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Earthquake Recovery.

4 SEPTEMBER EARTHQUAKE FACTSHEET

UPDATED 10 NOVEMBER

- The fault that caused the earthquake on 4 September 2010 has been named the Greendale Fault. It is a previously unknown fault under the Canterbury Plains.
- The rupture on the fault broke through to the ground surface from many kilometres below and created a 29 km long east-west running scarp in the land between the Hororata River and Railway Road near Rolleston.
- Up to 4.6 metres horizontal and 1.5 metres of vertical of permanent offset has been recorded across the fault at the ground surface.
- This is thought to be the first time that this fault has moved in several thousand years. It is highly unlikely that it will move again, producing another large earthquake, within the next few thousand years.
- Movement on the Greendale Fault that caused the earthquake on 4 September also placed stress on the rocks around the fault, and particularly at the ends of the fault. Aftershocks are happening as the rock readjusts to this movement. This readjustment takes some time, so aftershocks generally continue for a few months after a big earthquake. However, they do tend to become less frequent and tend to generally get a little smaller as well.
- The aftershock sequence we are seeing after the 4 September earthquake is normal and expected, and aftershocks will continue for several weeks. Most aftershocks are occurring around the eastern end, and to a lesser extent the western end of the fault, because these are the areas where the rock has been most stressed.
- Based on past large earthquakes elsewhere, we could still expect a few strong aftershocks in November. However, even though scientists cannot say for sure, it is now unlikely we will get another aftershock bigger than about magnitude 5.
- It is unclear at this stage how this earthquake has affected other faults in the region. The chance of another major earthquake in the central South Island is not likely to have changed. Earthquake activity in Canterbury and elsewhere in New Zealand following the earthquake appears to be normal.
- There is currently no scientifically proven way of predicting earthquakes. Predictions currently circulating giving the timing of another large earthquake are not based on scientific evidence.
- Liquefaction occurred during the earthquake in some specific areas where there were saturated, unconsolidated (loose) soils. This caused water and silt or sand to be ejected to the ground surface, resulting in subsidence and, in places, lateral spreading (sideways movement) of the ground. This has led to damage to houses and underground services.
- In general, liquefaction occurred in areas known to be susceptible. However, because soil properties vary greatly across the greater Christchurch area, and different earthquakes have different ground shaking patterns, it is very difficult to predict exactly where liquefaction will occur in a particular earthquake.
- There may be some further minor subsidence in areas of severe liquefaction. This is normal and may continue for a few more weeks.

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- Decisions around rebuilding in areas affected by liquefaction need to take into account many factors. There are several different methods for reducing the likelihood of liquefaction and its effects on buildings in future. The best combination of measures for a particular area will depend on the size of the area, its soil characteristics, the cost involved and the length of time before people could be back in their homes.
- Liquefaction itself does not improve the ground. If liquefaction has occurred in a particular location it can happen again in that location in another earthquake if the ground is not treated.
- Cracks seen in the ground in areas of Waimakariri district, Christchurch city and lower Selwyn district are not faults. They are where the ground has cracked, often because of liquefaction, during the earthquakes. These cracks only go down to a depth of up to several metres. The Greendale Fault itself continues down kilometres into the earth's crust.
- Building codes for modern buildings are intended to prevent collapse. Initial surveys suggest that modern buildings generally performed as expected, or better, in the earthquake and aftershocks. In general, residential houses suffered very little structural damage, except for that caused by chimneys falling and in areas of liquefaction. It is unlikely that earthquake design standards will need to change as a result of the earthquake.
- Older buildings that have had earthquake strengthening work undertaken on them generally performed very well in the earthquake, and suffered significantly less damage than nearby similar unstrengthened buildings.
- Parts of the Waimakariri River stopbank system downstream of State Highway 1 were damaged during the earthquake. At present there is approximately 1 in 20 year protection for this area. A programme of repairs is now being undertaken by Environment Canterbury staff - 1 in 30 year protection is expected by Christmas, and 1 in 500 year protection is anticipated by March 2011. Flood protection upstream of State Highway 1 has not been compromised and remains at 1 in 500 years.
- Liquefaction and lateral spreading within the Halswell catchment has affected the capacity of the Halswell river and drainage system. Environment Canterbury staff are currently dredging the worst affected parts of the Halswell River channel and digging out side drains, and will move on to stabilising river banks. Full restoration of the system, depending on the option chosen by the community and Environment Canterbury, could take up to two years.
- The level of flood protection on the Avon River has not been significantly affected by the earthquake. Christchurch City Council investigations show that the risk of flooding from the Avon and Heathcote rivers is no greater than before the earthquake. However, heavy rainfall could cause localised surface flooding in areas affected by liquefaction because of damage to stormwater systems.
- There was no tsunami associated with the earthquake because it happened on land, and involved no displacement of the sea floor. Offshore aftershocks are too small to generate a tsunami.
- Banks Peninsula is an extinct volcano and the earthquake activity is not related to it. Volcanic earthquakes are very different in style to the 4 September earthquake and subsequent aftershocks. Measurement of warm springs in the Lyttelton Harbour basin show an increase in flow, but no significant increase in temperature after the earthquake.
- Scientists have been working since the earthquake occurred to understand how it happened and what its effects are. Our understanding will continue to improve as we analyse more information over the coming weeks and months.

For more information contact Helen Grant, Hazard Analyst, Environment Canterbury, 03 365 3828

This information is sourced from GNS Science, the University of Canterbury, the New Zealand Society of Earthquake Engineering, Geonet, Environment Canterbury, Christchurch City Council and other contributors.

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