims; this part of the liability comprises:
  - Case estimates held within ClaimCentre.
  - An allowance for IBNER (incurred but not enough reported) claims costs where the case estimates are considered to be insufficient.
- Direct claims costs of reported, closed claims that reopen (Reopened).
- Non-reinsurance recoveries.
- Claims handling expenses.
- Reinsurance recoveries.
- Risk margins.
- Discounting for the time value of money.

7.2 Valuation groupings

The OS claims liabilities are subdivided by:

- Event (EQ1 – EQ4, BAU, KEQ).
- Sub-claim (land, building and contents).

This subdivision is necessary because different cover and reinsurance rules apply to the different valuation groupings and the underlying data for the creation of assumptions also varies.

7.3 Valuation methodology

In summary, the valuation model selected may be described as an aggregate stochastic frequency / severity model. The model itself runs in an MS-Excel spreadsheet and the R statistical package.

More details of the model's structure and operation are set out in Appendix I.

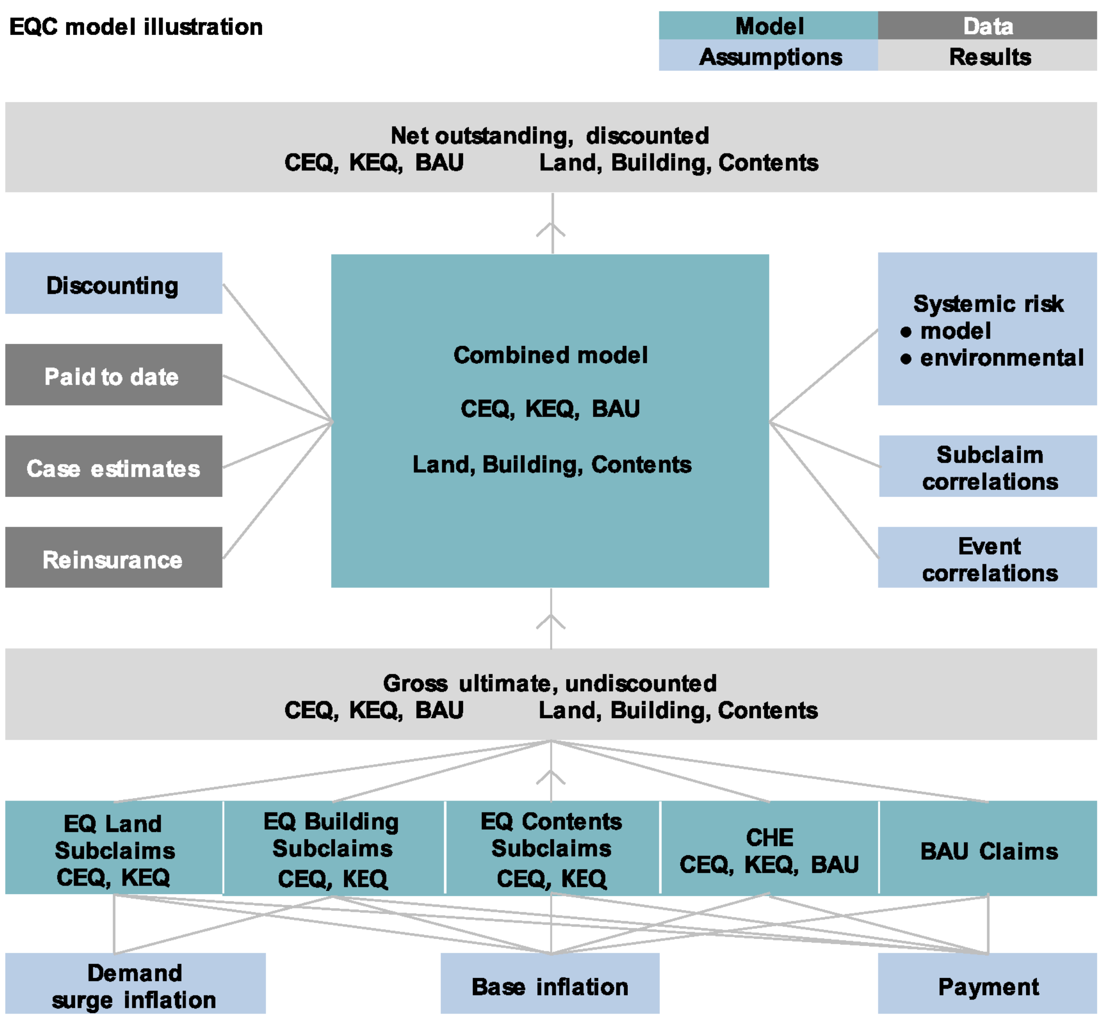
7.4 Gross incurred claims costs

The costs paid to date are known with certainty, but those to be paid in the future are unknown and so must be estimated. The approach that we have taken is to first estimate the projected ultimate claims costs and then to deduct payments made to 31 December 2016 in order to determine the estimated OS claims liability.

7.4.1 Diagrammatic illustration of the valuation model

The diagram below illustrates the components and overall structure of the valuation model.

The structure represents the process for a single run of the model. Each event will have its own unique set of assumptions but needs to be run in parallel in the model as it is the aggregate claims position across the whole entity that must be captured.



The model is run 10,000 times and the output (which is subdivided by the valuation groups described earlier) from each run is collected to form an aggregate gross claims distribution. The central estimate claims cost is found by taking the mean value of the distribution and the 85% probability of adequacy estimate is found by taking the 85th percentile of the distribution.

7.5 Changes since previous valuation

The methodology above has been adjusted to include the claims from the Kaikoura earthquake. This has a direct impact in respect of the ultimate claims costs and the net outstanding claims liabilities.

A description of the Kaikoura earthquake claims model can be found in Appendix **Error! Reference source not found.**.

8 Outstanding Claims Liabilities – Valuation Assumptions

8.1 Assumptions required

The assumptions required are driven by the structure of the valuation model as described in Section 7. In the sections that follow we set out the assumptions used in this valuation for each combination of liability component, event group and sub-claim group and provide some background to the assumptions and how they are derived.

A more detailed description of the assumptions is set out in Appendix J.

8.2 Actual vs. expected experience

A comparison between the current results and those determined as at 30 June 2016 is illustrated in Section 9.

8.3 Changes in assumptions

Due to the number of assumptions that are used in the models, a detailed analysis of all changes in assumptions would be of limited utility and potentially misleading.

However, the scenario analysis in Section 9.1 does identify the variations in claims liabilities from changes in key assumptions.

8.3.1 Land assumptions

A description of the Canterbury earthquake land model including the key assumptions used can be found in Appendix K.

8.3.2 Building assumptions

In respect of the building model, there have been some changes to the assumptions underlying the model. The new model's assumptions are described in detail in Appendix J.1.2.

9 Reconciliation of movement in outstanding claims liabilities

The net OSCL (85% probability of adequacy, discounted) has increased from $1.801b as at 30 June 2016 to $1.961b as at 31 December 2016.

The principal drivers of the change in total claims liabilities in decreasing order of impact are:

- Actuarial determination; this has increased by $516m on a net of reinsurance basis.
  - +$564m as a result of the Kaikoura earthquake.
  - -$39m as a result of changes from the Canterbury earthquakes.
  - -$9m as a result of BAU releases.
- Claim payments; $356m of net payments since 30 June 2016.
- Risk margin has remained relatively unchanged.
- Discounting has remained relatively unchanged.

The following table provides a reconciliation and explanation of the movement in outstanding claims liabilities, by event.

All EQC claims

Reconciliation of change in outstanding claims liability from 30 June 2016 ILVR

	Prior Periods (to 31 December 2015)							Current		All Periods			
	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	BAU $m	Subtotal $m	KEQ	BAU $m	CEQ $m	KEQ	BAU $m	Total $m
Net OSCL (85% PoA, discounted) as at 30 June 2016	26	1,391	219	27	28	9	n.a	-	101	1,691	-	110	1,801
Remove net risk margin (85% PoA)	(4)	(229)	(36)	(4)	(5)	(2)	n.a	-	(17)	(278)	-	(18)	(297)
Net OSCL (central estimate, discounted) as at 30 June 2016	21	1,162	183	23	23	8	1,420	-	84	1,412	-	92	1,504
Remove discounting	0	12	2	0	0	0	15	-	1	15	-	1	16
Net OSCL (central estimate, undiscounted) as at 30 June 2016	21	1,174	185	23	23	8	1,435	-	85	1,427	-	93	1,520
Estimated net paid over period	(2)	(315)	6	19	(5)	(1)	(299)	(8)	(49)	(298)	(8)	(50)	(356)
Change in net actuarial determination	(13)	50	(38)	(31)	(8)	1	(38)	564	(10)	(39)	564	(9)	516
Net OSCL (central estimate, undiscounted) as at 31 Dec 2016	7	909	153	11	10	8	1,098	555	27	1,090	555	35	1,680
Add discounting	(0)	(9)	(1)	(0)	(0)	(0)	(11)	(5)	(0)	(11)	(5)	(0)	(16)
Net OSCL (central estimate, discounted) as at 31 December 2016	7	900	152	11	10	8	1,087	550	27	1,079	550	34	1,664
Net diversified risk margin (85% PoA, discounted)	1	161	27	2	2	1	n.a	97	6	193	97	7	297
Net OSCL (85% PoA, discounted) as at 31 December 2016	8	1,061	179	13	12	9	n.a	647	33	1,272	647	42	1,961

9.1 Scenario Analysis

We have carried out some scenario analysis on key areas of judgement for the settlement of ILV damaged properties. These are shown below.

9(2)(j)
[redacted]

9(2)(h)
[redacted]

9.2 Quality control processes

The valuation was subject to internal peer review. In addition, all results were compared to those of the previous valuations.

10 Premium Liabilities – Valuation Methodologies

10.1 Liability components

In summary, EQC's premium liabilities are an estimate of the total value of net liabilities associated with the run-off of EQC's unexpired risks as at 31 December 2016. The focus is therefore on claims incurred as a result of events after the 31 December 2016 valuation date, i.e. future claims. This is in contrast to the OS claims liabilities, which relate to claims incurred up to 31 December 2016, i.e. past claims.

The premium liabilities comprise several components:

- The cost of future claims (net of reinsurance) arising from the unexpired risks.
- The claims handling expenses for the future claims arising from the unexpired risks.
- The cost of policy administration for the run-off of the unexpired risks.
- The cost of the reinsurance cover for the unexpired risks.

The estimate is set at a 75% probability of adequacy and discounted for the time value of money.

The premium liabilities are not included in EQC's balance sheet but will be used for the Liability Adequacy Test (LAT) of the unearned premium reserves (UPR). If the premium liabilities exceed the unearned premium reserves, then an additional unexpired risk reserve is required to make up the extent of shortfall. If the premium liabilities are less than the UPR then the UPR remains unchanged.

10.2 Valuation groupings

Because the focus of the premium liabilities is on future claims – for which, by definition, there can be no claims data held by EQC - the valuation groupings used for the premium liabilities are very different from those used for the OS claims liabilities.

10.2.1 Event valuation groupings

As we are now dealing with future claims it is not possible to categorise claims by event dates, however we must consider the sources from which future claims may arise. At the time of writing this report these are:

- 'BAU' (Business As Usual) claims
- Minerva claims - catastrophe event claims arising from earthquakes in NZ outside Canterbury
- Enhanced seismicity claims – claims arising from future earthquakes in the Canterbury or Kaikoura earthquake sequence.

The first two event groups above are traditional ones for the estimation of EQC's premium liabilities. The last item reflects the fact that the first two items were based on a 'stable' environment whereas the seismic conditions are more uncertain now. It is expected that this component will reduce over time as seismic conditions stabilise.

10.3 Valuation methodologies

We have decided to use a stochastic approach as it facilitated the determination of the risk margin and allowed us to directly model the effects of the catastrophe reinsurance.

This is consistent with the approach used for components of the OS claims liabilities so some of the assumptions developed for that work have been used.

10.4 Changes in methodology

The methodology has not materially changed from the previous valuation. The impact of the Kaikoura aftershocks has changed the assumptions for the 'Enhanced Seismicity' component.

11 Premium Liabilities – Valuation Assumptions

11.1 Assumptions required

The assumptions are driven by the valuation methodology. In the following sections, we set out the assumptions for each event group and provide some background to the assumption and how it was derived.

11.1.1 Minerva

The Minerva component is based on output from the Minerva model in 2011. The only assumption used here is the inflation rate, which is 2.5% p.a.

11.1.2 BAU

The assumptions used for the BAU component are frequency and severity based. The assumptions for these are shown in Appendix M.3.1.

11.1.3 Enhanced seismicity claims

The Enhanced seismicity claims component is based on the probabilities of aftershocks in the Canterbury and Kaikoura region. The table below illustrates the assumptions currently used.

Geonet forecasts - Canterbury region long-term probabilities
One year: 21 July 2016 - 20 July 2017

Magnitude lower	Magnitude upper	Midpoint	Expected Avge (yr)	Expected max events
5.0	6.0	5.50	0.8	3
6.0	7.0	6.50	0.07	1
7.0	8.0	7.50	0.006	1

Geonet forecasts - Kaikoura region long-term probabilities
One year: 19 January 2017 - 18 January 2018

Magnitude lower	Magnitude upper	Midpoint	Expected Avge (yr)	Expected max events
5.0	6.0	5.50	16.6	29
6.0	7.0	6.50	1.5	4
7.0	8.0	7.50	0.1	1

11.1.4 Non-acquisition expenses

The premium liabilities require assumptions on the policy administration costs and the costs to manage and settle claims. It is assumed that:

- The average annual policy administration costs for unexpired risk is $5m
- The average claims handling cost per claim is $1,495.

11.2 Changes in assumptions

Given the underlying claims process and the valuation methodology, the assumptions are largely based on those used for the 30 June 2016 valuation. The principal exception to this is the Enhanced Seismicity component which now includes allowances for aftershock from the Kaikoura earthquake. The latest GeoNet Canterbury forecasts were released on 21 July 2016. The latest GeoNet Kaikoura forecasts were released on 12 December 2016.

12 Premium Liabilities – Implications

12.1 Material implications of the results

As the net discounted premium liability at 75% probability of adequacy ($251 million) exceeds the unearned premium reserve ($148 million) it will be necessary to hold an additional unexpired risk reserve.

12.2 Key changes from results as at 30 June 2016

The net discounted premium liabilities at the 75th probability of adequacy have increased from $216 million as at 30 June 2016 to $251 million as at 31 December 2016. The increase is driven by the introduction of a new enhanced seismic provision following the Kaikoura earthquake event. We have also updated some of the attritional claims and expense assumptions.

12.3 Quality control processes

The valuation was subject to internal peer review and the results were compared to those from previous ILVRs.

12.3.1 Actual vs. expected experience

The current data does not support an exact analysis of actual claims experience against that expected from the 30 June 2016 premium liabilities calculations. This is because there is no way of identifying incurred claims costs arising from unexpired risks as at the previous valuation. However, it is still interesting to compare the estimated cost of claims incurred in the current period with the undiscounted central estimate future claims costs from 30 June 2016.

The undiscounted net central estimate cost of future claims as at 30 June 2016 was $216 million.

13 Uncertainty, Limitations and Reliances

13.1 General comment

There is inherent uncertainty in any estimation of insurance liabilities – estimates of liabilities are based on assumptions and deviations from estimates are normal and to be expected. The estimates are therefore a probability statement rather than an absolute judgement.

The actual ultimate incurred claim costs arising from the Canterbury earthquake events will not be known until the last claim is settled.

The actual ultimate incurred claim costs arising from the Kaikoura earthquake will take some time to estimate accurately. There is very little data with which to form an estimate.

13.2 General sources of valuation uncertainty

The general sources of error in the estimation of liabilities include:

- Normal variation that is inherent in any random process.
- The valuation model being a poor representation of reality.
- Incorrect valuation assumptions arising from:
  - Assumptions being derived from an unrepresentative sample.
  - Underlying experience drifting over time and chosen assumptions failing to accurately follow the 'drift' – this could be due to internal factors such as changes in the claims process or external factors such as changes in the legal environment, cost inflation etc.
- Incomplete or poor quality data.
- Errors in calculations.

All of these sources of error are potentially present in this investigation.

13.3 Key uncertainties

13.3.1 Exceptional uncertainties arising from the Canterbury earthquakes

The Canterbury earthquakes have resulted in a high level of uncertainty. Some of the key sources of uncertainty are:

- The impact of multiple events on the allocation of damage, EQC coverage and EQC's reinsurance coverage.
- Severe land damage and a very complex land claims environment from engineering, valuation and legal perspectives.
- Claims development. There has been considerable progress within EQC in regard to the operational aspects of assessing and settling claims, especially in trying to process land claims. However, for a number of reasons, outcomes of that progress cannot be fully reflected in the information available for the valuation, and so there remains residual uncertainty in the valuation results.

Consequently, at this stage of claims development, there is still a degree of unavoidable uncertainty regarding the future claims costs.

As noted in our previous reports, as the claims are settled and as the reasonableness of the model and its assumptions are refined and tested against the emerging claims experience, the level of uncertainty will reduce.

Land valuation uncertainties

The list below sets out some specific sources of uncertainty regarding the estimation of EQC's land liabilities. These sources include, but are not limited to:

- The extent to which properties have valid claims – this risk has reduced significantly with few challenges to claim eligibility.
- The impact of the 'diminution of value' cover interpretation.
- The assumed market value cap for a number of properties in Canterbury.
- Legal, valuation and engineering challenge and different interpretation of the land cover provisions in the EQC Act.

Some practical outcomes of the uncertainty associated with the valuation are:

- The actual claims outcome will differ to some degree from the estimates.
- There are confidence ranges in the estimated liabilities for each event.
- Different practitioners could legitimately arrive at quite different estimates of claims cost.

13.3.2 Uncertainties arising from the Kaikoura earthquakes

The Kaikoura earthquakes have resulted in a high level of uncertainty. This is primarily due to the lack of time between the event and this valuation. This has manifested itself in the following ways:

- The focus at this stage has been on restoring access to main towns.
- There is little information as to the extent of residential building damage in the South Island. Many properties will be rural and access to these will be limited.
- There is little information on the extent of damage to residential buildings in Wellington, especially apartment blocks which may have suffered disproportionately. This may take some time to assess fully as it will require detailed engineering investigations.
- The land damage that arose from the storms on 15 November may have been principally the result of the Kaikoura earthquake. It will be some time before this can be confirmed.
- The Memorandum of Understanding ('MoU') will place claims handling in the hands of the private insurers. It is expected that this will result in a more efficient claims outcome for the homeowners. However, it will necessarily impede the visibility that EQC has over the ultimate claims costs.

13.4 Limitations

In this report, we provide the results of our investigations together with an outline of the matters considered and the methods and assumptions applied to obtain these results. Opinions and estimates contained in this report constitute our judgement as at the date of the report.

This report must be read in its entirety. Individual sections of the report, including the Executive Summary, could be misleading if considered in isolation from each other.

This report is addressed to the management and Board of EQC and should not be provided to or used by any other party (except as specified below) without the express written permission of MJW. This limitation has been provided with the intention of preventing the use of the report for purposes for which the analysis was not intended. MJW will not be liable for the consequences of any third party acting upon or relying upon any information or conclusions contained within this report.

MJW has agreed to a request from EQC that this report may be provided to EQC's auditor, reinsurance broker (AON Benfield), reinsurers, legal counsel (Chapman Tripp), geotechnical engineers (Tonkin + Taylor) and the New Zealand Treasury. In agreeing to this request, we point out in particular that this report is addressed to EQC, and therefore we do not warrant or represent that any information, analysis or results set out in it are sufficient or appropriate for any other parties' purposes. This report cannot substitute for any investigations that any other party may wish to carry out for its own purposes, and the authors of this report and MJW will not accept any liability to any other party arising from the use of this report.

13.4.1 Official Information Act (OIA)

It is also recognised that this report will be covered by the OIA and therefore may be released (subject to any redactions) to the public. It is noted however that we are advised that there are grounds for EQC to withhold the ILVR under the OIA.

The limitations above also apply to any other reader of this report.

13.5 Key reliances

In completing this report, considerable reliance has been placed on data and information supplied to MJW by EQC and its external advisors. The most important reliances were placed on the data sources listed in Section 6.1.

More details regarding data, information and reliances are set out throughout Section 6.

13.6 Quality control and risk management processes

The estimation of EQCs liabilities, particularly the building component, involves constructing multiple complex statistical models.

The data, methodology and results that drive, and are output from, these models undergo a variety of quality control and audit processes.

We undertake to ensure the robustness of these by:

- Internal peer review, including:
  - Detailed review of data, assumptions, methodology and results.
  - Periodic rotation of staff which allows, over time, a 'fresh set of eyes' over aspects of the valuation process.
- Data validation where possible to independent sources (e.g. management accounts, daily reports)
- Analysis of change in assumptions for reasonableness.
- Comparison of results to previous models and valuations.
- Comparing results to alternative models.

- External review, including
  - Discussions with EQC staff
  - Discussions with external auditors at year end.

Earthquake Commission

21 March 2017

Insurance Liability Valuation as at 31 December 2016

Appendices

MELVILLE JESSUP WEAVER

Willis Towers Watson Alliance Partner

A EQC – Background

A.1 EQC structure and role

EQC is a NZ Government-owned Crown entity whose origins stretch back to 1945 and is currently established under the Earthquake Commission Act 1993 ('the Act') and associated schedules and regulations.

EQC's role may be summarised as follows:

- To provide insurance against insured perils (see Appendix A.2).
- To administer the Natural Disaster Fund (NDF), including investments, and obtain reinsurance.
- To facilitate research and education about matters relevant to natural disaster damage and its mitigation.
- To undertake other functions as required by the Minister of Finance or the Minister Responsible for the Earthquake Commission.

A Government Guarantee ensures that EQC will be able to meet its financial obligations in all circumstances.

A.2 EQC cover

EQC pays out on claims from insured New Zealand residential property owners for damage to the residential building and the land on which that building is situated and damage to personal possessions caused by earthquake, natural landslip, volcanic eruption, hydrothermal activity, tsunami and fire caused by any of these. In the case of residential land there is also cover for storm or flood damage. Claim payments are subject to limits and excesses.

Each claim lodged with EQC may result in repair and/or replacement costs arising from one or more of the following claims types (also known as 'sub-claims' or 'exposures'):

- Building claims (to a maximum of $100k plus GST).
- Personal property (contents) claims (to a maximum of $20k plus GST).
- Land claims (S19 of the Act) to a maximum liability of the indemnity value of bridges, culverts and retaining walls that are lost or damaged plus the lesser of:
  - the value of the land damaged,
  - the value at the site of the damage of an area of 4000m^2, or
  - the value of a parcel of land that is the minimum lot size under the District Plan of land used for that purpose.
  - This calculation is subject to the total liability over the Canterbury Earthquake Sequence not exceeding the value of the Insured Land Area (where the entire insured area has been damaged), plus the indemnity value of the bridges, culverts and retaining walls that are lost or damaged.

Cover can only be given in relation to a residential building where among other things, there are self-contained premises which are a home or a holiday home or capable of being or are intended by the owner to be a home or a holiday home.

Cover is only given in relation to land where there is a residential building lawfully situated on the land.

For there to be residential building cover, or residential land cover, the residential building must be covered by insurance with a private insurer against fire (although sometimes the cover may have been arranged directly with EQC).

Cover can only be given in relation to contents where there is insurance with a private insurer in respect of the contents (although sometimes the cover may have been arranged directly with EQC).

General exclusions are:

- Motor vehicles and vessels (boats).
- Plants and landscaping.
- Dams, breakwaters, fences, walls etc. not integral to the residential building.
- Reservoirs, swimming and spa pools, tanks etc. that are not integral to and within the building; or that do not form part of the storage or (in the case of tanks) water supply system.
- Jetties etc.
- Any paved or other artificial surface (including the surface of the access way).
- Certain specified types of valuables (including jewellery, stamps, works of art, securities etc.).

A.2.1 Property covered (including excess and limits)

Residential Buildings

- Eligibility and Exclusions: as above. Any exclusions under the policy with the private insurer apply also to EQC coverage. There is no EQC cover for temporary accommodation costs.
- Cover includes all water supply, drainage, sewerage, gas, electrical and telephone services serving the building, within 60m of the building and owned by the owner of the land or building.
- Cover is limited to replacement value and is subject to a maximum of the lesser of the replacement sum specified under the private insurance policy; the sum specified for insurance under the EQC Act; or $100k plus GST per building (see discussion of conditions for reinstatement of this dollar amount for second and subsequent events).
- Excess: 1% of amount payable under Act with a minimum of $200 per building.

Contents (Personal Property)

- Eligibility and Exclusions: as above. Any exclusions under the policy with the private insurer apply also to EQC coverage.
- Cover is on a replacement value basis (unless the private insurance is on a less favourable basis) and is limited to the lesser of the sum insured under the private insurance policy or $20k plus GST.
- Excess: $200 deducted from claim for contents only (otherwise the excess noted above for a building claim will apply for a claim for building and contents).

Land

- Applies to land on which the residential building stands; land within 8m of the building or outbuildings; land that is part of or supports the main access way up to 60m of the building; bridges and culverts within 8m of the residential building, or on land within 60m of the building that is part of or supports the main access way; and retaining walls and support systems within 60m of the building that are necessary to support or protect the building or insured land (including the main access way).
- Does not extend to plants or landscaping; fences and walls that are not integral to the building; or paved or artificial surfaces.
- Is based on:
  - the indemnity value of any bridges, culverts, and retaining walls and their support systems that are covered, plus
  - the cost to repair land that is physically damaged or lost in the earthquake (or in some circumstances the reduction in the value of the damaged land, where repair is not possible or unlikely to occur for practical reasons).
- Is subject to a maximum per event of the indemnity value of bridges, culverts and retaining walls that are lost or damaged plus the lesser of:
  - the value of the land damaged,
  - the value at the site of the damage of an area of 4000m^2, or
  - the value of a parcel of land that is the minimum lot size under the District Plan of land used for that purpose.
  - This calculation is subject to the total liability over the Canterbury Earthquake Sequence not exceeding the value of the Insured Land Area (where the entire insured area has been damaged), plus the indemnity value of the bridges, culverts and retaining walls that are lost or damaged.
- Is subject to an excess calculated as: the greater of $500 per building or 10% of land value, subject to $5,000 maximum per claim.
- In some cases, whether or not certain land damage results in a valid land claim can be a complex matter requiring specialised legal and engineering advice.

A.2.2 Reinstatement of cover limits

Following the High Court's declaratory judgment on 2 September 2011 (EQC v the Insurance Council / Vero / IAG; and Tower Insurance v EQC) the issue of the reinstatement of EQC's cover after an event has now been clarified.

In summary, EQC is liable for up to $100k plus GST for each building claim and $20k plus GST for each contents claim; i.e. there is immediate reinstatement of cover after each natural disaster event as long as the contract of fire insurance is in force.

A.3 EQC levies

EQC levies are collected via the insurance premiums on all domestic home and domestic contents policies issued by private insurers.

The current levy is that domestic home and contents policyholders pay 15c per $100 of insurance cover, up to a maximum of $207 per year.

A.4 EQC market and distribution

As the provision of EQC cover is compulsory for all domestic home and domestic contents policyholders (insured through private insurers) EQC does not have distribution activities. As a single, flat-rate levy is applied throughout New Zealand, there is no underwriting carried out by EQC. An amount equal to 2.5% of EQC levy commission is paid to the private insurer. This is intended to cover the insurer's costs of collecting and remitting the levy to EQC.

A.5 EQC operations

EQC's head office is based in Wellington.

EQC's normal activities include:

- Collection of levies, placement of reinsurance and management of the NDF.
- Claims management.
- Research facilitation.
- Education.

New (non-Canterbury) natural disaster claims are managed out of the Wellington and Hamilton Processing Centre. When there is a significant disaster and EQC declares an event, a field office is set up in a suitable location near where the damage occurs.

The Fletcher Earthquake Recovery programme was closed at the end of 2016. The EQR function has been brought in-house with the focus on managing the repairs arising from the CEDAR review and the general remediation function.

A.5.1 Kaikoura claims

Under the Memorandum of Understanding between EQC and eight private insurers, most of the claims arising from the Kaikoura earthquake will be managed by the private insurers.

A.6 EQC systems

EQC operates a number of systems. Those most relevant to the current investigation include:

- The CLAIMS (Claims Lodgement, Allocation, Information and Management System) which comprises:
  - The ClaimCentre CIMS (Claims Information Management System) system.
  - The GIS (Geographical Information System) system.
- The ACE (Apportioned Cost Estimate) database.
- The DataWarehouse.
- The Minerva risk model application.

The claims data which forms part of the basis for this investigation comes primarily from the ClaimCentre and COMET systems. The Minerva model provided output for use in the estimation of a component of the premium liabilities.

B Canterbury Earthquakes – Background

Since 4 September 2010, Canterbury has been shaken by over 10,000 earthquakes including three which have required the catastrophe treaties to respond.

GNS Science has noted that there are various particular features of the seismic activity in the Canterbury region that have led to the unusually high levels of damage recently experienced. These include:

- A high 'stress drop' and/or strong focusing of the February 2011 fault rupture toward Christchurch, associated with the orientation and breaking of strong faults, resulting in higher intensities of shaking.
- Extremely high peak horizontal and vertical ground accelerations were recorded close to the epicentres of the February and June 2011 earthquakes.
- The presence of several hundred metres of soft alluvial sediments beneath Christchurch city amplified the ground motion at certain frequencies.
- The hard volcanic rock comprising Banks Peninsula may have compounded the effect of the earthquakes by reflecting the seismic energy back into the soft sediments beneath Christchurch.
- High water tables and the presence of soft soils beneath parts of eastern Christchurch contributed to more severe liquefaction effects at the surface.

B.1 Main events

The four largest events, to which the bulk of property damage is attributable, were:

B.1.1 EQ1 – 4 September 2010

On 4 September 2010, an earthquake of magnitude 7.1 on the Richter scale occurred, centred at Darfield, 40km west of Christchurch City, at a depth of 11km. It caused significant non-structural damage to residential and commercial property across the region. Particular features of this event were the peak ground acceleration and the many residential areas of eastern Christchurch and to the north (Kaiapoi) that suffered liquefaction and lateral spreading along river banks.

B.1.2 EQ2 – 22 February 2011

On 22 February 2011, there was an earthquake of magnitude 6.3, centred 5km SE of Lyttelton, at a depth of only 5km, affecting the CBD and suburbs to the South and East of the city. Many significant buildings in the CBD were severely damaged with 185 deaths and many injuries, and there extensive and severe liquefaction damage in vulnerable areas as well as some landslides and rock falls from cliffs in the Port Hills.

B.1.3 EQ3 – 13 June 2011 (including 21 June 2011 earthquake)

On 13 June 2011, there were two earthquakes of magnitude 5.6 and 6.3 at shallow depth, both centred close to Sumner. The shaking was sufficient to cause further significant damage to already weakened buildings. There was again lateral spreading adjacent to the rivers and a great deal more liquefaction damage in areas previously affected by the February event.

B.1.4 EQ4 – 23 December 2011

On 23 December 2011, there were several earthquakes, the largest of magnitude 6.0 at a depth of 7km, centred close to South New Brighton Beach. Being centred off the coast, the effects have been generally less damaging to structures than the other main events, but vulnerable buildings and the same areas of land again suffered further damage.

B.2 Canterbury earthquakes and the implications of multiple events

Although there have been many earthquake events causing building damage, observable / measurable land damage is associated only with the four identified events (EQ1, EQ2, EQ3 and EQ4). The first two of these events caused enough damage in total to require EQC's reinsurance treaties to respond.

The phenomenon of multiple earthquake events in close succession (as opposed to a single, isolated event) has had many implications from both operational and valuation perspectives; these are considered in more detail below.

B.2.1 More damage

Each subsequent event adds to the existing damage and hinders the repair of already damaged structures. The impact of additional events on a single plot of land or building can be complex.

With buildings, the 'damage on damage' effect may limit ultimate repair costs to some extent, although some weakened buildings may suffer greater damage.

With land damage, the costs of repair can be exacerbated by later events, particularly for properties near waterways which were already vulnerable to the liquefaction hazards. Where these sites have materially subsided, the vulnerability of the land to the liquefaction and flooding hazards has considerably increased. This is most common in the residential red zone.

B.2.2 Resource issues

The additional damage creates additional demand for the professions and trades involved in the management of claims and rebuilding:

- Loss adjusters and assessors.
- Engineers.
- Valuers.
- Builders.

There will also be additional demand for building materials.

Finally, there is the issue of Council resources for consents, inspections and code compliance certificates.

B.2.3 Increased complexity in estimation and apportionment of costs

Multiple events result in increased difficulty in:

- Estimating costs of repair.
- Apportionment of repair costs to different events/claims.

- Potential delays in repair of land and buildings as ongoing earthquakes cause problems in planning and securing resources.

B.2.4 Increased complexity in determining cover – reinstatements

The High Court's declaratory judgment on 2 September 2011 (EQC v the Insurance Council / Vero / IAG, and TOWER Insurance v EQC) clarified the issue of the reinstatement of EQC's cover after an event.

In summary, EQC is liable for up to $100k plus GST for each building claim and $20k plus GST for each contents claim; i.e. there is immediate reinstatement of cover after each natural disaster event as long as the contract of fire insurance is in force.

B.2.5 Reinsurance

The operation of EQC's reinsurance cover arrangements have been made much more complicated due to the multiple events. Cover in later events is contingent upon the reinsurance impacts of earlier events (Top and Drop).

More details are provided in Appendix E.

B.2.6 Ministerial Directions

Given the need to apportion the costs of the claims between the various earthquake events, there is the issue that damage is deemed to have occurred to events where no valid claim has been lodged.

In these cases, there is therefore a possibility that the insured may not be covered for all of the damage that has occurred due to a lack of claim lodgement for a particular event. As a consequence, there have been a number of Ministerial Directions to clarify the issue.

For the purposes of this ILVR, the relevant directions were given on:

- 19 December 2012. Relates to residential building and states that all apportioned residential building damage will be covered by EQC, so long as at least one valid claim has been made for that residential building.
  - 19 December 2013. An amendment to the previous residential building direction stating that no excess shall apply to apportioned damage where no valid claim was made.
- 29 October 2015. Relates to residential land and states that all apportioned residential land damage will be covered by EQC (subject to the land cap), so long as at least one valid claim has been made. Excesses will be deducted from all apportioned damage claim payments

These directions have consequences for the gross and net exposure of EQC in that all damage is covered by EQC (subject to there being at least one claim) but not necessarily the reinsurers.

B.3 Canterbury land damage and EQC land claim liabilities

This section of the report sets out a high-level summary of the situation regarding the land damage caused by the Canterbury earthquakes and the land claim cost implications for EQC. The principal sources of information for this section were Tonkin + Taylor and EQC.

The notes in the remainder of this section should not be considered to be exhaustive – they are merely a high-level summary of some of the issues.

Land cover is described in Appendix A.2.1. The calculation of land cover is subject to the total liability over the Canterbury Earthquake Sequence not exceeding the value of the Insured Land Area (where the entire insured area has been damaged), plus the indemnity value of the bridges, culverts and retaining walls that are lost or damaged.

B.3.1 Land claims

Background

In terms of eligibility, EQC land cover is only given where:

- There is a residential building lawfully situated on the land, and
- The residential building is covered by insurance with a private insurer against fire (although sometimes the cover may have been arranged directly with EQC).

Refer to Appendix A.2 for details.

Canterbury land claims liabilities

The situation regarding EQC's land claims is complex from several perspectives:

- The nature of the damage caused.
- The engineering solutions to repair the damage (if feasible).
- The valuation of the Insured Land Area and the Diminution of Value.
- The legal issues surrounding the extent of cover provided by EQC in the context of multiple events.

A great deal of work has been done by T+T over the past several years and this has been incorporated into this valuation. However, it should be recognised that there remains uncertainty regarding certain components of the land claims cost estimates.

B.3.2 Land damage recognised by EQC

Flat Land

Land damage has occurred on the flat land as a result of soil layers below the ground surface liquefying, deforming the ground surface and inundating the properties with ejected water, silt and sand.

The flat land in eastern Christchurch is underlain by a series of soil layers of fine-grained alluvial sediments with varying composition and density. Each soil layer has a different liquefaction resistance which means that some soil layers are able to liquefy at lower shaking intensities while other soil layers are only able to liquefy at higher shaking intensities. Generally, the more soil layers that liquefy beneath a property, the more liquefaction induced damage that can be expected at the ground surface.

Each of the four main earthquake events had shaking intensities that were strong enough to trigger liquefaction of soil layers in Christchurch. The shaking intensity from EQ1 was only strong enough to cause consequential (damaging) liquefaction in the most vulnerable parts of Christchurch (these areas generally now comprise the residential red zone). The shaking intensity from EQ1 may have triggered liquefaction in isolated soil layers throughout other parts of Christchurch but with minor to no consequential effects at the ground surface. The shaking intensity from EQ2 was considerably stronger in eastern Christchurch causing more soil layers to liquefy, increasing the extent and severity of liquefaction induced damage at the ground surface. However, the shaking intensity from EQ2 was considerably lower in the western and northern parts of Christchurch resulting in no to minor consequential effects at the ground surface. The shaking intensities from EQ3 and EQ4 were less than EQ2 and were generally more localised, causing less extensive liquefaction damage compared with EQ2.

For the more vulnerable properties where severe liquefaction damage occurred, a lot of silt and sand was ejected also resulting in considerable ground surface subsidence. For these vulnerable properties, subsequent earthquake events have caused increasing amounts of land damage and associated repair cost.

The land damage may be divided into two broad groups – visible surface damage (Categories 1 to 7 land damage listed in the table below) and increased vulnerability to liquefaction and to flooding (Categories 8 and 9 respectively, listed in the table below).

Category		Description
1	Cracking caused by lateral spreading	Lateral spreading is the lateral movement of land, typically toward watercourses or other unconfined faces. Blocks of the crust raft laterally over liquefied soils toward an area of lower elevation. Surface manifestation of damage can range from minor to major cracks in the land, tilting of crust blocks and associated distortions to structures.
2	Cracking caused by oscillation movements	Cracks in land have resulted from oscillation type land movements. This category of land damage refers only to oscillation induced cracking. The cracks produced from this phenomenon are typically minor and isolated.
3	Undulating Ground	Undulating ground is caused by the differential ground settlement as a result of lateral spreading and the ejection of sand and silt and, to a lesser extent, the uneven settlement of the liquefied soils.
4	Local ponding	The local settlement or lowering of the ground at some sites has resulted in water ponding on the ground surface in locations where it did not pond before the earthquake
5	Local settlement causing drainage issues	At various sites land on an individual residential property has settled more than land on the adjacent road or land below which public services are located. In some situations, this has resulted in drains that formerly flowed toward public services now flowing back toward the building.
6	Groundwater springs	Formation of new groundwater springs now being emitted at the ground surface usually from a specific location on a site.
7	Inundation of ejected sand and silt	This includes the ejection of sand and silt to the ground surface from the zone below the water table through cracks in the crust. The ejected sand and silt can be deposited in isolated mounds, under buildings or over the entire site.

8	Increased Liquefaction Vulnerability	The physical change to land as a result of ground subsidence from an earthquake which materially increases the vulnerability of that land to liquefaction damage in future earthquakes.
9	Increased Flooding Vulnerability	The physical change to land as a result of an earthquake which adversely affects the use and amenity that could otherwise be associated with the land by increasing the vulnerability of that land to flooding events.

Port Hills

The Port Hills also sustained land damage although this was of a more traditional nature, and included rock falls, slips and damage to retaining walls.

The Port Hills now has properties zoned as red following a zoning review completed December 2013. These are properties where either:

- The property has been affected by cliff collapse and there is deemed to be an immediate risk to life, or
- The property has been affected by rock roll resulting in an unacceptable risk to life and an area-wide engineering solution to remediate the issue has been determined not to be practicable.

Some areas of Port Hills land have been recognised as susceptible to risks of 'Toe Slumping'. Toe Slumping is the characteristic whereby sloped land is at risk of mass land movement.

B.3.3 Rebuilding and land zones

The Canterbury Earthquake Recovery Authority (CERA) divided the land in greater Christchurch and in the Waimakariri District into two zones - red, and green. The zone definitions are:

- Green (Go Zone): repair / rebuild process can begin.
- Red (No Go Zone): land repair would be prolonged and uneconomic.

The green zone land is broken down further into commercial zoned land, Port Hills land, rural land, and three residential flat land categories. The three residential flat land categories describe how the land is expected to perform in future earthquakes, and also describe the foundation systems most likely to be required in the corresponding areas. These are defined as:

- Technical Category 1 (TC1) – future land damage from liquefaction unlikely.
- Technical Category 2 (TC2) – minor to moderate land damage from liquefaction is possible in future large earthquakes.
- Technical Category 3 (TC3) – moderate to significant land damage from liquefaction is possible in future large earthquakes.

B.3.4 Remediation of land claim damage

Shown below is the manner in which EQC is settling the various land claim categories. The land damage may be broken down into 4 broad groups as discussed below.

- Repair of damage categories 1 – 7 on the flat.
- Repair of, or compensation for, ILV damage on the flat (formerly known as category 8 damage).

- Repair of, or compensation for, IFV damage on the flat (formerly known as category 9 damage).
- Repair of damage on the Port Hills.

Damage categories 1 – 7 on the flat

The land damage reinstatement costs have been calculated for each property on an individual property basis.

In the same way that the land damage effects may overlap, so may the reinstatement process and hence tend to reduce the overall cost, i.e. a single repair process may reinstate several categories of damage for several events.

Diminution of value

Diminution of Value ('DoV') measures the reduction in a property's market value which has been caused by IFV or ILV land damage.

This is consistent with the indemnity principle of insurance and is being used by EQC (amongst other options) to settle land claims.

ILV and IFV land damage is a result of the ground surface subsidence caused by the four main earthquakes. There may not be any visible signs of the damage and the land may function in a perfectly reasonable state.

For the properties where the houses were not damaged beyond economic repair, remedying IFV or ILV damage by physically repairing the land would incur the combined costs of the (highly intrusive) land reinstatement and possibly the (also intrusive and often inappropriate) enabling costs associated with the demolition or temporary relocation of a building that is otherwise in reasonable condition. In any case, the combined costs for a property would be limited to the maximum level of cover, which is most often (but not always) the minimum lot value (MLV).

Furthermore, in the case of IFV land damage, it may not be possible to identify an appropriate repair for IFV land damage. For example, this may be because:

- It is not feasible to carry out a repair of the IFV land damage. This may be the case if the house has to be removed in order to do land repairs to address IFV damage under the house; or
- It is not possible to carry out the repair legally. For example, it may not be possible to get a resource consent required under the Resource Management Act for the land repairs to the IFV damage.

In these cases, EQC is not able to base the settlement on repair cost.

Declaratory Judgment

The Declaratory Judgment delivered on 10 December 2014 confirms that IFV and ILV are forms of natural disaster damage to residential land for the purposes of the Earthquake Commission Act ('the Act'), and that EQC may – and should – develop a policy to set out how it will settle claims involving IFV and ILV.

It also noted that the use of DoV as a measure of the amount of a settlement payment is lawful and proper in appropriate cases. At the date of the Declaratory Judgment, EQC had developed its IFV Policy but not the ILV Policy. The Declaratory Judgment confirms that use of DoV, in the circumstances set out in the IFV Policy, is lawful and proper; and the payment of claims out of the Natural Disaster Fund in accordance with the IFV Policy and the Act will be lawful.

Given this guidance, EQC has developed its ILV Policy to align with the principles endorsed by the court in relation to the IFV Policy.

Lastly, the Judgment held that individual claimants may contest EQC decisions (e.g. on qualification for, and the amount of, an IFV / ILV settlement) as an ordinary civil proceeding in the District Court or High Court rather than (as EQC contended) only judicial review.

IFV damage on the flat

Flooding encompasses both flooding from rivers which exceed their capacity during prolonged rainfall and also overflowed flow path stormwater run-off during shorter, more intense rainfall events.

Qualification for IFV land damage is based on three criteria.

- Detailed river flood modelling and overland flow path storm water modelling along with the subsidence information have been considered to determine whether a property is materially vulnerable to flooding
- Whether there is a material change in flooding vulnerability as a result of the ground surface subsidence of the insured land caused by each main earthquake.
- Whether the increase in flooding vulnerability impacted the market value of the property.

EQC's policy in respect of IFV damaged land considers the costs and ability to repair the land and the DoV that has been incurred.

We understand that there are a small number of properties (primarily rural) where land remediation may be possible.

ILV damage on the flat

Qualification for ILV land damage is based on three criteria:

- Detailed analysis of land damage and subsidence information as well as geotechnical investigations and corresponding liquefaction vulnerability modelling have been considered to determine whether a property has material liquefaction vulnerability
- Whether there is a material change in liquefaction vulnerability as a result of the ground surface subsidence caused by the 2010-2011 earthquake sequence.
- Whether the increase in liquefaction vulnerability impacted the market value of the property.

EQC will settle the financial loss to the claimant arising from ILV based on the Diminution of Value of the property unless EQC is satisfied that:

- there is a repair methodology for the repair of the Increased Liquefaction Vulnerability of the land;
- the claimant intends to undertake the repair of the land within a reasonable period of time using that methodology;

- the residential land has not been sold by the claimant; and
- the repair cost is not disproportionate to the Diminution of Value of the property, having regard to the particular circumstances of the claimant (including his or her stated intentions in relation to repair of the land)

in which case EQC will settle the claim by payment of the repair costs, together with any residual Diminution of Value associated with any area of damaged land not remediated by the repair methodology.

Repair of damage on the Port Hills

Port Hills land damage is more conventional as there is no liquefaction. Compared to damage on the flat, it is more straightforward to assess on a case by case basis. However, it is more difficult to assess, estimate and/or reinstate on a grouped basis.

Port Hills land damage occurred predominantly during the EQ2 and EQ3 events and most related to the failure of retaining walls. There was also damage arising from landslides and rock fall. There was a lot of minor slope failure in general but it is not considered to be ongoing or to represent an ongoing risk. The overall land stability is the same and any future damage would require the occurrence of future major events. In general, repairs and reinstatement of the damage is possible.

B.4 EQC operations outside those specified in the Act

EQC assumed, on behalf of Government, responsibility for a broader than usual range of activities related to the Canterbury earthquake recovery. However, the costs of these extra activities outside the Act were accounted for separately and funded from monies made available by the Crown specifically for these purposes.

Such activities include providing for:

- Emergency repairs (where outside EQC cover, for example for uninsured homes).
- Land strengthening at one locality (Spencerville) where the reinstatement of housing required engineering works that could not be facilitated under EQC cover rules and Government agreed to meet the cost.

C Kaikoura Earthquake – Background

C.1 Event

The 2016 Kaikoura earthquake was a magnitude 7.8 (Mw) earthquake in the South Island of New Zealand that occurred two minutes after midnight on 14 November 2016 NZDT. The earthquake started at about 15 kilometres (9 mi) north-east of Culverden and 60 kilometres (37 mi) south-west of the tourist town of Kaikoura and at a depth of approximately 15 kilometres (9 mi).

Ruptures occurred on multiple fault lines in a complex sequence that lasted for about two minutes. The cumulative magnitude of the ruptures was 7.8, with the largest amount of that energy released far to the north of the epicentre. The large magnitude of the quake makes it second in magnitude to only one New Zealand earthquake since European settlement of the country. Two casualties were reported in Culverden and Kaikoura.

C.2 Management of claims

In order to facilitate the efficient management of claims, a Memorandum of Understanding (MoU) has been signed between EQC and eight private insurers. In summary, almost all building and contents claims will be managed by the relevant private insurer, who will then invoice EQC for their share of claims costs and claims handling expenses.

Building and contents claims that will be managed by EQC include:

- Claims where there is still an open prior EQC claim.
- Claims where the private insurer is not party to the MoU.

EQC will also be managing all land claims.

C.2.1 Implications of the MoU

There are some challenges that arise from the MoU and these include the fact that third parties will be managing EQC's claims on its behalf. In addition, the timeliness and quality of claims information may be slower than would otherwise be experienced as EQC will be waiting for the insurers to submit supporting claim documentation. Lastly it is noted that EQC will need to connect with eight different insurers (with eight different ways of operating) in a detailed manner.

C.3 Insurance impact

Images of the earthquake damage focus on massive landslips that occurred on the eastern side of the South Island, especially around Kaikoura. Many of these slips will have no insurance impact for EQC.

In respect of residential buildings, there is unsurprisingly a great deal of damage around the area of the fault rupture with less damage the further away. An anomaly to this is that the frequency of shaking was such that it mirrored the natural shaking frequency of medium rise buildings in Wellington.

Therefore, there appears to be disproportionate damage in these medium rise buildings, relative to low and high rise buildings. These medium rise buildings include apartment blocks, which will fall under EQC's liability.

D Kaikoura Earthquake – Methodology

This appendix summarises the methodology used to estimate the cost of the Kaikoura earthquake of 14th November 2016 for the draft ILVR dated 24 January 2017. The Kaikoura model only deals with damage from the earthquakes, not damage from the storms in Wellington shortly afterward (which are addressed using the standard BAU model).

The valuation model prepared by MJW uses input (including a deterministic model) provided by T+T. The T+T model dealt only with building and land claims (not contents claims) in the LDL and LDU-H and LDU-M zones (defined below).

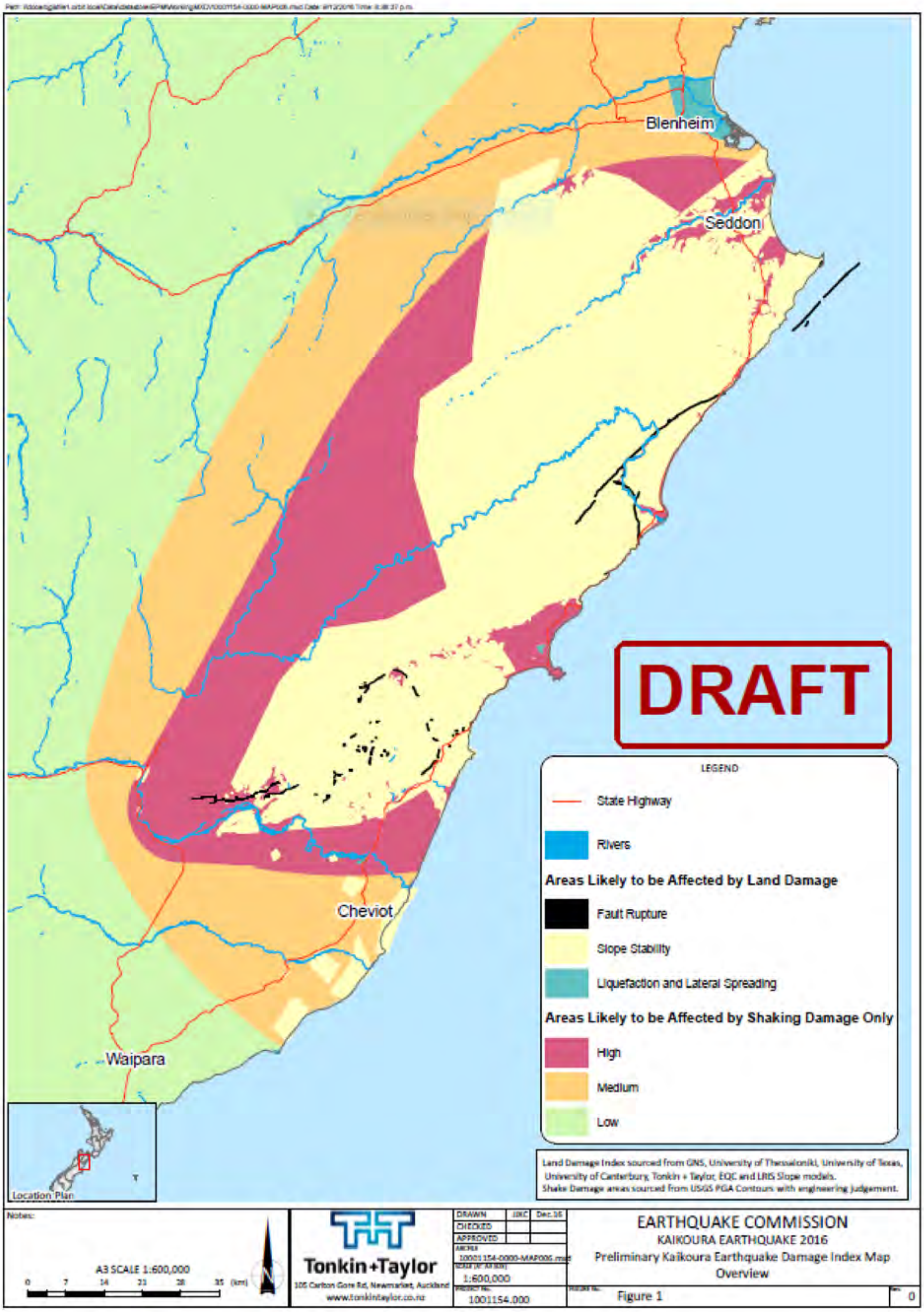
The assumptions selected by MJW are intended to be consistent with those shown in the T+T model.

D.1 Zone classification

The methodology described below is applied to eight distinct zones, based on discussions with T+T. The zones are:

- The Land Damage Likely ('LDL') zones:
  - Fault rupture: LDL-F
  - Slope instability: LDL-S
  - Both fault rupture and slope instability: LDL-FS
  - Liquefaction: LDL-L
- The Land Damage Unlikely ('LDU') zones:
  - High shaking: LDU-H
  - Moderate shaking: LDU-M
  - Low shaking: LDU-L
- Apartments in the Wellington region: WGN-A

The picture on the following page illustrates the various zones. The LDU-L zone is effectively the rest of New Zealand.


Blenheim
Seddon
Cheviot
Waipara
DRAFT
LEGEND
State Highway
Rivers
Areas Likely to be Affected by Land Damage
Fault Rupture
Slope Stability
Liquefaction and Lateral Spreading
Areas Likely to be Affected by Shaking Damage Only
High
Medium
Low
Land Damage Index sourced from GNS, University of Thessaloniki, University of Texas, University of Canterbury, Tonkin + Taylor, EQC and LRIS Slope models.
Shake Damage areas sourced from USGS PGA Contours with engineering judgement.
Location Plan
Notes:
A3 SCALE 1:600,000
0 7 14 21 28 35 (km)
Tonkin+Taylor
105 Carlton Gore Rd, Newmarket, Auckland
www.tonkintaylor.co.nz
DRAWN
CHECKED
APPROVED
Dec.16
1:600,000
1001154.000
EARTHQUAKE COMMISSION
KAIKOURA EARTHQUAKE 2016
Preliminary Kaikoura Earthquake Damage Index Map
Overview
Figure 1
0

D.2 Methodology overview

For building claims we have modelled the cost to EQC as being a function of four elements:

- The number of dwellings exposed to potential damage[1]
- The probability that each of these which will report a claim (where a claim has not already been reported for that dwelling)[1]
- The probability that a reported claim will result in some non-zero cost to EQC
- The distribution of the cost of each non-zero claim to EQC. This is specified as:
  - For claims other than those in the LDU-L zone and WNG-A zones, the percentage of the building which is damaged by the earthquakes i.e. a Building Damage Ratio ('BDR')
  - For claims in the LDU-L and WNG-A zones, the cost of the claim in dollars.

[1]Except for the LDU-L zone.

For the LDU-L zone we directly modelled the number of claims reported, rather than modelling the exposure and reporting percentage.

For land and contents claims we used a similar methodology with some exceptions:

- The likelihood of a claim notification was modelled as a function of whether or not a building claim is notified
- The claim amounts were modelled as dollar costs rather than BDRs.

D.2.1 Stochastic modelling

The methodology above is applied in a random, stochastic manner. That is, for each dwelling in each zone we randomly simulate:

- Whether or not a claim will be notified
- Whether or not a notified claim will result in some non-zero cost to EQC
- The amount of that non-zero cost to EQC.

Whether or not a claim is notified and whether it results in a non-zero cost are modelled using a binomial distribution. The number of notified claims for the LDU-L zone is modelled using a uniform distribution.

The cost of each non-zero claim is modelled based on a lognormal distribution, either based on the amount of damage (in absolute dollar terms) or as a building damage ratio (based on Minerva modelled dwelling values). After modelling the amount of damage to each dwelling, the EQC cost is calculated by applying the relevant caps and excesses.

The results are aggregated for each zone and for each type of claim i.e. land, building and contents. This is done 10,000 times and the distribution of results is analysed.

D.3 Exposure base

We obtained a dataset of housing stock from T+T, based on data from Minerva, detailing the residential dwellings categorised by zone. We also obtained a dataset directly from Minerva from which we extracted dwellings in the Wellington region which were categorised as residential apartments. The number of dwellings in each zone are given below.

Number of dwelling exposures

Zone	Number of dwellings
LDL-FS	140
LDL-F	13
LDL-S	1,006
LDL-L	2,800
LDU-H	3,179
LDU-M	18,086
LDU-L	rest of the country
WGN-A	8,144

D.4 Building claims

D.4.1 Reporting percentage

For the valuation model we allowed for those properties in each zone where there was already a claim associated with that dwelling and then applied probabilities that the remaining dwellings would lodge a claim. The table below summarises the assumptions.

Reporting percentage assumptions - building claims

Zone	Proportion having already notified a claim	Assumed probability of future notification	Implied ultimate proportion notified
LDL-FS	20.4%	95.0%	96.0%
LDL-F	85.7%	95.0%	99.3%
LDL-S	37.9%	93.5%	96.0%
LDL-L	18.3%	45.0%	55.1%
LDU-H	43.3%	60.0%	77.3%
LDU-M	10.0%	7.5%	16.7%
LDU-L	n.a.	n.a.	n.a.
WGN-A	4.5%	47.5%	49.9%

n.a. - not applicable

For the WGN-A zone, which was not addressed in the T+T model, we conducted some random sampling to test whether those dwellings in the exposure data labelled as apartments were genuinely mid-high rise apartments (as opposed to townhouses or 1-2 level terraced housing which might possibly be referred to as apartments). Our sampling found that the majority were genuine mid-high rise apartments, and we understand that these were fairly susceptible to the long, slow rocking of the Kaikoura event. We used a reporting percentage for new claims of 47.5% which implies an ultimate reporting rate of 50% for Wellington apartments.

For the LDU-L zone, which was also not addressed in the T+T model, we identified 11,068 claims notified to date where the QPID was matched to a property in the LDU-L zone. There were an additional 1,343 claims which were not matched to a QPID but for which T+T have estimated that they are located in the LDU-L zone. We have assumed there will be another 5,000 +/- 3,500 claims notified in the LDU-L zone.

D.4.2 Non-zero percentage

High level analysis of other events suggests that around 70% of building claims reported will result in some non-zero cost to EQC. The other 30% are closed without cost to EQC. This however is likely to vary by zone i.e. the more damaged zones will have fewer zero claims. The table below shows the assumptions we have used.

Non-zero probability assumptions - building claims

Zone	Assumed probability that a nofication will result in a non-zero cost
LDL-FS	99%
LDL-F	99%
LDL-S	99%
LDL-L	95%
LDU-H	90%
LDU-M	90%
LDU-L	60%
WGN-A	70%

Taking the weighted average non-zero percentage over all zones results in an overall non-zero percentage for the Kaikoura event of around 70%.

Combining our reporting and non-zero assumptions gives implied proportions of exposures resulting in non-zero damage by zone. These implied figures are reasonably consistent with the T+T assumptions.

D.4.3 Claim size

In the valuation model we have used a lognormal distribution to model BDRs for each zone and capped the results at 100%. The lognormal distributions are scaled to achieve the intended mean and proportion capping at 100% based on our discussions with T+T. The assumptions are:

BDR distribution assumptions

Zone	Lognormal parameter mu	Lognormal parameter sigma	Implied proportion of non-zero claims with 100% BDR	Average non-zero BDR where <100%
LDL-FS	0.3958	1.4075	61%	47%
LDL-F	0.3958	1.4075	61%	47%
LDL-S	-1.5013	1.4075	14%	26%
LDL-L	-1.4213	1.4075	16%	27%
LDU-H	-1.6032	1.2686	10%	25%
LDU-M	-1.9560	0.8326	1%	19%
LDU-L	n.a.	n.a.	n.a.	n.a.
WGN-A	n.a.	n.a.	n.a.	n.a.

n.a. - not applicable

For the LDU-L and WGN-A zones we have used a lognormal distribution to model the actual damage amount in dollar terms (rather than the BDR). The parameters of the lognormal distributions are such that:

- In the LDU-L zone the average building damage is $1,000 and the CoV[1] is 250%
- In the WGN-A zone the average building damage is $25,000 and the CoV[1] is 200%

[1]CoV – coefficient of variation i.e. the mean of a distribution divided by the standard deviation of that distribution.

D.5 Contents claims

D.5.1 Reporting percentage

The valuation model includes assumptions for contents claim notifications both where a building claim has been (modelled to be) notified for a property and also where there is no building claim notified. Analyses of historical events found that for BAU events the number of contents claims was typically around 20% that of building claims, whereas for EQ1 and EQ3 the figure was closer to 40%. Our assumptions are set out in the table below.

Reporting percentage assumptions - contents claims

Zone	Probability of contents claim given that there is a non-zero building claim	Probability of contents claim where there is a no non-zero building claim	Implied total contents notifications as a proportion of building notifications
LDL-FS	20%	15%	21%
LDL-F	20%	15%	20%
LDL-S	20%	15%	21%
LDL-L	20%	15%	32%
LDU-H	20%	15%	24%
LDU-M	20%	1%	23%
LDU-L	20%	n.a.	12%
WGN-A	25%	20%	44%

n.a. - not applicable

We expect there will be a higher ratio of contents to building claims for the Wellington apartments than for the other zones.

D.5.2 Non-zero percentage

Looking at other events shows non-zero percentages averaging around 60% for both large BAU events and EQ1 and EQ3. We have used a non-zero percentage for contents claims of 60% for each zone.

D.5.3 Claim size

We looked at the ratio of average contents to building claim sizes for other events. For large BAU events this was generally around 25-35% whilst for EQ1 and EQ3 the ratio was around 10-20%. Generally, (though with exceptions) the larger the event, the lower the average contents claim when expressed as a proportion of the average building claim.

For the valuation model we used selected assumptions for lognormal distributions to model the contents claims with the building/contents ratios from other events in mind. The table below shows the assumptions we used.

Claim distribution assumptions - contents

Zone	Lognormal parameter mu	Lognormal parameter sigma	Implied average non-zero contents claim
LDL-FS	9.2692	0.8326	15,000
LDL-F	9.2692	0.8326	15,000
LDL-S	9.2692	0.8326	15,000
LDL-L	8.9591	0.8326	11,000
LDU-H	8.9591	0.8326	11,000
LDU-M	7.9475	0.8326	4,000
LDU-L	7.2543	0.8326	2,000
WGN-A	8.1706	0.8326	5,000

D.6 Land claims

D.6.1 Reporting percentage

Similarly to contents claims we have modelled the probability that a property will lodge a land claim as a function of whether a non-zero building was lodged. However, we have not allowed for any land claims where there is no non-zero building claim.

The factors affecting our selection of land notification probabilities were:

The T+T model assumes there will be around 1,800 non-zero land claims

As at 9 January 2017 there were around 2,000 land claims reported for the Kaikoura event (some of which will ultimately be zero claims).

For EQ1 and EQ3 around 75% of land claims were notified by day 56 (9-Jan being day 56 for the Kaikoura event); for the 14th February 2016 event the figure was around 60%.

We expect very high land claim proportions in the LDL zones and much lower proportions in the LDU zones.

The table below shows the assumptions we have used.

Reporting percentage assumptions - land claims

Zone	Probability of land claim given that there is a non-zero building claim	Implied number of land claim notifications
LDL-FS	95%	98
LDL-F	95%	7
LDL-S	95%	744
LDL-L	95%	1,325
LDU-H	10%	204
LDU-M	5%	127
LDU-L	0%	0
WGN-A	30%	815

D.6.2 Non-zero percentage

There is little history to draw upon in regard to the proportion of land claim notifications resulting in a non-zero cost. The Canterbury events are still developing in terms of land damage and earlier BAU events are generally not comparable to the Kaikoura event in terms of land damage.

We expect that most of the claims notified in the LDL zones will result in some non-zero cost to EQC whereas much fewer of those in the LDU will result in some non-zero cost. The table below shows our assumed non-zero claim probabilities.

Non-zero percentage assumptions - land claims

Zone	Assumed probability that a notification will result in a non-zero cost
LDL-FS	95%
LDL-F	95%
LDL-S	90%
LDL-L	80%
LDU-H	50%
LDU-M	25%
LDU-L	0%
WGN-A	15%

D.6.3 Claim size

We have modelled the claim sizes as lognormal distributions. The parameters chosen are such that the average costs are consistent with the T+T model for the LDL zones. . We have also allowed for smaller land claims for the few potential land claims outside of the LDL zones. The table below sets out our assumptions.

Claim distribution assumptions - land

Zone	Lognormal parameter mu	Lognormal parameter sigma	Implied average non-zero contents claim
LDL-FS	9.5569	0.8326	20,000
LDL-F	9.5569	0.8326	20,000
LDL-S	8.8638	0.8326	10,000
LDL-L	8.1706	0.8326	5,000
LDU-H	7.4775	0.8326	2,500
LDU-M	7.4775	0.8326	2,500
LDU-L	7.4775	0.8326	2,500
WGN-A	7.4775	0.8326	2,500

D.7 Claims handling expenses

A range of potential claims handling expenses was estimated by EQC as a function of the likely number of claims involved and categorised according to the various cost elements.

We reviewed the calculation in the context of the claims management agreements with insurers and also the experience of the Canterbury earthquakes. We selected a figure within the range that we believe represents a reasonable central estimate of CHE costs and included an allowance for potential cost inflation.

For the Kaikoura event the CHE as a percentage of ultimate cost (including CHE) is around 15%. As a sense check we compared this with the CHE percentages for Canterbury earthquake events. These range from around 12% for EQ2 to 23% for EQ4. One would generally expect a higher CHE percentage for a smaller event (as indirect costs are spread over a smaller volume of claims), although it should be noted that the Canterbury CHE costs include significant PMO fees which aren’t part of the Kaikoura CHE costs under the MoU. As such the 15% CHE for Kaikoura appears reasonable in the context of the Canterbury events.

E EQC Reinsurance

E.1 EQC reinsurance

E.1.1 Cover

EQC utilises catastrophe reinsurance to reduce net claims volatility. From 1 June 2010 EQC had reinsurance treaties in place providing cover per event above a $1.5b deductible up to an upper limit of $4.0b – i.e. maximum $2.5b reinsurance cover per event (less a small amount of coinsurance). This cover was placed in tranches and layers subject to different terms. Ongoing reinsurance cover after each event is complex as it depends on the usage of each layer and the reinstatement, replacement or renewal of each tranche and / or layer as relevant.

This reinsurance structure was the same for the 2011/12 year.

9(2)(j) [redacted]

E.2 Reinsurance periods

EQC reinsurance periods commence 1 June (and so do not correspond with EQC financial year that commences 1 July.) Reinsurance is a mix of annual and 3 year contracts.

EQC has had several different reinsurance situations over the period from 1 June 2010. The situations are complex as each depends on the level of costs incurred by EQC for the various events that have occurred and the layers of reinsurance that are ultimately triggered by each event, as these affect the ongoing cover provided by the reinsurance treaties in place.

E.3 Reinsurance event definition

In EQC reinsurance treaties, there are two sections within the clauses dealing with reinsurance 'event' definition, the vital points being:

- Losses incurred within 720 hours of the nominated event start time but also
- All additional losses, as a result of earthquakes/aftershocks occurring within 250km radius of the originally nominated earthquake.

Further, the reinsurance is limited to coverage of losses as set out in the Earthquake Commission Act.

E.4 Reinsurance events occurring in the financial year 1 July 2010 – 30 June 2011

Of the earthquake events that have given rise to claims on EQC over the financial year ended 30 June 2011, it is clear that two will trigger the reinsurance.

- EQ1 on 4 September 2010,
- EQ2 on 22 February 2011,

A third is possible - EQ3 on 13 June 2011 - although the estimate remains subject to uncertainty until the land settlement framework and apportionment is confirmed. At this stage, the estimated ultimate incurred costs suggest that the top and drop layer may not be required to respond.

For reinsurance purposes, all other earthquake claims can be regarded as 'other earthquake' claims.

E.5 Reinsurance events occurring in the financial year 1 July 2011 – 30 June 2012

There have been further aftershocks since 1 July 2011 that have given rise to claims on EQC, including EQ4 on 23 December 2011. However, it is not expected that these will trigger the reinsurance.

E.6 Reinsurance protection in place for EQC for the period 1 June 2010 – 31 May 2011

As from 1 June 2010, and effective for EQ1, EQC reinsurance programme was made up of three layers, providing a total of NZD 2.4775b* cover excess of NZD 1.5b first loss deductible:

- Layer 1: NZD $500m xs NZD $1,500m
- Layer 2: NZD $1,500m xs NZD $2,000m
- Layer 3: NZD $500m xs NZD $3,500m

*Note that EQC co-insured 1.5% or NZD 22,500,000 of Layer 2 (on the 2009 3-year placement).

Layers 1 and 2 were made up from four equal tranches, with 3 of the tranches placed on 3-year contracts and the fourth tranche as an annual contract. The 3-year contracts for these layers have annual re-signing. (This structure had been used for some years so that 50% of Layers 1 and 2 were renewed each year.) Both these layers had one automatic reinstatement. After EQ1 a back-up cover for Layer 1 was purchased.

Layer 3 was placed 100% on a 3-year contract in 2009 and had one automatic reinstatement after a loss over the period of the contract (3 years) with a 'Top and Drop' feature.

EQC reinsurance year ends on 31 May each year.

E.7 Reinsurance protection in place for EQC for the period 1 June 2011 – 31 May 2012

From 1 June 2011, the reinsurance situation depended to some degree on the extent to which events during the previous year (EQ1 and EQ2) impacted on reinsurers.

The 2009 and 2010 3-year Layer 1 and 2 contracts were re-signed. As at 1 June 2011, new cover for 50% of Layers 1 and 2 was placed under annual contracts (no 3-year contract being available). The 2011/12 parts of Layers 1 and 2 allow for one reinstatement at 100%.

As noted above, EQC co-insured 1.5% or NZD 22,500,000 of Layer 2 (on the 2009 3-year placement), and it now also co-insures 0.719% (or NZD 10,785,000) of Layer 2 on the 2011/12 placement.

Layer 3 was placed 100% on a 3-year contract in 2009 and had one automatic reinstatement after a loss over the period of the contract (3 years) with a 'Top and Drop' feature. As there is a cap of NZD 1b on total recoveries under this contract, the extent of cover available after 1 June 2011 is dependent on the extent to which it has been impacted by earlier events.

Ongoing cover depends on the impact of EQ3, as well as on EQ1 and EQ2.

E.8 Reinsurance protection in place for EQC for the period 1 June 2016 – 31 May 2017

9(2)(j)

[redacted]

E.9 Reinsurance recoveries

Reinsurance recoveries become payable to EQC once gross payments (claims and associated claims handling expenses) exceed the relevant treaty deductible.

Pre-funding for any event can only be requested once an official incurred estimate exceeding the programme deductible has been issued.

F Information and Data – Further Detail – Canterbury only

The figures in the following tables are based on an Actuarial Data Extract from ClaimCentre as at 31 December 2016.

F.1 Actuarial Data Extract from ClaimCentre (31 December 2016)

F.1.1 Number of notified claims

Number of notified claims (ClaimCentre)

	EQ1	EQ2	EQ3	EQ4	AS	Total
Total	144,996	144,314	54,185	47,298	41,412	432,205

Number of notified claims (ClaimCentre) - all incl duplicates

	EQ1	EQ2	EQ3	EQ4	AS	Total
Total	156,622	157,304	56,441	48,794	42,725	461,886

- Duplicate claims are excluded from our tables (unless noted otherwise). Duplicate claims are included in the BIU daily report.
- The total number of claims on the daily report includes those from a number of other earthquake events which are not specifically identified. In this section, we have included these claims in the AS group.

The following tables are based on sub-claims rather than claims. Each claim lodged with EQC includes up to three sub-claims (also known as 'exposures') corresponding to land, building or contents losses.

F.1.2 Number of notified sub-claims – excludes duplicates

Number of notified sub-claims (ClaimCentre)

	EQ1	EQ2	EQ3	EQ4	AS	Total
Land sub-claims						
Total	48,828	64,059	19,054	14,164	5,612	151,717
Building sub-claims						
Total	135,891	126,429	48,797	42,627	38,555	392,299
Contents sub-claims						
Total	55,302	82,248	20,286	12,109	7,794	177,739
All sub-claims						
Total	240,021	272,736	88,137	68,900	51,961	721,755

- In respect of the Canterbury earthquake claims, there were 1.7 sub-claims per claim on average.
- Comparing EQ1 and EQ2 we see a similar number of building claims but a higher number of land and contents claims for EQ2.

F.1.3 Sub-claims paid to date

Sub-claims paid to date (ClaimCentre)

	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
Land sub-claims						
Total	24.7	279.4	8.3	0.9	0.7	314.1
Building sub-claims						
Total	1,393.9	3,066.8	312.8	109.5	93.4	4,976.3
Contents sub-claims						
Total	125.2	300.4	28.8	12.4	7.5	474.3
All sub-claims						
Total	1,543.7	3,646.6	349.9	122.8	101.6	5,764.8

- This table only includes claims paid to date as recorded in ClaimCentre.
- Claims costs attributable to Fletcher EQR are not in ClaimCentre and account for another $2,521m. Total building sub-claim payments equal $7,498m.
- EQ1 and EQ2 account for 90% of the total claims paid to date and building claims amount to 87% of the total paid.

F.2 Minerva loss model

Minerva is a complex and powerful model built specifically for EQC to predict the cost of natural catastrophes. It was created to provide data on the potential cost of disasters and hypothetical disasters, and to assist in assessing the capital and reinsurance needs of EQC.

When calculating unexpired risk reserves for use in the Liability Adequacy Test, we have referred to Minerva output providing a probability distribution for potential major catastrophes occurring throughout New Zealand over a specified period of time (usually one year).

Minerva generates, according to the type of event, the nature and severity at which the event will impact on surrounding locations. Algorithms for levels of damage to each eligible property are applied, and hence the dollar amount arising from each EQC claim is projected.

The model takes into account the extent of EQC coverage provided (excesses and limits), and allows for assumed levels of non-insurance of eligible properties. The value of contents is related to the value of buildings, and expected claims are then projected based on severity. Variations about central values of severity and level of damage are incorporated in the calculations.

F.2.1 The model and its calibration

With regards to properties covered by EQC (i.e. primarily domestic buildings), the data includes details of age, construction and size as well as current value. Data has been derived from a full set of information obtained from Quotable Value New Zealand, usually in the second half of each year.

Data on properties covered was last updated as at mid-2009 for calculations carried out in early 2010. Information relating to properties in Canterbury would have been significantly affected by earthquakes. This situation has to be taken into account when reviewing the output from Minerva after mid-2010.

9(2)(ba)(i) [redacted]

F.2.2 *Use of the model for this valuation*

As noted above, the data on Canterbury buildings currently held in Minerva will need to be updated to reflect the current situation, including a review of the frequencies assumed to apply for earthquakes affecting Christchurch. Over the next several years, the probability of further earthquakes in the Canterbury area remains at a heightened level.

Also, it is noted that data for the rest of New Zealand should be updated and that the Minerva model requires recalibration for new exposure, risk and damage levels, particularly land damage information. However, in the absence of other modelling, the Minerva output is considered to be the most suitable for this valuation.

As a result of the issues identified above we have adapted our premium liabilities modelling by referring to a Minerva run excluding Canterbury and adding a new component to the premium liabilities to allow for Canterbury and Kaikoura earthquakes.

F.3 People consulted

MJW has consulted a number of people in the course of preparing this valuation for EQC. The people noted below are those with whom we had had discussions recently to help in the production of this report.

F.3.1 *EQC Executive*

Bryan Dunne – GM Strategy and Transformation

Hugh Cowan – GM Reinsurance, Research and Education

Gillian Dudgeon – GM Internal Partners

- Land issues.
- ‘Big picture’ issues.

- Financial statements.
- Claims handling expenses.

F.3.2 EQC Finance Team

9(2)(a) [redacted] – Reinsurance Claims Manager

- 'Big picture' issues.
- Accounts.
- Apportionments.
- Reinsurance

Chris Chainey – Financial Controller

- Accounts.
- Claims handling expenses

F.3.3 EQC Canterbury Event Field Office

Trish Keith– GM Customer & Claims

- Operational claims progression.

Jonathan Reid – Manager – Canterbury close out

- Progression of remaining Canterbury claims

9(2)(a) [redacted] – Business Services Manager

- Liaison to EQR.

F.3.4 EQC legal team

Jeremy Ford – Chief Legal Advisor

F.3.5 Chapman Tripp

9(2)(a) [redacted] – Partner

- Legal issues

9(2)(a) [redacted] – Partner

- Legal issues

F.3.6 Tonkin + Taylor

9(2)(a) [redacted] – Senior Geotechnical Engineer

- Land claims issues and costs (Canterbury and Kaikoura).

9(2)(a) [redacted] – Geotechnical Engineer

- Land claims issues and costs (Canterbury and Kaikoura).

G Data Validation

G.1.1 Actuarial Data Extract vs Daily Report

The table below shows a reconciliation of the 31 December 2016 Actuarial Data Extract received from the ClaimCentre (CIMS) system against the Business Information Unit's Daily Report for 31 December 2016.

Canterbury earthquakes only
Reconciliation of ADE to Daily Report

Event	Event Date	ADE - 31 Dec 2016 Number of Claims	Building $000s	Land $000s	Contents $000s	Paid $m	EQR Paid $m	Total Paid $m	Daily Report - 31 Dec 16 Number of Claims	Paid $m	Difference Number of Claims	Paid $m
EQ1	4-Sep-10	156,622	1,390,611	25,077	125,319	1,541	497	2,038	156,621	2,039	(1)	1
AS	19-Oct-10	3,631	8,531	74	470	9	8	17	3,631	17	0	0
AS	14-Nov-10	2,611	5,881	54	238	6	6	12	2,611	12	0	0
AS	26-Dec-10	19,040	38,237	281	3,411	42	41	83	19,040	83	0	0
AS	20-Jan-11	2,852	5,889	101	466	6	8	14	2,852	14	0	0
AS	4-Feb-11	633	2,538	45	347	3	3	6	633	6	0	0
EQ2	22-Feb-11	157,304	3,062,999	287,632	300,722	3,651	1,339	4,991	157,304	4,994	0	3
AS	16-Apr-11	3,646	7,574	34	1,144	9	23	32	3,646	32	0	0
AS	30-Apr-11	192	469	-	33	1	1	2	192	2	0	0
AS	10-May-11	975	2,398	2	135	3	6	9	975	9	0	0
AS	6-Jun-11	2,291	6,536	63	449	7	14	21	2,291	21	0	0
EQ3	13-Jun-11	54,206	303,902	8,115	28,359	340	493	833	54,206	834	0	1
EQ3	21-Jun-11	2,235	8,950	213	517	10	20	30	2,235	30	0	0
AS	9-Oct-11	5,635	13,392	83	613	14	11	26	5,635	26	0	0
EQ4	23-Dec-11	48,794	105,938	924	12,462	119	51	170	48,794	170	0	0
Other Canterbury event*		1,219	2,408	-	176	3	-	3	8,793	22	7,574	19
Total		461,886	4,966,254	322,698	474,861	5,764	2,521	8,285	469,459	8,310	7,573	24

The level of agreement is satisfactory for valuation purposes.

The table below illustrates a reconciliation of the 31 December 2016 Actuarial Data Extract received from the ClaimCentre (CIMS) system against the Business Information Unit's Daily Report for 31 December 2016.

Validation of ClaimsCentre (CIMS) Actuarial Data Extract
Comparison to BIU Daily Report - Canterbury Earthquakes only

	ADE - 31 December 2016					
	EQ1	EQ2	EQ3	EQ4	AS + Other Canterbury	Total
ADE and Fletcher - 31 December 2016						
Number of claims						
Open	59,351	67,598	21,494	9,224	11,827	169,494
Closed	97,271	89,706	34,947	39,570	29,679	291,173
Total	156,622	157,304	56,441	48,794	41,506	460,667
Paid to Date ($000s)						
Total	2,038,235	4,990,667	862,631	170,072	221,039	8,282,644
Number of subclaims						
Land	50,255	67,083	19,540	14,476	5,609	156,963
Building	146,370	137,022	50,677	43,914	38,602	416,585
Contents	57,780	87,598	20,978	12,478	7,797	186,631
Total	254,405	291,703	91,195	70,868	52,008	760,179
Daily Report - 31 December 2016						
Number of claims						
Open	59,351	67,598	21,494	9,224	13,156	170,823
Closed	97,270	89,706	34,947	39,570	37,143	298,636
Total	156,621	157,304	56,441	48,794	50,299	469,459
Paid to Date ($000s)						
Total	2,039,308	4,993,558	863,737	170,181	221,302	8,288,086
Number of subclaims						
Land	50,254	67,083	19,540	14,476	6,406	157,759
Building	146,369	137,022	50,677	43,914	47,009	424,991
Contents	57,780	87,598	20,978	12,478	8,501	187,335
Total	254,403	291,703	91,195	70,868	61,916	770,085
Difference						
Number of claims						
Open	-	-	-	-	(1,329)	(1,329)
Closed	1	-	-	-	(7,464)	(7,463)
Total	1	-	-	-	(8,793)	(8,792)
Paid to Date ($000s)						
Total	(1,073)	(2,891)	(1,106)	(110)	(262)	(5,442)
Number of subclaims						
Land	1	-	-	-	(797)	(796)
Building	1	-	-	-	(8,407)	(8,406)
Contents	-	-	-	-	(704)	(704)
Total	2	-	-	-	(9,908)	(9,906)

H Expense Analysis

EQC have provided a CHE forecast which summarises the indirect claims expenses paid to date and projects these forward for the remaining expected duration of the Canterbury earthquake settlement programme.

This forecast is seen as being the most credible source of claims handling expense information.

For this valuation, we have reviewed the forecast and compared it to previous forecasts.

H.1 Adopted approach

The CHE Forecast (provided by EQC finance) has been blended with an expense analysis to arrive at assumptions for the valuation.

The expense analysis apportions the total CHE costs between events.

H.2 CHE event apportionment

CHE costs that can be identified as being wholly related to specific claim costs are separated from the remainder of the CHE. These related indirect expenses have been apportioned in relation to the underlying claim costs. The remaining unrelated indirect expenses have been apportioned in relation to sub-claim counts.

Specifically, the methodology used is:

- CHE - paid to date
  - A trial balance is obtained from EQC and the expenses are summarised by cost centre.
  - Cost centres which relate wholly to a particular claim cost are tagged as *related indirect expenses* ('RIE'). An example of this is the costs associated with EQR.
    - There will be separate RIE for land, building, and contents.
  - The remaining costs are tagged as *unrelated indirect expenses* ('UIE'). An example of this might be head office salaries.
  - The sum of RIE and UIE will equal the CHE costs paid to date.
- CHE - future
  - The CHE forecast has been broken down by cost centres. In a similar manner to CHE – paid to date, future RIE have been identified and apportioned in line with the underlying claim costs. The remaining future CHE is assumed to UIE.
  - Future UIE is apportioned between events in relation to sub-claim counts.

H.3 Kaikoura CHE

Under the Memorandum of Understanding, the eight relevant insurers will invoice EQC in respect of claims handling expenses incurred as a result of managing EQC's claims.

9(2)(i) [redacted]

EQC finance has carried out a projection exercise and has estimated that the total CHE costs for Kaikoura may be in the range of $78 million - $91 million.

We have used a figure in the middle of this range for our valuation, that being $85 million. NB that after modelling and allowing for inflation, this is shown as $86 million in the results.

H.4 Conclusion

The results are shown below.

Estimated undiscounted/uninflated Claims Handling Expenses (CHE) - all indirect costs

	EQ1	EQ2	EQ3	EQ4	AS	KEQ	Total
Total Costs							
Paid to date - reinsurable ($000s)	465,646	766,538	112,640	37,537	49,930	0	1,432,292
Paid to date - non reinsurable ($000s)	558	694	171	77	83	0	1,582
Paid to date - total ($000s)	466,204	767,231	112,811	37,614	50,013	0	1,433,874
0							
Estimated future - reinsurable ($000s)	16,524	34,248	11,649	1,899	1,155	85,000	150,474
Estimated future - non reinsurable ($000s)	0	0	0	0	0	0	0
Total future - total ($000s)	16,524	34,248	11,649	1,899	1,155	85,000	150,474
Total ($000s)	482,727	801,479	124,460	39,513	51,168	85,000	1,584,347

I Outstanding Claims Liabilities – Detailed Methodology

I.1 Construction of individual event / sub-claim distributions

The outstanding claim liabilities were estimated using separate models for each valuation group (i.e. by sub-claim and event). The models vary significantly for each sub-claim group with further variations included as required to adequately model each event. The output from each model produced an estimated ultimate claims cost distribution (including inflation and demand surge) for the relevant event / sub-claim group as well as CHE.

I.1.1 Land sub-claims cost distribution

Canterbury earthquakes

The Canterbury earthquake land model is described in Appendix K.

BAU

An aggregate frequency/severity stochastic model was adopted for this component of the liability estimation.

The frequency (i.e. number) of claims was taken to be the number of claims recorded in ClaimCentre as well as an estimated number of future IBNR claims. These were then grouped by loss cause and sub-claim profile (i.e. which combination of sub-claims was notified for a given claim).

Duplicate claims were removed from ClaimCentre and a further allowance was made for nil claims (e.g. declined).

The number of estimated non-nil claims for each event / location group was then multiplied by the claim profile group's average claim size (weighted by loss cause proportion). Variance for each claim profile group was added to create aggregate loss distributions – from which a loss was simulated. The simulations from each claim profile group were then aggregated to a single land aggregate distribution.

The above process was repeated 10,000 times to create an estimated claims cost distribution for each event.

The claims costs were then projected using an assumed payment pattern and base inflation was applied.

I.1.2 Building sub-claims cost distribution

Canterbury earthquakes

The building sub-claim cost distribution uses the ACE apportionment data and EQR repair data to estimate the ultimate cost distribution.

The ACE model uses an individual property stochastic claims model to estimate the cost of Canterbury earthquake building sub-claims.

The model relies on two sets of data:

- ACE apportionment data

- EQR completed properties repair data

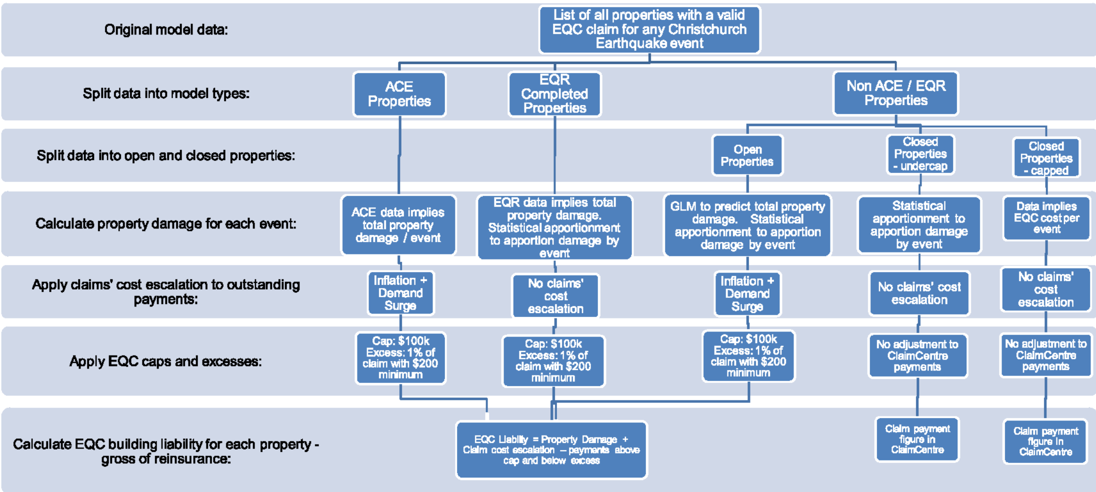
The model consists of three main components:

- Modelling the probability that a building sub-claim will settle for nil cost. This is based on both ACE data and EQR data.
- Modelling average property damage estimates across all events for non-nil sub-claims. This is based on both ACE data and EQR completed repairs data
- Modelling event damage apportionment. This is based solely on ACE apportionment data.

The ACE data is biased towards highly damaged properties. Thus, we expect the settled properties in the ACE database to be significantly different to the other damaged properties without an ACE estimate. The EQR data is also biased but towards properties with mid-range damage. Generalised Linear Models (GLMs) were used to account for biases in the ACE data and EQR data. The GLMs project average claim sizes and nil claim rates onto properties without an ACE or EQR estimate.

See Section 6.1.3 for more details on the ACE apportionment data.

The following diagram illustrates how the ACE model estimates the ultimate building sub-claim cost.



Additional provisions

The ACE model is based on the experience to date and will therefore tend to predict that the outstanding claims will behave in a manner similar to those already settled.

There will therefore need to be additional provisions to allow for tail deterioration and reopened claims.

- Tail deterioration is the expectation that the remaining properties are likely to be more difficult to settle than those that are already settled and will probably cost more.
- Reopened claims include building warranty issues, complaints and insurer washup.
  - Building warranties apply to all properties that have been settled through the Fletcher EQR programme. There will be some proportion of these that require remediation.

- Complaints may come from any undercap property. A proportion of these may result in a higher ultimate settlement.
- Insurer finalisation is the process to ensure there is an appropriate allocation of costs by EQ event and by owner (EQC or insurer) for overcap building claims.

Tail deterioration has been modelled within the GLMs in the ACE model. Residual open EQR claims incur a higher estimated settlement amount than the EQR properties that have closed to date. The Reopened Claims provisions are modelled using a frequency / severity model.

BAU

The outstanding BAU building sub-claims were grossed up by a ratio to reflect future development. A ratio was applied to calculate both a mean and 85th percentile for the aggregate distribution – from which a distribution was inferred.

The claims costs were then projected using an assumed payment pattern and base inflation was applied.

I.1.3 Contents sub-claims cost distribution

Canterbury earthquakes

An aggregate frequency/severity stochastic model was adopted for this component of the liability estimation.

The frequency (i.e. number) of claims was a known value for all events, and was taken from ClaimCentre. These claims were grouped by event and sub-claim profile (i.e. which combination of sub-claims were notified for a given claim).

Duplicate claims were removed from ClaimCentre and a further allowance was made for future nil claims (arising from duplicate claims and other reasons e.g. declined).

The number of estimated non-nil claims for each event / location group was then multiplied by the event / claim profile group's average claim size. Variance for each event / claim profile was added to create aggregate loss distributions by event – from which a loss was simulated. The simulations from each event / claim profile group were then aggregated to a single event distribution.

The above process was repeated 10,000 times to create an estimated claims cost distribution for each event.

The claims costs were then projected using an assumed payment pattern and base inflation was applied.

BAU

Outstanding contents BAU sub-claims were estimated using the same methodology as per land and building sub-claims.

I.1.4 Kaikoura claims cost distribution

A description of the Kaikoura claims costs distribution is shown in Appendix **Error! Reference source not found.**

I.1.5 Claims handling expenses distribution

Canterbury earthquakes & BAU

The estimation of central estimate of CHE (before inflation) for each event was discussed in Appendix H. A cost distribution was then assumed around this central estimate.

The CHE costs were then projected using an assumed payment pattern and base inflation was applied.

I.2 Construction of individual event distributions

The individual sub-claim event distributions derived above were combined to form aggregate gross claims cost distributions (including inflation) for each event. A multivariate copula was used to aggregate these individual distributions.

The variance of each event's aggregate claim cost distribution was adjusted to allow for model (internal systemic) risk and environmental (external systemic) risk. The details of the systemic risk adjustment are set out in Appendix J.2.2. The output of this is the final estimated gross claim cost distribution assumed for each event.

The impacts of reinsurance recoveries were applied to each event's gross distribution to obtain net distributions for each event.

Gross and net paid to date were deducted from the estimated gross and net ultimate distributions to create corresponding outstanding claims distributions.

Discounting for the time value of money was carried out after projecting the aggregate claims costs using an assumed payment pattern.

I.3 Construction of the total EQC entity level distribution

The discounted outstanding net distributions for each event were then combined using a multivariate copula. This created a total aggregate outstanding claims liability distribution for EQC at the entity level from which the final outstanding central estimate and risk margin were obtained.

J Outstanding Claims Liabilities – Detailed Assumptions

J.1 Construction of individual event sub-claim distributions

J.1.1 Land sub-claims cost distribution – Canterbury earthquakes

The land model assumptions are discussed in Appendix K.

J.1.2 Building sub-claims cost distribution – Canterbury earthquakes

Offer & Payment pattern

Estimates for the timing of offers and settlement were based on information provided by the EQC finance team. The table below summarises the assumed, uninflated payment pattern. From this, an estimated mean term to settlement was derived and this was allowed to vary in the model.

Quarter Ending	Cumulative paid
30/06/2017	20%
31/12/2017	63%
30/06/2018	91%
31/12/2018	100%

Claim size and event apportionment

Generalised Linear Models were used to predict the damage each property incurred – both the mean and standard deviation of damage were estimated.

Apportionment was derived from the ACE apportioned cost estimates as well as the David Baird statistical apportionment model (Small PAT).

EQC excesses and limits were then applied to the estimates to calculate the average EQC liability per property for each event.

As a result of using GLMs, the raw assumptions are complex and are best given in a digital format. We are happy to supply these upon request.

GLM predicted damage amounts were only applied to the Non-ACE or EQR properties. Average damage costs for ACE and EQR properties were given by their respective estimates.

Modelled damage apportionments were only applied to the Non-ACE properties. Damage apportionment for ACE properties was given by their ACE apportionment estimates.

Payment pattern

The timing of cash flow payments was based on information initially provided by EQC finance.

Base Inflation and Demand Surge

The total costs were inflated according to when the payment was estimated to be made using the long-term Treasury rate of 2.5% p.a.

Demand surge was simulated on a semi-annual basis – for each half year a demand surge event was simulated using a Bernoulli process and the percentage increase in cost (on top of base inflation) was also simulated. Any payments during that year were correspondingly increased.

The assumptions used were:

- Demand surge probability 50%
- Demand surge mean 15%

J.1.3 Contents sub-claims cost distribution – Canterbury earthquakes

Nil claim rates

The nil claim rates for each event / sub-claim profile group were set to zero for the 31 December 2016 valuation. This assumption implies that all nil contents claims have been identified as such.

Estimated claim size average and standard deviation

The average claim size and variance for claims in each event / sub-claim profile group were estimated using closed contents sub-claims paid amounts.

Average Claim Size

Profile	EQ1	EQ2	EQ3	EQ4	AS
-BC	3,044	6,028	3,078	2,041	2,072
--C	2,053	3,608	2,270	1,950	1,913
LBC	9,389	10,277	5,026	3,635	4,169
L-C	2,410	4,558	4,168	4,123	1,768

Claim Size Standard Deviation

Profile	EQ1	EQ2	EQ3	EQ4	AS
-BC	4,794	7,507	4,483	3,120	3,325
--C	2,481	4,195	3,357	2,856	2,679
LBC	7,721	9,204	5,767	5,433	5,877
L-C	3,078	5,280	5,404	5,858	1,713

Contents sub-claims aggregate distribution

For each event / sub-claim profile group the number of non-nil claims was multiplied by their corresponding estimated average claim size and variances to provide an aggregate distribution mean and variance. For the purposes of estimating the contents claims cost distribution a normal distribution was then fitted to these parameters.

Payment pattern

The payment pattern assumes all remaining contents claims settle within the next year.

Month ending	Cumulative paid
31-Dec-16	-
31-Jan-17	44%
28-Feb-17	68%
31-Mar-17	82%
30-Apr-17	90%
31-May-17	94%
30-Jun-17	97%
31-Jul-17	98%
31-Aug-17	99%
30-Sep-17	99%
31-Oct-17	100%
30-Nov-17	100%
31-Dec-17	100%

Base Inflation and Demand Surge

Costs were then inflated according to when the payment was estimated to be made using the recommended long-term Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for contents sub-claims.

J.1.4 Claims handling expenses – Canterbury earthquakes

The central estimate of CHE (before inflation) was discussed in Appendix H. A coefficient of variation of 20% was assumed and applied to the inflated CHE central estimate. For the purposes of estimating the CHE cost distribution, a normal distribution was fitted to these parameters.

Payment pattern

CHE payments arising from the Canterbury earthquake claims were assumed to follow a payment pattern which is consistent with the EQC budget projections.

Half year ending	Cumualtive inflated paid
30/06/2017	63%
31/12/2017	63%
30/06/2018	96%
31/12/2018	96%
30/06/2019	100%
31/12/2019	100%
30/06/2020	100%
31/12/2020	100%

Base Inflation and Demand Surge

Costs were then inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for CHE. It is noted that the duration of the rebuild programme will have a more material impact on the overall CHE costs than any margin for demand surge.

J.1.5 Land, Building & Contents sub-claims cost distributions – BAU & BAU Past Periods

Nil claim rates

The nil claim rates for each sub-claim type and profile were set with regard to assumptions for the 31 December 2016 outstanding claims estimation. The number of non-nil contents sub-claims for the group was then simulated according to a binomial distribution. The probability of a nil claim for each event / sub-claim profile is set out below. The assumptions adopted for BAU and BAU Past Periods were the same.

Nil claim probabiltiy

Profile	Land	Building	Contents
—	5.0%	7.5%	2.5%
-B-	5.0%	7.5%	2.5%
-BC	5.0%	7.5%	2.5%
–C	5.0%	7.5%	2.5%
L–	5.0%	7.5%	2.5%
LB-	5.0%	7.5%	2.5%
LBC	5.0%	7.5%	2.5%
L-C	5.0%	7.5%	2.5%

Sub-claim transitions (SCT)

The rate of sub-claim transition (i.e. claims which will change their sub-claim profile before settling – in this case to add a contents sub-claim) for each sub-claim type and profile were set with regard to those set for 31 December 2016.

Claims with no contents sub-claim which are predicted to ultimately register a contents sub-claim are also expected to have a reduced average claim size. The following tables set out these assumptions for each sub-claim type and profile.

Sub-claim transition probability

Profile	SCT	Land	Building	Contents
-B-	-BC	12.5%	12.5%	12.5%
–C	-BC	7.5%	7.5%	7.5%

Sub-claim transition cost

Profile	SCT	Land	Building	Contents
-B-	-BC	50%	50%	50%
–C	-BC	75%	75%	75%

Estimated claim size average and standard deviation

The average claim size and variance for claims in each for each sub-claim type and profile were estimated using a GLM on all sub-claims which had loss adjuster estimates. However, the GLM predicted claim sizes were only applied to open claims without a loss adjuster estimate.

The risk factors used in the GLM were:

- Loss date
- Loss cause
- Sub-claim profile
- Initial computer estimate

The following tables illustrate the final averages used in the model.

BAU

Average Claim Size

Profile	Land	Building	Contents
—			
-B-		3,888	
-BC		6,373	1,489
–C			1,443
L–	8,604		
LB-	27,759	16,788	
LBC	59,160	36,609	4,676
L-C	14,936		1,544

Claim Size Standard Deviation

Profile	Land	Building	Contents

-B-		7,382	
-BC		12,776	2,155
–C			2,147
L–	19,046		
LB-	50,114	26,408	
LBC	80,834	37,956	5,814
L-C	20,903		2,077

BAU Prior Period (PP)

Average Claim Size

Profile	Land	Building	Contents
—			
-B-		3,888	
-BC		6,373	1,489
–C			1,443
L–	8,604		
LB-	27,759	16,788	
LBC	59,160	36,609	4,676
L-C	14,936		1,544

Claim Size Standard Deviation

Profile	Land	Building	Contents
—			
-B-		7,382	
-BC		12,776	2,155
–C			2,147
L–	19,046		
LB-	50,114	26,408	
LBC	80,834	37,956	5,814
L-C	20,903		2,077

Contents sub-claims aggregate distribution

For each sub-claim type and profile group the number of non-nil claims and sub-claim transitions was multiplied by their corresponding estimated average claim size and variances to provide an aggregate distribution mean and variance. For the purposes of estimating the contents claims cost distribution a lognormal distribution was then fitted to these parameters.

Payment pattern

An analysis of historical experience informed the choice of the following assumed payment pattern which is summarised below.

Half year ending	Cumulative paid BAU	Cumulative paid BAU PP
30 Jun 2017	40%	80%
31 Dec 2017	80%	90%
30 Jun 2018	90%	100%
31 Dec 2018	100%	100%
30 Jun 2019	100%	100%
31 Dec 2019	100%	100%
30 Jun 2020	100%	100%
31 Dec 2020	100%	100%

Base Inflation and Demand Surge

Costs were then inflated according to when the payment was estimated to be made using the recommended Treasury rate of 2.5% p.a.

No demand surge inflation was assumed for BAU sub-claims.

J.2 Construction of individual event distributions

J.2.1 Sub-claim distribution aggregation

The individual sub-claim distributions for each event were combined to a single event claim cost distribution. A Gaussian copula dependency structure was assumed between each sub-claim distribution with the following correlation matrix.

Subclaim correlation

	Land	Building	Contents	CHE
Land	100%	50%	25%	25%
Building	50%	100%	50%	25%
Contents	25%	50%	100%	25%
CHE	25%	25%	25%	100%

J.2.2 Systemic risk adjustment

The following systemic risk assumptions were applied to each event distribution to recognise risks not allowed for in the stochastic nature of the model.

Systemic risk assumptions

	Land	Building	Contents	CHE
Coefficients of variation				
Model risk	10.0%	20.0%	15.0%	10.0%
Environmental risk	10.0%	15.0%	2.5%	5.0%
Correlation matrices				
Model risk				
Land	100%	0%	0%	25%
Building	0%	100%	25%	25%
Contents	0%	25%	100%	25%
CHE	25%	25%	25%	100%
Environmental risk				
Land	100%	50%	0%	25%
Building	50%	100%	0%	25%
Contents	0%	0%	100%	0%
CHE	25%	25%	0%	100%

J.2.3 Reinsurance

The reinsurance rules assumed follow from the terms and conditions of the reinsurance in place for each event and are discussed in Appendix E.

J.2.4 Payment patterns

In respect of each event, net payments to date were deducted from the estimated net ultimate distribution to create the corresponding estimated outstanding net claims cost distribution.

The net payment pattern mirrored the gross payment pattern subject to the application of the reinsurance layers. Net payments were zero during the reinsurance layers (subject to small amounts of co-insurance), and resume after gross payments exceeded the upper reinsurance retention limit.

Net payments made during the coinsurance layers were assumed to be made at the same time as the reinsurance deductible and thus are subject to less discounting than might be expected.

J.3 Construction of the total EQC entity level distribution

The individual event distributions were combined to a single EQC entity claim cost distribution. A Gaussian copula dependency structure was assumed between each event distribution.

K Canterbury land model methodology and assumptions

K.1 Land model methodology

K.1.1 Data

The dataset used for the model details each property that is expected to potentially have incurred land damage, excluding those in the Port Hills. The data includes:

- The insured land area and building footprint.
- The CV (as of 2007) and minimum lot size valuation i.e. value of minimum sized residential building site allowed in the area (provided by EQC's valuers).
- Information regarding whether the building has been repaired or rebuilt, where known.
- Whether or not the property is noted as being affected by an activity on the Hazardous Activities and Industries List ('HAIL').
- A Land Damage Indicator ('LDI') value for each event.
- The actual settlement amounts to date for Category 1-7, ILV and IFV damage where applicable.
- Whether or not the property qualifies for ILV or IFV damage.
- The determined DoV percentage for ILV where applicable.
- The Exacerbated Flooding Coverage ('EFC') i.e. the proportion of the property for which flooding risk has been exacerbated.
- Apportionment information for Category 1-7, ILV and IFV damage

K.1.2 Category 1-7 damage

Where the cost of Category 1-7 damage is not yet known, we have simulated the cost as a function of the LDI information for the property.

We also allow for the impact of inflation on the future cost of Category 1-7 damage for claims not yet settled.

K.1.3 ILV damage

Where a property qualifies for ILV we model the settlement path (i.e. via land repair or diminution of value – DoV – settlement) according to EQC's ILV policy to the extent that the valuation data permits. For example, we don't have data on each homeowner's intent to remediate their land.

Generally then, we base the settlement path on whether the property is a cleared site or has a house in-situ and whether we have any information as to whether the property has been sold. The cleared site/house in situ status is estimated as a function of the zone of the property (Red/Green) as well as information regarding whether or not the building has been rebuilt or repaired.

Note that we have also modelled an element to reflect the risk of successful legal challenge.

Where a property is settled via repair to the damaged land:

- We first estimate the building halo area i.e. the area around the building for which the land will be repaired (estimated as a function of the building footprint and insured land area).

- We then estimate the fixed costs involved in repairing the land (irrespective of the area to be repaired).
- We then estimate the cost of repairing the damaged land on a square metre basis.
- We include an additional amount to allow for diminution of value of the insured land area outside of the halo (which has not been repaired).
- We also include an additional allowance for HAIL identified properties.

The land repair costs (fixed and per square metre) include an allowance for inflation and possibly demand surge.

Where a property is settled via DoV we apply the DoV rates to the CV to calculate the DoV cost.

K.1.4 IFV damage

Where the valuation data does not specify whether a property qualifies for IFV, we first simulate whether or not it will ultimately qualify. Having simulated which properties qualify for IFV:

- We first estimate the DoV percentage as a function of the EFC information for the property.
- We then multiply the DoV percentage by the CV to estimate the DoV cost.

K.1.5 Aggregating the results for Category 1-7, ILV and IFV

We then bring together the estimates for Category 1-7, ILV and IFV damage for each property and:

- Allow for a reduced cost where a crossover property is settled by DoV for both ILV and IFV
- Allocate each type of damage to an event (or combination of events) according to the land damage information supplied.
- Cap the cost for each event according to the minimum lot size valuation.
- Apply an excess to the claim for each event.

K.1.6 Silt removal

We have allowed for the cost that EQC has incurred (and may potentially incur in future) in respect of silt removal from affected properties.

K.1.7 Port Hills

We have allowed for the aggregate cost to EQC of land damage to properties in the Port Hills. This has been estimated based on a list of open Port Hills claims which was provided to us by EQC. The aggregate cost is estimated as a function of the land value component of the CV for each property.

K.1.8 Analysing the distribution of results

The cost to EQC for each damage type and property is simulated 10,000 times. The results are aggregated and the distribution of aggregated costs is analysed.

K.2 Land model assumptions

The tables below set out the assumptions used in the land model.

Payment pattern

Quarter Ending	Payment of future outstanding
30/06/2017	33%
31/12/2017	67%
30/06/2018	100%
30/09/2018	100%
31/12/2018	100%

9(2)(j)

[redacted]

L Premium Liabilities – Valuation Methodologies

L.1 Valuation methodologies considered

The choice of valuation methodology for premium liabilities is driven by the similar factors as for the OS claims liabilities.

For the future claims costs components of the premium liabilities the two main decisions are:

- Loss ratio basis or frequency / severity approach.
- Deterministic or stochastic approach.

For the other liability components, the figures are usually developed from a consideration of budget figures and the expense analysis.

L.2 Valuation methodologies selected

Although several methodologies would have been reasonable, we decided to use a stochastic approach as it facilitated the determination of the risk margin and allowed us to directly model the effects of the catastrophe reinsurance.

This is consistent with the approach used for components of the OS claims liabilities so some of the assumptions developed for that work have been used.

The valuation methodologies selected for each event valuation grouping were:

- BAU: an aggregate stochastic frequency / severity model.
- Minerva claims: a stochastic model based on the supplied return period curve.
- Enhanced seismicity: an aggregate stochastic frequency / severity model.

L.2.1 Diagrammatic illustration of the valuation methodology

Notation (for the following diagram):

Policies in force$_{BA\,/\,EQ\,/\,MINERVA}$	Proportion of current unexpired policies still in force when a future event occurs (decreases uniformly over the year).
Sub-claims$_{BA\,/\,EQ}$	Predicted number of sub-claims (depends on event severity).
$\bar{x}_{BAU\,/\,EQ}$	Assumed average sub-claim size (varies by sub-claim type and combination).
Resilience	Resilience factor (assumed for building and contents sub-claims only to model the fact that subsequent future aftershocks are less damaging than previous ones).
CCE$_{BAU\,/\,EQ}$	Assumed claims cost escalation (inflation)
Estimated Event Cost	Output from the Minerva Model which simulates the cost of future events (depends on event severity).

Land ↓ **Building** ↓ **Contents** ↓

Future Business As Usual (BAU) Sub-claims

$$\sum_{\text{Future Events}} \text{Policies in force}_{BAU} \times \text{Sub-claims}_{BAU} \times \bar{x}_{BAU} \times (1 + CCE_{BAU})$$

+

Future Enhanced Seismic Sub-claims

$$\sum_{\text{Future Events}} \text{Policies in force}_{EQ} \times \text{Sub-claims}_{EQ} \times \bar{x}_{EQ} \times \text{Resilience} \times (1 + CCE_{EQ})$$

+

Minerva Future Claims

$$\text{Policies in force}_{MINERVA} \times \text{Estimated Event Cost}$$

L.3 Changes in methodology

The valuation methodology used is similar to that used for 30 June 2016 and prior valuations. The only change is in respect of the Canterbury earthquake component to reflect the increased seismicity from the Kaikoura events.

L.4 Cost of future claims

L.4.1 BAU

The BAU model structure is an aggregate stochastic frequency / severity model:

- The number of sub-claims for the year is estimated.
- The average claim size is estimated.
- A claims cost escalation factor is applied in the same way as for the OSC model for BAU claims.
- The mean and variance of the aggregate claims cost are estimated as the number of claims multiplied by the average claims cost and the claims cost escalation.
- Claims handling costs are added and assumed to be stochastic.
- No reinsurance adjustment is applied as the aggregate cost distribution does not approach the reinsurance deductible.
- Discounting for the time value of money is applied to all claim payments.

- The model is run many times to develop an aggregate claims distribution and this is used to derive the risk margin.

L.4.2 Minerva

MJW was supplied with output from the Minerva model which provides simulated loss data based on property exposures and return periods for events across New Zealand (but excluding the Christchurch area, which is considered separately).

The model process is as follows:

- Each run of the MJW model (which operates based on the Minerva output) simulates an event and registers the appropriate cost to EQC should all policies be on risk at the time of the event.
- The timing of the event is simulated and the associated number of policies still unexpired is estimated.
- The proportion of policies on risk at the time of the event is multiplied by the estimated total cost.
- Claims handling costs are added and assumed to be stochastic.
- Reinsurance cover rules are applied.
- Net of reinsurance payments are discounted for the time value of money.
- The model is run many times to develop an aggregate claims distribution and hence a risk margin.

L.4.3 Enhanced seismic factor (Canterbury & Kaikoura)

The Enhanced seismic model structure is an aggregate stochastic frequency / severity model:

- The number of events to occur over the year (to 31 December 2017) is estimated.
- The number of claims arising from each event if all policies were on risk is estimated.
- The timing of the event is simulated and the associated number of policies still unexpired is estimated.
- The average claim size is estimated.
- A resilience effect was assumed for building and contents sub-claims, whereby each subsequent aftershock is less damaging than the previous one, so that the average claim size is reduced based on the previous number of events.
- A claims cost escalation factor is applied in the same way as in the OSC model for Christchurch earthquake claims.
- The actual cost is estimated by multiplying:
  - The number of claims arising from events if all policies were on risk.
  - The proportion of policies still on risk at the time of the event.
  - The estimated cost, the resilience effect, and the claims cost escalation.
- Claims handling costs are added and are assumed to be stochastic.
- Reinsurance cover rules are applied.
- Net of reinsurance payments are discounted for the time value of money.
- The model is run many times to develop an aggregate claims distribution and this is used to derive the net risk margin.

L.5 Policy and claims administration expenses

Policy and claims administration expenses have been estimated based on a review of BAU expenses.

L.6 Future reinsurance costs

Future reinsurance costs were derived directly from budgets having regard to the fraction of future claims costs expected to arise from unexpired risks as at 31 December 2016.

L.7 Risk margin

The risk margin was a direct outcome (75th percentile less the mean) of the generated net aggregate claims distribution.

L.8 Discounting for the time value of money

Projected cash flows arising from future claims were discounted for the time of money using Treasury's forward rates as at 31 December 2016. These rates are set out in Appendix O.

M Premium Liabilities – Valuation Assumptions

M.1 Assumptions required

The assumptions are driven by the valuation methodology. In the following sections, we set out the assumptions for each event group and provide some background to the assumption and how it was derived.

M.2 Changes in assumptions

Given the underlying claims process and the valuation methodology, the assumptions are largely based on those used for the 30 June 2016 valuation. The principal exception to this is the Canterbury earthquakes component which was updated for the latest GeoNet forecasts for Canterbury and also for Kaikoura. We have also updated some of the expense assumptions.

M.3 Cost of future claims

M.3.1 BAU

The following table and graph illustrate the number of claims projected to be incurred over the 2016 financial year. The standard deviation of this projection is also shown. For each run of the model a randomised number of claims is generated based on these parameters.

Predicted number of claims by sub-claim

Profile	Mean	Std dev
-B-	2,212	1,572
-BC	238	501
–C	183	291
L–	623	202
LB-	330	131
LBC	32	23
L-C	2	2

The assumptions above were obtained by the application of a Holt Winters smoothing technique to historical claims data.

The average claim sizes for this component are derived from the same generalised linear model (GLM) used to estimate BAU computer estimate claims for the outstanding claims component.

Assumptions for payment patterns, inflation and discounting are consistent with the BAU claims in the OSC model.

M.3.2 Minerva

In using the output from the Minerva model (excluding Canterbury) we assume the following:

- The probability of an event is uniform over the year.
- The rundown in number of policies remaining unexpired is uniform over the year.
- Claims handling costs are 10% of the estimated ultimate gross cost of claims.
- The current reinsurance deductible is applied.

- Discounting follows the same pattern as for the continuing Christchurch earthquakes outstanding claims component as at 30 June 2016.

M.3.3 Canterbury Earthquakes and Kaikoura

The probability of certain size events was taken from the GeoNet website. The expected average number of events was assumed to be the parameter for a Poisson distribution (the natural distribution for a counting process). The maximum number of events that could be simulated by the Poisson distribution was limited to that shown in the following tables.

Geonet forecasts - Canterbury region long-term probabilities
One year: 21 July 2016 - 20 July 2017

Magnitude lower	Magnitude upper	Midpoint	Expected Avge (yr)	Expected max events
5.0	6.0	5.50	0.8	3
6.0	7.0	6.50	0.07	1
7.0	8.0	7.50	0.006	1

Geonet forecasts - Kaikoura region long-term probabilities
One year: 19 January 2017 - 18 January 2018

Magnitude lower	Magnitude upper	Midpoint	Expected Avge (yr)	Expected max events
5.0	6.0	5.50	16.6	29
6.0	7.0	6.50	1.5	4
7.0	8.0	7.50	0.1	1

Analysis indicates that the number of sub-claims arising from an event is correlated to the magnitude of the event. This relationship is used as the sole risk factor in the simulation of the number of claims from an event. The following tables illustrate the number of sub-claims assumed for an event of a given magnitude.

Number of claims by magnitude

Magnitude	Land		Building		Contents	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
5.5	1,874	4,990	14,867	39,379	317	839
6.5	12,230	32,569	84,247	223,147	4,067	10,773
7.5	25,000	66,578	120,000	317,848	55,000	145,680

Number of claims by magnitude - Kaikoura

Magnitude	Land		Building		Contents	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
5.5	423	1,128	4,092	10,839	105	278
6.5	1,798	4,788	17,859	47,303	740	1,960
7.5	3,120	8,308	24,118	63,882	5,435	14,397

The number of sub-claims generated assumes all policies are on risk at the time of the event. The proportion of policies predicted to be still unexpired is simulated and the number of sub-claims adjusted accordingly. The risk of an event and the rundown in the number of policies is assumed to be uniform over the year.

The average claim size was also found to be correlated to the magnitude of the event. The average claim size used in this analysis was the estimated ultimate average generated by the OSC model. The following tables illustrate the average claim size assumed for an event of a given magnitude.

Assumed claim size - Canterbury

Magnitude	Land	Building	Contents
5.5	23,355	10,000	2,000
6.5	23,355	15,000	2,000
7.5	42,854	40,000	3,000

Assumed claim size - Kaikoura

Magnitude	Land	Building	Contents
5.5	3,815	5,000	2,000
6.5	3,815	7,500	2,000
7.5	7,000	20,000	3,000

The following resilience factors were applied to each average claim size depending on the number of events before it. For example, the first future event's building sub-claim average will be 100% of the basic assumption and the 5th event's building sub-claim average would be 24% of that figure. The resilience assumption attempts to capture the impact of 'damage on damage' effects arising from consecutive earthquakes and, in the absence of established data, the assumptions were chosen subjectively.

Assumed resilience by event order

Event	Land	Buliding	Contents
1	1.00	1.000	1.000
2	1.00	0.700	0.850
3	1.00	0.490	0.723
4	1.00	0.343	0.614
5	1.00	0.240	0.522
6	1.00	0.168	0.444
7	1.00	0.118	0.377
8	1.00	0.082	0.321
9	1.00	0.058	0.272
10	1.00	0.040	0.232

Claims handling costs were assumed to be 10% of the estimated ultimate gross cost of claims. The current reinsurance deductible was applied.

Assumptions in regard to payment patterns, inflation and discounting are broadly consistent with the Christchurch earthquake claims in the OSC model.

M.4 Administration and future reinsurance costs

The table below illustrates the key components in the determination of the costs of administering and reinsuring unexpired risks.

Premium liabilities - unexpired risks assumptions - reinsurance / policy administration expenses	
Figures from accounts and budget	**$000's**
Unearned premium reserve as at 31 December 2016	147,895
Actual earned premiums over six months to 31 December 2016	149,628
Actual reinsurance costs over year to 31 December 2016	163,144
Budget non-Canterbury policy administration expenses over year to 31 December 2016	10,000
Percentage of annual costs relating to unexpired risks as at 31 December 2016	50.0%
Unexpired risks assumptions as at 31 December 2016	**$000's**
Reinsurance expenses for unexpired risks	81,572
Policy administration expenses for unexpired risks	5,000

M.5 Discounting for the time value of money

Projected cash flows arising from future claims were discounted for the time of money using Treasury's forward rates as at 31 December 2016. These rates are set out in Appendix O.

N Additional results

N.1 Historical progression of ultimate incurred

The table below shows the progression of the estimated gross ultimate incurred claims costs at each valuation since 31 December 2010.

Canterbury earthquakes only

Gross ultimate incurred claims costs, central estimate, undiscounted, including CHE

Valuation date	EQ1 $m	EQ2 $m	EQ3 $m	EQ4 $m	AS $m	Total $m
31 December 2010	2,754	-	-	-	-	2,754
Change in period	+494	+6,536	+1,382	-	+514	+8,925
30 June 2011	3,247	6,536	1,382	-	514	11,678
Change in period	+210	-22	-13	+448	-139	+485
31 December 2011	3,458	6,514	1,369	448	374	12,164
Change in period	-3	-27	+2	+69	+0	+42
30 June 2012	3,455	6,487	1,371	517	375	12,205
Change in period	-298	-89	-253	-1	-8	-649
31 December 2012	3,157	6,398	1,118	517	367	11,556
Change in period	+101	-28	+13	-38	+15	+63
30 June 2013	3,258	6,370	1,131	478	382	11,620
Change in period	-46	-111	-75	-75	-28	-335
31 December 2013	3,212	6,259	1,057	403	354	11,284
Change in period	+66	+242	-42	-2	+3	+267
30 June 2014	3,277	6,501	1,015	401	357	11,551
Change in period	+41	+231	-156	-90	-33	-8
31 December 2014	3,318	6,732	859	310	324	11,543
Change in period	+23	-57	-69	-112	-80	-294
30 June 2015	3,341	6,675	790	199	244	11,249
Change in period	+34	-29	-7	-2	+14	+10
31 December 2015	3,375	6,646	783	197	258	11,259
Change in period	-13	+103	-71	-1	+1	+20
30 June 2016	3,362	6,749	712	196	259	11,279
Change in period	-72	+50	-38	-31	-8	-98
31 December 2016	3,290	6,800	675	165	251	11,181

Key reasons for the movements:

- Dec 10: EQ1 only.
- Jun 11: EQ2 and EQ3 events occurred.
- Dec 11: EQ4 event. Aggregate Tonkin + Taylor ('T+T') land model.
- Dec 12: Introduction of T+T property based land model (introduced DoV).

- Jun 13: ILVR result ($11,620m) based on revised building model (ACE model introduced) and T+T property based model (with DoV on ILV and IFV). Board elected to book results without DoV ($12,016m).
- Dec 13: ILVR result ($11,284m) based on revised building model. Board elected to book only those gains that were hard / definitive ($11,600m).
- Jun 14: ILVR result ($11,551m) based on new land model (higher remediation costs for ILV and IFV) but offset by increasing dominance of ACE model (within the building claim model).
- Dec 14: ILVR result ($11,543m) based on revised land model (more properties eligible for ILV and IFV settlement and slightly revised ILV repair costs). Building model now more weighted to ACE model, includes statistical apportionment model for undercap properties and more refinement of classifying open claims.
- Jun 15: ILVR result ($11,249m) incorporates ILV settlement (DoV) policy.
- Dec 15: ILVR result ($11,259m) incorporates changed approach as a result of draft ILV DoV rates and a strengthened insurer washup provision.
- Jun 16: ILVR result ($11,279m) incorporates strengthening of reopened provision with changes in the modelling of uncertainty in the land model.
- Dec 16: ILVR result ($11,181m) incorporates further strengthening of building provision with actual land settlements being lower than expected.

N.2 Estimated ultimate claims costs – variability in modelled results

Estimated gross ultimate incurred cost incl CHE

	EQ1	EQ2	EQ3	EQ4	AS
31 December 2016 ILVR					
5%	$3.178b	$6.541b	$0.619b	$0.162b	$0.248b
25%	$3.231b	$6.665b	$0.636b	$0.164b	$0.250b
50%	$3.288b	$6.795b	$0.660b	$0.165b	$0.251b
75%	$3.348b	$6.928b	$0.713b	$0.167b	$0.253b
95%	$3.406b	$7.077b	$0.756b	$0.168b	$0.255b
Central Est	$3.290b	$6.800b	$0.675b	$0.165b	$0.251b
30 June 2016 ILVR					
5%	$3.221b	$6.390b	$0.651b	$0.189b	$0.250b
25%	$3.293b	$6.574b	$0.671b	$0.193b	$0.256b
50%	$3.363b	$6.733b	$0.698b	$0.196b	$0.259b
75%	$3.430b	$6.907b	$0.753b	$0.199b	$0.263b
95%	$3.504b	$7.177b	$0.801b	$0.204b	$0.268b
Central Est	$3.362b	$6.749b	$0.712b	$0.196b	$0.259b

N.3 Future Cashflows by event

All EQC claims
Undiscounted cashflows - central estimate

From	1 Jan 17	1 Jul 17	1 Jan 18	1 Jul 18	1 Jan 19	1 Jul 19	1 Jan 20	1 Jul 20	1 Jan 17
To	30 Jun 17	#######	30 Jun 18	#######	30 Jun 19	#######	30 Jun 20	#######	31 Dec 20
Gross OSCL payments including CHE ($m)									
EQ1	123	146	130	13	1	0	-	-	413
EQ2	274	318	291	25	1	0	-	(0)	909
EQ3	51	49	50	2	1	0	-	0	153
EQ4	4	3	3	0	0	0	-	0	11
AS	3	4	3	1	0	0	-	0	10
BAU PP	6	1	1	-	-	-	-	-	8
BAU	230	233	59	60	-	-	-	-	582
Total	691	754	537	101	3	0	-	(0)	2,086
Reinsurance recovery payments ($m)									
EQ1	116	146	130	13	1	0	-	-	406
EQ2	-	-	-	-	-	-	-	-	-
EQ3	-	-	-	-	-	(0)	(0)	(0)	(0)
Total	116	146	130	13	1	0	(0)	(0)	406

O Discount Rates

Where cashflows have been discounted for the time value of money, the following discount rates were adopted as specified by Treasury. Discounts rates used for the 30 June 2016 valuation have been included for comparative purposes only.

Treasury Discount rates

Valuation Year (for Annual Cash Flows to 31 Dec)	Forward Rate as at 31 December 2016	Forward Rate as at 30 June 2016
2017	2.02%	2.12%
2018	2.51%	1.95%
2019	2.91%	1.93%
2020	3.21%	2.03%
2021	3.46%	2.16%
2022	3.68%	2.31%
2023	3.89%	2.46%
2024	4.07%	2.63%
2025	4.24%	2.81%
2026	4.39%	2.98%
2027	4.53%	3.14%
2028	4.65%	3.27%

The forward rates at various durations are appropriate to use in our model as we have projected future yearly cash flows which we then discount to the present.

All other things being equal, the reduction in discount rates would lead to an increase in EQC discounted claims liability.

P Glossary

Accounting standard

In New Zealand, the accounting standards of the NZ Institute of Chartered Accountants apply. The standard most relevant to **insurance entities** is *NZ IFRS4 Insurance Contracts*.

Actuarial Data Extract (ADE)

A data extract used to facilitate an actuarial valuation. The data is typically sourced from the claims and policy administration systems.

Actuary

In general, in New Zealand an actuary is a Fellow or Accredited Member of the New Zealand Society of Actuaries or equivalent body.

Aggregate excess of loss reinsurance

See **catastrophe reinsurance.**

Apportioned Cost Estimate (ACE) data

A number of properties have had their building damage apportioned between events in a manual fashion. This process uses all available information on that property (quantity surveyor reports, land damage information, neighbourhood damage, customer reports etc.) to inform the apportionment. These apportionments are called Apportioned Cost Estimates and will be included the ACE data set. The ACE data set includes all overcap properties and a number of undercap properties too.

Attachment date

See **inception date**.

Best estimate

In the context of scenarios, a best estimate means a realistic future scenario, rather than a deliberately pessimistic or optimistic one. Also see **central estimate**.

Brokerage

An alternative term for commission paid to a **broker**.

Broker

An intermediary who acts for an insured in negotiating their insurance. The broker usually receives payment by way of commission from the insurer with whom the business is placed.

Business as Usual (BAU)

A distinction has been drawn between claims that are related to the Canterbury earthquake events and those that are from other events (earthquake or other). These non-Canterbury earthquake events are referred to as Business as Usual (BAU) events.

Canterbury Earthquake Sequence ('CES')

The sequence of earthquakes and aftershocks in the Canterbury area from 4 September 2010 to the end of 2011. This included four main earthquakes on 4 September 2010, 22 February 2011, 13 June 2011 and 23 December 2011.

Case estimate

The amount recorded by the insurer's claims personnel (including external claims assessors) as being the amount required to settle an open claim, based on the information available on that particular case. When a claim is first reported and recorded, a nominal placeholder estimate may be entered into the system. Estimates should be updated as extra information comes to light and adjusted to reflect any partial payments that may be made prior to final settlement.

Catastrophe

A catastrophe event for an insurer is generally considered to be a single event that results in one or more claims for very large amounts or in an aggregation of many claims collectively costing an extremely large amount. The nature and impact of potential catastrophe events will vary by insurer according to their business, amount of capital and risk management arrangements. Examples include earthquakes and terrorism.

Catastrophe reinsurance

Usually an excess of loss reinsurance arrangement providing cover to an insurer against very high losses arising from a **catastrophe** event, which meets the definition of 'catastrophe' as specified in the reinsurance policy. The nature and extent of the cover available / provided depends on the nature of the underlying insurer's business and the terms available for such protection. For some events, such as storm or earthquake, the reinsurer may impose a specified time limit on when claims may be covered under the catastrophe treaty.

Cedant or ceding insurer

An insurer who has ceded (passed on) all or part of the risks it has underwritten by way of reinsurance. Analogous to an insured who cedes risk to an insurer.

CEDAR

Canterbury Earthquake Defect And Repair review. MBIE commissioned an independent survey of the repairs of a sample (101 properties) of the earthquake-damaged Canterbury homes selected from more than 2,700 addresses provided by the Earthquake Commission (EQC), Housing New Zealand, and insurers Southern Response and IAG. The survey also included a small sample of houses where homeowners had opted out of an insurer-led home repair programme.

The aim was to assess the Building Code compliance of structural repairs that were exempt from a building consent under Schedule 1 (repairs and maintenance) of the Building Act.

Central Estimate

An estimate that contains no deliberate or conscious over- or under-estimation. NZ Accounting standards define this to be the mean of the probability distribution of future outcomes. Also see **probability of adequacy**.

Claim frequency

The number of claims divided by exposure over a given time period. This could apply to **reported** or **incurred** claims.

Claims handling expenses (CHE)

The expenses involved in the processing and settlement of claims. Note that this term usually relates only to indirect claims expenses such as internal general administration claims costs. Expenses such as assessors' fees or legal costs, that arise in relation to specific claims, are termed direct expenses and are usually treated as part of the cost of those claims.

Claims paid

The amount paid in respect of claims.

Claims provision and claims reserve

These are both terms used to refer to the amount held or required to provide for future payments on outstanding claims. These terms are sometimes seen as being interchangeable. However, there are variations in the precise usage of both terms according to the context in which they appear.

A claims provision is often used to refer to the amount held in an insurer's accounts. In management accounts, claims reserve may refer to the total **case estimates**, possibly with an additional amount for **IBNR** claims. In actuarial contexts the technical terms are, respectively, **incurred claims liability** and **outstanding claims liability**. These amounts might also include allowances for **CHE**, **discounting**, **claims paid**, and a **risk margin**. Figures may be given **net** or **gross of reinsurance**.

Closed claims

Those claims for which records have been closed, because settlement has been made and no recoveries are expected. However, see **reopened** claims.

Cover

The extent and nature of protection provided by an insurance policy. This will be defined in the policy documentation.

Deductible

See **excess.**

Demand surge

The increase in the cost of insurance claims following a major loss event. The event puts pressure on the demand for labour and materials to pay for repairs which, in the absence of increased supply, increases the price of these costs.

Diminution of Value (DoV)

Diminution of Value, in the context of IFV or ILV is the loss in value suffered by the homeowner, as a result of the land damage that caused the loss. In assessing the DOV, it does not include any change in value resulting from matters other than the land damage (e.g. a change in the building regulations and practices after the 2010-2011 Canterbury earthquakes).

Discounting

Discounting refers to the (absolute) reduction, for the time value of money, of any future cashflows. The extent of discounting is a consequence of two factors: length of time until payment and the discount rate with an increase in either of these increasing the impact of discounting. Cashflows which have been discounted are said to be *present values*.

Actuarial **professional standards** state that **risk-free discount rates** must be used to calculate present values.

Effective date

The effective date of an **ILVR** is the date to which the valuation calculations apply.

Exacerbated Flooding Coverage ('EFC')

Exacerbated Flooding Coverage ('EFC') is the area of a property that has had exacerbated flooding as a result of the Canterbury Earthquake Sequence. The exacerbated flooding is assessed for a 100 year return period event (as stated in the EQC IFV policy). In the report, 'EFC' is presented as a percentage of the EQC insured land area for a property. It has been used as a proxy to estimate the likely DoV rates for IFV properties which are yet to be assessed.

Excess

The amount of an insured loss that must be borne by the policyholder before the insurer becomes liable to make a claim payment. The amount of the excess will be set out in the policy documentation.

Excess of loss reinsurance

A non-proportional form of reinsurance whereby the insurer pays the cost of a claim up to a specified point (their **retention**) and the reinsurer pays the remainder of the cost. The amount payable by the reinsurer is usually subject to a specified maximum amount which may apply per claim or to the total amount. Also see **catastrophe reinsurance**.

Experience

The term used to describe the results of blocks of insurance business, particularly when the results are the subject of detailed analysis.

Future Claim Liability (FCL)

A term sometimes used to refer to the **premium liability** arising from unearned policies. It is the value of future claim payments and related **CHE**, arising from future events for which the insurer is liable.

Gross

Refers to the amounts of premiums, claims and expenses before allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

Inception date

Inception date is the date on which cover commences.

Increased Flooding Vulnerability (IFV)

The physical change to land as a result of an earthquake which adversely affects the use and amenity that could otherwise be associated with the land by increasing the vulnerability of that land to flooding events.

Increased Liquefaction Vulnerability (ILV)

The physical change to land as a result of ground subsidence from an earthquake which materially increases the vulnerability of that land to liquefaction damage in future earthquakes.

Incurred

A term relating to claims arising from events that occurring in a specified period.

There are differences in the precise usage of the term according to the context in which it appears. In some contexts it may refer to the group of claims *occurring* in the period (whether **reported** to the insurer or not) and their eventual cost. In accounting contexts, the term may refer to the amount of *claims payments made plus the change in outstanding claims provisions* from the start to the end of the period.

In an actuarial context, 'incurred' costs are taken to mean the claim costs cost which arise, or come to light) during the period. An alternative expression of this is: claim payments made plus outstanding estimates (inclusive of **IBNR** and **IBNER**).

Further differences may also apply in regard to the inclusion (or not) of **CHE** and **risk margins.** Clarification should be provided in the actuarial commentary as to the precise meaning applied. It should also be stated whether there has been allowance for **discounting** in the quantification of future payments to be made on these claims. Also see **discounting** and **ultimate cost**.

Incurred but not reported (IBNR)

Any claim or claim amount for which, at a particular point in time, the loss event has occurred but the insurer has not yet been notified and/or the claim entered into the claims system. Any **outstanding claims liability** must include an allowance for these claims.

Incurred but not enough reported (IBNER)

A monetary amount relating to **reported** claims. IBNER is defined as the ultimate cost of the claim less the current **case estimate** and could be positive or negative. The **outstanding claims liability** must include an allowance for this.

Incurred claims

Claims that were **incurred** during a specified time period.

Incurred claims liability

See **Outstanding Claims Liability**.

Indirect claims handling expenses

See **claims handling expenses**

Insurance liability valuation report (ILVR)

A report detailing a valuation by the **actuary** of the **insurance liabilities** of an insurer.

Liability adequacy test (LAT)

A test applied under the **accounting standard** which consists of a comparison of the **unearned premium**, less deferred acquisition costs (DAC), against the **premium liability**. If the test indicates a deficiency, the DAC must be written down by an appropriate amount in the entity's income statement. If the deficiency is greater than the DAC, a premium deficiency reserve must be set up.

Material

In the context of an actuarial report, an item is deemed material if it is significant in the professional judgement of the actuary. This may not necessarily correspond exactly with 'material' as applied in an accounting context.

Net

Refers to the amounts of premiums, claims and expenses after allowing for the costs or income (including commission as well as claim recoveries) from reinsurance and other non-reinsurance recoveries.

Net outstanding claims liability

See **outstanding claims liability.**

Non-reinsurance recoveries

Non-reinsurance recoveries refer to the recoveries against claim payments that come from entities other than reinsurers. It includes amounts in respect of salvage and third parties. It doesn't refer to excesses and deductibles that are deducted from the claim.

Open claims

Those claims that have been **reported** to the insurer but are not regarded as finally settled as claim payments and/or recoveries associated with the claim, may occur in future.

Outstanding Claims Liability (OCL)

The expected value of future payments on claims that were **incurred** on or before the **effective valuation date.** This usually includes future **CHE** associated with those claims, allows for **discounting**, and includes a specified **risk margin**. It may be calculated **gross** or **net of reinsurance** and **non-reinsurance recoveries.**

Outstanding Claims Provisions

The amount in the insurer's accounts providing for **outstanding claims liabilities** at the accounting date.

Premium Liabilities

The value of future claim payments and related **CHE**, arising from future events for which the insurer is liable at the date of calculation.

Probability of adequacy

The statistical probability that a reserve or provision will ultimately prove to be adequate to provide for all relevant payments to be made.

Professional Standard

The form of professional guidance as issued by the New Zealand Society of Actuaries, or such other professional body as may be stated.

Reinstatement premiums

Premiums that become payable under reinsurance treaties, particularly catastrophe reinsurances, when all or part of a layer of cover has been 'used' by the insurer making a claim, but the insurer wishes to reinstate full coverage for the remaining term of the treaty. A 'free reinstatement' may sometimes be included in the original terms of a treaty.

Reopened claims

Claims that had been regarded as settled (i.e. no further claim payments or recoveries) but for which claims records have since been reopened because an additional payment or receipt has been made or is now expected to be made. The **Outstanding Claims Liability** must take the possibility of claims reopening in future into account.

Reported

Claims are said to be reported if the insurer has been notified of their existence. This is in contrast to **IBNR** claims.

Resolved

For exposures settled by cash payment, the valid building, contents or land exposure is recorded as resolved when the claimant has been paid for that exposure. In the case where the building exposure is settled by managed repair, building exposures are only recorded as resolved when all planned repairs are complete (but the 90-day defect liability and warranty period may not have expired) and the customer has received a full cash payment from EQC for all contents and land exposures. Exposures are also considered resolved if the exposure has not been accepted and the customer informed.

Retention

The amount of risk retained by the direct insurer above which an excess of loss reinsurance will be triggered. Also see **excess**.

Risk-free discount rates

These are the rates of interest that would be available on a theoretical, riskless investment. In practice, they are the rates available on very secure investments, such as government bonds of suitable durations, which may be assumed to be free of default risk.

Risk Margin

The amount of extra provision over and above the **central estimate** which is intended to allow for the inherent uncertainty of insurance liabilities. The relevant **probability of adequacy** associated with the increased amount should be stated.

Sensitivity

The uncertainty in the calculation of insurance liabilities due to the assumptions involved. Accounting and **professional standards** require statements of the effects on the results to be illustrated by sensitivity tests. These involve reviewing the calculations after varying key assumptions.

Uncertainty

Where full, known information is not available, uncertainty exists as to the exact nature and extent of the ultimate outcome. In particular, there is inherent uncertainty in any estimation of insurance liabilities, which are necessarily based on assumptions, usually derived from analyses of past experience. Deviations from estimates are normal and are to be expected. See also **central estimate, probability of adequacy** and **sensitivity**.

Unearned Premium

The proportion of written premium that relates to the risk still to be covered after the balance date or effective date of the valuation. The calculation usually assumes that premium is earned evenly over the term of a policy, except for unusual types of risk where this is clearly not the case (for example, Contractors All Risks). Should a policy be cancelled, the unearned premium as at the cancellation date may be refunded to the policyholder, possibly after allowance for expenses incurred.

Unearned Premium Reserve (UPR)

The total amount of **unearned premiums** held, reflecting the periods of future cover to be provided under policies in force at the balance date or effective date of the valuation.

Valuation date

The **effective date** as at which a valuation has been made.