Lidar Collection:
Peggy's Cove Technical Report

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Executive Summary

The Nova Scotia Community College Applied Geomatics Research Group was contracted by Develop Nova Scotia to collet lidar elevation data and imagery over Peggy's Cove and surrounding areas. Data were successfully collected on October 24, 2019. Quality assurance and control measures have validated that the collected data meet or exceed all project specifications. Additional clarifications or requests can be forwarded to Nathan Crowell (Nathan.crowell@NSCC.ca; 902-824-3953).

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1 Introduction

The Nova Scotia Community College – Applied geomatics Research Group (NSCC-AGRG) was contracted to conduct a topo-bathymetric lidar survey over the Peggy's Cove area of interest (AOI; Figure 1) by Develop Nova Scotia, DNS-1920-0021.

Figure 1. Peggy's Cove area of interest as defined by Develop Nova Scotia.

In this contract NSCC-AGRG agreed to provide the following deliverables: 1) classified point cloud data (LAS file) at >= 5 ppm, b) gridded elevation models (DEM and DSM) at a cell resolution equal to or better than 1 m^2, c) multispectral ortho imagery at a resolution of <= 5 cm, d) contour mapping (DWG file) at an accuracy equal to or better than 0.15 m.

2 Lidar Data Collection

NSCC-AGRG developed a plan to collect the requested data using a Leica Chiroptera II topo-bathymetric lidar system coupled with a high-resolution Leica RCD30 multispectral camera mounted in an Air America Piper Aztec aircraft. Flight lines we planned at 400 m above ground level altitude at 65 m/s velocity with 30% side-lap to eliminate the potential for data slivers during collection (Figure 2, Figure 3). Aircraft trajectory positions were differentially corrected using control data from the Nova Scotia Active Control Network Brookside Active Control Station (`250037`) located 16 km from the center point of the AOI.

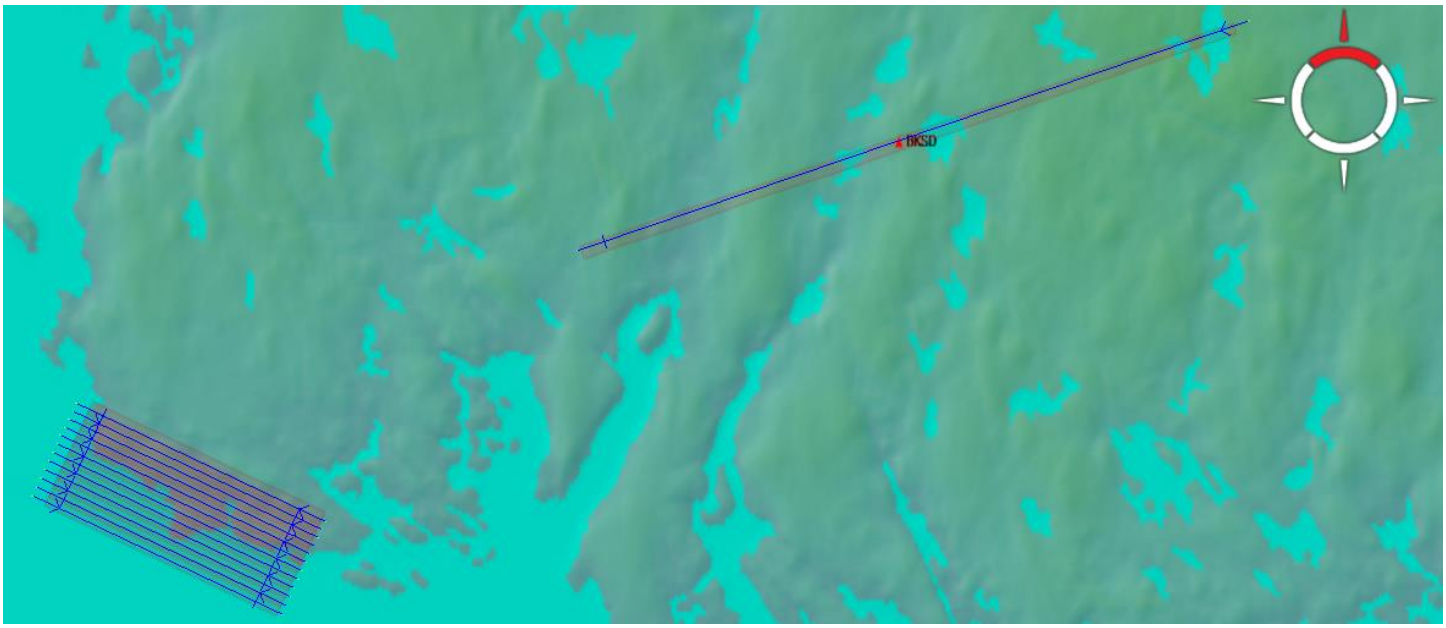

Figure 2. Planned survey and control line locations.

Figure 3. Planned lines over contextual imagery.

The planned survey was successfully executed on October 24th, 2019 at 1642 UTC. Conditions were favourable and data collection was without issue. Low tide occurred at 1437 (0.5 m) on the 24th and all coastal data were collected 2.5 hours following low tide (high tide 1.7 m).

3 Data Processing

Lidar system positions were computed using Inertial Explorer to generate trajectory data from aircraft GNSS positions and inertial measurement corrected using control station 250037. The computed trajectories were found to be of high quality with a positional error of <0.02 m. Raw laser ranges and return amplitudes positioned and discretized to LAS point data using Leica Lidar Survey Studio. Points were classified to ground, bathymetry, vegetation, and water surface using point geometry algorithms and manual classification methods (Figure 4). Image triangulation and mosaicking was performed in Agisoft Metashape.

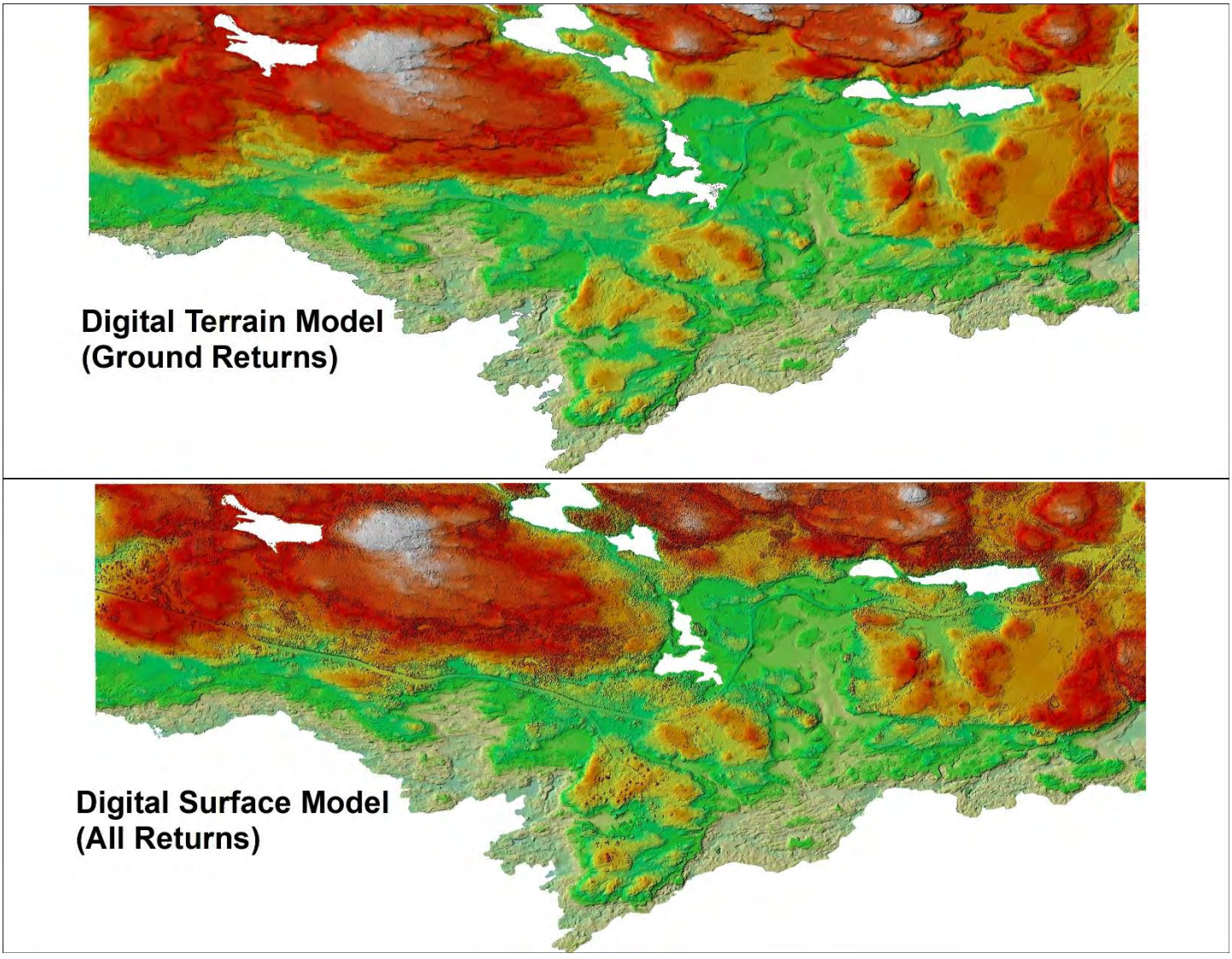

Figure 4. Digital Elevation Models generated from classified LAS data.

Develop Nova Scotia requested that NSCC-AGRG compute the high water coverage as it related to higher high water large tide (HHWLT). NSCC-AGRG confirmed the high water elevation with the Canadian Hydrographic Service (CHS) to ensure the best possible projection was achieved. CHS calculated the HHWLT elevation to be 0.63 m above CGVD2013 at the Peggy's Cove location. A high water vector was delineated by masking elevation data below 0.62 m CGVD2013 and vectorizing the resultant flood area into a polygon shapefile for delivery (Figure 5).

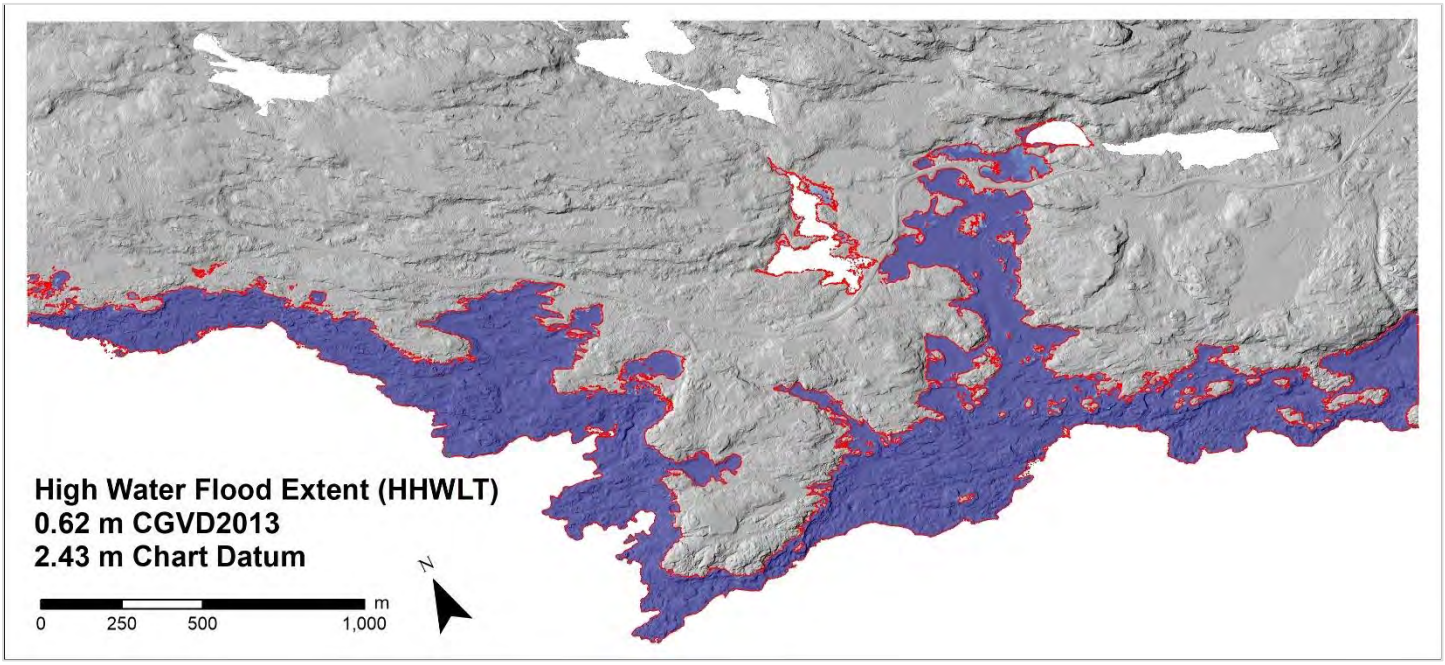

Figure 5. Computed flood extent based on CHS HHWLT elevation plotted against lidar DTM elevation data.

4 Quality Assurance

Ground truth data were collected using a Leica GS14 GNSS receiver receiving real time corrections from the Leica Smartnet service on October 24th, 2019 at 1246 UTC. Ground control data were manually collected using a pole mount to correct image positions. Control data were collected over hard road surfaces throughout the study area using an NSCC-AGRG fleet vehicle equipped with a magnetic GNSS car mount while the receiver was programmed to auto log positions at 1 point per second (N = 584). Hard surface control data were used to compute elevation residuals between the control data and lidar survey data (zResidual = zControl – zLidar). Residuals were computed on delivered data in the requested Canadian Geodetic Vertical Datum of 2013 and were found to be within the provided specifications with a mean offset of -0.046 m and a standard deviation of 0.026 m. Residuals were found to exhibit an normal distribution of error, suggesting that no systematic errors were present in the collected data (Figure 6).

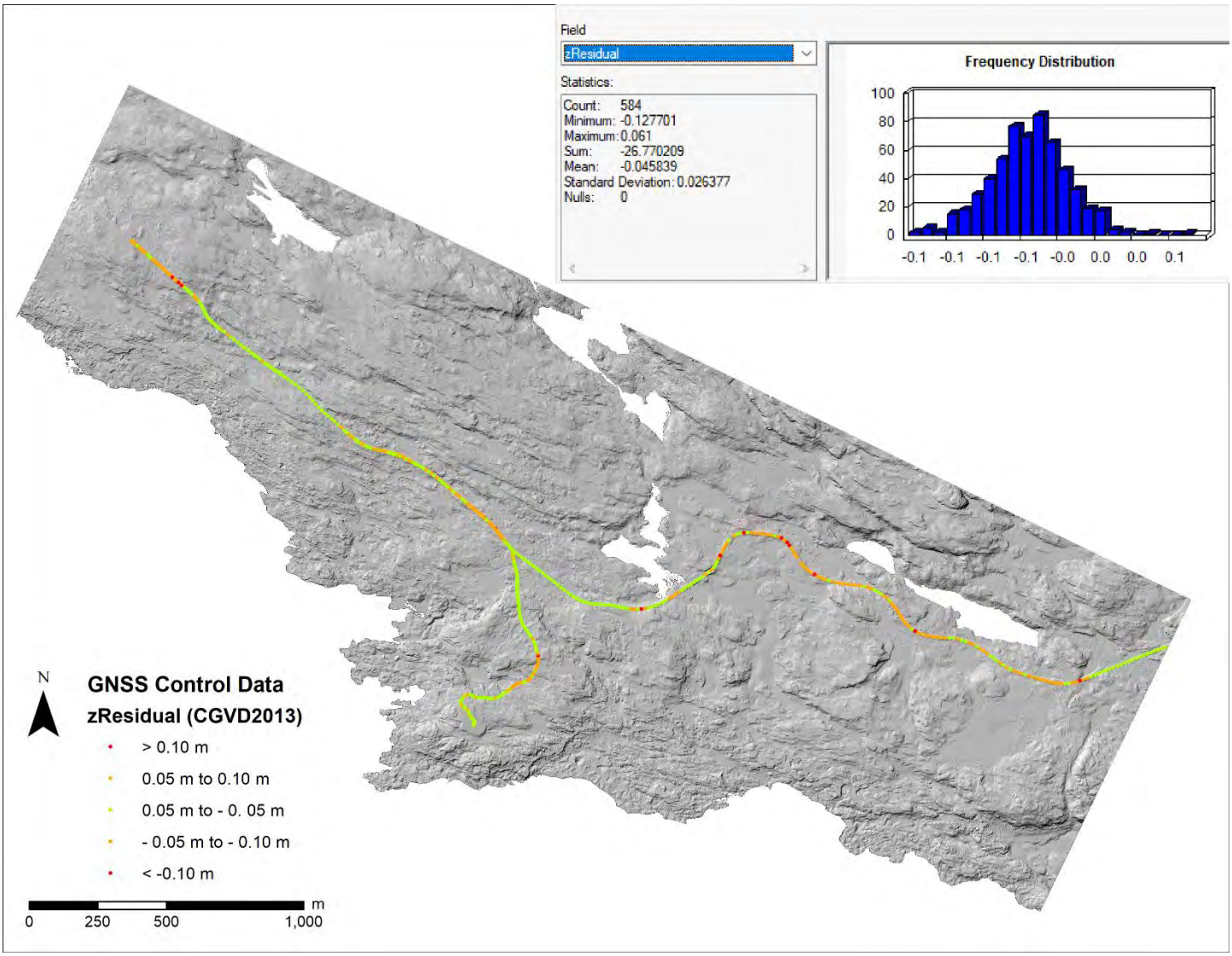

Figure 6. Quality assurance computations using GNSS control data to validate lidar elevations.