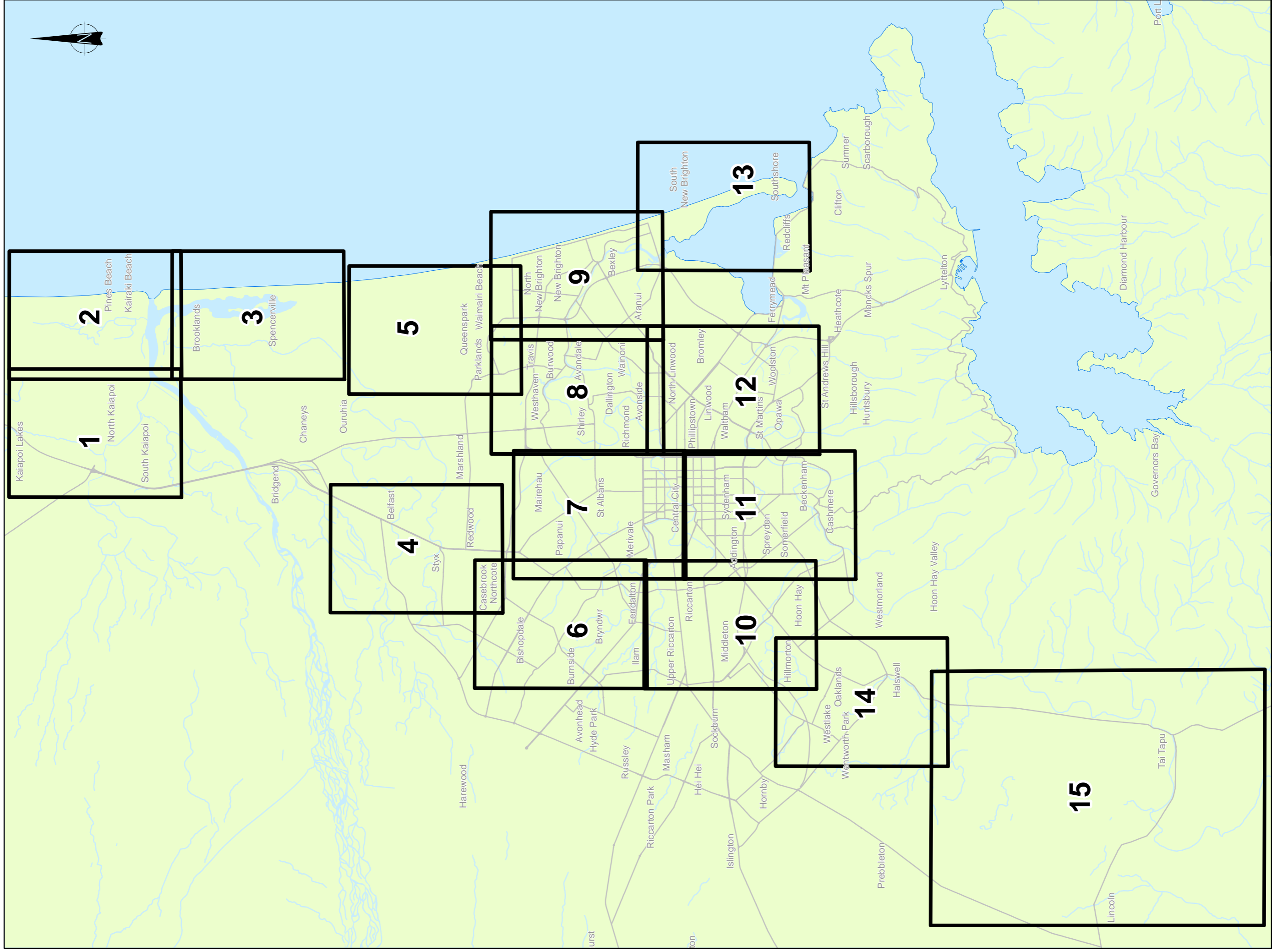


APPENDIX C

The Plains - area-wide suburb
technical land information



NOTES:
 Road Database supplied by Terralink International Ltd.
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A3 SCALE 1:100,000

**TECHNICAL LAND INFORMATION
 FACT SHEETS**
 Area-wide Suburbs

Map Reference Sheet

FIGURE NO. 52020.0200

SCALE (MAP SHEET) 1:100,000

APPROVED

CHECKED

DRAWN

Location Plan

Factsheet 2 - Kairaki Beach to Pines Beach

2.1 Ground conditions and groundwater

Regional geology maps show this area is underlain by stabilised beach sand dunes or river sand (and back dune deposits) of Holocene age.

Table C2.1 summarises the area-wide subsurface ground investigations undertaken by EQC in this area following the 4 September 2010 and 22 February 2011 earthquakes. These investigations indicate that the near-surface soil profile in the area generally comprises very loose to dense sand and silts.

Table C2.2 summarises typical ground elevation and groundwater depths in the area (the values listed correspond to the 10th and 90th percentiles and the median). This was derived from LiDAR ground elevation survey commissioned by EQC in February 2012, and a groundwater surface developed from recent EQC groundwater monitoring in conjunction with historic Environment Canterbury groundwater data. This area is generally moderately low-lying with shallow groundwater.

The ground conditions and groundwater in this area are generally similar to most of the eastern suburbs of Christchurch and Waimakariri District.

While ground surface disturbance has occurred in some areas (e.g. settlement, cracking and ejection of material), the underlying ground which liquefied appears to have now returned to its pre-earthquake strength.

2.2 Post-earthquake observations

Rapid mapping of liquefaction and lateral spreading observations was undertaken following the 4 September 2010 earthquake, first on a regional and street-by-street

level in the days immediately after the earthquake, and then on a property-by-property level over the following weeks. This mapping was supported by additional air-photo, regional or street-level mapping for the subsequent main earthquakes. This additional mapping indicated that the pattern of liquefaction and lateral spreading in this area for the subsequent earthquakes was generally similar to that observed in the first main earthquake, but usually less extensive and severe.

Figure C2.1 and Table C2.3 present a summary of the property-by-property rapid mapping of liquefaction and lateral spread observations in this area. These observed liquefaction and lateral spread mapping colours have completely different meaning to the colour codes used by the Canterbury Earthquake Recovery Authority (Cera) for residential land zoning and the Department of Building and Housing (DBH) for technical categories.

Table C2.4 summarises the change in ground elevation inferred from the LiDAR survey. The total change in ground elevation which has occurred is a combination of regional uplift or subsidence due to fault movements (tectonics) and local ground subsidence due to liquefaction and related effects. The LiDAR is of limited accuracy (about $\pm 100\text{mm}$). This means that the LiDAR is more suitable for measuring large changes in ground elevation (greater than about 100 to 200mm), and may not accurately represent areas where only minor changes in ground elevation have occurred.

Table C2.5 summarises the extent and severity of observed liquefaction and lateral spread.

Table C2.1 - Area-wide geotechnical investigations undertaken by EQC (December 2011)

Suburb	Number of cone penetration tests	Number of boreholes	Number of groundwater standpipes	Length of MASW geophysical testing (m)
Kairaki Beach	3	1	4	-
Pines Beach	11	1	9	-

Table C2.2 - Summary of ground elevation and groundwater depth (February 2012)

Suburb	Ground elevation above sea level	Groundwater depth
Kairaki Beach	Typically 1.2m to 1.8m (Avg 1.5m)	Typically 0.5m to 1.1m (Avg 0.7m)
Pines Beach	Typically 1.1m to 4.2m (Avg 1.4m)	Typically 0.6m to 5.4m (Avg 1.2m)

Kairaki Beach and Pines Beach

Table C2.3 - Summary of liquefaction and lateral spread observations for residential land, aggregated from mapping undertaken by EQC following earthquake of 4 September 2010

Suburb	Total residential property count	Not mapped	No observed ground cracking or ejected liquefied material	Minor ground cracking, but no observed ejected liquefied material	No lateral spreading, but minor to moderate quantities of ejected material	Moderate to major lateral spreading or large quantities of ejected material	Severe lateral spreading, ejected material often observed
Kairaki Beach	70	0%	0%	1%	73%	26%	0%
Pines Beach	226	2%	0%	60%	11%	27%	0%

Table C2.4 - Changes in ground elevation inferred from LiDAR survey

Suburb	Change in ground elevation from July 2005 to February 2012 (positive values are uplift, negative values are subsidence)
Kairaki Beach	Typically -500mm to -200mm (Average -300mm)
Pines Beach	Typically -450mm to +100mm (Average -150mm)



Factsheet 2 - Kairaki Beach to Pines Beach

Table C2.5 - Liquefaction and lateral spread observations

Suburb	Observations
Kairaki Beach	Widespread moderate to severe liquefaction, sand ejection and settlement. Moderate to major lateral spreading towards Kairaki Creek.
Pines Beach	In the south and west of the area (surrounding the domain), moderate to severe liquefaction, sand ejection and settlement. Seismic densification and shaking of the sand dunes to the north and east has resulted in minor settlement and ground cracking in this area. Localised moderate lateral spreading towards the creek and lower-lying ground to the west, and at the foot of the dunes towards the domain.

For further area-wide geotechnical information, refer to the technical data reports on the EQC website, at <http://canterbury.eqc.govt.nz/news/reports>

Kairaki Beach and Pines Beach

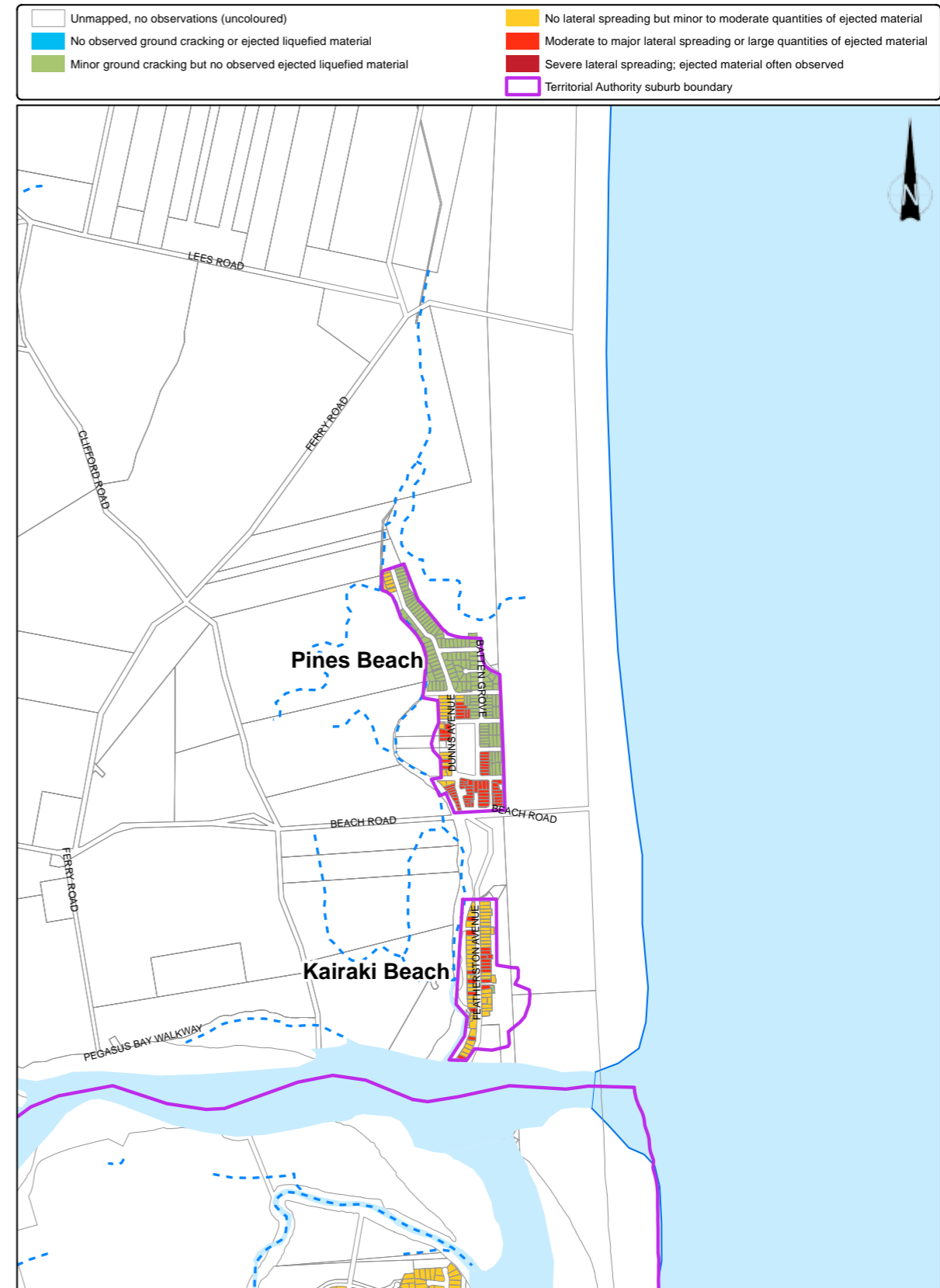


Figure C2.1 - Overview of liquefaction and lateral spreading observations, from mapping undertaken following the earthquake of 4 September 2010

Applicability - This report was prepared and/or compiled for the Earthquake Commission (EQC) to communicate information that may be relevant to residential land claims under the Earthquake Commission Act 1993. The report was not intended for any other purpose and may not be relied upon for any other purpose. EQC and its engineers, Tonkin & Taylor, have no liability to any user of any map(s) and data in this report or for the consequences of any other person relying on them in any way. This information is not intended to form a complete technical report on land changes in all or any part of Canterbury.

