10 Premium Liabilities – Valuation Assumptions

10.1 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.

10.2 Changes in assumptions

Given the underlying claims process and the valuation methodology, it was decided to base the assumptions on those used for the 30 June 2015 valuation. The principal exception to this is the Canterbury earthquakes component which was updated for the latest forecasts released on 4 September 2015.

10.3 Cost of future claims

10.3.1 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.

<table>
<thead>
<tr>
<th>Profile</th>
<th>Mean</th>
<th>Std dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>L-</td>
<td>622</td>
<td>214</td>
</tr>
<tr>
<td>LB-</td>
<td>332</td>
<td>136</td>
</tr>
<tr>
<td>LBC</td>
<td>32</td>
<td>24</td>
</tr>
<tr>
<td>L-C</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

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.

10.3.2 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.
10.3.3 Canterbury Earthquakes

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 table.

Assumptions for discounting are the same as for the Canterbury earthquake claims in the OSC model.

<table>
<thead>
<tr>
<th>Geonet forecasts - Canterbury region long-term probabilities</th>
<th>One year: 1 November 2015 - 1 November 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude lower</td>
<td>Magnitude upper</td>
</tr>
<tr>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td>6.0</td>
<td>7.0</td>
</tr>
<tr>
<td>7.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

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 table illustrates the number of sub-claims assumed for an event of a given magnitude.

<table>
<thead>
<tr>
<th>Number of claims by magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude</td>
</tr>
<tr>
<td>5.5</td>
</tr>
<tr>
<td>6.5</td>
</tr>
<tr>
<td>7.5</td>
</tr>
</tbody>
</table>

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 table illustrates the average claim size assumed for an event of a given magnitude.

<table>
<thead>
<tr>
<th>Assumed claim size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnitude</td>
</tr>
<tr>
<td>5.5</td>
</tr>
<tr>
<td>6.5</td>
</tr>
<tr>
<td>7.5</td>
</tr>
</tbody>
</table>
Released under the Official Information Act 1982

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.

<table>
<thead>
<tr>
<th>Assumed resilience by event order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

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.

10.4 Administration and future reinsurance costs

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

<table>
<thead>
<tr>
<th>Premium liabilities - unexpired risks assumptions - reinsurance / policy administration expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figures from accounts and budget</td>
</tr>
<tr>
<td>$000's</td>
</tr>
<tr>
<td>Unearned premium reserve as at 31 December 2015</td>
</tr>
<tr>
<td>Actual earned premiums over six months to 31 December 2015</td>
</tr>
<tr>
<td>Actual reinsurance costs over year to 31 December 2015</td>
</tr>
<tr>
<td>Budget non-Canterbury policy administration expenses over year to 31 December 2015</td>
</tr>
<tr>
<td>Percentage of annual costs relating to unexpired risks as at 31 December 2015</td>
</tr>
<tr>
<td>Unexpired risks assumptions as at 31 December 2015</td>
</tr>
<tr>
<td>Reinsurance expenses for unexpired risks</td>
</tr>
<tr>
<td>Policy administration expenses for unexpired risks</td>
</tr>
</tbody>
</table>

10.5 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 2015. These rates are set out in Appendix I.
11 Premium Liabilities – Valuation Results

11.1 Results

Estimated Premium Liabilities - 31 December 2015

<table>
<thead>
<tr>
<th></th>
<th>BAU $m</th>
<th>Minerva $m</th>
<th>Cant EQ $m</th>
<th>Total $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unearned premium reserve</td>
<td>146</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of future claims from unexpired risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross claims, undiscounted - central estimate</td>
<td>16</td>
<td>46</td>
<td>60</td>
<td>123</td>
</tr>
<tr>
<td>Administration and reinsurance costs for unexpired risks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claims administration expenses</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Policy (non-claims) admin expenses for unexpired risks</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Future reinsurance costs for unexpired risks</td>
<td>0</td>
<td>58</td>
<td>17</td>
<td>75</td>
</tr>
<tr>
<td>Reinsurance recoveries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinsurance recoveries, undiscounted</td>
<td>0</td>
<td>(12)</td>
<td>(3)</td>
<td>(15)</td>
</tr>
<tr>
<td>Net premium liabilities, undiscounted - central estimate</td>
<td>21</td>
<td>97</td>
<td>79</td>
<td>198</td>
</tr>
<tr>
<td>Discounting</td>
<td>(0)</td>
<td>(2)</td>
<td>(1)</td>
<td>(3)</td>
</tr>
<tr>
<td>Net premium liabilities, discounted - central estimate</td>
<td>21</td>
<td>95</td>
<td>78</td>
<td>195</td>
</tr>
<tr>
<td>Diversified risk margin, discounted - 75% PoA</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net premium liabilities, discounted - 75% PoA</td>
<td>195</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The future reinsurance costs for unexpired risks do not take into account any unearned reinsurance premium asset that may be held on EQC’s balance sheet and this should be considered when carrying out the Liability Adequacy Test.

The risk margin for premium liabilities is nil as the central estimate of the net premium liabilities is greater than the 75th percentile.

11.2 Material implications of the results

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

11.3 Key changes from results as at 30 June 2015

The net discounted premium liabilities at the 75th probability of adequacy have decreased from $196m as at 30 June 2015 to $195m as at 31 December 2015. The decrease is driven by reduced probabilities of the likelihood of future Canterbury earthquake events as per the Geonet website. This reduction in probability has occurred due to the passing of time as well as a tightening of the potential earthquake region.

11.4 Quality control processes

The valuation was subject to internal peer review and the results were compared to those from previous ILVRs.
11.4.1 Actual vs. expected experience

The current data does not support an exact analysis of actual claims experience against that expected from the 30 June 2015 premium liabilities calculations. This is because there is no way of identifying incurred claims costs arising from unexpired risks as at 30 June 2015. 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 2015.

The undiscounted net central estimate cost of future claims as at 30 June 2015 was $196m.
12 Uncertainty

12.1 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 judgment.

12.2 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.

12.3 Uncertainties arising from the Canterbury earthquakes

12.3.1 Background

The Canterbury earthquakes have resulted in a higher than usual level of uncertainty associated with this valuation.

Some of the key sources of uncertainty are:

- The impact of multiple events on EQC coverage and reinsurance coverage.
- Severe damage resulting from liquefaction and a complex land claims environment from both engineering, valuation and legal perspectives.
- The potential for construction cost inflation to exceed expectations.

Consequently, at this stage of claims development, there is still a degree of unavoidable uncertainty regarding the future claims costs. Over time, as claims are settled, and as the reasonableness of the model and its assumptions can be tested against the emerging claims experience, the level of uncertainty will further reduce.

12.3.2 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.
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- The impact of the ‘diminution of value’ cover interpretation.
- The assumed market value cap for a number of properties in Canterbury.
- The implementation of the IFV and ILV settlement methodologies.
- The possible impact of demand surge due to labour shortages.
- Legal, valuation and engineering challenge and different interpretation of the land cover provisions in the EQC Act.

12.4 Implications of uncertainty

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 wide confidence ranges in the estimated liabilities for each event.
- Different practitioners could legitimately arrive at quite different estimates of the cost of claims.
Earthquake Commission
10 February 2016

Insurance Liability Valuation
as at 31 December 2015

Appendices
A 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.

A.1 Main events

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

A.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.

A.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.

A.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.
A.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.

A.2  **Future events**

The understanding of the active fault system in the Christchurch area is evolving but analysis of the series of events to date indicates a progressive ‘unlocking’ towards the east. If continued this would imply that future events may be centred offshore and further away from the city.

As at 1 November 2015 the Geonet website stated that their latest computer modelling showed a 6% - 7% chance of a magnitude 6 or greater earthquake occurring within the wider Canterbury aftershock region in the course of the next year. The extent of the area of the earth’s crust that has experienced a stress change indicates that aftershocks can be expected to continue (at reducing levels) for decades. It is noted that the percentage chance of a magnitude 6 event is for the greater Canterbury region. The percentage chance of another magnitude 6 event within a 20km window of urban Christchurch is considerably smaller.
B EQC – Organisational Background

B.1 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 only 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’):

- 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 4000m², 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.

- Building claims (to a maximum of $100k plus GST).

- Personal property (contents) claims (to a maximum of $20k plus GST).

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

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.

For there to be residential building, 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.
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- 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.).

**B.1.1 Property covered (including excess and limits)**

**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 4000m², 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 dwelling 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.

**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 dwelling, within 60m of the dwelling and owned by the owner of the land or dwelling.
- 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 dwelling (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 dwelling.
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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).

B.1.2 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.

B.2 EQC levies

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

Prior to 1 February 2012, domestic home and contents policyholders paid 5c per $100 of insurance cover, up to a maximum of $69 per year.

From 1 February 2012 the levy increased for contracts entered into on or after that date to 15c per $100 of insurance cover, up to a maximum of $207 per year.

The purpose of the increase (as noted in the Minister of Finance’s press release dated 11 October 2011) was to:

- Provide revenue to meet EQC’s operating costs, which for many years have been subsidised by NDF investment income, and to cover higher reinsurance costs.
- Enable EQC to rebuild the NDF to its pre-earthquake level of $6 billion in about 30 years.
- Reduce EQC’s estimated $1.2 billion cash shortfall to $490 million, reducing the amount the Government may have to provide under EQC’s Crown guarantee.

B.3 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.
B.4 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.

Fletcher Earthquake Recovery or EQR (also known as the Project Management Office or PMO) acting as an agent of EQC for repair of damaged houses had established 20 hubs in the Christchurch area. This has now reduced to just one hub as the Christchurch Home Repair Programme enters the final phase.

B.5 EQC claims handling process

The key points of EQC’s Canterbury earthquake claim process may be summarised as follows:
- A claimant lodges a notice of damage via EQC’s 0800 claims freephone number or website. Claimants have three months following each event in which to lodge a notice.
- EQC allocates to each claim an initial triage status and estimated cost based on the lodgement information.
- Building and land claims are assessed on site by a loss adjuster and a builder, supported by an engineer as required and a new estimate is produced via the COMET-based iPad system. Based on the assessment, one of the following actions occurs:
  - Some claims are settled via payment in cash:
    - Small claims for contents, minor damage and emergency repairs.
    - Claims over EQC ‘claims cap’.
  - For claims not paid in cash, settlement via repair will usually be undertaken by the EQR but the claimant can elect to use another repairer under certain conditions.
- Contents claims are managed in Wellington, Christchurch and Hamilton.
- BAU claims are managed in Wellington and Hamilton.

B.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.
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- The Alchemy COMET systems (A & B) that manage the iPad-based field assessments.
- The ACE (Apportioned Cost Estimate) database.
- 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.
C  EQC Reinsurance

C.1  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.

C.2  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.

C.3  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.

C.4  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.
C.5 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.

C.6 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.

C.7 Reinsurance protection in place for EQC for the period 1 June 2015 – 31 May 2016

From 1 June 2015, the reinsurance programme has five layers, beginning at NZD $1,750m and finishing at $6,250m.

The top layer, which is $1,250m xs $5,000m, is 76% covered.
C.8 EQC reinsurance accounting

C.8.1 Reinsurance premiums

Premiums on Layers 1, 2 and 3 are payable quarterly in advance on 1 June, 1 September, 1 December and 1 March.

For 2010/11 reinsurance year:

- Layers 1 and 2 were placed on the basis of one pre-paid (or ‘free’) reinstatement. The contracts therefore reinstate up to one limit of indemnity with no additional reinstatement premium payable. Back-up cover for Layer 1 was purchased for the period from 30 September 2010 to 31 May 2011.
- Layer 3 (the top and drop) was placed with one reinstatement at 100% additional premium. In the event of a loss the cover is reinstated up to one limit of indemnity for the payment of a premium that is pro rata as to the amount of the cover utilised but 100% as to time. The reinstatement premium is payable at the time of EQC requesting payment of the claim from reinsurers, that is only once claims from one event exceed the trigger point of $3.5 bn.

There was an asset representing the ‘unearned’ 2/3 of the reinsurance premiums paid at 1 June 2011 in EQC accounts as at 1 July 2011.

For the 2011/12 reinsurance year:

- The unexpired 3 year deals continue on the same basis as before, after annual resigning; i.e. premiums payable quarterly in advance and one pre-paid reinstatement for each of Layers 1 and 2.
- The 2011/12 annual placement is on the basis of one reinstatement at 100% additional premium.
- The situation in regard to Layer 3 (the top and drop) depends on the extent to which cover has been used by EQ1 and / or EQ2, as discussed in Appendix C. There was one reinstatement at 100% additional premium, but this is subject to the proviso that there may be limited cover to reinstate on this contract as the NZ$1bn total limit of indemnity applies across the 3 year term.

As noted above, reinstatement premiums are only payable once claim payments actually trigger the situation. Therefore, amounts that may become payable in future as a result of past events may be regarded as contingent liabilities in EQC accounts.

For 2015/16 (current) reinsurance year:

- The details for the current year are commercially sensitive.

C.9 Reinsurance recoveries

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

Pre-funding for any event can only be requested once an official incurred estimate exceeding the programme deductible has been issued.
D. Information and Data – Further Detail

D.1 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.

D.1.1 The model and its calibration

9(2)(a) A consultant, collects and inputs the data required by Minerva. In July 2011, MJW has discussed with him, in general terms, the nature of the data and aspects of the operation of Minerva. 9(2)(ba)(i) We summarise some of the points that were discussed below, in order to provide a suitable context for the results used.

With regards to properties covered by EQC (i.e. primarily domestic buildings), this 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. 9(2)(ba)(ii) 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.
D.1.2 Use of the model for this valuation

As noted above, the data on Canterbury dwellings 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 year 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 earthquakes.

D.2 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.

D.2.1 EQC Executive

Hugh Cowan – GM Reinsurance, Research and Education:
- Land issues.
- Apportionment issues.
- ‘Big picture’ issues.

Gillian Dudgeon – General Manager Shared Services:
- Financial statements.
- Claims handling expenses.

D.2.2 EQC Finance Team

[Redacted] – Reinsurance Claims Manager:
- ‘Big picture’ issues.
- Accounts.
- Inflation and discounting.
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- Apportionments.
  - 9(2)(a) – Financial Controller
  - Accounts.
  - Claims handling expenses

D.2.3 **EQC Canterbury Event Field Office**

- 9(2)(a) – Business Services Manager:
  - Liaison to EQR.
- 9(2)(a) – Head of Canterbury Land:
  - Land issues.

D.2.4 **EQC Business Information Unit**

- 9(2)(a) – BIU Manager:
  - ClaimCentre and Actuarial Data Extract.
  - Background material.

D.2.5 **EQC legal team**

- 9(2)(a) – Chief Legal Advisor
- 9(2)(a) – Legal Counsel (secondment)
  - Legal issues

D.2.6 **EQC policy team**

- 9(2)(a) – Principal Policy Analyst
  - EQC policy responses

D.2.7 **Tonkin + Taylor**

- 9(2)(a) – Senior Geotechnical Engineer:
  - Land claims issues and costs.
- 9(2)(a) – Geotechnical Engineer:
  - Land claims issues and costs.
E Data Validation

E.1.1 Actuarial Data Extract vs Daily Report

The table below shows a reconciliation of the 4 January 2016 Actuarial Data Extract received from the ClaimCentre (CIMS) system against the Business Information Unit’s Daily Report for 31 December 2015.

<table>
<thead>
<tr>
<th>Event</th>
<th>Event Date</th>
<th>ADE - 4 Jan 2016</th>
<th>EQR</th>
<th>Total</th>
<th>Daily Report - 31 Dec 15</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td>Number of claims</td>
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<td>Paid $m</td>
<td>Number of claims</td>
<td>Paid $m</td>
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<td>483</td>
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<td>8</td>
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<td>6</td>
<td>12</td>
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<td>40</td>
<td>81</td>
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<td>7</td>
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<td>5,399</td>
<td>2,422</td>
<td>7,823</td>
<td>469,400</td>
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</table>

*not shown separately on the Daily Report, but included in the total.

The level of agreement is satisfactory for valuation purposes.
Released under the Official Information Act 1982

The table below illustrates a reconciliation of the 4 January 2016 Actuarial Data Extract received from the ClaimCentre (CIMS) system against the Business Information Unit’s Daily Report for 31 December 2015.

<table>
<thead>
<tr>
<th>Validation of ClaimsCentre (CIMS) Actuarial Data Extract</th>
<th>Canterbury Earthquakes only</th>
<th>ADE - 4 January 2016</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>EQ1</td>
<td>EQ2</td>
<td>EQ3</td>
</tr>
<tr>
<td>ADE and Fletcher - 4 January 2016</td>
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<td></td>
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<tr>
<td>Number of claims</td>
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<tr>
<td>Open</td>
<td>64,330</td>
<td>73,004</td>
<td>24,373</td>
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<tr>
<td>Closed</td>
<td>92,259</td>
<td>84,254</td>
<td>32,058</td>
</tr>
<tr>
<td>Total</td>
<td>156,589</td>
<td>157,258</td>
<td>56,431</td>
</tr>
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<td>Paid to Date ($000s)</td>
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<td>811,330</td>
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<tr>
<td>Number of subclaims</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Land</td>
<td>47,998</td>
<td>65,974</td>
<td>18,580</td>
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<tr>
<td>Building</td>
<td>146,329</td>
<td>136,974</td>
<td>50,671</td>
</tr>
<tr>
<td>Contents</td>
<td>57,738</td>
<td>87,494</td>
<td>20,969</td>
</tr>
<tr>
<td>Total</td>
<td>252,065</td>
<td>290,442</td>
<td>90,220</td>
</tr>
<tr>
<td>Daily Report - 31 December 2015</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Number of claims</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>64,330</td>
<td>73,004</td>
<td>24,373</td>
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<tr>
<td>Closed</td>
<td>92,258</td>
<td>84,254</td>
<td>32,058</td>
</tr>
<tr>
<td>Total</td>
<td>156,588</td>
<td>157,258</td>
<td>56,431</td>
</tr>
<tr>
<td>Paid to Date ($000s)</td>
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<td>813,034</td>
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<td>Number of subclaims</td>
<td></td>
<td></td>
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<tr>
<td>Land</td>
<td>47,997</td>
<td>65,974</td>
<td>18,580</td>
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<tr>
<td>Building</td>
<td>146,328</td>
<td>136,974</td>
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<tr>
<td>Contents</td>
<td>57,738</td>
<td>87,494</td>
<td>20,969</td>
</tr>
<tr>
<td>Total</td>
<td>252,063</td>
<td>290,442</td>
<td>90,220</td>
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<tr>
<td>Difference</td>
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<tr>
<td>Number of claims</td>
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<tr>
<td>Total</td>
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<td>(1,705)</td>
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<td>-</td>
</tr>
<tr>
<td>Building</td>
<td>1</td>
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<tr>
<td>Total</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
F  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.

F.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.

Note that in Section 8.2 we have provided sensitivity analysis results for a lengthening of the settlement pattern with consequential impact on CHE.

F.2  CHE event apportionment

CHE costs that can be identified as being wholly related to specific claim costs are now 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.
F.3 Conclusion

The results are shown below.

| Estimated undiscounted/uninflated Claims Handling Expenses (CHE) - all indirect costs |
|-----------------------------------|---|---|---|---|---|---|
|                                  | EQ1 | EQ2 | EQ3 | EQ4 | AS | BAU* |
| Total Costs                      |     |     |     |     |    |    |     |
| Paid to date - reinsurable ($000s) | 420,094 | 688,169 | 108,396 | 34,432 | 44,685 | 0 | 1,290,776 |
| Paid to date - non-reinsurable ($000s) | 3,860 | 4,700 | 1,196 | 567 | 567 | 0 | 10,840 |
| Paid to date - total ($000s)      | 423,953 | 692,869 | 110,593 | 35,009 | 45,252 | 0 | 1,391,616 |
| Estimated future - reinsurable ($000s) | 46,487 | 98,967 | 26,091 | 5,086 | 3,489 | 0 | 177,990 |
| Estimated future - non-reinsurable ($000s) | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total future - total ($000s)      | 46,487 | 98,967 | 26,091 | 5,086 | 3,489 | 0 | 177,990 |
| Total ($000s)                     | 470,381 | 786,736 | 133,643 | 40,085 | 48,761 | 0 | 1,468,606 |

The BAU expenses assumptions have remained unchanged since 30 June 2015.