LAND INFORMATION NEW ZEALAND

141116 EQ Wide Area Response

VOLUME 27413A14NOK

<u>**Summary**</u>

Project

AAM was engaged by Land Information New Zealand to undertake an airborne LiDAR survey over areas of interest in Canterbury / Marlborough following the 14 November 2016 North Canterbury earthquake. This data volume contains the complete set of products created through the course of the project as a single dataset. The extent of data coverage is shown in the coverage plot on the last page of this document.

LiDAR data and other products supplied in this volume are as follows:
1. Classified point cloud as LAS v1.2
2. DEM as 1m cell size ESRI ASCII Grid
3. Contours as 1m interval ESRI Shape file
4. Orthophotos as GeoTIFF
5. Ancillary Files:
   Tile Index Metadata as ESRI Shapefile
   Project Extent as ESRI Shapefile

The data is in terms of NZTM map projection and NZVD2016 vertical datum. With reported displacements up to 2 metres of geodetic reference marks during the initial earthquake, details on the reference stations and coordinate system data processing are provided here within.

(Ref: PWNZ 11342A PW 27413A)

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1.   PROJECT REPORT

Acquisition: AAM was engaged by Land Information New Zealand to undertake an airborne LiDAR survey over areas of interest in Canterbury / Marlborough following the 14 November 2016 North Canterbury earthquake. The acquisition design was planned on recording a minimum 3.5 pulses per square metre (NPS) for each flightline swath.

Ground Support: GPS base station support was sourced from GeoNET CORS. The CORS sites KAIK, CMBL, LRR1 and SEDD were used for sensor position and orientation system processing. Ground check points were acquired by Opus International Consultants Limited. Opus surveyed ground check points at 29 locations distributed across the wider project area. CORS stations LLR1, SEDD, KAIK, MRBL and HAMN were utilised. The ITRF2008 daily coordinates made available from GNS Science and the current LINZ deformation model (20160701) were utilised for positioning.

Data Processing: Reduction of the ALS data proceeded without any significant problems. Laser strikes were classified to ICSM Level2 standard.

The focus of the classification was to ensure that only ground points were assigned to the ground class. Following automated classification, additional manual classification editing involved removal and adding of points to the ground class. Target classification accuracy for ground points is 98%.

The classified point cloud product contains the following classes: Default, Ground, Water, Bridges

DEM and Contour datasets were derived from the classified point cloud data. The DEM were created with 1m grid spacing and interpolated from TIN created from the ground classified points. The contours were compiled from triangulated surfaces also derived from the ground classified points.

The orthophotos were created using concurrently acquired medium format camera imagery, a terrain model produced from the LiDAR dataset and direct georeferencing orientation data for positioning. The ground sample distance of the orthophotos is 20cm.

Data Presentation: The data provided on this volume has been supplied in accordance with a specification agreed with the primary client. Subsequent users experiencing difficulties in handling the data should please contact AAM to arrange a more appropriate data presentation.

Further Issues: There are no further issues to report.

Project Contacts:

Client Contact
Andrew Ferrel

Company

aferrel@linz.govt.nz

AAM Contact
Tim Farrier

T.Farrier@aamgroup.com

2.   DATA INSTALLATION

Data formats   :   ESRI Shapefile, LAS 1.2, ESRI ASCII GRID
Information files on media   :   Readme_27413A14NOK.pdf

Data formatted on   :   26/06/2017
Disk volume   :   27413A14NOK

READFILE FILE

This document (Readme_27413A14NOK.pdf) is provided as an Acrobat file in this volume.

FILE SIZES AND NAMES

The data products are provided in NZTopo50 1:1,000 tiles. Tiles have the following file naming convention:

*PRODUCT*_NZTOPO50_YEAR_SCALE_XXYY
e.g. DEM_BT26_2016_1000_4913
[format] - *.las, *.shp, *.asc

LAS file point classifications levels are formatted to comply with ASPRS Standard LiDAR Point Classes.

    1.   Default
    2   Ground
   **9.   Water**
    10.   Bridges

3.   ADDITIONAL SERVICES

Product Generation

AAM can perform the following additional services on the data contained on this volume if required:

Change horizontal datum	:	to other local grid
Alter geoid modeling	:	by transforming ALS data to fit orthometric survey heights
Improve data classification	:	by tailoring parameters to suit regional variations
Further classification	:	assist building identification by further classifying non-ground strikes
Further point cloud manipulation		by normalising point cloud to terrain, creating canopy height models etc
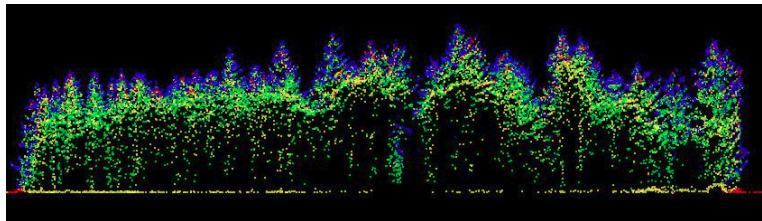
Data thinning	:	to remove superfluous points not adding to the terrain definition
Data subset	:	by dividing the data into different tiles or polygons
Data presentation	:	by creating additional contours, hill shade reliefs profiles, perspectives, flythrough, colour-coded height plots etc.
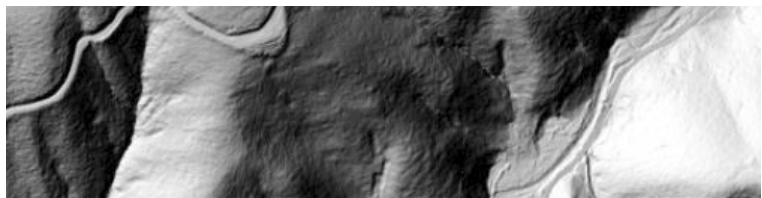
Data gridding	:	to convert the measured spot heights into a regular grid
Intensity Image	:	greyscale image created from laser's intensity returns
3d Perspectives	:	image draping /slope models
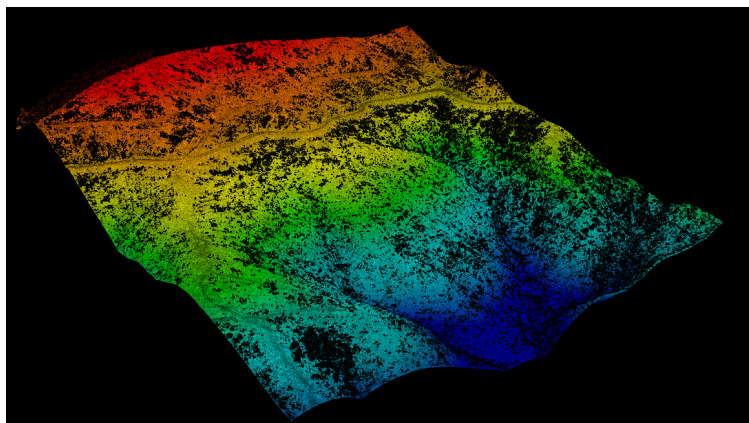
4. METADATA

SOURCE DATA

Item	Source	Description	Ref No	Date
Laser System	AAM	Riegl Q1560	11342A	3.12.2016-6.1.2017
Base Stn Coords	GeoNET	CORS	11342A	3.12.2016-6.1.2017
Field Survey Data	Opus	RTK GPS	11342A	20.12.2016-11.1.2017

LASER DATA CHARACTERISTICS

Characteristic	Description
Device Name:	Riegl Q1560 – 2 laser channel system
Scan Angle:	58 degrees
Laser Pulse Rate:	200-400 kHz
Laser Pulse Mode:	Multipulse
Laser Return Types:	1st, 2nd, 3rd … and last

REFERENCE SYSTEMS

	Horizontal	Vertical
Datum	NZGD2000	NZVD2016
Projection	NZTM	N/A
Geoid Model	N/A	NZGeiod2016

GNS Science provided AAM and Opus with daily updates of ITRF08 coordinates for the earthquake affected CORS that were used for sensor position and orientation system processing and ground check point surveying.

The point cloud data was transformed into NZTM utilising the LINZ NZGD2000 deformation model 20160701 and date 12 December 2016.

Changes to the CORS coordinates for the period of survey were observed to be insignificant in terms of the LiDAR point cloud error budget.

5.   ACCURACY

PROJECT DESIGN ACCURACY

Project specifications and technical processes were designed to achieve data accuracies as follows:

	Measured Point	**Basis of Estimation**
Vertical data	<= 0.1 m	Project Design
Horizontal data	<= 0.5 m	Project Design
Test points	<= 0.05m	Survey methodology used

Notes on Expected Accuracy
•   Accuracy estimates for terrain modeling refer to the terrain definition on clear ground. Ground definition in vegetated terrain may contain localized areas with systematic errors or outliers which fall outside this accuracy estimate.
• Laser strikes have been classified into "ground" and "non-ground", based upon algorithms tailored for major terrain/vegetation combinations existing in the project area. The definition of the ground may be less accurate in isolated pockets of dissimilar terrain/vegetation combinations.

LIMITATIONS OF DATA

•   The definition of the ground under trees may be less accurate.

DATA VALIDATION

The horizontal accuracy of the LiDAR point cloud was check by visual inspection of the test point data overlaid on the point cloud data displayed with height and intensity attributes. The point cloud data was observed to fit all against the test point data.

The vertical accuracy of the LiDAR point cloud was checked by computing height difference statistics between the test point data surveyed as spot heights and a TIN created from the ground classified points. For this test the field survey points are assumed to be error-free.

No. of Locations	No. of Points	Mean Difference (m)	Std Deviation	RMS
31	983	0.0	0.04	0.04

The point data classification has been manually reviewed and checked for completeness.

Features in the orthophotos were also checked against field survey data. The datasets were found to align well with one another, although measurement vectors have not yet been observed.

USE OF DATA

•   Intended use   : Preliminary Design subject to final survey
•   Intended use   : Planning, Conceptual Design
•   Intended scale of use : 1:500

6. CONDITIONS OF SUPPLY

The data in this volume has been commissioned by **LAND INFORMATION NEW ZEALAND**.

The data in this volume is provided by AAM NZ Limited (AAM) to **LAND INFORMATION NEW ZEALAND** under contract terms, which provide **LAND INFORMATION NEW ZEALAND** with an unrestricted royal-free license in perpetuity to use the data, in accord with documented provisions, and subject to the following conditions:

1. This file (Readme_27513A14NOK.PDF) is always stored with the unaltered data contained in this volume.

2. This volume of data is not altered in any way without the approval of AAM. The data may be copied from this file to another.

Any breach of these conditions will result in the immediate termination of the license issued by AAM, and LAND INFORMATION NEW ZEALAND will indemnify AAM from all resulting liabilities.

Any problems associated with the information in the data files contained in this volume should be reported to AAM NZ Limited. A complete list of project related contacts is listed on page 4 under the Project Report heading.

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7. COVERAGE PLOT
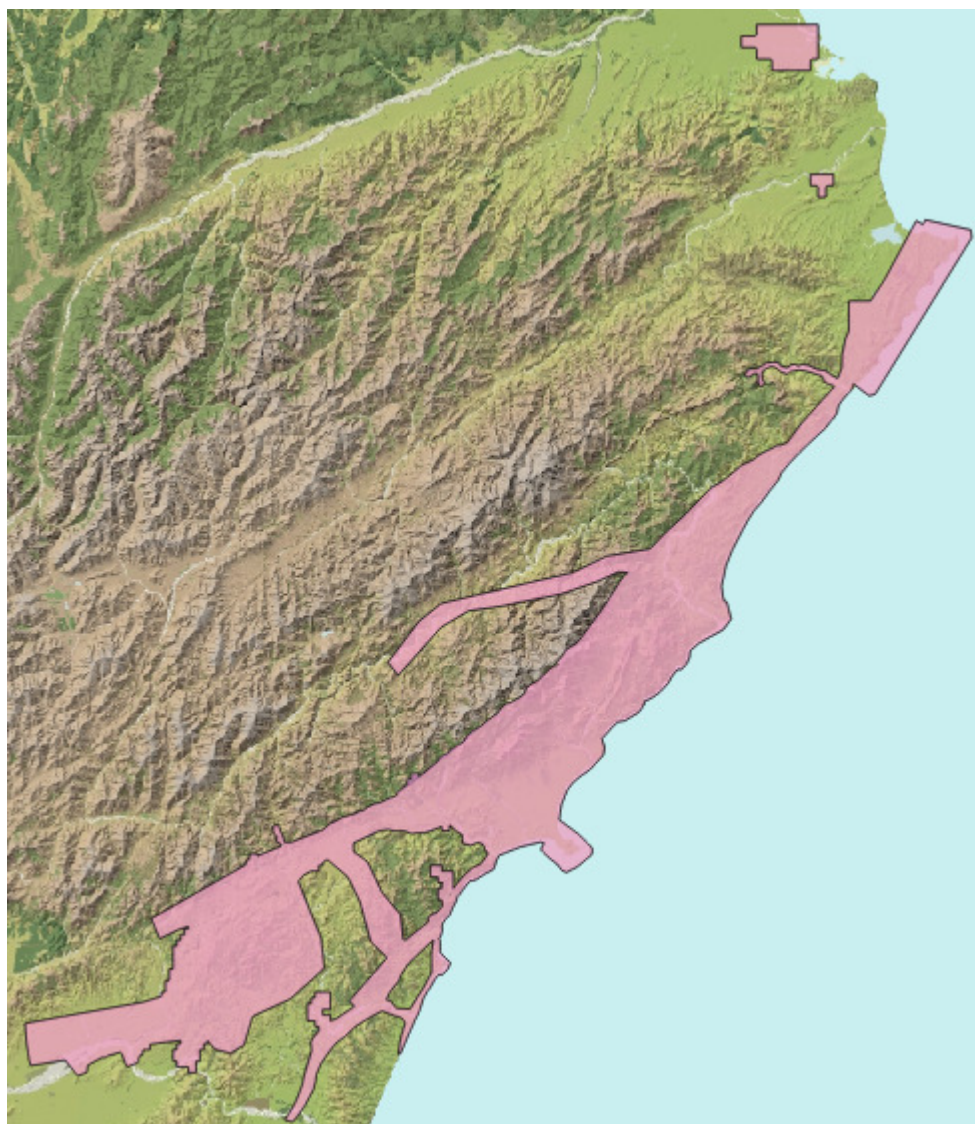
Background: Landcover Raster CC BY 3.0 NZ (Geographx)

Terrain and Orthophoto Dataset Extent.