KAPITI COAST DISTRICT COUNCIL

Ortho-photography & Associated Digital Products 2020/21

VOLUME PRJ38777NOM02

Summary

Project

AAM NZ was engaged by Kapiti Coast DC to undertake acquisition of Aerial Survey (LiDAR & imagery) for Orthophotos, LiDAR and vector generated products. LiDAR data was captured between 13th - 15th of March 2021.

This volume contains the LiDAR data products.

Data

LiDAR products supplied in this volume are as follows:

- Classified Point Cloud Data in LAS v1.4, NZTopo50 1:500 tiles
- 1m DEM in ESRI ASCII GRID, NZTopo50 1:500 tiles
- 1m DSM in ESRI ASCII GRID, NZTopo50 1:500 tiles
- 1m contours 3D Shapefile format, NZTopo50 1:500 tiles
- 0.5m contours 3D Shapefile format, NZTopo50 1:500 tiles
- 1m DEM in GeoTiff, NZTopo50 1:1000 tiles
- 1m DSM in GeoTiff, NZTopo50 1:1000 tiles
- Tile Index Metadata in Shapefile format
- Project Report - PDF file format.

The vertical accuracy ≤10cm and positional accuracy for this dataset is ≤50cm (95% confidence in clear, open grounds). This dataset is supplied in NZTM, heights are in NZVD2016.

(Ref PRJ38777)

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1. PROJECT REPORT

Safety: No safety Incidents were reported during the project.

Acquisition: LiDAR data was acquired from a fixed wing aircraft on:

Date	Time range	
13/03/2021	11:25	16:45
14/03/2021	11:10	12:37
14/03/2021	16:43	20:46
15/03/2021	14:00	15:06

Ground Support: RTX processing was used to calculate the GPS trajectory solution. Trimble CenterPoint® RTX™ is a proprietary GPS, GLONASS, BeiDou, and QZSS enabled technology that provides high-accuracy GNSS positioning worldwide without the use of traditional local base stations or a VRS network. By combining real-time data from a global reference station infrastructure with innovative positioning and compression algorithms, Trimble RTX technology computes centimeter-level positions based on satellite orbit and clock information. Ground surveyed test point sites were acquired by WSP, these allowed an assessment of the accuracy of the ALS point cloud data.

Data Processing: Laser strikes were classified into ground and non-ground points using a single algorithm across the project area. Manual checking and editing of the data classification further improved the quality of the ground point classification. Further detail is provided on page 6.

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 alternate data presentation.

Project Contacts:

Client
Keith Miller — Keith.Miller@kapiticoast.govt.nz
Kapiti Coast District Council

AAM Account Manager
Rohan Potter — R.Potter@aamgroup.com

AAM Project Manager
Lorraine Claydon (Ph +64 275 323 382) — L.Claydon@aamgroup.com

2. DATA INSTALLATION

Data formats	:	LAS v1.4, ESRI ASCII GRID, GeoTiff, SHP, PDF
Number & type of media	:	HDD
Information files on media	:	Readme_PRJ38777NOM02
Data formatted on	:	26/05/2021
Disk volume	:	PRJ38777NOM02

README FILE

This document (Readme_PRJ38777NOM02.pdf) is provided as an Acrobat file in this volume.

FILE SIZES AND NAMES

Kapiti Coast DC project extents were defined in standard LINZ NZTopo 50 1:500 tiles, 240m x 360m. Products have been named according to the LINZ LiDAR file naming convention:

Product_NZTopo50Sheet_MapScale_TileNumber
eg. CL2_BP34_500_016085.abc
DEM_BP34_500_016085.abc
DSM_BP34_500_016085.abc
CON05_BP34_500_016085.abc
CON1_BP34_500_016085.abc

To meet the LINZ request for DEM and DSM in NZTopo 50 1:1000 tiles, 480m x 720m - AAM NZ have supplied a second set of DEM and DSM products in this tile system, with the standard LINZ file naming convention:

Product_NZTopo50Sheet_MapScale_TileNumber
eg. DEM_BP34_1000_1605.abc
DSM_BP34_1000_1605.abc

Please Note: The Kapiti Coast DC LiDAR project boundary extent is based on 1:500 tiles. Some inland 1:1000 tiles will contain "NODATA" values beyond the Kapiti Coast DC LiDAR project extent. This approach was agreed between KCDC and AAM NZ to provide LINZ with the DEM and DSM in 1:1000 tiles, without increasing the coverage and cost of the project.

Full list of directories on HDD: ***PRJ38777NOM02_File_List.txt***

3. METADATA

SOURCE DATA

Item	Source	Description	Ref No	Date
Laser System	AAM	Optech Galaxy Prime 473	FL014724 FL014734 FL014729 FL014735	13/03/2021 14/03/2021 14/03/2021 15/03/2021
Trajectory	AAM	CenterPoint® RTX™	PRJ38777	As above
Field Survey	WSP	RTK GPS	PRJ38777	February 2021

DATA CHARACTERISTICS

Characteristic	Description
Device Name	Galaxy Prime +
Half Scan Angle	22.5 degrees
Laser Pulse Rate	450kHz
Laser Pulse Mode	Multipulse Pulse
Returns	1st, second, third and last
Point Density	8.26pts/ m^2 per swath
Overlap	60% - to achieve 16pts/m^2 in total
Capture Altitude (AGL)	805m
Survey Speed (Kts)	140
Horizontal Datum	NZGD2000
Vertical Datum	NZVD2016
Map Projection	NZTM
Vertical Accuracy Specification	±0.10m at 95% confidence level
Horizontal Accuracy Specification	±0.50m at 95% confidence level

REFERENCE SYSTEMS

	Horizontal	Vertical
Datum	NZGD2000/NZTM	NZVD2016
Projection	NZTM	N/A
Geoid Model		NZGeoid2016

OTHER CAPTURE CRITERIA

Item	Description
Tidal Constraints	Capture within 3 hours of low tide

4. DATA PROCESSING LINEAGE

LiDAR Processing Workflow:

- LiDAR upload and inspection
- Raw LiDAR processing – GPS & Flight line matching
- Accuracy assessment against test point sites
- Automated classification and manual classification editing
- Product creation
- Quality assurance

Classified LiDAR Point Cloud:

All LAS file point cloud files have been classified to the schema shown in the table below.

The data has been classified to ICSM Level 2 Classification (Ground Surface Improvement) within the clients defined project area of interest (AOI).

Number	Point Class	Description	ICSM Classification Level
1	Default	Unclassified	1
2	Ground	Bare ground	2
3	Low vegetation	<2m high	1
4	Medium Vegetation	2-8m high	1
5	High Vegetation	> 8m high	1
6	Buildings/ Structures		1
7	Low Noise		1
9	Water		2
10	Bridges		2
18	High Noise		1

AAM uses proprietary ground classification routines to provide the initial automated ground / non-ground classification and generate the initial ground surface. The classification is then manually edited to improve the ground classification to ICSM level 2 standard. Following this process, further automated techniques are used to classify the other classes shown above to ICSM level 1 standard.

A QA review is completed on a percentage of the classified tiles within the AOI.

Digital Elevation Model (DEM): Generated using LiDAR point cloud class 2 (Ground).

Hydro flattening was undertaken based on the current LINZ Specifications: PGF_Version_New_Zealand_National_Aerial_LiDAR_Base_Specification – January 2020. Otaki River has been considered a braided river.

Surface models (DSM): Generated using ground and non-ground classified points.

Elevation Grids were derived using the LAStools las2dem command. This tool reads LIDAR points from the LAS/LAZ format (or some ASCII formats) and triangulates them temporarily into a TIN with a user defined interpolation distance. LAStools then applies a TIN to raster conversion to create the 1m DEM raster dataset.

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	<=0.10m	Project design
Horizontal data	<=0.5m	
Test Points	0.05m	Survey methodology used

Notes on Expected Accuracy

- Values shown represent standard error (68% confidence level or 1 sigma), in meters.
- "Measured points" are those observed directly.
- 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.

LiDAR DATA VALIDATION

- Ground data in this volume has been compared to test points obtained by field survey and assumed to be error-free. The test points were located on open clear ground. Comparison of the field test points with elevations interpolated from measured data, after removing the mean offset yielded the following accuracy assessment:

Test Point Sites	No. of Points	Mean Difference	Std Deviation (m)	RMS (m)
5	221	0.00	0.01	0.01

6. CONDITIONS OF SUPPLY

The data in this volume has been commissioned by **KAPITI COAST DISTRICT COUNCIL**.

The data in this volume is provided by AAM NZ Limited (AAM) to **KAPITI COAST DISTRICT COUNCIL** under **Kapiti Coast District Council Contract 2020/C370: Ortho-photography and Associated Digital Products 2020/21,** this allows for release of the products under Creative Commons Attribution 4.0 International, and is subject to the following conditions:

1. This file (Readme_PRJ38777NOM02.PDF) is always stored with the unaltered data contained in this volume.

2. The data is not used for purposes beyond that explicitly agreed in the description of the Services provided by AAM.

Any problems associated with the information in the data files contained in this volume should be reported to AAM NZ Limited. A list of project related contacts is listed on page 3 under the Project Report heading.

Email info@aamgroup.com
Web www.aamgroup.com

7. TEST POINT ANALYSIS

Project: PRJ38777 Kapiti CDC LiDAR
Name: LiDAR_Test_Sites_Check
Coordinate system: NZTM2000
Date: 25/05/2021
Report type: LiDAR

Name	Easting	Northing	Known Z	Laser Z	Dz
1	1764487.62	5460929.56	6.29	6.29	0.00
2	1764485.64	5460928.03	6.31	6.31	0.00
3	1764483.69	5460926.48	6.31	6.32	0.01
4	1764482.11	5460928.80	6.34	6.37	0.02
5	1764475.71	5460937.26	6.55	6.57	0.02
6	1764473.77	5460935.76	6.55	6.57	0.02
7	1764480.03	5460927.33	6.37	6.40	0.02
8	1764481.74	5460925.02	6.33	6.34	0.01
9	1764479.85	5460923.32	6.34	6.34	0.00
10	1764477.97	5460925.99	6.40	6.41	0.02
11	1764471.93	5460933.99	6.56	6.58	0.03
12	1764469.91	5460932.61	6.58	6.59	0.01
13	1764476.04	5460924.44	6.40	6.42	0.02
14	1764477.81	5460921.78	6.36	6.37	0.01
15	1764475.89	5460920.27	6.37	6.38	0.01
16	1764473.75	5460922.80	6.42	6.43	0.02
17	1764467.54	5460930.99	6.59	6.62	0.02
18	1764465.69	5460929.56	6.61	6.63	0.02
19	1764471.86	5460921.38	6.43	6.46	0.03
20	1764473.93	5460918.73	6.38	6.38	0.00
21	1764471.94	5460917.31	6.39	6.39	0.00
22	1764469.99	5460919.98	6.44	6.46	0.02
23	1764463.79	5460928.12	6.62	6.63	0.01
24	1764461.88	5460926.59	6.63	6.64	0.01
25	1764468.19	5460918.32	6.45	6.47	0.02
26	1764469.98	5460915.72	6.39	6.40	0.02
27	1764467.98	5460914.31	6.39	6.42	0.03
28	1764466.22	5460916.82	6.45	6.47	0.02
29	1764459.86	5460925.16	6.63	6.65	0.02
30	1764457.81	5460923.69	6.65	6.67	0.01
31	1764464.16	5460915.26	6.46	6.48	0.02
32	1764465.97	5460912.77	6.41	6.42	0.01
33	1764464.03	5460911.23	6.42	6.44	0.02
34	1764462.17	5460913.78	6.47	6.48	0.02
35	1764455.81	5460922.26	6.66	6.66	0.01
36	1764453.84	5460920.66	6.65	6.67	0.02
37	1764460.25	5460912.32	6.47	6.48	0.01

38	1764462.00	5460909.73	6.43	6.45	0.02
39	1764459.98	5460908.31	6.45	6.45	0.00
40	1764458.11	5460910.83	6.48	6.50	0.02
41	1764451.91	5460919.20	6.66	6.66	0.01
42	1764449.83	5460917.76	6.66	6.68	0.02
43	1764456.23	5460909.37	6.48	6.51	0.03
44	1764457.95	5460906.85	6.45	6.47	0.02
45	1764455.96	5460905.30	6.45	6.46	0.01
46	1764454.30	5460907.87	6.48	6.51	0.03
47	1764447.68	5460916.44	6.67	6.69	0.02
48	1774137.00	5472913.35	30.96	30.96	-0.01
49	1774143.54	5472909.37	30.88	30.87	-0.02
50	1774142.20	5472907.28	30.90	30.89	-0.01
51	1774135.63	5472911.27	30.97	30.95	-0.02
52	1774134.24	5472909.21	30.98	30.97	0.00
53	1774140.85	5472905.17	30.92	30.91	-0.01
54	1774139.52	5472903.04	30.94	30.93	-0.01
55	1774132.91	5472907.09	30.99	30.99	-0.01
56	1774131.61	5472904.98	31.02	31.00	-0.02
57	1774138.20	5472900.92	30.96	30.94	-0.01
58	1774136.86	5472898.78	30.98	30.96	-0.02
59	1774130.22	5472902.89	31.02	31.01	-0.01
60	1774128.87	5472900.74	31.04	31.03	-0.01
61	1774135.54	5472896.65	30.98	30.97	-0.01
62	1774131.61	5472890.33	31.02	31.01	-0.01
63	1774124.91	5472894.41	31.11	31.10	-0.02
64	1774123.55	5472892.27	31.12	31.11	0.00
65	1774130.29	5472888.19	31.03	31.03	0.00
66	1774128.98	5472886.10	31.06	31.05	-0.01
67	1774122.22	5472890.19	31.12	31.11	-0.01
68	1774120.91	5472888.05	31.14	31.14	0.00
69	1774127.60	5472883.96	31.07	31.06	-0.01
70	1774126.24	5472881.91	31.09	31.07	-0.02
71	1774119.57	5472885.95	31.15	31.14	-0.02
72	1774124.96	5472879.73	31.10	31.08	-0.02
73	1774123.58	5472877.62	31.11	31.11	-0.01
74	1774116.92	5472881.68	31.15	31.15	0.00
75	1774115.51	5472879.62	31.17	31.16	-0.01
76	1774122.19	5472875.53	31.13	31.12	-0.01
77	1774120.98	5472873.30	31.16	31.15	-0.01
78	1774114.30	5472877.43	31.18	31.18	0.00
79	1774112.80	5472875.41	31.19	31.19	0.00
80	1774119.57	5472871.31	31.17	31.16	-0.01
81	1774118.28	5472869.25	31.19	31.19	0.00
82	1774111.51	5472873.36	31.21	31.20	0.00
83	1774110.20	5472871.22	31.24	31.23	-0.01

84	1774116.96	5472867.07	31.20	31.19	-0.01
85	1774106.03	5472852.31	31.30	31.29	-0.01
86	1774102.02	5472854.94	31.31	31.30	-0.01
87	1774102.18	5472845.95	31.30	31.30	0.00
88	1774097.86	5472848.55	31.36	31.34	-0.02
89	1768734.22	5471803.53	4.85	4.86	0.01
90	1768729.44	5471800.91	4.89	4.89	-0.01
91	1768728.27	5471799.73	4.92	4.90	-0.02
92	1768723.58	5471796.79	4.86	4.85	-0.01
93	1768725.30	5471794.92	4.94	4.92	-0.02
94	1768730.67	5471798.73	4.96	4.96	0.01
95	1768732.03	5471796.71	5.04	5.04	0.00
96	1768726.43	5471792.63	4.97	4.96	-0.01
97	1768733.09	5471794.36	5.09	5.09	-0.01
98	1768727.70	5471790.52	5.01	5.00	-0.01
99	1768730.42	5471786.40	5.07	5.06	-0.01
100	1768735.67	5471790.31	5.16	5.17	0.01
101	1768737.55	5471786.91	5.23	5.20	-0.02
102	1768731.79	5471784.31	5.10	5.10	-0.01
103	1768733.10	5471782.09	5.16	5.14	-0.02
104	1768738.55	5471784.70	5.23	5.23	0.00
105	1768739.90	5471782.56	5.26	5.25	-0.01
106	1768741.15	5471780.47	5.30	5.28	-0.03
107	1768735.69	5471777.68	5.19	5.19	0.00
108	1768736.84	5471775.46	5.24	5.23	-0.01
109	1768743.95	5471776.26	5.34	5.32	-0.02
110	1768738.23	5471773.40	5.27	5.27	-0.01
111	1768739.59	5471771.12	5.30	5.29	0.00
112	1768745.31	5471774.10	5.38	5.36	-0.02
113	1768746.53	5471771.89	5.38	5.39	0.01
114	1768741.02	5471769.08	5.35	5.32	-0.02
115	1768742.08	5471766.89	5.35	5.35	-0.01
116	1768747.71	5471769.76	5.42	5.42	0.00
117	1768748.87	5471767.54	5.45	5.43	-0.02
118	1768743.56	5471764.80	5.38	5.37	-0.01
119	1768744.78	5471762.69	5.40	5.40	-0.01
120	1768750.18	5471765.42	5.47	5.45	-0.02
121	1768746.06	5471760.45	5.42	5.41	-0.01
122	1768751.60	5471763.30	5.50	5.48	-0.02
123	1768752.86	5471761.20	5.53	5.51	-0.02
124	1768747.46	5471758.38	5.45	5.43	-0.02
125	1768754.07	5471759.01	5.56	5.55	-0.01
126	1768755.29	5471756.89	5.60	5.59	-0.02
127	1768756.69	5471754.79	5.67	5.66	-0.01
128	1768758.11	5471752.77	5.74	5.74	0.00
129	1768759.41	5471750.50	5.80	5.79	-0.01

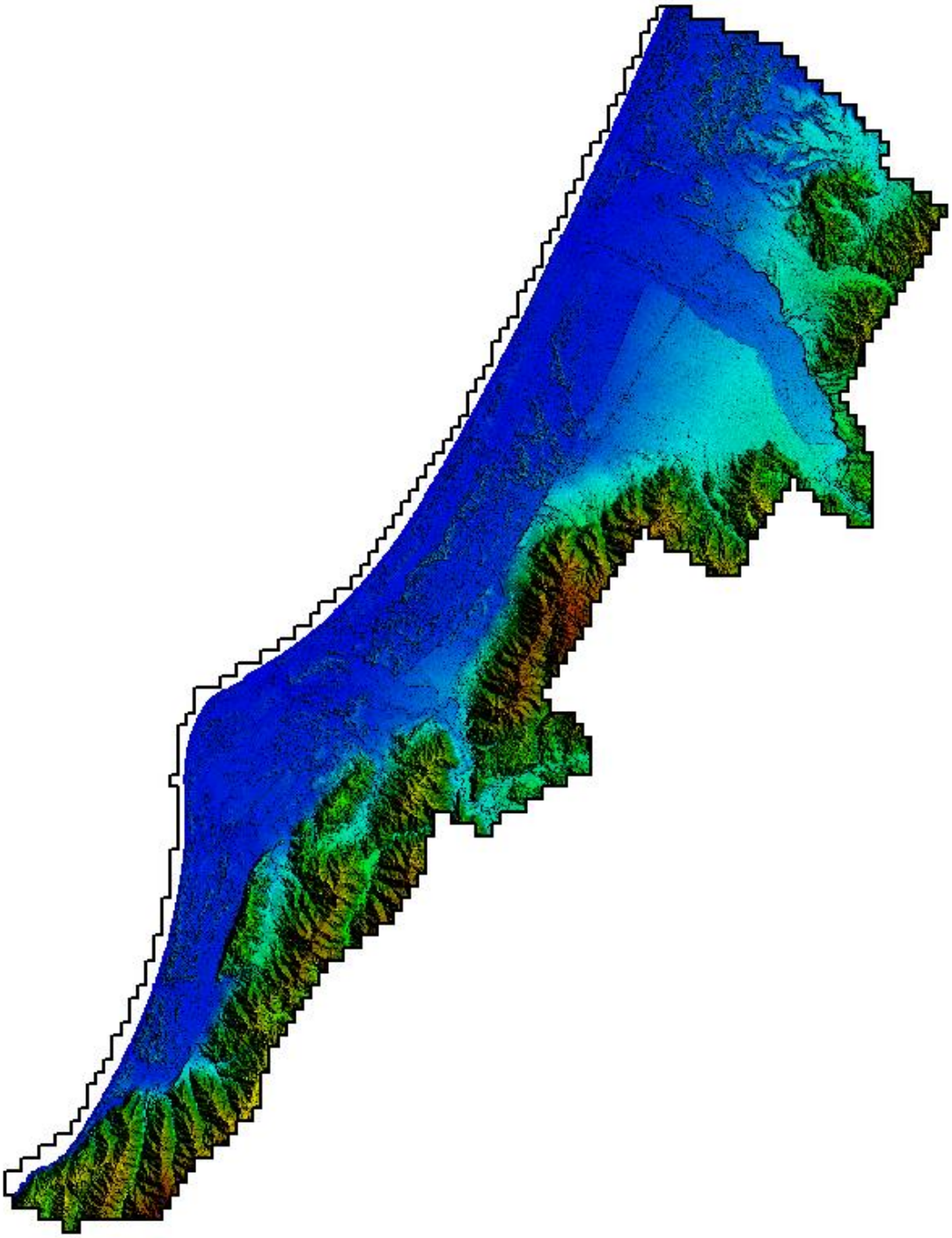
130	1778711.69	5488305.89	5.92	5.91	-0.01
131	1778716.87	5488303.18	6.16	6.15	-0.01
132	1778725.75	5488298.27	6.53	6.52	-0.01
133	1778724.52	5488296.12	6.54	6.54	0.00
134	1778715.81	5488301.01	6.18	6.17	-0.01
135	1778711.05	5488303.17	5.97	5.97	0.00
136	1778710.07	5488301.09	5.97	5.97	0.00
137	1778714.53	5488298.76	6.17	6.15	-0.01
138	1778723.31	5488294.00	6.57	6.55	-0.02
139	1778722.01	5488291.89	6.57	6.56	-0.01
140	1778713.27	5488296.60	6.16	6.15	0.00
141	1778708.85	5488298.72	5.98	5.97	-0.01
142	1778707.77	5488296.56	5.97	5.98	0.01
143	1778712.58	5488294.17	6.17	6.18	0.00
144	1778720.98	5488289.61	6.58	6.57	-0.02
145	1778719.85	5488287.59	6.59	6.59	0.00
146	1778710.97	5488292.21	6.18	6.18	-0.01
147	1778706.61	5488294.26	5.99	5.99	0.00
148	1778705.53	5488291.97	5.99	5.98	-0.01
149	1778710.28	5488290.04	6.19	6.19	0.00
150	1778709.51	5488288.06	6.23	6.21	-0.02
151	1778704.63	5488290.24	6.00	6.00	0.01
152	1778700.27	5488267.92	6.38	6.38	-0.01
153	1778697.75	5488263.60	6.43	6.43	0.00
154	1778694.90	5488259.27	6.47	6.47	0.00
155	1778692.41	5488254.93	6.40	6.40	-0.01
156	1778689.28	5488256.21	6.14	6.13	-0.01
157	1778691.67	5488261.06	6.17	6.18	0.01
158	1778693.73	5488265.09	6.25	6.23	-0.02
159	1778695.59	5488269.59	6.16	6.15	-0.01
160	1778692.26	5488272.13	5.92	5.91	-0.01
161	1778689.78	5488267.46	5.95	5.93	-0.01
162	1778687.50	5488262.78	5.93	5.93	0.00
163	1778685.27	5488258.78	5.86	5.87	0.00
164	1778681.64	5488260.29	5.70	5.69	-0.01
165	1778683.81	5488264.87	5.72	5.71	-0.01
166	1778686.11	5488269.06	5.73	5.71	-0.02
167	1778688.43	5488273.95	5.68	5.67	0.00
168	1778684.60	5488276.30	5.50	5.48	-0.02
169	1778681.81	5488271.67	5.49	5.48	-0.01
170	1778679.36	5488267.12	5.49	5.49	0.00
171	1778676.62	5488262.54	5.52	5.51	-0.02
172	1778672.36	5488264.57	5.42	5.41	-0.01
173	1778674.47	5488269.41	5.32	5.31	0.00
174	1778679.43	5488279.71	5.34	5.33	-0.01
175	1778672.50	5488274.26	5.23	5.21	-0.02

176	1782057.03	5485379.43	13.40	13.41	0.01
177	1782055.12	5485377.80	13.41	13.42	0.01
178	1782058.83	5485373.02	13.49	13.51	0.01
179	1782056.71	5485371.69	13.47	13.49	0.02
180	1782053.16	5485376.17	13.40	13.43	0.02
181	1782051.18	5485374.70	13.41	13.43	0.01
182	1782054.72	5485370.14	13.47	13.49	0.03
183	1782052.67	5485368.70	13.48	13.49	0.01
184	1782049.25	5485373.11	13.40	13.42	0.02
185	1782047.24	5485371.64	13.41	13.43	0.02
186	1782050.73	5485367.08	13.48	13.50	0.02
187	1782048.69	5485365.61	13.49	13.50	0.01
188	1782045.31	5485370.03	13.42	13.42	0.01
189	1782046.78	5485363.98	13.50	13.50	0.00
190	1782043.31	5485368.44	13.43	13.44	0.01
191	1782041.52	5485367.03	13.42	13.43	0.01
192	1782044.87	5485362.43	13.51	13.53	0.02
193	1782042.87	5485360.89	13.52	13.53	0.01
194	1782039.63	5485365.37	13.43	13.44	0.01
195	1782037.80	5485363.86	13.44	13.44	0.00
196	1782040.94	5485359.38	13.53	13.53	0.00
197	1782038.82	5485357.93	13.53	13.54	0.02
198	1782035.77	5485362.20	13.47	13.46	0.00
199	1782034.24	5485360.45	13.48	13.49	0.01
200	1782034.92	5485354.93	13.58	13.60	0.02
201	1782031.78	5485359.34	13.48	13.50	0.02
202	1782029.79	5485357.81	13.48	13.50	0.02
203	1782032.92	5485353.61	13.58	13.59	0.02
204	1782031.15	5485351.99	13.59	13.59	0.01
205	1782027.98	5485356.23	13.46	13.48	0.02
206	1782026.09	5485354.62	13.50	13.51	0.01
207	1782029.28	5485350.63	13.59	13.59	0.00
208	1782027.37	5485349.14	13.60	13.61	0.01
209	1782024.26	5485353.02	13.51	13.53	0.02
210	1782022.45	5485351.52	13.52	13.52	0.00
211	1782025.42	5485347.75	13.61	13.61	0.00
212	1782046.53	5485392.63	13.22	13.22	0.01
213	1782038.52	5485386.17	13.13	13.14	0.01
214	1782022.24	5485373.07	13.21	13.22	0.02

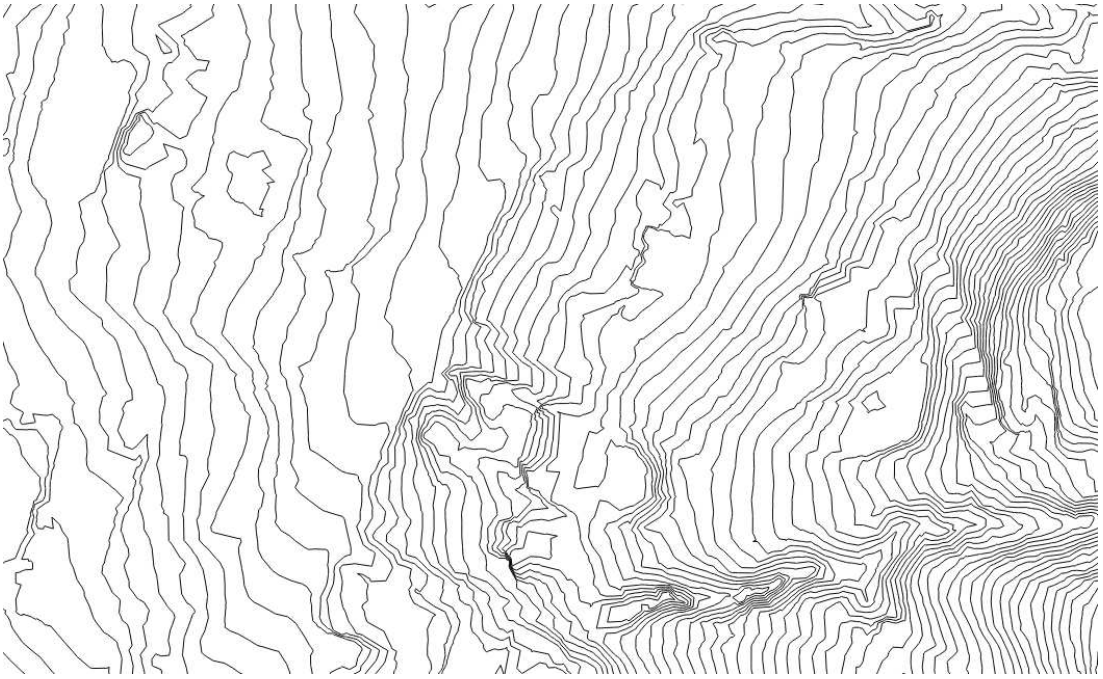
MIN	-0.03
MAX	0.03
Mean	0.00
STDEV	0.01
RMSE	0.01
95% confidence	0.03

8. VALIDATION PLOTS

Overview of Ground data – colour elevation plot



Sample of the Contour



KAPITI COAST DISTRICT COUNCIL

Ortho-photography & Associated Digital Products 2020/21

VOLUME PRJ38777NOM04

Summary

Project

AAM NZ was engaged by Kapiti Coast DC to undertake acquisition of Aerial Survey (LiDAR & imagery) for Orthophotos, LiDAR and vector generated products. LiDAR data was captured between 13th - 15th of March 2021.

This volume contains the resubmission of the following LiDAR data products. These files replace the LAS, DEM and DSM products sent in PRJ38777NOM02.

Data

LiDAR products supplied in this volume are as follows:

- Classified Point Cloud Data in LAS v1.4, NZTopo50 1:500 tiles
- 1m DEM in ESRI ASCII GRID, NZTopo50 1:500 tiles
- 1m DSM in ESRI ASCII GRID, NZTopo50 1:500 tiles
- 1m DEM in GeoTiff, NZTopo50 1:1000 tiles
- 1m DSM in GeoTiff, NZTopo50 1:1000 tiles
- Tile Index Metadata in Shapefile format
- Project Report - PDF file format.

The vertical accuracy ≤10cm and positional accuracy for this dataset is ≤50cm (95% confidence in clear, open grounds). This dataset is supplied in NZTM, heights are in NZVD2016.

(Ref PRJ38777)

6 Ossian Street, Napier, New Zealand Phone +64 296 030 382
Other Offices: Melbourne, Sydney, Brisbane, Perth, Wollongong, Newcastle, Whyalla, Kuala Lumpur

CONTENTS **Page Nos.**

1. PROJECT REPORT

Safety: No safety Incidents were reported during the project.

Acquisition: LiDAR data was acquired from a fixed wing aircraft on:

Date	Time range	
13/03/2021	11:25	16:45
14/03/2021	11:10	12:37
14/03/2021	16:43	20:46
15/03/2021	14:00	15:06

Ground Support: RTX processing was used to calculate the GPS trajectory solution. Trimble CenterPoint® RTX™ is a proprietary GPS, GLONASS, BeiDou, and QZSS enabled technology that provides high-accuracy GNSS positioning worldwide without the use of traditional local base stations or a VRS network. By combining real-time data from a global reference station infrastructure with innovative positioning and compression algorithms, Trimble RTX technology computes centimeter-level positions based on satellite orbit and clock information. Ground surveyed test point sites were acquired by WSP, these allowed an assessment of the accuracy of the ALS point cloud data.

Data Processing: Laser strikes were classified into ground and non-ground points using a single algorithm across the project area. Manual checking and editing of the data classification further improved the quality of the ground point classification. Further detail is provided on page 6.

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 alternate data presentation.

Resubmission: The client requested amendments be made to align with the LINZ Elevation programme. The following amendments were made:

1. DEM and DSM re-output to revised tile index (LINZ standard).
2. LAS tile CL2_BP32_2021_500_050033.las contained 1 point with GPS timestamp of zero. This point deleted from LAS file.
3. Intensity re-scaled by multiplying all LiDAR intensity values by 16. This gets all data normalized 0-65535 values.
4. File Source ID set to zero for all tiles. See LAS headers.
5. All bridges re-classified from class 10 to class 17.
6. NZVD2016 information added to LAS headers.

Project Contacts:

Client
Keith Miller Keith.Miller@kapiticoast.govt.nz

AAM Project Manager
Lorraine Claydon (Ph +64 275 323 382) L.Claydon@aamgroup.com

2. DATA INSTALLATION

Data formats	:	LAS v1.4, ESRI ASCII GRID, GeoTiff, SHP, PDF
Number & type of media	:	HDD
Information files on media	:	Readme_PRJ38777NOM04
Data formatted on	:	09/12/2021
Disk volume	:	PRJ38777NOM04

README FILE

This document (Readme_PRJ38777NOM04.pdf) is provided as an Acrobat file in this volume.

FILE SIZES AND NAMES

Kapiti Coast DC project extents were defined in standard LINZ NZTopo 50 1:500 tiles, 240m x 360m. Products have been named according to the LINZ LiDAR file naming convention:

Product_NZTopo50Sheet_MapScale_TileNumber
eg. CL2_BP34_500_016085.abc
DEM_BP34_500_016085.abc
DSM_BP34_500_016085.abc
CON05_BP34_500_016085.abc
CON1_BP34_500_016085.abc

To meet the LINZ request for DEM and DSM in NZTopo 50 1:1000 tiles, 480m x 720m - AAM NZ have supplied a second set of DEM and DSM products in this tile system, with the standard LINZ file naming convention:

Product_NZTopo50Sheet_MapScale_TileNumber
eg. DEM_BP34_1000_1605.abc
DSM_BP34_1000_1605.abc

Please Note: The Kapiti Coast DC LiDAR project extent is a boundary is based on 1:500 tiles. Some inland 1:1000 tiles will contain "NODATA" values beyond the Kapiti Coast DC LiDAR project extent. This approach was agreed between KCDC and AAM NZ to provide LINZ with the DEM and DSM in 1:1000 tiles, without increasing the coverage and cost of the project.

Full list of directories on HDD: ***PRJ38777NOM04_File_List.txt***

3. METADATA

SOURCE DATA

Item	Source	Description	Ref No	Date
Laser System	AAM	Optech Galaxy Prime 473	FL014724 FL014734 FL014729 FL014735	13/03/2021 14/03/2021 14/03/2021 15/03/2021
Trajectory	AAM	CenterPoint® RTX™	PRJ38777	As above
Field Survey	WSP	RTK GPS	PRJ38777	February 2021

DATA CHARACTERISTICS

Characteristic	Description
Device Name	Galaxy Prime +
Half Scan Angle	22.5 degrees
Laser Pulse Rate	450kHz
Laser Pulse Mode	Multipulse Pulse
Returns	1st, second, third and last
Point Density	8.26pts/ m^2 per swath
Overlap	60% - to achieve 16pts/m^2 in total
Capture Altitude (AGL)	805m
Survey Speed (Kts)	140
Horizontal Datum	NZGD2000
Vertical Datum	NZVD2016
Map Projection	NZTM
Vertical Accuracy Specification	±0.10m at 95% confidence level
Horizontal Accuracy Specification	±0.50m at 95% confidence level

REFERENCE SYSTEMS

	Horizontal	Vertical
Datum	NZGD2000/NZTM	NZVD2016
Projection	NZTM	N/A
Geoid Model		NZGeoid2016

OTHER CAPTURE CRITERIA

Item	Description
Tidal Constraints	Capture within 3 hours of low tide

4. DATA PROCESSING LINEAGE

LiDAR Processing Workflow:

- LiDAR upload and inspection
- Raw LiDAR processing – GPS & Flight line matching
- Accuracy assessment against test point sites
- Automated classification and manual classification editing
- Product creation
- Quality assurance

Classified LiDAR Point Cloud:

All LAS file point cloud files have been classified to the schema shown in the table below.

The data has been classified to ICSM Level 2 Classification (Ground Surface Improvement) within the clients defined project area of interest (AOI).

Number	Point Class	Description	ICSM Classification Level
1	Default	Unclassified	1
2	Ground	Bare ground	2
3	Low vegetation	<2m high	1
4	Medium Vegetation	2-8m high	1
5	High Vegetation	> 8m high	1
6	Buildings/ Structures		1
7	Low Noise		1
9	Water		2
17	Bridges		2
18	High Noise		1

AAM uses proprietary ground classification routines to provide the initial automated ground / non-ground classification and generate the initial ground surface. The classification is then manually edited to improve the ground classification to ICSM level 2 standard. Following this process, further automated techniques are used to classify the other classes shown above to ICSM level 1 standard.

A QA review is completed on a percentage of the classified tiles within the AOI.

Digital Elevation Model (DEM): Generated using LiDAR point cloud class 2 (Ground).

Hydro flattening was undertaken based on the current LINZ Specifications: PGF_Version_New_Zealand_National_Aerial_LiDAR_Base_Specification – January 2020. Otaki River has been considered a braided river.

Surface models (DSM): Generated using ground and non-ground classified points.

Elevation Grids were derived using the LAStools las2dem command. This tool reads LIDAR points from the LAS/LAZ format (or some ASCII formats) and triangulates them temporarily into a TIN with a user defined interpolation distance. LAStools then applies a TIN to raster conversion to create the 1m DEM raster dataset.

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	<=0.10m	Project design
Horizontal data	<=0.5m	
Test Points	0.05m	Survey methodology used

Notes on Expected Accuracy

- Values shown represent standard error (68% confidence level or 1 sigma), in meters.
- "Measured points" are those observed directly.
- 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.

LiDAR DATA VALIDATION

- Ground data in this volume has been compared to test points obtained by field survey and assumed to be error-free. The test points were located on open clear ground. Comparison of the field test points with elevations interpolated from measured data, after removing the mean offset yielded the following accuracy assessment:

Test Point Sites	No. of Points	Mean Difference	Std Deviation (m)	RMS (m)
5	221	0.00	0.01	0.01

6. CONDITIONS OF SUPPLY

The data in this volume has been commissioned by **KAPITI COAST DISTRICT COUNCIL**.

The data in this volume is provided by AAM NZ Limited (AAM) to **KAPITI COAST DISTRICT COUNCIL** under **Kapiti Coast District Council Contract 2020/C370: Ortho-photography and Associated Digital Products 2020/21,** this allows for release of the products under Creative Commons Attribution 4.0 International, and is subject to the following conditions:

1. This file (Readme_PRJ38777NOM04.PDF) is always stored with the unaltered data contained in this volume.

2. The data is not used for purposes beyond that explicitly agreed in the description of the Services provided by AAM.

Any problems associated with the information in the data files contained in this volume should be reported to AAM NZ Limited. A list of project related contacts is listed on page 3 under the Project Report heading.

Email info@aamgroup.com
Web www.aamgroup.com

7. TEST POINT ANALYSIS

Project:	PRJ38777 Kapiti CDC LiDAR
Name:	LiDAR_Test_Sites_Check
Coordinate system:	NZTM2000
Date:	25/05/2021
Report type:	LiDAR

Name	Easting	Northing	Known Z	Laser Z	Dz
1	1764487.62	5460929.56	6.29	6.29	0.00
2	1764485.64	5460928.03	6.31	6.31	0.00
3	1764483.69	5460926.48	6.31	6.32	0.01
4	1764482.11	5460928.80	6.34	6.37	0.02
5	1764475.71	5460937.26	6.55	6.57	0.02
6	1764473.77	5460935.76	6.55	6.57	0.02
7	1764480.03	5460927.33	6.37	6.40	0.02
8	1764481.74	5460925.02	6.33	6.34	0.01
9	1764479.85	5460923.32	6.34	6.34	0.00
10	1764477.97	5460925.99	6.40	6.41	0.02
11	1764471.93	5460933.99	6.56	6.58	0.03
12	1764469.91	5460932.61	6.58	6.59	0.01
13	1764476.04	5460924.44	6.40	6.42	0.02
14	1764477.81	5460921.78	6.36	6.37	0.01
15	1764475.89	5460920.27	6.37	6.38	0.01
16	1764473.75	5460922.80	6.42	6.43	0.02
17	1764467.54	5460930.99	6.59	6.62	0.02
18	1764465.69	5460929.56	6.61	6.63	0.02
19	1764471.86	5460921.38	6.43	6.46	0.03
20	1764473.93	5460918.73	6.38	6.38	0.00
21	1764471.94	5460917.31	6.39	6.39	0.00
22	1764469.99	5460919.98	6.44	6.46	0.02
23	1764463.79	5460928.12	6.62	6.63	0.01
24	1764461.88	5460926.59	6.63	6.64	0.01
25	1764468.19	5460918.32	6.45	6.47	0.02
26	1764469.98	5460915.72	6.39	6.40	0.02
27	1764467.98	5460914.31	6.39	6.42	0.03
28	1764466.22	5460916.82	6.45	6.47	0.02
29	1764459.86	5460925.16	6.63	6.65	0.02
30	1764457.81	5460923.69	6.65	6.67	0.01
31	1764464.16	5460915.26	6.46	6.48	0.02
32	1764465.97	5460912.77	6.41	6.42	0.01
33	1764464.03	5460911.23	6.42	6.44	0.02
34	1764462.17	5460913.78	6.47	6.48	0.02
35	1764455.81	5460922.26	6.66	6.66	0.01
36	1764453.84	5460920.66	6.65	6.67	0.02
37	1764460.25	5460912.32	6.47	6.48	0.01

38	1764462.00	5460909.73	6.43	6.45	0.02
39	1764459.98	5460908.31	6.45	6.45	0.00
40	1764458.11	5460910.83	6.48	6.50	0.02
41	1764451.91	5460919.20	6.66	6.66	0.01
42	1764449.83	5460917.76	6.66	6.68	0.02
43	1764456.23	5460909.37	6.48	6.51	0.03
44	1764457.95	5460906.85	6.45	6.47	0.02
45	1764455.96	5460905.30	6.45	6.46	0.01
46	1764454.30	5460907.87	6.48	6.51	0.03
47	1764447.68	5460916.44	6.67	6.69	0.02
48	1774137.00	5472913.35	30.96	30.96	-0.01
49	1774143.54	5472909.37	30.88	30.87	-0.02
50	1774142.20	5472907.28	30.90	30.89	-0.01
51	1774135.63	5472911.27	30.97	30.95	-0.02
52	1774134.24	5472909.21	30.98	30.97	0.00
53	1774140.85	5472905.17	30.92	30.91	-0.01
54	1774139.52	5472903.04	30.94	30.93	-0.01
55	1774132.91	5472907.09	30.99	30.99	-0.01
56	1774131.61	5472904.98	31.02	31.00	-0.02
57	1774138.20	5472900.92	30.96	30.94	-0.01
58	1774136.86	5472898.78	30.98	30.96	-0.02
59	1774130.22	5472902.89	31.02	31.01	-0.01
60	1774128.87	5472900.74	31.04	31.03	-0.01
61	1774135.54	5472896.65	30.98	30.97	-0.01
62	1774131.61	5472890.33	31.02	31.01	-0.01
63	1774124.91	5472894.41	31.11	31.10	-0.02
64	1774123.55	5472892.27	31.12	31.11	0.00
65	1774130.29	5472888.19	31.03	31.03	0.00
66	1774128.98	5472886.10	31.06	31.05	-0.01
67	1774122.22	5472890.19	31.12	31.11	-0.01
68	1774120.91	5472888.05	31.14	31.14	0.00
69	1774127.60	5472883.96	31.07	31.06	-0.01
70	1774126.24	5472881.91	31.09	31.07	-0.02
71	1774119.57	5472885.95	31.15	31.14	-0.02
72	1774124.96	5472879.73	31.10	31.08	-0.02
73	1774123.58	5472877.62	31.11	31.11	-0.01
74	1774116.92	5472881.68	31.15	31.15	0.00
75	1774115.51	5472879.62	31.17	31.16	-0.01
76	1774122.19	5472875.53	31.13	31.12	-0.01
77	1774120.98	5472873.30	31.16	31.15	-0.01
78	1774114.30	5472877.43	31.18	31.18	0.00
79	1774112.80	5472875.41	31.19	31.19	0.00
80	1774119.57	5472871.31	31.17	31.16	-0.01
81	1774118.28	5472869.25	31.19	31.19	0.00
82	1774111.51	5472873.36	31.21	31.20	0.00
83	1774110.20	5472871.22	31.24	31.23	-0.01

84	1774116.96	5472867.07	31.20	31.19	-0.01
85	1774106.03	5472852.31	31.30	31.29	-0.01
86	1774102.02	5472854.94	31.31	31.30	-0.01
87	1774102.18	5472845.95	31.30	31.30	0.00
88	1774097.86	5472848.55	31.36	31.34	-0.02
89	1768734.22	5471803.53	4.85	4.86	0.01
90	1768729.44	5471800.91	4.89	4.89	-0.01
91	1768728.27	5471799.73	4.92	4.90	-0.02
92	1768723.58	5471796.79	4.86	4.85	-0.01
93	1768725.30	5471794.92	4.94	4.92	-0.02
94	1768730.67	5471798.73	4.96	4.96	0.01
95	1768732.03	5471796.71	5.04	5.04	0.00
96	1768726.43	5471792.63	4.97	4.96	-0.01
97	1768733.09	5471794.36	5.09	5.09	-0.01
98	1768727.70	5471790.52	5.01	5.00	-0.01
99	1768730.42	5471786.40	5.07	5.06	-0.01
100	1768735.67	5471790.31	5.16	5.17	0.01
101	1768737.55	5471786.91	5.23	5.20	-0.02
102	1768731.79	5471784.31	5.10	5.10	-0.01
103	1768733.10	5471782.09	5.16	5.14	-0.02
104	1768738.55	5471784.70	5.23	5.23	0.00
105	1768739.90	5471782.56	5.26	5.25	-0.01
106	1768741.15	5471780.47	5.30	5.28	-0.03
107	1768735.69	5471777.68	5.19	5.19	0.00
108	1768736.84	5471775.46	5.24	5.23	-0.01
109	1768743.95	5471776.26	5.34	5.32	-0.02
110	1768738.23	5471773.40	5.27	5.27	-0.01
111	1768739.59	5471771.12	5.30	5.29	0.00
112	1768745.31	5471774.10	5.38	5.36	-0.02
113	1768746.53	5471771.89	5.38	5.39	0.01
114	1768741.02	5471769.08	5.35	5.32	-0.02
115	1768742.08	5471766.89	5.35	5.35	-0.01
116	1768747.71	5471769.76	5.42	5.42	0.00
117	1768748.87	5471767.54	5.45	5.43	-0.02
118	1768743.56	5471764.80	5.38	5.37	-0.01
119	1768744.78	5471762.69	5.40	5.40	-0.01
120	1768750.18	5471765.42	5.47	5.45	-0.02
121	1768746.06	5471760.45	5.42	5.41	-0.01
122	1768751.60	5471763.30	5.50	5.48	-0.02
123	1768752.86	5471761.20	5.53	5.51	-0.02
124	1768747.46	5471758.38	5.45	5.43	-0.02
125	1768754.07	5471759.01	5.56	5.55	-0.01
126	1768755.29	5471756.89	5.60	5.59	-0.02
127	1768756.69	5471754.79	5.67	5.66	-0.01
128	1768758.11	5471752.77	5.74	5.74	0.00
129	1768759.41	5471750.50	5.80	5.79	-0.01

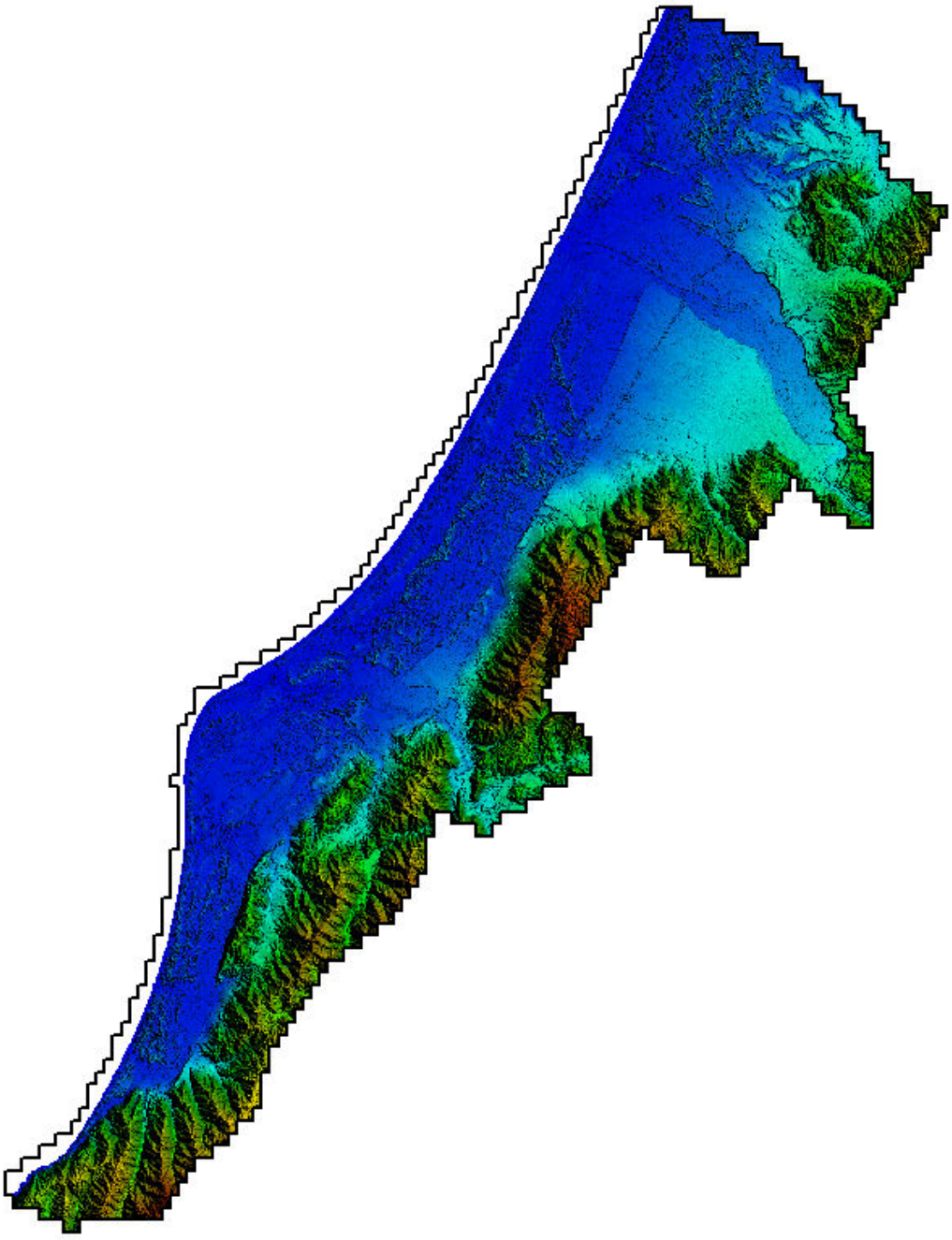
130	1778711.69	5488305.89	5.92	5.91	-0.01
131	1778716.87	5488303.18	6.16	6.15	-0.01
132	1778725.75	5488298.27	6.53	6.52	-0.01
133	1778724.52	5488296.12	6.54	6.54	0.00
134	1778715.81	5488301.01	6.18	6.17	-0.01
135	1778711.05	5488303.17	5.97	5.97	0.00
136	1778710.07	5488301.09	5.97	5.97	0.00
137	1778714.53	5488298.76	6.17	6.15	-0.01
138	1778723.31	5488294.00	6.57	6.55	-0.02
139	1778722.01	5488291.89	6.57	6.56	-0.01
140	1778713.27	5488296.60	6.16	6.15	0.00
141	1778708.85	5488298.72	5.98	5.97	-0.01
142	1778707.77	5488296.56	5.97	5.98	0.01
143	1778712.58	5488294.17	6.17	6.18	0.00
144	1778720.98	5488289.61	6.58	6.57	-0.02
145	1778719.85	5488287.59	6.59	6.59	0.00
146	1778710.97	5488292.21	6.18	6.18	-0.01
147	1778706.61	5488294.26	5.99	5.99	0.00
148	1778705.53	5488291.97	5.99	5.98	-0.01
149	1778710.28	5488290.04	6.19	6.19	0.00
150	1778709.51	5488288.06	6.23	6.21	-0.02
151	1778704.63	5488290.24	6.00	6.00	0.01
152	1778700.27	5488267.92	6.38	6.38	-0.01
153	1778697.75	5488263.60	6.43	6.43	0.00
154	1778694.90	5488259.27	6.47	6.47	0.00
155	1778692.41	5488254.93	6.40	6.40	-0.01
156	1778689.28	5488256.21	6.14	6.13	-0.01
157	1778691.67	5488261.06	6.17	6.18	0.01
158	1778693.73	5488265.09	6.25	6.23	-0.02
159	1778695.59	5488269.59	6.16	6.15	-0.01
160	1778692.26	5488272.13	5.92	5.91	-0.01
161	1778689.78	5488267.46	5.95	5.93	-0.01
162	1778687.50	5488262.78	5.93	5.93	0.00
163	1778685.27	5488258.78	5.86	5.87	0.00
164	1778681.64	5488260.29	5.70	5.69	-0.01
165	1778683.81	5488264.87	5.72	5.71	-0.01
166	1778686.11	5488269.06	5.73	5.71	-0.02
167	1778688.43	5488273.95	5.68	5.67	0.00
168	1778684.60	5488276.30	5.50	5.48	-0.02
169	1778681.81	5488271.67	5.49	5.48	-0.01
170	1778679.36	5488267.12	5.49	5.49	0.00
171	1778676.62	5488262.54	5.52	5.51	-0.02
172	1778672.36	5488264.57	5.42	5.41	-0.01
173	1778674.47	5488269.41	5.32	5.31	0.00
174	1778679.43	5488279.71	5.34	5.33	-0.01
175	1778672.50	5488274.26	5.23	5.21	-0.02

176	1782057.03	5485379.43	13.40	13.41	0.01
177	1782055.12	5485377.80	13.41	13.42	0.01
178	1782058.83	5485373.02	13.49	13.51	0.01
179	1782056.71	5485371.69	13.47	13.49	0.02
180	1782053.16	5485376.17	13.40	13.43	0.02
181	1782051.18	5485374.70	13.41	13.43	0.01
182	1782054.72	5485370.14	13.47	13.49	0.03
183	1782052.67	5485368.70	13.48	13.49	0.01
184	1782049.25	5485373.11	13.40	13.42	0.02
185	1782047.24	5485371.64	13.41	13.43	0.02
186	1782050.73	5485367.08	13.48	13.50	0.02
187	1782048.69	5485365.61	13.49	13.50	0.01
188	1782045.31	5485370.03	13.42	13.42	0.01
189	1782046.78	5485363.98	13.50	13.50	0.00
190	1782043.31	5485368.44	13.43	13.44	0.01
191	1782041.52	5485367.03	13.42	13.43	0.01
192	1782044.87	5485362.43	13.51	13.53	0.02
193	1782042.87	5485360.89	13.52	13.53	0.01
194	1782039.63	5485365.37	13.43	13.44	0.01
195	1782037.80	5485363.86	13.44	13.44	0.00
196	1782040.94	5485359.38	13.53	13.53	0.00
197	1782038.82	5485357.93	13.53	13.54	0.02
198	1782035.77	5485362.20	13.47	13.46	0.00
199	1782034.24	5485360.45	13.48	13.49	0.01
200	1782034.92	5485354.93	13.58	13.60	0.02
201	1782031.78	5485359.34	13.48	13.50	0.02
202	1782029.79	5485357.81	13.48	13.50	0.02
203	1782032.92	5485353.61	13.58	13.59	0.02
204	1782031.15	5485351.99	13.59	13.59	0.01
205	1782027.98	5485356.23	13.46	13.48	0.02
206	1782026.09	5485354.62	13.50	13.51	0.01
207	1782029.28	5485350.63	13.59	13.59	0.00
208	1782027.37	5485349.14	13.60	13.61	0.01
209	1782024.26	5485353.02	13.51	13.53	0.02
210	1782022.45	5485351.52	13.52	13.52	0.00
211	1782025.42	5485347.75	13.61	13.61	0.00
212	1782046.53	5485392.63	13.22	13.22	0.01
213	1782038.52	5485386.17	13.13	13.14	0.01
214	1782022.24	5485373.07	13.21	13.22	0.02

MIN	-0.03
MAX	0.03
Mean	0.00
STDEV	0.01
RMSE	0.01
95% confidence	0.03

8. VALIDATION PLOTS

Overview of Ground data – colour elevation plot



Sample of the Contour