

# OTAGO REGIONAL COUNCIL

## PGF-LIDAR OTAGO REGION SURVEY

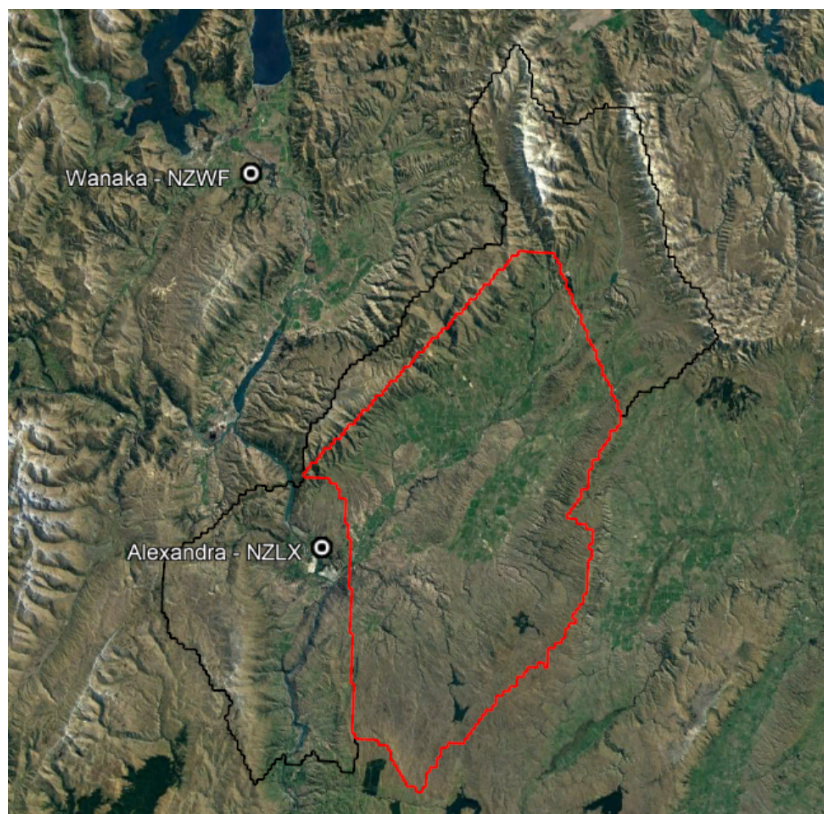
### VOLUME: PRJ38924\_05

## PROJECT SUMMARY

This project is for provision of Airborne LiDAR survey over 8,191 km<sup>2</sup> of the Otago Region.

This volume contains data over Central Otago1 – approximately 2,029 km<sup>2</sup> shown in red below (part of the Priority 3, black boundary). This area was captured between the 22<sup>nd</sup> of June – 10<sup>th</sup> of July 2022.

The survey was planned to achieve  $\leq 20\text{cm}$  vertical accuracy (95% CI),  $\leq 100\text{cm}$  horizontal accuracy (95% CI) with an emitted pulse density of 4ppsm, and ground classification to ICSM level 2.



*Background image from Google Earth*

## DATA SUMMARY

This volume includes the following data in NZTM2000 projection and NZVD2016 vertical datum:

- Classified Point Cloud data in LAS v1.4 format
- Ground Classified Point Cloud data in LAS v1.4 format
- DEM Grids, 1m cell size in GeoTIFF and ASCII XYZ formats
- DSM Grids, 1m cell size in GeoTIFF and ASCII XYZ formats
- Hydro-flattening features in ESRI Shapefile format
- Flight lines in ESRI Shapefile format
- Tile layout, 1:1000 NZTopo50 in Shapefile format
- Extent file, describing the delivered data in Shapefile format
- Areas marked to recapture – ESRI Shapefile format\*
- File listing in text file format
- Metadata file: This document in PDF format

This data has been supplied in accordance with the specifications agreed with Otago Regional Council and the *LINZ PGF Version: New Zealand National Aerial LiDAR Base Specification – January 2020*. Users requiring other formats and projections please contact AAM NZ Ltd.

Contours, Intensity Images and Point Cloud in ASCII format will be supplied once the above has been reviewed and accepted by the client.

\*Cloud gaps noted during processing, will be re flown and resupplied.

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# 1. DATA INFORMATION

Data supply: Hard Drive  
 Number of files: 46,990 data files, 1 file list  
 Data formatted on: 21.11.2022  
 README Document: This file

| Previous Deliveries | Date       | Title                  | Contents                 |
|---------------------|------------|------------------------|--------------------------|
| PRJ38924_01         | 02.09.2021 | PGF-LIDAR Otago Region | Dunedin and Mosgiel      |
| PRJ38924_02         | 23.12.2021 | PGF-LIDAR Otago Region | Catlins area             |
| PRJ38924_03         | 04.02.2022 | PGF-LIDAR Otago Region | Milton area              |
| PRJ38924_04         | 05.04.2022 | PGF-LIDAR Otago Region | Palmerston area          |
| PRJ38924_04_rev2    | 02.08.2022 | PGF-LIDAR Otago Region | Palmerston area resupply |

| File Details of this Delivery                  | Contents  |
|--|---|
| Folder: 01_Classified_Point_Cloud/1_LAS        | Classified Point Cloud in LAS format  |
| Folder: 01_Classified_Point_Cloud/3_Ground_LAS | Ground Points in LAS format   |
| Folder: 02_Grids/1_DEM                         | DEM tiles in GeoTiff and ASCII XYZ  |
| Folder: 02_Grids/2_DSM                         | DSM tiles in GeoTiff and ASCII XYZ  |
| Folder: 05_Ancillary                           | Ancillary files in ESRI shapefile format – Tile Layout, Trajectories, Extent, Hydro-flattening features |
| Readme_PRJ38924_05.pdf                         | Metadata Report   |
| PRJ38924_05_File_List_HDD1.txt                 | Listing of product files delivered in this volume   |

## 2. METADATA

| Source Data  | Source     | Description       | Ref No   | Date                |
|--------------|------------|-------------------|----------|---------------------|
| LiDAR        | AAM        | Optech Galaxy 397 | FL017566 | 22.06.2022          |
|              |            | Optech Galaxy 397 | FL017579 | 24.06.2022          |
|              |            | Optech Galaxy 397 | FL017652 | 07.07.2022          |
|              |            | Optech Galaxy 397 | FL017661 | 04.07.2022          |
|              |            | Optech Galaxy 397 | FL017673 | 06.07.2022          |
|              |            | Optech Galaxy 397 | FL017695 | 10.07.2022          |
| Trajectory   | AAM        | RTX™              | As above | As above            |
| Field Survey | WSP NZ Ltd | RTK / PPK         | 6-XZ685  | 29.08.22 – 14.09.22 |

| LiDAR Characteristics | Description                         |
|-----------------------|-------------------------------------|
| Format                | LAS 1.4                             |
| Emitted Density       | 4 ppm2                              |
| Tile size             | 480m x 720m (NZTopo50 1:1000 tiles) |
| ICSM Classification   | Level 2. Ground surface improvement |

| Number | Point Class           | Description                            | ICSM | CI % |
|--------|-----------------------|--|------|------|
| 1      | Default               | Unclassified                           | 1    | 95   |
| 2      | Ground                | Bare ground                            | 2    | 98   |
| 3      | Low vegetation        | < 2 m                                  | 1    | 95   |
| 4      | Medium vegetation     | 2-8 m                                  | 1    | 95   |
| 5      | High vegetation       | > 8 m                                  | 1    | 95   |
| 6      | Buildings, structures | Buildings, houses, silos etc.          | 1    | 95   |
| 7      | Low Noise             | Spurious low point returns (unusable)  | 1    | 95   |
| 9      | Water                 | Any point in water                     | 2    | 98   |
| 17     | Bridge                | Any bridge or overpass                 | 2    | 98   |
| 18     | High Noise            | Spurious high point returns (unusable) | 1    | 95   |

| Reference Systems | Horizontal | Vertical    |
|-------------------|------------|-------------|
| Datum             | NZGD2000   | NZVD2016    |
| Projection        | NZTM2000   | N/A         |
| Geoid Model       | N/A        | NZGeoid2016 |

| Accuracy Specification | Measured Point | Derived Point | Basis of Estimation     |
|------------------------|----------------|---------------|-------------------------|
| Field Survey           | 5 cm           |               | Survey methodology used |
| LiDAR (Horizontal)     | < 100 cm       |               | Project design          |
| LiDAR (Vertical)       | < 20 cm        |               | Project design          |

Project specifications and technical processes were designed to achieve data accuracies as above.

### Notes On Expected Accuracy

- Values shown represent 95% confidence level (2 sigma), in centimetres.
- “Derived points” are those interpolated from a terrain model.
- “Measured points” are those observed directly.
- Accuracy estimates for terrain modeling by LiDAR refer to the terrain definition on clear ground.
- 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 – LiDAR Data

- Vertical Accuracy Validation - Ground data in this volume has been compared to 544 test points obtained by field survey and assumed to be error-free. The test points were distributed in 11 sites across the mapping area and located on clear ground. Comparison of the test points with elevations interpolated from measured data resulted in:  
 Mean difference: -0.017 m  
 St. Deviation: 0.025 m  
 Standard Error (RMS): 0.030 m or 0.059 m (95% CI)  
 The mean elevation difference of -0.131m has been removed from the data supplied in this volume



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- Horizontal Accuracy – the LiDAR point cloud was compared to survey data and found to fit well in position. Expected accuracy is well within the specified range.



- Data classification has been manually checked and edited against available imagery.

### 3. CONDITIONS OF SUPPLY

The data in this volume has been commissioned by **OTAGO REGIONAL COUNCIL**.

The data in this volume is provided by AAM Pty Limited (AAM) to **OTAGO REGIONAL COUNCIL** under the Terms of Engagement described in PGF-LiDAR Otago Region Survey Contract for Services. Which transfers copyright and IP rights in the Deliverables from AAM to **OTAGO REGIONAL COUNCIL** upon payment of all amounts and subject to the conditions below:

1. This file (Readme\_PRJ38924\_05.pdf) is always stored with the unaltered data contained in this volume.

AAM retains all rights to the raw data, and perpetual royalty free license to use the Deliverables.

Otago Regional Council intend to make this data available for reuse under Creative Commons BY INT 4.0 <https://creativecommons.org/licenses/by/4.0/>.

This data is provided in accordance with the specifications agreed with Otago Regional Council. Any problems associated with the information in the data files contained in this volume should be reported to AAM NZ Limited.

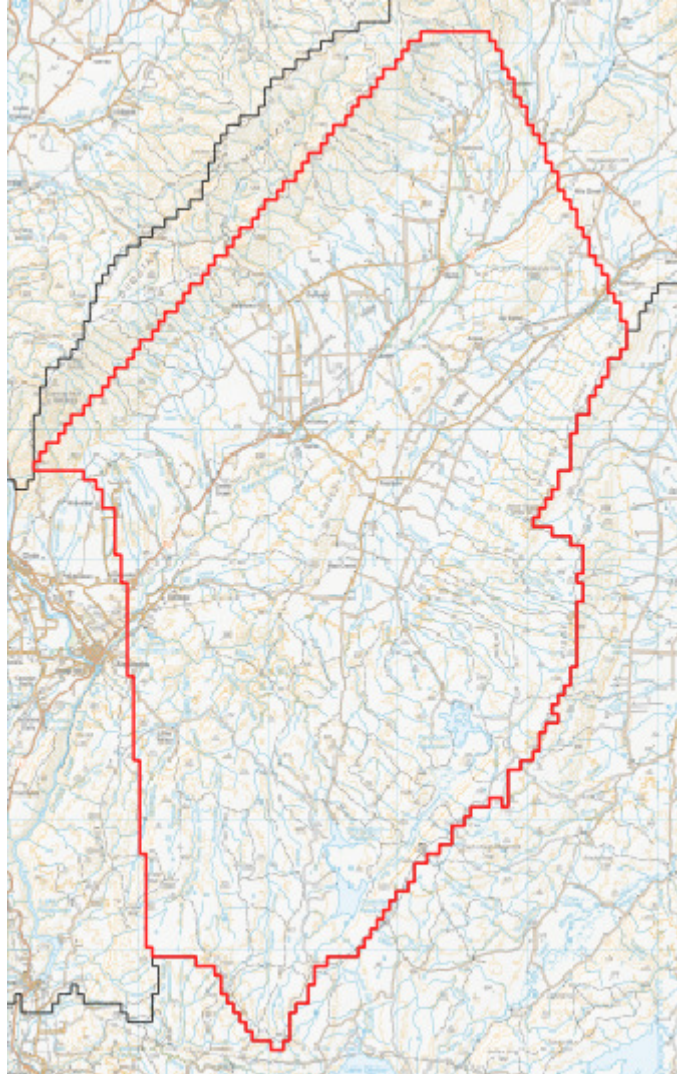
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New Zealand

Email [info@aamgroup.com](mailto:info@aamgroup.com)  
Web [www.aamgroup.com](http://www.aamgroup.com)

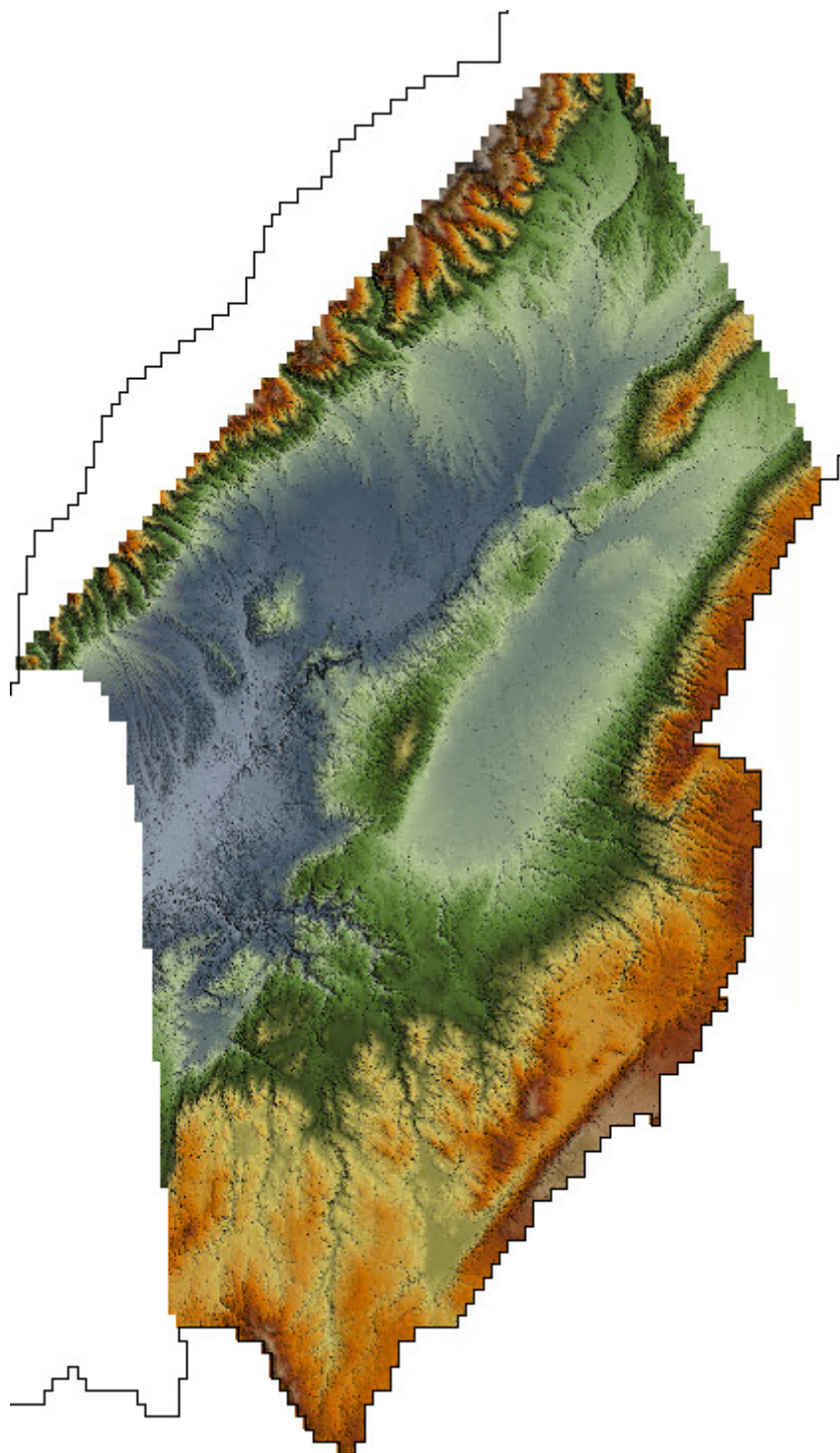


## 4. VALIDATION

Volume Extent – red boundary



Colour Elevation Image



# OTAGO REGIONAL COUNCIL

## PGF-LIDAR OTAGO REGION SURVEY

### VOLUME: PRJ38924\_07

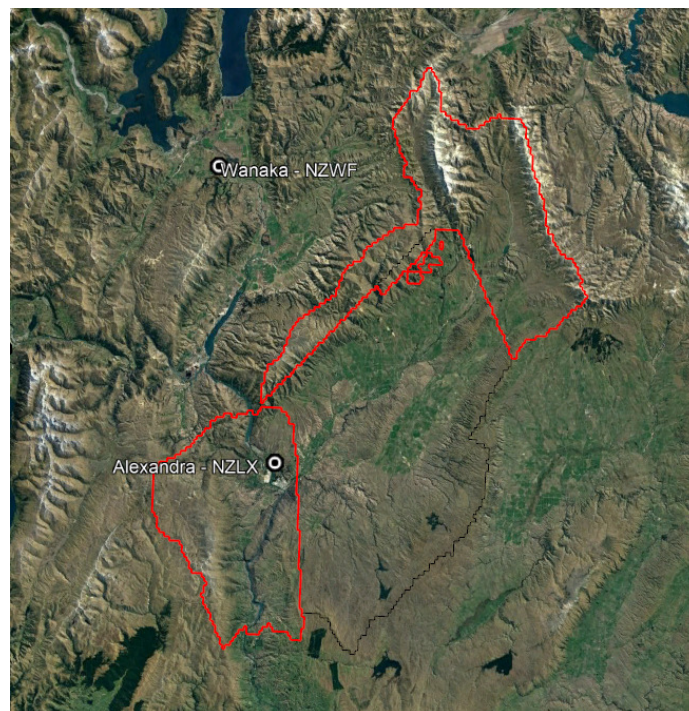
## PROJECT SUMMARY

This project is for provision of Airborne LiDAR survey over 8,191 km<sup>2</sup> of the Otago Region.

This volume contains data over Central Otago, approximately 1,948 km<sup>2</sup> shown in red below (part of the Priority 3, black boundary). This area was captured between the 22<sup>nd</sup> of June – 10<sup>th</sup> of July 2022, and a second capture window between the 13<sup>th</sup> of December 2022 - 9<sup>th</sup> of January 2023.

This volume adjoins and replaces some tiles delivered in PRJ38924\_05 Central Otago Part 1 and completes the coverage of the Otago LiDAR Priority 3 area.

The survey was planned to achieve  $\leq 20\text{cm}$  vertical accuracy (95% CI),  $\leq 100\text{cm}$  horizontal accuracy (95% CI) with an emitted pulse density of 4ppsm, and ground classification to ICSM level 2.



*Background image from Google Earth*

## DATA SUMMARY

This volume includes the following data in NZTM2000 projection and NZVD2016 vertical datum:

- Classified Point Cloud data in LAS v1.4 and ASCII XYZi formats
- Ground Classified Point Cloud data in LAS v1.4 format
- DEM Grids, 1m cell size in GeoTIFF and ASCII XYZ formats
- DSM Grids, 1m cell size in GeoTIFF and ASCII XYZ formats
- Intensity Images, 1m cell size in GeoTIFF format
- 0.5m Contours in Shapefile format \*
- Hydro-flattening features in ESRI Shapefile format
- Flight lines in ESRI Shapefile format
- Tile layout, 1:1000 NZTopo50 in Shapefile format
- Extent file, describing the delivered data in Shapefile format
- Areas marked to recapture – ESRI Shapefile format\*
- File listing in text file format
- Metadata file: This document in PDF format

This data has been supplied in accordance with the specifications agreed with Otago Regional Council and the *LINZ PGF Version: New Zealand National Aerial LiDAR Base Specification – January 2020*. Users requiring other formats and projections please contact AAM NZ Ltd.

\*Please note, the contours in this volume cover both Central Otago Part 1 and Part 2

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| 4. Validation .....           | 10 |



## 1. DATA INFORMATION

Data supply: Hard Drive  
 Number of files: 139,563 data files, 1 file list  
 Data formatted on: 21.04.2023  
 README Document: This file

| Previous Deliveries | Date       | Title                  | Contents   |
|---------------------|------------|------------------------|--|
| PRJ38924_01         | 02.09.2021 | PGF-LIDAR Otago Region | Dunedin and Mosgiel                              |
| PRJ38924_02         | 23.12.2021 | PGF-LIDAR Otago Region | Catlins area                                     |
| PRJ38924_03         | 04.02.2022 | PGF-LIDAR Otago Region | Milton area                                      |
| PRJ38924_04         | 05.04.2022 | PGF-LIDAR Otago Region | Palmerston area                                  |
| PRJ38924_04_rev2    | 02.08.2022 | PGF-LIDAR Otago Region | Palmerston area resupply                         |
| PRJ38924_05         | 21.11.2022 | PGF-LIDAR Otago Region | P3 Central Otago Part 1                          |
| PRJ38924_06         | 21.11.2022 | PGF-LIDAR Otago Region | Palmerston resupply<br>Replaces PRJ38924_04_rev2 |

| File Details of this Delivery                  | Contents  |
|--|---|
| Folder: 01_Classified_Point_Cloud/1_LAS        | Classified Point Cloud in LAS format                    |
| Folder: 01_Classified_Point_Cloud/1_ASCII_XYZ  | Classified Point Cloud in ASCII XYZ format              |
| Folder: 01_Classified_Point_Cloud/3_Ground_LAS | Ground Points in LAS format                             |
| Folder: 02_Grids/1_DEM                         | DEM tiles in GeoTiff and ASCII XYZ                      |
| Folder: 02_Grids/2_DSM                         | DSM tiles in GeoTiff and ASCII XYZ                      |
| Folder: 03_Contours                            | Contours over the <b>entire P3 Central Otago extent</b> |
| Folder: 04_Intensity                           | Intensity imagery in Geotiff format                     |



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|                           |   |
|---------------------------|---|
| Folder: 05_Ancillary      | Ancillary files in ESRI shapefile format – Tile Layout, Trajectories, Extent, Hydro-flattening features |
| Readme_PRJ38924_07.pdf    | Metadata Report   |
| PRJ38924_07_File_List.txt | Listing of product files delivered in this volume   |

## 2. METADATA

| Source Data  | Source     | Description       | Ref No   | Date                |
|--------------|------------|-------------------|----------|---------------------|
| LiDAR        | AAM        | Optech Galaxy 397 | FL017566 | 22.06.2022          |
|              |            | Optech Galaxy 397 | FL017579 | 24.06.2022          |
|              |            | Optech Galaxy 397 | FL017652 | 02.07.2022          |
|              |            | Optech Galaxy 397 | FL017657 | 03.07.2022          |
|              |            | Optech Galaxy 397 | FL017661 | 04.07.2022          |
|              |            | Optech Galaxy 397 | FL017673 | 06.07.2022          |
|              |            | Optech Galaxy 397 | FL017695 | 10.07.2022          |
|              |            | Optech Galaxy 397 | FL018561 | 13.12.2022          |
|              |            | Optech Galaxy 397 | FL018568 | 13.12.2022          |
|              |            | Optech Galaxy 397 | FL018600 | 17.12.2022          |
|              |            | Optech Galaxy 397 | FL018663 | 28.12.2022          |
|              |            | Optech Galaxy 397 | FL018667 | 28.12.2022          |
|              |            | Optech Galaxy 397 | FL018670 | 29.12.2022          |
|              |            | Optech Galaxy 397 | FL018674 | 29.12.2022          |
|              |            | Optech Galaxy 397 | FL018688 | 02/01/2023          |
|              |            | Optech Galaxy 397 | FL018704 | 03/01/2023          |
|              |            | Optech Galaxy 397 | FL018720 | 08/01/2023          |
|              |            | Optech Galaxy 397 | FL018721 | 08/01/2023          |
|              |            | Optech Galaxy 397 | FL018727 | 09/01/2023          |
| Trajectory   | AAM        | RTX™              | As above | As above            |
| Field Survey | WSP NZ Ltd | RTK / PPK         | 6-XZ685  | 29.08.22 – 14.09.22 |

| LiDAR Characteristics | Description                         |
|-----------------------|-------------------------------------|
| Format                | LAS 1.4                             |
| Emitted Density       | 4 ppm2                              |
| Tile size             | 480m x 720m (NZTopo50 1:1000 tiles) |
| ICSM Classification   | Level 2. Ground surface improvement |

| Number | Point Class           | Description                            | ICSM | CI % |
|--------|-----------------------|--|------|------|
| 1      | Default               | Unclassified                           | 1    | 95   |
| 2      | Ground                | Bare ground                            | 2    | 98   |
| 3      | Low vegetation        | < 2 m                                  | 1    | 95   |
| 4      | Medium vegetation     | 2-8 m                                  | 1    | 95   |
| 5      | High vegetation       | > 8 m                                  | 1    | 95   |
| 6      | Buildings, structures | Buildings, houses, silos etc.          | 1    | 95   |
| 7      | Low Noise             | Spurious low point returns (unusable)  | 1    | 95   |
| 9      | Water                 | Any point in water                     | 2    | 98   |
| 17     | Bridge                | Any bridge or overpass                 | 2    | 98   |
| 18     | High Noise            | Spurious high point returns (unusable) | 1    | 95   |

| Reference Systems | Horizontal | Vertical    |
|-------------------|------------|-------------|
| Datum             | NZGD2000   | NZVD2016    |
| Projection        | NZTM2000   | N/A         |
| Geoid Model       | N/A        | NZGeoid2016 |

| Accuracy Specification | Measured Point | Derived Point | Basis of Estimation     |
|------------------------|----------------|---------------|-------------------------|
| Field Survey           | 5 cm           |               | Survey methodology used |
| LiDAR (Horizontal)     | < 100 cm       |               | Project design          |
| LiDAR (Vertical)       | < 20 cm        |               | Project design          |

Project specifications and technical processes were designed to achieve data accuracies as above.

### Notes On Expected Accuracy

- Values shown represent 95% confidence level (2 sigma), in centimetres.
- “Derived points” are those interpolated from a terrain model.
- “Measured points” are those observed directly.
- Accuracy estimates for terrain modeling by LiDAR refer to the terrain definition on clear ground.

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- 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 – LiDAR Data

- Vertical Accuracy Validation - Ground data in this volume has been compared to 543 test points obtained by field survey and assumed to be error-free. The test points were distributed in 13 sites across the mapping area and located on clear ground. Comparison of the test points with elevations interpolated from measured data resulted in:

|                       |                             |
|-----------------------|-----------------------------|
| Mean difference:      | -0.009 m                    |
| St. Deviation:        | 0.030 m                     |
| Standard Error (RMS): | 0.031 m or 0.062 m (95% CI) |

This data set was compared to the adjoining block at 11 locations to determine the mean elevation difference between blocks. A shift of -0.149m was applied to the data, before testing against the test points to produce the results shown above.

- Horizontal Accuracy – the LiDAR point cloud was compared to survey data and found to fit well in position. Expected accuracy is well within the specified range.
- Data classification has been manually checked and edited against available imagery.

### 3. CONDITIONS OF SUPPLY

The data in this volume has been commissioned by **OTAGO REGIONAL COUNCIL**.

The data in this volume is provided by AAM Pty Limited (AAM) to **OTAGO REGIONAL COUNCIL** under the Terms of Engagement described in PGF-LiDAR Otago Region Survey Contract for Services. Which transfers copyright and IP rights in the Deliverables from AAM to **OTAGO REGIONAL COUNCIL** upon payment of all amounts and subject to the conditions below:

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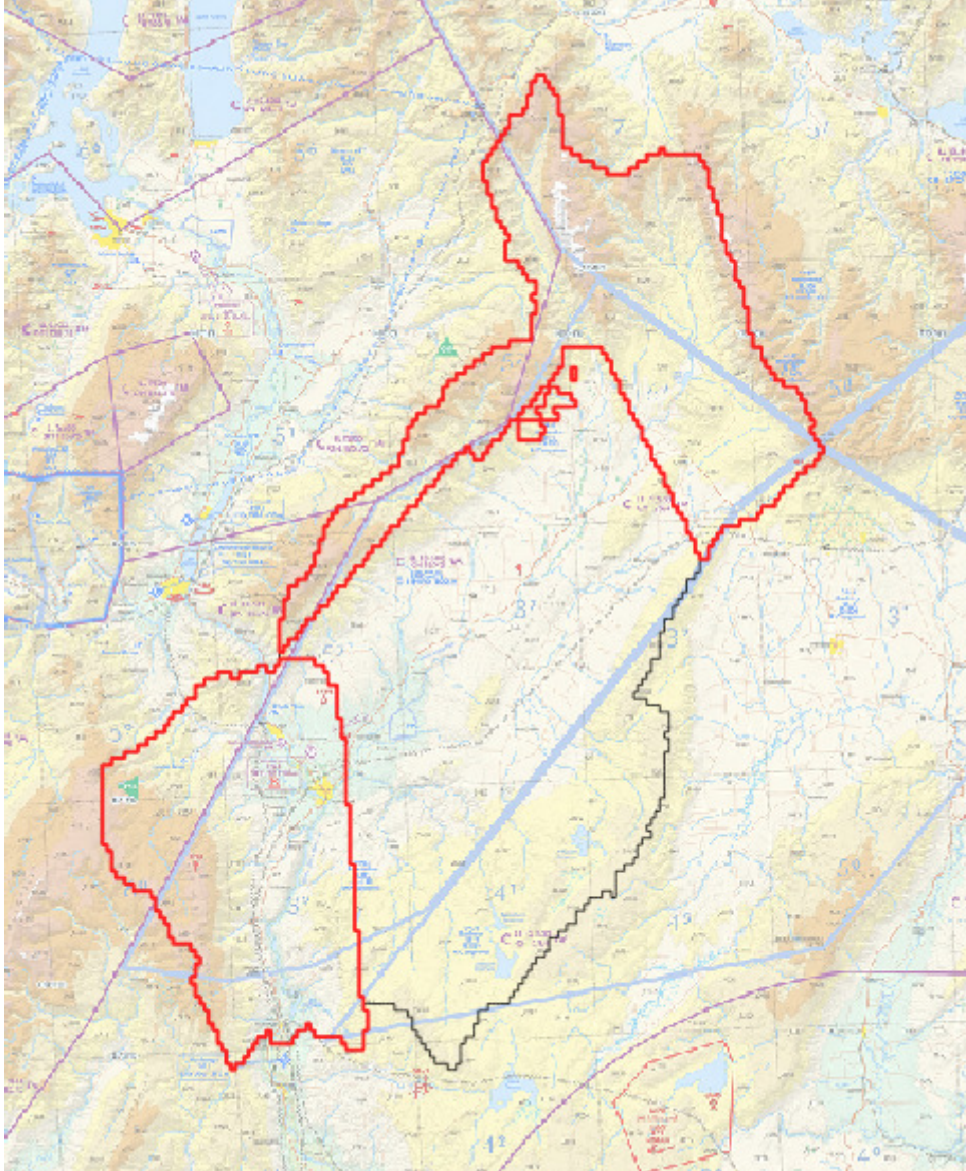
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## 4. VALIDATION

Volume Extent – red boundary





Colour Elevation Image

