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1 Executive Summary

1.1 Addressee

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

1.2 Report commissioned by

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

1.3 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 30 June 2016.
- The development of EQC's Canterbury earthquakes claims costs since 31 December 2015.

1.4 Scope

1.4.1 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 30 June 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 30 June 2016.

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

Premium liabilities are not included directly in 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 are set out in Section 1.10 as well as Sections 7 and 12.

1.5 Effective valuation date

The effective date of the valuation is 30 June 2016.
1.6 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).

1.7 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 31 December 2015 (dated 10 February 2016).

1.8 Definitions of technical terms

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 J.

1.9 Event groups

1.9.1 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 dwellings.

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

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.
1.9.2 **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.

1.9.3 **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.
- Canterbury earthquake claims.

1.10 **Operational Developments since the 31 December 2015 valuation**

There were a number of operational developments that occurred in the first half of the 2015-2016 financial year which had an impact on the valuation models at 31 December 2015.

Since then, there have not been any material new developments but rather refinement in the operational process that has helped to guide the valuation process. These refinements relate to:
- Land model
  - ILV DoV rates
- Building model
  - Reopened claims

A description of these operational developments is shown below with detail on how each of these has affected the valuation being shown in Section 1.11.

1.10.1 **Canterbury earthquakes: land model**

**ILV DoV rates**

As at 31 December 2015 a draft set of DoV rates for ILV were available to inform the valuation process. Subsequently, a revised version of these rates was presented to the Board in May and finalised on 10 June 2016. The document:
- is focused on assessing DoV for properties where the house that existed before the Canterbury Earthquake Sequence is still in situ on the property,
- does not deal with properties with both IFV and ILV qualifying damage.

DoV payments on ILV affected properties have recently commenced.

1.10.2 **Canterbury earthquakes: building model**

**Reopened claims**

The valuation as at 31 December 2015 had provisions in respect of the remaining unresolved claims and in respect of claims that may reopen. The reopened claims provision was broadly divided into the following categories:
• Overcap claims
• Undercap EQR claims
• Undercap non-EQR claims

Since 31 December 2015 there has been further information in respect of the first two of these items. In respect of overcap claims, there have been initial conversations between EQC and some insurers as part of the Financial Completion (Insurer Washup). In respect of undercap EQR claims, there is now more visibility on the frequency and severity of remediation work and also of work required to repair damage to drains.

1.11 Valuation Developments since 31 December 2015

The operational developments noted above along with additional items of data have been factored into the valuation model. The sections below describe how this has occurred. Further information on all of the items below is found in Section 5 and Appendix G.

The impact of these changes is shown in Section 1.13.3.

1.11.1 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 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.

1.11.2 Canterbury earthquakes: land model

ILV land damage

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’s policy in respect of settlement of ILV damaged land is set out in Section 2.5.5 and considers the ability and homeowner intent to repair the land, costs and the DoV that has been incurred.
Many of these criteria are not readily available (e.g. whether property has been sold, intent of homeowner to repair land) or in a form that is useable for valuation purposes. We have therefore based our valuation approach for ILV damage on whether the property appears to be a cleared site or has a house in-situ. Specifically, we have modelled the ILV policy in the following manner.

**Cleared Site**

In respect of cleared site land, the valuation approach will be a combination of:

- Repair costs applied to the land area that is reasonably required to reinstate a residential building. This land area is usually less than the Insured Land Area.
- DoV applied to the remainder of the Insured Land Area.

The estimated costs of indemnifying a home owner for ILV damage where the land is repaired are apportioned 100% to the first qualifying event.

**Houses in-situ**

In respect of properties with in-situ houses, the valuation approach will be on the basis of DoV applied to the Insured Land Area. The estimated costs of indemnifying a home owner through DoV for ILV damage have been apportioned amongst all qualifying events.

**Uncertainty of eventual settlement outcomes**

The uniqueness of ILV damage in Canterbury and therefore the lack of historical precedent presents a significant level of uncertainty around the eventual settlement outcome. There are a number of reasons for this but the principal one is the relative amounts produced by the two settlement paths.

For this reason, we have taken a prudent view of the settlement outcome for properties with a house in-situ, and have assumed that the ultimate settlement outcome will result in either; DoV (as intended), or as a repair cost on an equivalent cleared site.

**Silt removal**

Within the land model is a provision for the removal of silt, which will have largely been completed.

We have made enquiries as to how the relevant costs might have been accounted for and the responses we have got indicate that any silt removal costs incurred by EQC will likely have been recorded as either:

- EQR cost of remediation – and hence included in the dwelling model.
- Land damage category 1 – 7 cost.

In both these cases, the costs of silt removal will have been captured by other parts of the valuation model. There may yet be silt removal costs incurred outside these two avenues and we consider it appropriate to retain a provision (albeit reduced) for silt removal at this stage.

**Unclaimed damage**

Following the Ministerial Directions on unclaimed damage, we have investigated the extent to which properties with land damage may not have valid claims.
The flat land model is based on a list of all Canterbury properties that may have incurred land damage. Not all of these properties will have had insurance during the period of the Canterbury earthquakes, and of those that did have insurance, not all will have lodged a claim for every event to which land damage has been allocated.

For this valuation we have undertaken an exercise to match each of the properties in the flat land model to a property in the claims system where possible. Where we were unable to find a match at all, we have treated the flat land property as being uninsured and have assumed that EQC will not have any liability to pay for land damage which may have occurred.

Where we were able to match the flat land property to a property with at least one valid claim, we determined whether any of the allocated damage fell on events for which there was no valid claim. This has been treated as unclaimed damage. Under the Ministerial Direction, as noted in Section 2.2.6, unclaimed damage is to be covered by EQC. However, we have treated the unclaimed damage as unrecoverable from EQC’s reinsurers.

We have estimated that there are
- 2,266 uninsured properties with land damage. The land costs associated with these properties sums to $27m for which we assume EQC is not liable.
- A number of properties with unclaimed damage totalling approximately $10 million which relates to the EQ1 event, for which reinsurance may therefore not be recoverable. Whilst there is unclaimed damage in respect of the other events, there is no reinsurance impact.

This treatment of uninsured damage and unclaimed damage is reflected in the tables shown throughout this report.

1.11.3 Canterbury earthquakes: building model

Reopened claims – overcap

Since the valuation at 31 December 2015, we have had further discussions with EQC in respect of the Insurer Washup process. We understand there has been some further interaction between EQC and the private insurers.

As a result of these discussions we consider that we have no reason to change the estimated ultimate cost that was set as at the previous valuation.

Reopened claims - EQR

Through the repair work that EQC has undertaken through the Canterbury Home Repair Programme, it is expected that there will be a number of properties that experience materials failure, mis-scoping and/or workmanship issues.

We have had discussions with EQC staff that have been collating and reviewing information on the extent of the remedial work that may be required in respect of these issues.

We have also spoken to Master Builders Services (‘MBS’) who have visibility over a wider group of building practitioners and also over non-earthquake building work.

Based on these discussions, we have increased the provision held to address these costs.
Reopened claims - drainage

An additional item of work that has emerged relates to residential drains requiring remediation after initial dwelling remediation work has concluded.

It is very difficult to identify the proximate cause of drain failure, with earthquake damage being one of many possible reasons. In addition, the expected failure times for laterals could be five to seven years after an event. EQC's lateral policy provides claimants with a grace period up to 31 December 2016 where the 'benefit of the doubt' is granted. Where the circumstances are assessed to be consistent with earthquake damage by EQC's inspection programme, EQC will cover the repairs with no further proof required.

We estimate that there may be 6,000 properties requiring drainage remediation. For these properties we have applied an average remediation cost, based on some early trials.

Unclaimed damage

Following the Ministerial Directions on unclaimed dwelling damage, we have investigated the extent to which properties with dwelling damage may not have valid claims.

We have estimated that there is approximately $12 million of unclaimed dwelling damage related to the EQ1 event, for which reinsurance may therefore not be recoverable. Whilst there is unclaimed damage in respect of the other events, there is no reinsurance impact.

This is reflected in the tables shown throughout this report.

Recoveries

In a number of cases, claimants have returned or lost their settlement payments. In these cases, the returned / lost payment was recorded as a recovery and a new payment was issued. For these claims, the correct paid position should be the difference between the paid field (with two lots of payments) and the recoveries field (with the returned / lost cheque).

In addition to the above there are other categories of recovery which require more in-depth analysis.

EQC Finance have recently undertaken a project to ratify these records and have provided us with a list of those records where the recoveries amount should be netted off the paid amount. This adjustment has taken place and the results reflect the change.

Fees

Within the claims management system is a field called Fees. These direct fees are primarily in respect of dwelling sub-claims although some will relate to land sub-claims. There is no easy way to separate the fees into the appropriate sub-claim.

It was decided that a pragmatic approach to including them in the valuation was to include them in the dwelling model.

The total of the Fees amount was $7m.

1.11.4 Canterbury earthquakes: contents model

No material changes to the model.
1.11.5 BAU model

No material changes to the model.

1.11.6 Claims handling expenses (CHE) model

No material changes to the model.

1.12 Principal areas of judgment

The valuation of the Canterbury earthquake claims costs requires judgment to be applied in many areas. Some of these areas have a material impact on the outcome and these are described below.

1.12.1 Land model

The land model is based on information provided by T+T and EQC. A key part of this information is a scenario based model with detailed geotechnical and financial information on every flat land property that may be eligible for a land claim. We have then translated this into a stochastic land model and applied judgment in a number of key areas. The most material of these relate to:

- IFV DoV rates
- ILV DoV rates
- ILV Settlement path

IFV DoV Rates

Settlement on IFV damaged properties has begun with properties in the Green Zone that have IFV damage only being addressed first. These properties are considered easier to assess and therefore estimate settlement costs than combination IFV+ILV damaged properties or qualifying Red Zone properties.

It has been established that there is a strong correlation between the extent of the Exacerbated Flooding Coverage (EFC), as a percentage of the insured land area, and the DoV rates that have been applied. This relationship has been used to estimate DoV rates for the remaining IFV properties, given that the EFC has been assessed for those properties.

The remaining properties, particularly combination IFV+ILV damaged properties and Red Zone properties, have higher EFC than the properties that have been settled to date. We would therefore expect higher settlement amounts on average for the remaining properties.

We have considered that the relationship between EFC and DoV rate may break down for the more difficult remaining areas and to address this we have assumed higher DoV rates for the remaining Green Zone properties. The rates assumed for this valuation are the same as those as at 31 December 2015.

In respect of the Red Zone properties, we have left our DoV rate assumptions unchanged from 31 December 2015. These were based on engineering judgment at the time and will be re-assessed as more information is forthcoming.
ILV DoV Rates

The question of the appropriate ILV DoV rates to apply has been noted above in Section 1.11.2. The model supplied by T+T uses the final (house in-situ) DoV rates for all ILV affected properties. There are not as of yet DoV rates for combination IFV+ILV damaged properties or cleared site properties and so the house in-situ rates have been used.

There is a final DoV methodology document detailing how the DoV rates should be calculated. The document:

- Produces DoV rates for properties where the house that existed before the Canterbury Earthquake Sequence is still in situ on the property.
- Does not deal with properties with both IFV and ILV qualifying damage.

As discussed in Section 1.10.1 the draft DoV methodology in place as at 31 December 2015 has now been revised and presented to the Board. As at 30 June 2016 EQC have begun presenting settlement amounts to Green Zone claimants although this has only occurred in the last month.

The ILV operational process has not commenced to a material degree as at the date of the valuation. The eventual outcome is uncertain and reasons for this are noted in Section 1.11.2.

At 31 December 2015 we allowed for this uncertainty by adjusting the ILV DoV rates used in the model. For this valuation, given that the DoV methodology has now been presented to the Board, and that this document is intended to form the basis for any settlement amounts paid to claimants, and that the rates are slightly higher than that as at 31 December 2015, we have not applied any adjustment to the ILV DoV rates from the DoV methodology.

For this valuation, we have allowed for the uncertainty by modelling a range of potential settlement outcomes. As the outworkings of the operational process become clearer, the uncertainty (and range of modelled outcomes) will reduce.

ILV Settlement path

EQC’s policy on settling ILV damaged land is detailed in Section 2.5.5. For qualifying properties, the settlement amount will be based on DoV unless a number of criteria are met, in which case the settlement amount will be based on repair cost.

Unfortunately, not all of the ILV criteria that will be used to inform the settlement path are readily available in a form fit for valuation purposes. We do have visibility on which properties are cleared sites (which is one of the criteria) and have prudently used this as the sole valuation criteria for determining the ILV settlement path.

Scenario analysis

We have carried out some scenario analysis around the ILV issues noted above. The results of this are shown in Section 8.3.

1.12.2 Building model

Within the building model there is a provision for reopened claims for undercap EQR claims. This is discussed in Section 1.11.3.

Judgment has been applied to extrapolate from the small sample of completed remediations and the small sample of drainage claims.
Remedial claims

Through the repair work that EQC has undertaken through the Canterbury Home Repair Programme, it is expected that there will be a number of properties that experience materials failure, mis-scoping and/or workmanship issues.

This is due to the significant demands on the workforce and the demands of the insureds who, unsurprisingly, want their repairs carried out as quickly as possible. It is difficult to compare the rate of remedial works experienced by EQC and that of other industry experts due to the varying definition between parties of what broadly constitutes remedial works.

However, discussions with MBS have indicated that the rate at which EQC is incurring remedial costs is not inconsistent with that which might be expected in the wider industry.

EQC / EQR staff have carried out a triage process on the identified remedial claims and made assessments as to likely costs. In the absence of a number of fully completed test cases it is difficult to assess the adequacy of this cost assessment process. However, in our opinion the process used to estimate the costs was reasonable and we have taken this as a guide as to the ultimate costs of remediation.

Drainage claims

The situation in respect of drainage claims is slightly less robust as the reporting of these claims began more recently than the remedial work. It is expected that the rate of reporting for drainage failure will continue unabated until the end of 2016 with a reduced rate in 2017.

The average cost to remediate drain failure is based on a pilot study of 150 properties.

1.13 Key results – claims incurred

The gross incurred claims costs for all Canterbury EQ events, incurred to 30 June 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 30 June 2016 in order to determine the estimated OS claims liability.

The ultimate incurred claims costs are calculated in respect of Canterbury earthquake events only as it is not useful (or practical) to include ultimate incurred claims costs from BAU events. 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 earthquakes plus BAU) and are discounted for the time value of money and include risk margins at the 85th percentile.
1.13.1 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 30 June 2016. A more detailed version of this table, including comparatives with the 31 December 2015 ILVR, is given in Section 7.5.

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).

<table>
<thead>
<tr>
<th>Canterbury earthquakes only</th>
<th>Ultimate claims costs, central estimate, undiscounted, including CHE - 30 June 2016 valuation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EQ1</td>
</tr>
<tr>
<td>Claims paid to date*</td>
<td>2,399</td>
</tr>
<tr>
<td>Case estimates</td>
<td>(66)</td>
</tr>
<tr>
<td>Actuarial determination</td>
<td>555</td>
</tr>
<tr>
<td>Gross estimated ultimate incurred claims</td>
<td>2,887</td>
</tr>
<tr>
<td>Claims handling expenses (CHE)</td>
<td></td>
</tr>
<tr>
<td>Paid to date</td>
<td>450</td>
</tr>
<tr>
<td>Estimated future</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>475</td>
</tr>
<tr>
<td>Gross ultimate incurred claims including CHE</td>
<td>3,362</td>
</tr>
<tr>
<td>Reinsurance recoveries</td>
<td>(1.821)</td>
</tr>
<tr>
<td>Net ultimate incurred claims including CHE</td>
<td>1,541</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>31 December 2015 comparatives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross ult incurred claims including CHE</td>
<td>3,375</td>
</tr>
<tr>
<td>Net ult incurred claims including CHE</td>
<td>1,521</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>30 June 2015 comparatives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross ult incurred claims including CHE</td>
<td>3,341</td>
</tr>
<tr>
<td>Net ult incurred claims including CHE</td>
<td>1,520</td>
</tr>
</tbody>
</table>

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

For the 4 September 2010 event (EQ1), the central estimate, undiscounted ultimate cost of claims including CHE and gross of reinsurance is $3.362b. The estimated reinsurance recoveries are $1.821b, giving a central estimate net of reinsurance of $1.541b.

By far the biggest single item is the $6.749b gross ultimate incurred claims (including CHE) arising from the 22 February 2011 event. This is $4.272b more than the $2.477b reinsurance available for that event.

In respect of EQ3, the gross central estimate ultimate incurred claims cost is $0.712b. This falls below the retention point of $1b.

The actuarial determination for AS is shown as - $3m. A negative actuarial determination is due to the loading of total property damage estimates to the most recent claim, which tends to overstate the case estimates for AS (and underestimate for the other events).
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.

### 1.13.2 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 1.13.1 are the central estimate (mean) of a distribution of modelled outcomes.

The chart above illustrates the variability in ultimate claims liabilities according to our valuation model, split by event. The numbers shown correspond to the central estimates.

The numbers underlying the chart above are shown in the following table which gives figures at various percentiles. For example, the estimated 75th percentile loss for EQ2 is $6.907b.

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
<th>5%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>95%</th>
<th>Central Est</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2016 ILVR</td>
<td>EQ1</td>
<td>$3.221b</td>
<td>$6.390b</td>
<td>$0.651b</td>
<td>$0.189b</td>
<td>$0.250b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ2</td>
<td>$3.293b</td>
<td>$6.574b</td>
<td>$0.671b</td>
<td>$0.193b</td>
<td>$0.256b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ3</td>
<td>$3.363b</td>
<td>$6.733b</td>
<td>$0.698b</td>
<td>$0.196b</td>
<td>$0.259b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EQ4</td>
<td>$3.430b</td>
<td>$6.907b</td>
<td>$0.753b</td>
<td>$0.199b</td>
<td>$0.263b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS</td>
<td>$3.504b</td>
<td>$7.177b</td>
<td>$0.801b</td>
<td>$0.204b</td>
<td>$0.268b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Central Est</td>
<td>$3.362b</td>
<td>$6.749b</td>
<td>$0.712b</td>
<td>$0.196b</td>
<td>$0.259b</td>
<td></td>
</tr>
</tbody>
</table>

| 31 December 2015 ILVR | EQ1  | $3.224b | $6.338b | $0.700b | $0.183b | $0.250b |
|                       | EQ2  | $3.301b | $6.496b | $0.729b | $0.190b | $0.256b |
|                       | EQ3  | $3.377b | $6.643b | $0.766b | $0.196b | $0.258b |
|                       | EQ4  | $3.446b | $6.796b | $0.837b | $0.204b | $0.262b |
|                       | AS   | $3.524b | $6.964b | $0.895b | $0.212b | $0.267b |
|                       | Central Est | $3.375b | $6.646b | $0.783b | $0.197b | $0.258b |
1.13.3 Estimated ultimate claims costs – movement since 31 December 2015

The estimated ultimate gross claims cost for Canterbury earthquake events has moved from $11.259b as at 31 December 2015 to $11.279b as at 30 June 2016. Shown below is a graphical representation of the change in estimated ultimate incurred liabilities with a breakdown of this change below.

![Graph showing changes in estimated ultimate incurred costs](image)

**Canterbury earthquakes only**

Change in estimated ultimate incurred claims cost (undiscounted, incl CHE)

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
</tr>
<tr>
<td>Gross ultimate incurred claims including CHE - central estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 December 2015 ILVR</td>
<td>3,375</td>
<td>6,646</td>
<td>783</td>
<td>197</td>
<td>258</td>
<td>11,259</td>
</tr>
<tr>
<td><strong>Change in:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land claim costs</td>
<td>-65</td>
<td>-2</td>
<td>-65</td>
<td>-2</td>
<td>-0</td>
<td>-134</td>
</tr>
<tr>
<td>Building claim costs</td>
<td>+48</td>
<td>+97</td>
<td>+6</td>
<td>+3</td>
<td>+0</td>
<td>+154</td>
</tr>
<tr>
<td>Contents claim costs</td>
<td>+0</td>
<td>+1</td>
<td>-0</td>
<td>-0</td>
<td>-0</td>
<td>+1</td>
</tr>
<tr>
<td>CHE</td>
<td>+4</td>
<td>+8</td>
<td>-11</td>
<td>-2</td>
<td>+1</td>
<td>-1</td>
</tr>
<tr>
<td><strong>Total change</strong></td>
<td>-13</td>
<td>+103</td>
<td>-71</td>
<td>-1</td>
<td>+1</td>
<td>+20</td>
</tr>
<tr>
<td>30 June 2016 ILVR</td>
<td>3,362</td>
<td>6,749</td>
<td>712</td>
<td>196</td>
<td>259</td>
<td>11,279</td>
</tr>
<tr>
<td>Net ultimate incurred claims including CHE - central estimate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 December 2015 ILVR</td>
<td>1,521</td>
<td>4,169</td>
<td>783</td>
<td>197</td>
<td>258</td>
<td>6,927</td>
</tr>
<tr>
<td><strong>Movements</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Claims costs + CHE</td>
<td>-13</td>
<td>+103</td>
<td>-71</td>
<td>-1</td>
<td>+1</td>
<td>+20</td>
</tr>
<tr>
<td>Reinsurance recoveries</td>
<td>+34</td>
<td>-0</td>
<td>-0</td>
<td>-0</td>
<td>+34</td>
<td></td>
</tr>
<tr>
<td><strong>Total movements</strong></td>
<td>+21</td>
<td>+103</td>
<td>-71</td>
<td>-1</td>
<td>+1</td>
<td>+53</td>
</tr>
<tr>
<td>30 June 2016 ILVR</td>
<td>1,541</td>
<td>4,272</td>
<td>712</td>
<td>196</td>
<td>259</td>
<td>6,981</td>
</tr>
</tbody>
</table>

The biggest changes are in respect of land claims and building claims.
Estimated costs for land claims have decreased by $134m. This is a combination of the using more informed land data, the changed approach to modelling the uncertainty around settling ILV claims and identifying properties which have valid claims (uninsured properties).

The estimated costs for building claims have increased by $154m. The increase in expected costs relates primarily to two workstreams addressing remediation work related to the EQR programme as well as drainage issues. These workstreams are at an early stage and the provisions for these issues are based on limited information. In addition, Direct Fees are now included in the dwelling model.

The other movements since 31 December 2015 are an increase in contents claims of $1m and a reduction in CHE of $1m.

In addition to the aggregate movements above, there has been a movement in expected claims costs towards EQ2 and away from EQ1 and EQ3. This is primarily as a result of the changes in the land model, see Section 1.13.5.

### 1.13.4 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.

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

<table>
<thead>
<tr>
<th>Valuation date</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 June 2013 (post-DoV adjustment)</td>
<td>3,351</td>
<td>6,591</td>
<td>1,180</td>
<td>512</td>
<td>382</td>
<td>12,016</td>
</tr>
<tr>
<td>Change in period</td>
<td>-66</td>
<td>-108</td>
<td>-124</td>
<td>-90</td>
<td>-28</td>
<td>-415</td>
</tr>
<tr>
<td>31 December 2013 (post hard/soft)</td>
<td>3,285</td>
<td>6,483</td>
<td>1,056</td>
<td>422</td>
<td>354</td>
<td>11,600</td>
</tr>
<tr>
<td>Change in period</td>
<td>+58</td>
<td>+110</td>
<td>-28</td>
<td>+2</td>
<td>+3</td>
<td>+146</td>
</tr>
<tr>
<td>30 June 2014 (post hard/soft)</td>
<td>3,343</td>
<td>6,593</td>
<td>1,028</td>
<td>424</td>
<td>357</td>
<td>11,746</td>
</tr>
</tbody>
</table>

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.

1.13.5 Estimated ultimate claims costs – land claims cost movement

Background

The land claims cost is a highly uncertain and dynamic component of EQC’s estimated ultimate claims costs. This component involves many complex engineering and legal issues and MJW relies on information provided by EQC and their engineering consultants, T+T.

The structure of the current land liability model is similar to the 31 December 2015 model although the parameters have been updated to reflect emerging knowledge.

The model development is described in Section 1.10.1.
Movement in ultimate incurred cost

The chart below illustrates the movement in estimated gross ultimate claims costs in respect of land sub-claims between 31 December 2015 ($1.60b) and 30 June 2016 ($1.46b). Note that the split between ILV and IFV is an estimation. The ILV/IFV split reflects the amount of land damage to a property which can be attributed to each damage type, prior to the application of EQC caps.

The movement of $140m can be attributed to four key areas:

- $30m – With a change in way uncertainty has been modelled, this has a flow on impact to demand surge and the excesses applicable to settlement amounts.
1.13.6 **Gross claim payments – comparison to previous estimates**

The following chart shows actual gross claim payments for Canterbury earthquakes to 30 June 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 Section 8.1, 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.
1.13.7 Outstanding claims liabilities – all claims

The table below summarises the key components of the outstanding claims liabilities (‘OSCL’) as at 30 June 2016. A more detailed breakdown is set out in Section 7.6.

The net discounted OSCL at a probability of adequacy of 85% is $1.801b. The largest component of the liabilities is in respect of EQ2. The BAU claims are dominated by the 14 February 2016 earthquake.

### All EQC claims

<table>
<thead>
<tr>
<th>Estimated outstanding claims liabilities (OSCL) - 30 June 2016</th>
<th>EQ1 $m</th>
<th>EQ2 $m</th>
<th>EQ3 $m</th>
<th>EQ4 $m</th>
<th>AS $m</th>
<th>BAU $m</th>
<th>Total $m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross outstanding claims liabilities - central estimate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross claims including CHE, undiscounted</td>
<td>514</td>
<td>1,174</td>
<td>185</td>
<td>23</td>
<td>23</td>
<td>93</td>
<td>2,012</td>
</tr>
<tr>
<td>Discounting</td>
<td>(5)</td>
<td>(12)</td>
<td>(2)</td>
<td>(0)</td>
<td>(0)</td>
<td>(1)</td>
<td>(21)</td>
</tr>
<tr>
<td>Gross claims including CHE, discounted</td>
<td>508</td>
<td>1,162</td>
<td>183</td>
<td>23</td>
<td>23</td>
<td>92</td>
<td>1,991</td>
</tr>
<tr>
<td><strong>Reinsurance recoveries - central estimate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinsurance recoveries, undiscounted</td>
<td>492</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>492</td>
</tr>
<tr>
<td>Discounting</td>
<td>(5)</td>
<td>-</td>
<td>(0)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>(5)</td>
</tr>
<tr>
<td>Reinsurance recoveries, discounted</td>
<td>487</td>
<td>-</td>
<td>(0)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>487</td>
</tr>
<tr>
<td><strong>Net outstanding claims liabilities - central estimate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net claims excluding BAU CHE, undiscounted</td>
<td>21</td>
<td>1,174</td>
<td>185</td>
<td>23</td>
<td>23</td>
<td>93</td>
<td>1,520</td>
</tr>
<tr>
<td>Non-reinsurable CHE, undiscounted</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Net claims including CHE, undiscounted</td>
<td>21</td>
<td>1,174</td>
<td>185</td>
<td>23</td>
<td>23</td>
<td>93</td>
<td>1,520</td>
</tr>
<tr>
<td>Discounting</td>
<td>(0)</td>
<td>(12)</td>
<td>(2)</td>
<td>(0)</td>
<td>(0)</td>
<td>(1)</td>
<td>(16)</td>
</tr>
<tr>
<td>Net claims including CHE, discounted</td>
<td>21</td>
<td>1,162</td>
<td>183</td>
<td>23</td>
<td>23</td>
<td>92</td>
<td>1,504</td>
</tr>
<tr>
<td><strong>Net outstanding claims liabilities - risk margin, 85% PoA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net risk margin, diversified</td>
<td>4</td>
<td>229</td>
<td>36</td>
<td>4</td>
<td>5</td>
<td>18</td>
<td>297</td>
</tr>
<tr>
<td>Net OSCL and risk margin 85% PoA, discounted</td>
<td>28</td>
<td>1,391</td>
<td>219</td>
<td>27</td>
<td>28</td>
<td>110</td>
<td>1,801</td>
</tr>
</tbody>
</table>

14 February 2016 earthquake

It is estimated that the ultimate claims costs arising from the 14 February 2016 earthquake are $76m of which $72m is outstanding.
1.13.8 Outstanding claims liabilities – movement since 31 December 2015

The net of reinsurance OSCL (85% probability of adequacy, discounted) has decreased from $1.805b at 31 December 2015 to $1.801b at 30 June 2016. A summary of the change is shown below with more detail in Section 7.5.

### All EQC claims

<table>
<thead>
<tr>
<th>Reconciliation of change in outstanding claims liability from 31 December 2015 ILVR</th>
<th>All Periods</th>
<th>[\text{$m}]</th>
<th>[\text{$m}]</th>
<th>[\text{$m}]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net OSCL (85% PoA, discounted) as at 31 December 2015</td>
<td>1,795</td>
<td>9</td>
<td>1,805</td>
<td></td>
</tr>
<tr>
<td>Remove net risk margin (85% PoA)</td>
<td>(307)</td>
<td>(2)</td>
<td>(309)</td>
<td></td>
</tr>
<tr>
<td>Net OSCL (central estimate, discounted) as at 31 December 2015</td>
<td>1,488</td>
<td>8</td>
<td>1,495</td>
<td></td>
</tr>
<tr>
<td>Remove discounting</td>
<td>38</td>
<td>0</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Net OSCL (central estimate, undiscounted) as at 31 December 2015</td>
<td>1,526</td>
<td>8</td>
<td>1,534</td>
<td></td>
</tr>
<tr>
<td>Estimated net paid over period</td>
<td>(152)</td>
<td>(4)</td>
<td>(156)</td>
<td></td>
</tr>
<tr>
<td>Change in net actuarial determination</td>
<td>53</td>
<td>89</td>
<td>142</td>
<td></td>
</tr>
<tr>
<td>Net OSCL (central estimate, undiscounted) as at 30 Jun 2016</td>
<td>1,427</td>
<td>93</td>
<td>1,520</td>
<td></td>
</tr>
<tr>
<td>Add discounting</td>
<td>(15)</td>
<td>(1)</td>
<td>(16)</td>
<td></td>
</tr>
<tr>
<td>Net OSCL (central estimate, discounted) as at 30 June 2016</td>
<td>1,412</td>
<td>92</td>
<td>1,504</td>
<td></td>
</tr>
<tr>
<td>Net diversified risk margin (85% PoA, discounted)</td>
<td>278</td>
<td>18</td>
<td>297</td>
<td></td>
</tr>
<tr>
<td>Net OSCL (85% PoA, discounted) as at 30 June 2016</td>
<td>1,691</td>
<td>110</td>
<td>1,801</td>
<td></td>
</tr>
</tbody>
</table>

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

- Claim payments; net payments since 31 December 2015 have amounted to $156m.
- Risk margin; this has decreased by $12m.
- Discounting; this has decreased by $22m.
- Actuarial determination; this has increased by $142m on a net of reinsurance basis. Section 1.13.3 details how the underlying claims models have moved over the period.

1.14 Key results – premium liabilities

1.14.1 Premium liabilities

The table below summarises the key results of the estimation of EQC’s premium liabilities as at 30 June 2016. The premium liabilities will be used in the liability adequacy test.

The total value at 75% probability of adequacy is $216m. This is greater than the $146m unearned premium reserve. This means that an additional unexpired risk reserve will be required in the accounts as at 30 June 2016.

The largest component ($96m, as compared to $95m as at 31 December 2015) 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 30 June 2016. These claims are modelled by Minerva.
The next largest component ($90m, as compared to $78m as at 31 December 2015) relates to projected costs of future claims arising from Canterbury earthquakes during the period of the runoff of existing risks as at 30 June 2016. This increased slightly as a result of increased probabilities of seismic activity as reported by GeoNet.

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 $75m.

### Estimated Premium Liabilities - 30 June 2016

<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></td>
<td></td>
<td></td>
<td>146</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>22</td>
<td>47</td>
<td>70</td>
<td>139</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>3</td>
<td>5</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Policy (non-claims) admin expenses for unexpired risks</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Future reinsurance costs for unexpired risks</td>
<td>0</td>
<td>57</td>
<td>19</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>(11)</td>
<td>(4)</td>
<td>(15)</td>
</tr>
<tr>
<td>Net premium liabilities, undiscounted - central estimate</td>
<td>30</td>
<td>97</td>
<td>92</td>
<td>219</td>
</tr>
<tr>
<td>Discounting</td>
<td></td>
<td>(0)</td>
<td>(1)</td>
<td>(3)</td>
</tr>
<tr>
<td>Net premium liabilities, discounted - central estimate</td>
<td>30</td>
<td>96</td>
<td>90</td>
<td>216</td>
</tr>
<tr>
<td>Diversified risk margin, discounted - 75% PoA</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Net premium liabilities, discounted - 75% PoA</td>
<td></td>
<td></td>
<td></td>
<td>216</td>
</tr>
</tbody>
</table>

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.
1.15 Data

1.15.1 Sources

The most important sources of data for the investigations were:

- Data extracts from the Claim Centre Claims Information Management System (‘CIMS’).
  - Data as at 13 June 2016 was used to inform the ultimate incurred claims costs.
  - Data as at 30 June 2016 was used to derive the net outstanding claims liabilities.
- ACE apportionment data from the BIU.
- Small PAT results
- 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 30 June 2016.
- Discussions with EQC employees and contractors.

1.15.2 Adequacy and appropriateness

The completion of this valuation report requires many sources of data.

The demanding operational aspects of the Canterbury earthquake response and recovery have meant that the provision of data and information suitable for actuarial analysis is but one priority among many – consequently the data available for actuarial analysis is limited in some respects.

However, as for previous investigations, we have sought alternative sources of data and chosen valuation methodologies that mitigate these data issues as much as possible.

1.16 Key uncertainties

1.16.1 General comment

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

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

1.16.2 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.

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.

A more detailed description of uncertainty associated with this valuation – in particular arising from the Canterbury earthquakes - is set out in Section 12.

1.17 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 1.15.

More details regarding data, information and reliances are set out in Section 3.

1.18 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.
1.19 Key recommendations

1.19.1 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

1.19.2 Current Recommendations

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

- In respect of settling the remaining 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.

Further data recommendations are set out in Section 3.6.

1.20 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 judgment 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 (Deloitte), 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.

1.20.1 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.

1.21 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
- Analyst
- Analyst
- Mark Weaver Principal (Peer review)

1.22 Level of detail and additional information

In writing this report we have tried to strike a reasonable balance between describing what has been done and why, and keeping the report to a manageable size. Because of this, a considerable amount of detail has been either summarised at a high level or omitted. Readers requiring more detailed information are invited to contact the authors of the report.

1.23 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.
1.24 Authors

Craig Lough
Fellow of the NZ Society of Actuaries

Jeremy Holmes
Fellow of the NZ Society of Actuaries

Mark Weaver
Peer review
Fellow of the NZ Society of Actuaries
2 Background

2.1 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 B).
- 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.

2.2 Canterbury earthquakes and the implications of multiple events

Since 4 September 2010, a series of damaging earthquakes has affected the Canterbury region in general and the city of Christchurch in particular.

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

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 events
- 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.

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.
2.2.1 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.

2.2.2 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 rebuilding materials.

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

2.2.3 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.

2.2.4 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.
2.2.5 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 2.4 and Appendix C.

2.2.6 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:

- 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.

- 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.

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).

2.3 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.
2.4 EQC reinsurance

2.4.1 Cover

2.4.2 Premium accounting

Reinsurance premiums are paid quarterly in advance.

More details are provided in Appendix C.

2.4.3 Recoveries accounting

Reinsurance recoveries processes are described in Appendix C.

2.5 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.

2.5.1 Land cover

Section 19 of the Earthquake Commission Act 1993 details what is legally covered by EQC in respect of land damage. In summary, EQC’s maximum liability for each event is the sum of:

- the indemnity value of bridges, culverts and retaining walls that are lost or damaged, and

- the minimum 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.

2.5.2 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 B.1 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.

2.5.3 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).

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Cracking caused by lateral spreading</td>
<td>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.</td>
</tr>
<tr>
<td>2 Cracking caused by oscillation movements</td>
<td>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.</td>
</tr>
<tr>
<td>3 Undulating Ground</td>
<td>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.</td>
</tr>
<tr>
<td>4 Local ponding</td>
<td>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</td>
</tr>
<tr>
<td>5 Local settlement causing drainage issues</td>
<td>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 dwelling.</td>
</tr>
<tr>
<td>6 Groundwater springs</td>
<td>Formation of new groundwater springs now being emitted at the ground surface usually from a specific location on a site.</td>
</tr>
<tr>
<td>7 Inundation of ejected sand and silt</td>
<td>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 dwellings or over the entire site.</td>
</tr>
</tbody>
</table>
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.

2.5.4 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.

2.5.5 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 (defined in Section 2.5.3) 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’s 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.

**Apportionment of settlement costs**

For IFV and ILV settlement amounts that are based on DoV, the costs are apportioned amongst all qualifying events.

For settlement amounts based on repair cost (whether category 1-7, ILV, IFV and Port Hills), the costs are apportioned to the first event with qualifying damage.

**Silt removal**

One component of land damage has yet to be estimated in a detailed way, removal of ejected silt from underneath dwellings. It is estimated that approximately 5,000 properties (which are not included for ILV and IFV land damage) with silt inundation required silt to be removed from under the house.

2.6 **New Zealand economic environment**

2.6.1 **Economic growth**

GDP increased 0.7% in the March 2016 quarter with annual growth of 2.4%.

2.6.2 **Inflation**

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

2.6.3 **Interest rates**

The Reserve Bank has recently decreased the OCR so that it is now 2.25% p.a.

The five-year government stock rate was 2.02% pa as at 30 June 2016 (3.00% as at 31 December 2015).
3 Data and Information

3.1 Sources of data

The main sources of data used for the investigation are set out below.

3.1.1 Actuarial Data Extract from ClaimCentre

Weekly Actuarial Data Extracts (ADE) were taken from ClaimCentre and the key extracts used were dated 13 June 2016 and 30 June 2016.

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 ClaimCentre can be found in Appendix B.

3.1.2 ACE damage data

The ACE damage data (as at 2 May 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 52,615 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. A summary of the approved status information that was used is shown in Section 4.2.

ACE data cleaning process

<table>
<thead>
<tr>
<th>Number of Properties</th>
<th>Sum of Raw ACE Estimates</th>
<th>Total $m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw ACE Data</td>
<td>128,236</td>
<td>6,736</td>
</tr>
<tr>
<td>Remove:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAs</td>
<td>(75,520)</td>
<td></td>
</tr>
<tr>
<td>Duplicates</td>
<td>(46)</td>
<td></td>
</tr>
<tr>
<td>Property ID errors</td>
<td>(55)</td>
<td></td>
</tr>
<tr>
<td>Extremely large estimates (&gt;100m)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Data used in model</td>
<td>52,615</td>
<td>6,733</td>
</tr>
</tbody>
</table>

The BIU supplied two additional tables of data:

- A supplementary table identifying multi-unit buildings (MuBs) and whether the MuB was comprised of dependent or independent dwellings.
- A claim-to-address mapping. Other address fields in the Actuarial Data Extract were unsuitable for this purpose as there were known issues within their records (e.g. they were free-form text fields).

3.1.3 EQR paid data

The EQR paid data (as at 2 May 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.
3.1.4 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.

3.1.5 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 D.

3.2 Sources of information

The additional sources of information used for the investigation were:
- Draft accounts for the period ending 30 June 2016.
- Trial balance for the period ending 30 June 2016.
- Small PAT results.
- CHE Forecast 30 June 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 D).

3.3 Validation of data

3.3.1 Actuarial data extract

The first table in Appendix E illustrates a reconciliation of the 30 June 2016 Actuarial Data Extract system against the BIU’s Daily Report for 30 June 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 Section 4.

3.3.2 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.

Further validation of the ACE data and Fletcher data is set out in Section 4.
3.4 Reliances

The key data and information upon which we have placed reliance are described in Sections 3.1 and 3.2 above.

3.5 Concerns and qualifications

3.5.1 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).

3.6 Recommendations

3.6.1 Progress against previous recommendations

Several data-related recommendations were set out in Section 3.6 of the 31 December 2015 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

3.6.2 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.

3.7 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 3.5 and 3.6, we consider that the information provided to us was adequate and appropriate for the purposes of this valuation.
4 Canterbury Earthquake Claims Analysis

The figures in the following tables are based on an Actuarial Data Extract from ClaimCentre as at 30 June 2016.

4.1 Actuarial Data Extract from ClaimCentre (30 June 2016)

4.1.1 Number of notified claims

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>82,977</td>
<td>73,971</td>
<td>31,453</td>
<td>36,636</td>
<td>28,653</td>
<td>253,690</td>
</tr>
<tr>
<td>Open</td>
<td>62,009</td>
<td>70,316</td>
<td>22,728</td>
<td>10,661</td>
<td>12,772</td>
<td>178,486</td>
</tr>
<tr>
<td>Total</td>
<td>144,986</td>
<td>144,287</td>
<td>54,181</td>
<td>47,297</td>
<td>41,425</td>
<td>432,176</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closed</td>
<td>94,458</td>
<td>86,766</td>
<td>33,672</td>
<td>38,108</td>
<td>29,949</td>
<td>282,953</td>
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<tr>
<td>Open</td>
<td>62,152</td>
<td>70,520</td>
<td>22,766</td>
<td>10,686</td>
<td>12,790</td>
<td>178,914</td>
</tr>
<tr>
<td>Total</td>
<td>156,610</td>
<td>157,286</td>
<td>56,438</td>
<td>48,794</td>
<td>42,739</td>
<td>461,867</td>
</tr>
</tbody>
</table>

- 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.
4.1.2 Number of notified sub-claims

<table>
<thead>
<tr>
<th>Number of notified sub-claims (ClaimCentre)</th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>39,583</td>
<td>54,512</td>
<td>15,791</td>
<td>11,781</td>
<td>4,456</td>
<td>126,123</td>
</tr>
<tr>
<td>Open</td>
<td>7,927</td>
<td>8,941</td>
<td>2,721</td>
<td>1,917</td>
<td>1,136</td>
<td>22,642</td>
</tr>
<tr>
<td>Total</td>
<td>47,510</td>
<td>63,453</td>
<td>18,512</td>
<td>13,698</td>
<td>5,592</td>
<td>148,765</td>
</tr>
<tr>
<td>Building sub-claims</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>86,711</td>
<td>74,919</td>
<td>32,492</td>
<td>36,462</td>
<td>28,494</td>
<td>259,078</td>
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<tr>
<td>Open</td>
<td>49,189</td>
<td>51,482</td>
<td>16,301</td>
<td>6,163</td>
<td>10,074</td>
<td>133,189</td>
</tr>
<tr>
<td>Total</td>
<td>135,890</td>
<td>126,401</td>
<td>48,793</td>
<td>42,625</td>
<td>38,568</td>
<td>392,267</td>
</tr>
<tr>
<td>Contents sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>55,270</td>
<td>82,128</td>
<td>20,272</td>
<td>12,103</td>
<td>7,785</td>
<td>177,558</td>
</tr>
<tr>
<td>Open</td>
<td>17</td>
<td>84</td>
<td>8</td>
<td>5</td>
<td>11</td>
<td>125</td>
</tr>
<tr>
<td>Total</td>
<td>55,287</td>
<td>82,212</td>
<td>20,280</td>
<td>12,108</td>
<td>7,796</td>
<td>177,683</td>
</tr>
<tr>
<td>All sub-claims</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>181,564</td>
<td>211,559</td>
<td>68,555</td>
<td>60,346</td>
<td>40,735</td>
<td>562,759</td>
</tr>
<tr>
<td>Open</td>
<td>57,113</td>
<td>60,507</td>
<td>19,030</td>
<td>8,085</td>
<td>11,221</td>
<td>155,956</td>
</tr>
<tr>
<td>Total</td>
<td>238,677</td>
<td>272,066</td>
<td>87,585</td>
<td>68,431</td>
<td>51,956</td>
<td>718,715</td>
</tr>
</tbody>
</table>

- In respect of the Canterbury earthquake claims, there were 1.7 sub-claims per claim on average.
- 562,759 sub-claims (78% of the total) have been closed to date.
- It is worth noting that a significant portion of the 133k open building sub-claims are closed with EQR but are not recorded as such in ClaimCentre.
- Comparing EQ1 and EQ2 we see a similar number of building claims but a higher number of land and contents claims for EQ2.
The following table shows the number of sub-claims, including duplicates. The total matches closely to the BIU daily report as at 30 June 2016.

### Number of notified sub-claims (ClaimCentre) - all incl duplicates

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>40,987</td>
<td>57,527</td>
<td>16,275</td>
<td>12,088</td>
<td>4,614</td>
<td>131,491</td>
</tr>
<tr>
<td>Open</td>
<td>7,946</td>
<td>8,956</td>
<td>2,722</td>
<td>1,922</td>
<td>1,136</td>
<td>22,882</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>48,933</td>
<td>66,483</td>
<td>18,997</td>
<td>14,010</td>
<td>5,750</td>
<td>154,373</td>
</tr>
<tr>
<td><strong>Building sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>97,128</td>
<td>85,446</td>
<td>34,355</td>
<td>37,739</td>
<td>29,677</td>
<td>284,345</td>
</tr>
<tr>
<td>Open</td>
<td>49,229</td>
<td>51,557</td>
<td>16,319</td>
<td>6,174</td>
<td>10,082</td>
<td>133,361</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>146,357</td>
<td>137,003</td>
<td>50,674</td>
<td>43,913</td>
<td>39,759</td>
<td>417,706</td>
</tr>
<tr>
<td><strong>Contents sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>57,747</td>
<td>87,481</td>
<td>20,965</td>
<td>12,472</td>
<td>7,998</td>
<td>186,663</td>
</tr>
<tr>
<td>Open</td>
<td>17</td>
<td>84</td>
<td>8</td>
<td>5</td>
<td>11</td>
<td>125</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>57,864</td>
<td>87,565</td>
<td>20,973</td>
<td>12,477</td>
<td>8,009</td>
<td>186,788</td>
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<td><strong>All sub-claims</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>195,862</td>
<td>230,454</td>
<td>71,595</td>
<td>62,299</td>
<td>42,289</td>
<td>602,499</td>
</tr>
<tr>
<td>Open</td>
<td>57,192</td>
<td>60,997</td>
<td>19,049</td>
<td>8,101</td>
<td>11,229</td>
<td>156,168</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>253,054</td>
<td>291,051</td>
<td>90,644</td>
<td>70,400</td>
<td>53,518</td>
<td>758,667</td>
</tr>
</tbody>
</table>

#### 4.1.3 Sub-claims paid to date

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>16.0</td>
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<td>5.4</td>
<td>0.5</td>
<td>0.7</td>
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<tr>
<td>Open</td>
<td>3.5</td>
<td>5.5</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>9.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>19.5</td>
<td>230.8</td>
<td>5.5</td>
<td>0.6</td>
<td>0.7</td>
<td>257.1</td>
</tr>
<tr>
<td><strong>Building sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>1,286.0</td>
<td>2,756.8</td>
<td>267.6</td>
<td>100.2</td>
<td>82.9</td>
<td>4,493.5</td>
</tr>
<tr>
<td>Open</td>
<td>86.3</td>
<td>204.2</td>
<td>34.3</td>
<td>6.1</td>
<td>8.0</td>
<td>338.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,372.3</td>
<td>2,961.0</td>
<td>301.9</td>
<td>106.3</td>
<td>91.0</td>
<td>4,832.4</td>
</tr>
<tr>
<td><strong>Contents sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>125.1</td>
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<td>28.7</td>
<td>12.4</td>
<td>7.5</td>
<td>472.5</td>
</tr>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
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<td>299.0</td>
<td>28.7</td>
<td>12.4</td>
<td>7.5</td>
<td>472.7</td>
</tr>
<tr>
<td><strong>All sub-claims</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>1,427.1</td>
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<td>301.8</td>
<td>113.1</td>
<td>91.1</td>
<td>5,213.9</td>
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<td>209.9</td>
<td>34.4</td>
<td>6.2</td>
<td>8.0</td>
<td>348.3</td>
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<tr>
<td><strong>Total</strong></td>
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<td>3,490.8</td>
<td>336.1</td>
<td>119.3</td>
<td>99.2</td>
<td>5,562.2</td>
</tr>
</tbody>
</table>

*Includes duplicates & non-duplicates

- 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 $2,471m. Total building sub-claim payments equal $7,303m.
- EQ1 and EQ2 account for 90% of the total claims paid to date and building claims amount to 87% of the total paid.

4.1.4 Reported incurred sub-claims

<table>
<thead>
<tr>
<th></th>
<th>EO1</th>
<th>EO2</th>
<th>EO3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
<td>$m</td>
</tr>
<tr>
<td>Land sub-claims</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>16.0</td>
<td>225.3</td>
<td>5.4</td>
<td>0.5</td>
<td>0.7</td>
<td>247.9</td>
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<td>36.4</td>
<td>9.9</td>
<td>4.1</td>
<td>3.9</td>
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<tr>
<td>Total</td>
<td>38.6</td>
<td>261.7</td>
<td>15.4</td>
<td>4.6</td>
<td>4.6</td>
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<tr>
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<td>2,757.2</td>
<td>268.7</td>
<td>96.6</td>
<td>82.9</td>
<td>4,491.5</td>
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<tr>
<td>Open</td>
<td>903.4</td>
<td>1,267.9</td>
<td>246.7</td>
<td>57.0</td>
<td>130.2</td>
<td>2,665.1</td>
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<tr>
<td>Total</td>
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<td>4,025.1</td>
<td>515.4</td>
<td>153.7</td>
<td>213.1</td>
<td>7,066.6</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>125.0</td>
<td>298.6</td>
<td>28.7</td>
<td>12.4</td>
<td>7.5</td>
<td>472.2</td>
</tr>
<tr>
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<td>0.0</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Total</td>
<td>125.1</td>
<td>298.8</td>
<td>28.7</td>
<td>12.4</td>
<td>7.5</td>
<td>472.5</td>
</tr>
<tr>
<td>All sub-claims</td>
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<tr>
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<td>3,281.1</td>
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<td>5,211.6</td>
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<td>256.6</td>
<td>61.1</td>
<td>134.1</td>
<td>2,682.4</td>
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<tr>
<td>Total</td>
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<td>4,585.6</td>
<td>559.5</td>
<td>170.7</td>
<td>225.3</td>
<td>7,894.0</td>
</tr>
</tbody>
</table>

Reported claims incurred is the sum of claims paid to date plus the case estimates held as at 30 June 2016. To the extent that EQR claim payments may not be reflected in Claim Centre, the reported incurred will not be reflective of the actual position.

Building claims closed by EQR may still be recorded as open claims within the ClaimCentre.
4.1.5 **Observed average sub-claims cost (reported incurred only)**

<table>
<thead>
<tr>
<th></th>
<th>EQ1</th>
<th>EQ2</th>
<th>EQ3</th>
<th>EQ4</th>
<th>AS</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land sub-claims</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td>4,132</td>
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<td>4,076</td>
<td>3,645</td>
<td>2,140</td>
<td>3,419</td>
<td>3,399</td>
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<tr>
<td><strong>Total</strong></td>
<td>813</td>
<td>4,124</td>
<td>829</td>
<td>335</td>
<td>826</td>
<td>2,184</td>
</tr>
<tr>
<td><strong>Building sub-claims</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
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<td>36,803</td>
<td>8,270</td>
<td>2,651</td>
<td>2,911</td>
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</tr>
<tr>
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<td>15,133</td>
<td>9,254</td>
<td>12,924</td>
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<tr>
<td><strong>Total</strong></td>
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<td>31,844</td>
<td>10,563</td>
<td>3,605</td>
<td>5,526</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Closed</td>
<td>2,262</td>
<td>3,635</td>
<td>1,417</td>
<td>1,025</td>
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<td>2,659</td>
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<tr>
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<td>2,644</td>
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<tr>
<td><strong>Total</strong></td>
<td>2,262</td>
<td>3,635</td>
<td>1,416</td>
<td>1,025</td>
<td>964</td>
<td>2,659</td>
</tr>
</tbody>
</table>

The land claim estimates held in ClaimCentre are not yet reliable. For an average sub-claim costs analysis based on ultimate incurred, see Section 7.2.1.

4.2 **ACE data**

The tables below show a summary of the ACE data (received as at 2 May 2016). Costs are shown only in respect of ACE approved properties. These figures relate to costs damage caused to a property rather than EQC liability arising.

4.2.1 **Costs**

The following conventions were used when determining average damage figures:

- In respect of the average damage, for each event and zone, the average is determined as the total apportioned damage divided by the number of properties in that zone.

- In respect of the EQ4 / AS events, the total damage has not been divided by the number of events that apply to the properties as the data did not allow this analysis.
### 4.2.2 Percentages

This table converts the damage costs (as determined in the table in 4.2.1) into percentages.