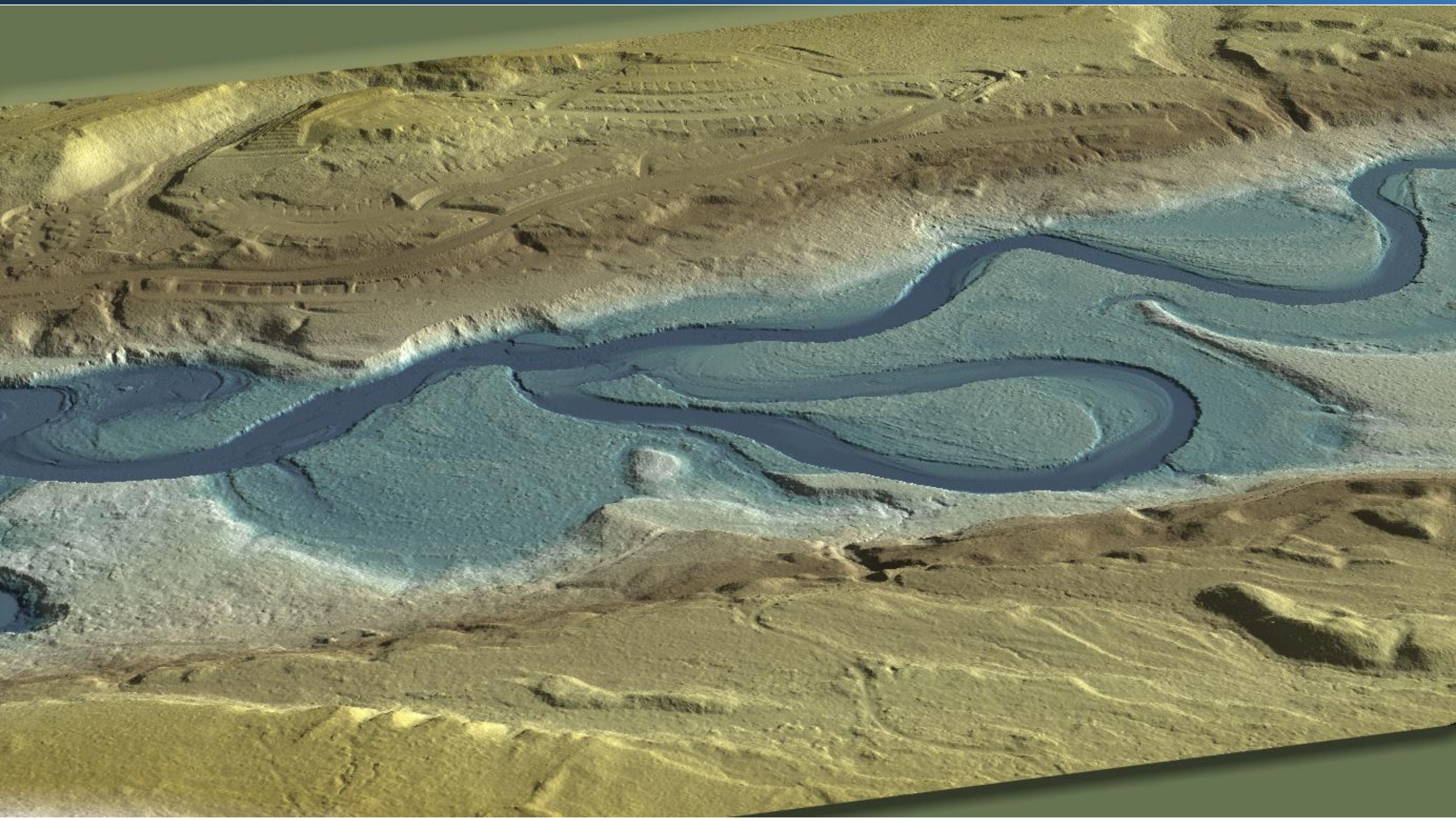
December 16, 2014



Eagle River Greenbelt LiDAR

Technical Data Report

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Cover Photo: View looking northeast at Eagle River, Alaska, located west of Briggs Bridge. The image was created from the LiDAR bare earth model colored by elevation.

INTRODUCTION

This photo taken by MLA acquisition staff shows a view of static survey equipment set up in the Eagle River Greenbelt project site.

In September 2014 Quantum Spatial (QSI) was contracted by the Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation (AK DNR DPOR) to collect Light Detection and Ranging (LiDAR) data in leaf off conditions for the Eagle River Greenbelt site in Alaska. Data were collected to aid AK DNR DPOR in assessing the topographic and geophysical properties of the study area to support recreational access development activities in the study area.

This report accompanies the delivered LiDAR data, and documents contract specifications, data acquisition procedures, processing methods, and analysis of the final dataset including LiDAR accuracy and density. Acquisition dates and acreage are shown in Table 1, a complete list of contracted deliverables provided to AK DNR DPOR is shown in Table 2, and the project extent is shown in Figure 1.

Table 1: Acquisition dates, acreage, and data types collected on the Eagle River Greenbelt site

Project Site	Contracted Acres	Buffered Acres	Acquisition Dates	Data Type
Eagle River Greenbelt	7,617	8,644	10/19/2014, 10/22/2014, 10/23/2014 & 10/28/2014	LiDAR

Deliverable Products

Table 2: Products delivered to AK DNR DPOR for the Eagle River Greenbelt site

<table>
<tr><th colspan="2">Eagle River Greenbelt Products
Projection: Alaska State Plane Zone 4
Horizontal Datum: NAD83 (2011)
Vertical Datum: NAVD88 (GEOID12A)
Units: US Survey Feet</th></tr>
<tr><td>Points</td><td>LAS v 1.2
• All Returns
• Ground Returns</td></tr>
<tr><td>Rasters</td><td>3.0 Foot ESRI Grids
• Hyroflattened Bare Earth Model
• Highest Hit Model
Autodesk Civil3D Surfaces
• Bare Earth Model
1.5 Foot GeoTiffs
• Intensity Images</td></tr>
<tr><td>Vectors</td><td>Shapefiles (*.shp)
• Site Boundary
• LiDAR Tile Index
• Ground Control Points
• Smooth Best Estimate of Trajectory (SBETs)
• Hydro Breaklines</td></tr>
</table>

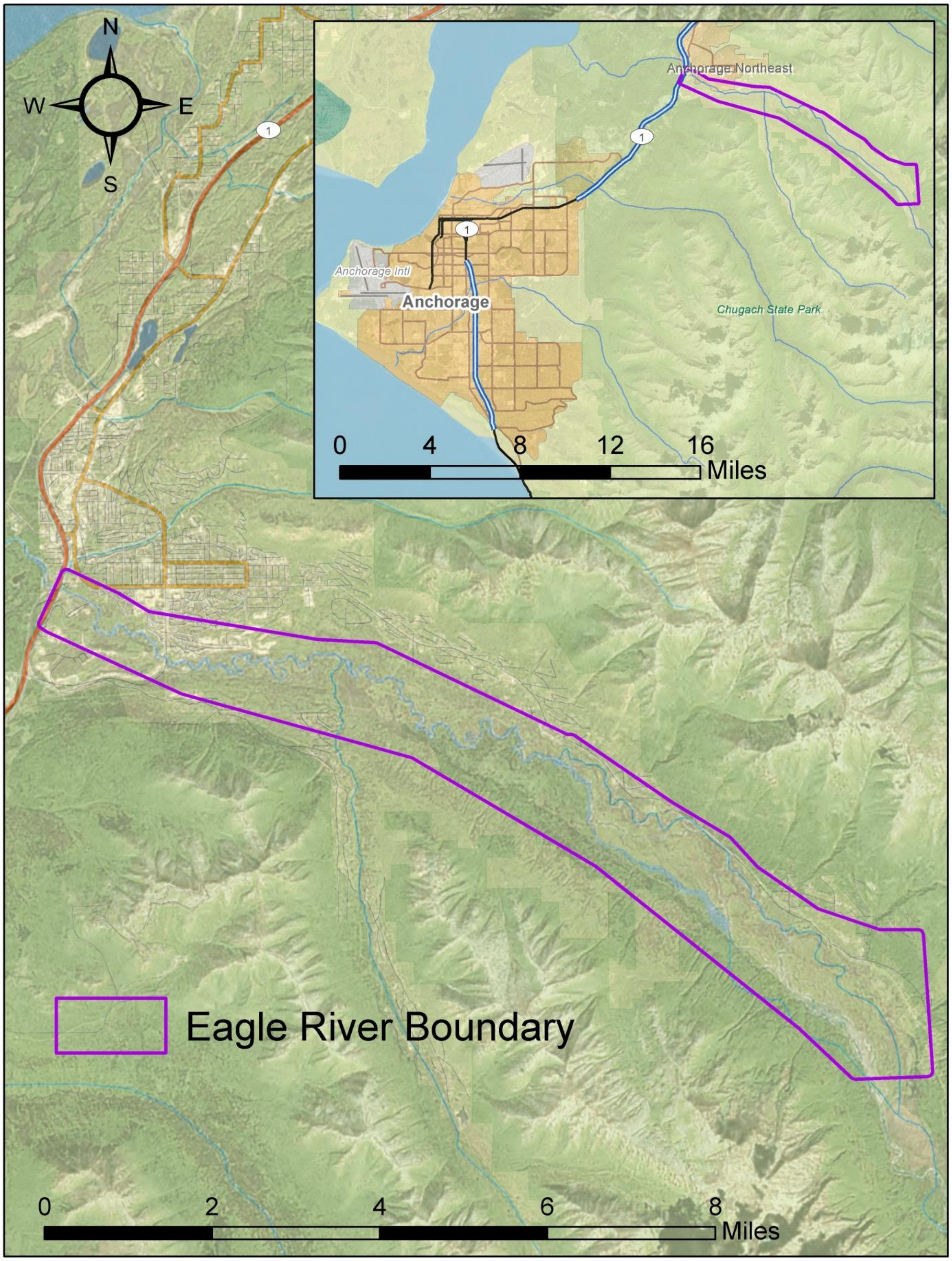


Figure 1: Location map of the Eagle River Greenbelt site in Alaska

ACQUISITION

QSI's Piper Navajo used for the Eagle River Greenbelt LiDAR acquisition.

Planning

In preparation for data collection, QSI reviewed the project area and developed a specialized flight plan to ensure complete coverage of the Eagle River Greenbelt LiDAR study area at the target point density of ≥8.0 points/m^2 (0.74 points/ft^2). Acquisition parameters including orientation relative to terrain, flight altitude, pulse rate, scan angle, and ground speed were adapted to optimize flight paths and flight times while meeting all contract specifications.

Factors such as satellite constellation availability and weather windows must be considered during the planning stage. Any weather hazards or conditions affecting the flight were continuously monitored due to their potential impact on the daily success of airborne and ground operations. In addition, logistical considerations including private property access and potential air space restrictions were reviewed.

Ground Control

Ground control surveys, including monumentation and ground survey points (GSPs), were conducted by McClintock Land Associates, Inc. (MLA) to support the airborne acquisition. Ground control data were used to geospatially correct the aircraft positional coordinate data and to perform quality assurance checks on final LiDAR.

MLA-Established Marker CP-4

Monumentation

The spatial configuration of ground survey monuments provided redundant control within 13 nautical miles of the mission areas for LiDAR flights. Monument locations were selected with consideration for satellite visibility and field crew safety. MLA utilized three monuments for the Eagle River Greenbelt project. Bill McClintock oversaw the establishment of all GNSS control.

Table 3: Monuments established for the Eagle River Greenbelt acquisition. Coordinates are on the NAD83 (2011) datum, epoch 2010.00

Monument ID	Latitude	Longitude	Ellipsoid (meters)
ERR-2	61° 17' 04.33781"	-149° 23' 54.23717"	142.313
ERR-3	61° 16' 06.09283"	-149° 20' 52.49694"	118.760
ERR-4	61° 15' 16.60637"	-149° 18' 57.15592"	152.278

To correct the continuously recorded onboard measurements of the aircraft position, MLA concurrently conducted multiple static Global Navigation Satellite System (GNSS) ground surveys (1 Hz recording frequency) over each monument. Multiple independent sessions over the same monument were processed to confirm antenna height measurements and to refine position accuracy.

Ground Survey Points (GSPs)

Ground survey points were collected by MLA and provided in Alaska State Plane coordinates. These GSPs provided vertical adjustments to the final LiDAR data to improve its absolute vertical accuracy. The distribution of GSPs depended on ground access constraints and monument locations and may not be equitably distributed throughout the study area.

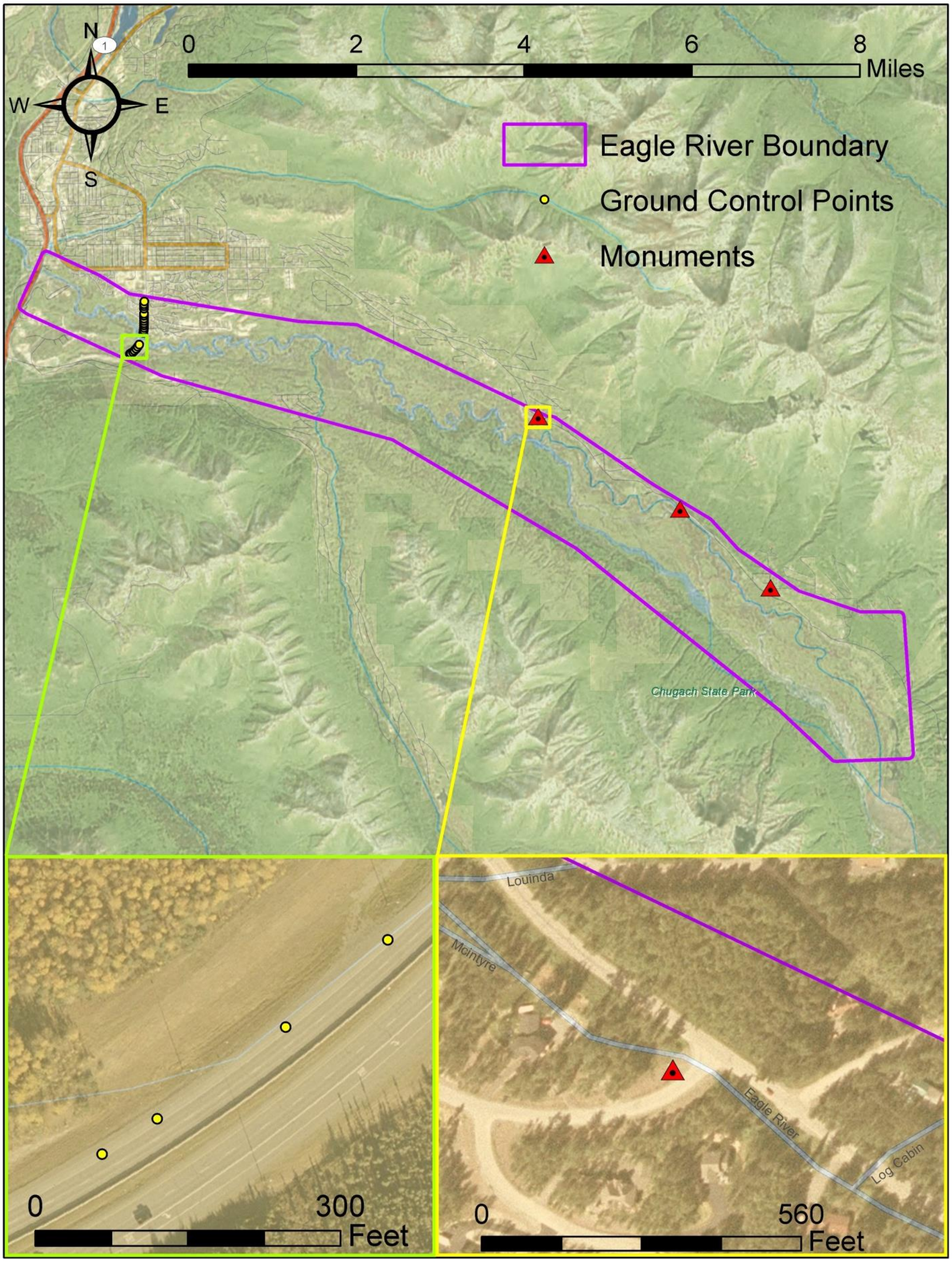


Figure 2: Ground survey location map

Airborne Survey

LiDAR

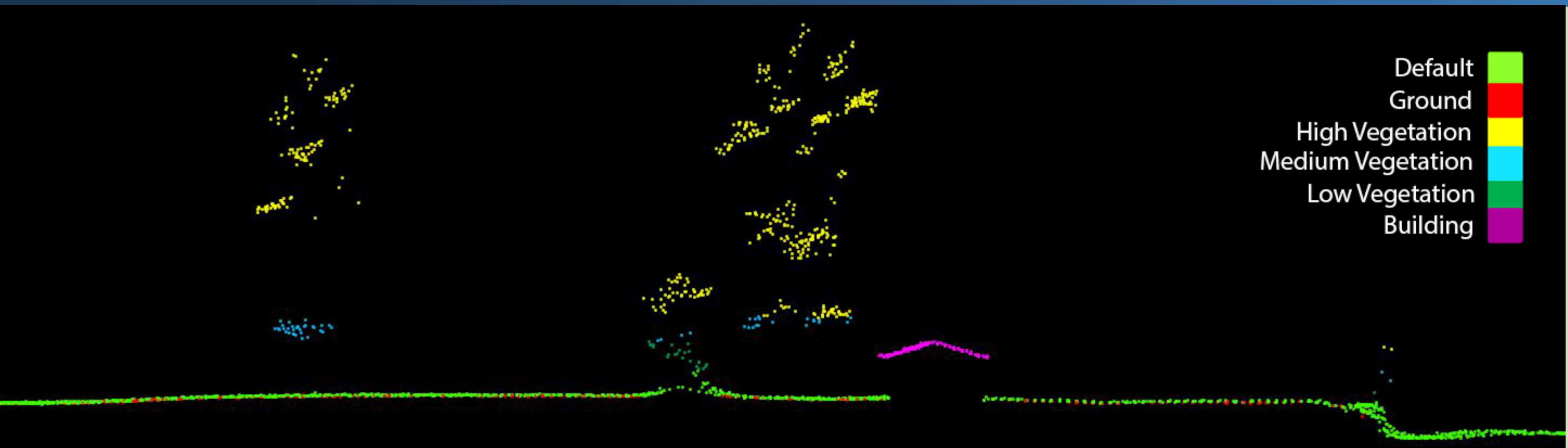
The LiDAR survey was accomplished using an Optech Gemini system mounted in a Piper Navajo. Table 4 summarizes the settings used to yield an average pulse density of ≥8 pulses/m^2 over the Eagle River Greenbelt project area. The Optech Gemini laser system records up to four range measurements (returns) per pulse. It is not uncommon for some types of surfaces (e.g., dense vegetation or water) to return fewer pulses to the LiDAR sensor than the laser originally emitted. The discrepancy between first return and overall delivered density will vary depending on terrain, land cover, and the prevalence of water bodies. All discernible laser returns were processed for the output dataset.

Table 4: LiDAR specifications and survey settings

LiDAR Survey Settings & Specifications	
Acquisition Dates	October 19, 22, 23 & 28, 2014
Aircraft Used	Piper Navajo
Sensor	Optech Gemini
Survey Altitude (AGL)	1600 m
Target Pulse Rate	70 kHz
Pulse Mode	Single Pulse in Air (SPiA)
Beam Divergence	0.8 mrad
Field of View	8°
GPS Baselines	≤13 nm
GPS PDOP	≤3.0
GPS Satellite Constellation	≥6
Maximum Returns	4
Intensity	8-bit
Resolution/Density	Average 8 pulses/m^2
Accuracy	$RMSE_Z$ ≤ 15 cm

Optech Gemini LiDAR sensor

All areas were surveyed with an opposing flight line side-lap of ≥50% (≥100% overlap) in order to reduce laser shadowing and increase surface laser painting. To accurately solve for laser point position (geographic coordinates x, y and z), the positional coordinates of the airborne sensor and the attitude of the aircraft were recorded continuously throughout the LiDAR data collection mission. Position of the aircraft was measured twice per second (2 Hz) by an onboard differential GPS unit, and aircraft attitude was measured 200 times per second (200 Hz) as pitch, roll and yaw (heading) from an onboard inertial measurement unit (IMU). To allow for post-processing correction and calibration, aircraft and sensor position and attitude data are indexed by GPS time.



View of a building surrounded by vegetation near Eagle River campground. The image was created from a 3 meter cross section of the LiDAR point cloud, colored by point class.

LiDAR Data

Upon completion of data acquisition, QSI processing staff initiated a suite of automated and manual techniques to process the data into the requested deliverables. Processing tasks included GPS control computations, smoothed best estimate trajectory (SBET) calculations, kinematic corrections, calculation of laser point position, sensor and data calibration for optimal relative and absolute accuracy, and LiDAR point classification (Table 5). Processing methodologies were tailored for the landscape. Brief descriptions of these tasks are shown in Table 6.

Table 5: ASPRS LAS classification standards applied to the Eagle River Greenbelt dataset

Classification Number	Classification Name	Classification Description
1	Default/ Unclassified	Laser returns that are not included in the other classes composed of the thin layer of returns above the ground class but under the low veg class.
2	Ground	Laser returns that are determined to be ground using automated and manual cleaning algorithms
3	Low Vegetation	Any vegetation within 5 – 10 feet of the ground surface
4	Medium Vegetation	Any vegetation greater than 10 feet and less than 15 feet above the ground
5	High Vegetation	First return vegetation greater than 15 feet above ground
6	Buildings and Structures	Permanent man-made structures such as buildings, bridges and fences
8	Model Key Points	Previously classified ground points, thinned using a spacing tolerance of 5 feet+0.03
9	Water	Laser returns that are determined to be water using automated and manual cleaning algorithms
12	Withheld	Laser returns that have intensity values of 0 or 255

Table 6: LiDAR processing workflow

LiDAR Processing Step	Software Used
Resolve kinematic corrections for aircraft position data using kinematic aircraft GPS and static ground GPS data. Develop a smoothed best estimate of trajectory (SBET) file that blends post-processed aircraft position with sensor head position and attitude recorded throughout the survey.	POSPac v.6.2 SP#2
Calculate laser point position by associating SBET position to each laser point return time, scan angle, intensity, etc. Create raw laser point cloud data for the entire survey in *.las (ASPRS v. 1.2) format. Convert data to orthometric elevations by applying a geoid12a correction.	Optech Lidar Mapping Suite (LMS) v.2.3
Import raw laser points into manageable blocks (less than 500 MB) to perform manual relative accuracy calibration and filter erroneous points. Classify ground points for individual flight lines.	TerraScan v.14
Using ground classified points per each flight line, test the relative accuracy. Perform automated line-to-line calibrations for system attitude parameters (pitch, roll, heading), mirror flex (scale) and GPS/IMU drift. Calculate calibrations on ground classified points from paired flight lines and apply results to all points in a flight line. Use every flight line for relative accuracy calibration.	TerraMatch v.14
Classify resulting data to ground and other client designated ASPRS classifications (Table 5). Assess statistical absolute accuracy via direct comparisons of ground classified points to ground control survey data.	TerraScan v.14 TerraModeler v.14
Generate bare earth models as triangulated surfaces. Generate highest hit models as a surface expression of all classified points (classes 1, 2, 3, 4, 5, 6 and 9). Export all surface models as ESRI GRIDs at a 3.0 foot pixel resolution.	TerraScan v.14 TerraModeler v.14 ArcMap v. 10.1
Export intensity images as GeoTIFFs at a 1.5 foot pixel resolution.	TerraScan v.14 TerraModeler v.14 ArcMap v. 10.1

Feature Extraction

Hydro-flattening and Water's edge breaklines

The Eagle River Greenbelt River and other water bodies within the project area were flattened to a consistent water level. Bodies of water that were flattened include lakes and other closed water bodies with a surface area greater than 2 acres, all streams and rivers that are nominally wider than 100 feet, and select smaller bodies of water as feasible. The hydro-flattening process eliminates artifacts in the digital terrain model caused by both increased variability in ranges or dropouts in laser returns due to the low reflectivity of water.

Hydro-flattening of closed water bodies was performed through a combination of automated and manual detection and adjustment techniques designed to identify water boundaries and water levels. Boundary polygons were developed using an algorithm which weights LiDAR-derived slopes, intensities, and return densities to detect the water's edge. The water edges were then manually reviewed and edited as necessary.

Once polygons were developed the initial ground classified points falling within water polygons were reclassified as water points to omit them from the final ground model. Elevations were then obtained from the filtered LiDAR returns to create the final breaklines. Lakes were assigned a consistent elevation for an entire polygon while rivers were assigned consistent elevations on opposing banks and smoothed to ensure downstream flow through the entire river channel.

Water boundary breaklines were then incorporated into the hydro-flattened DEM by enforcing triangle edges (adjacent to the breakline) to the elevation values of the breakline. This implementation corrected interpolation along the hard edge. Water surfaces were obtained from a TIN of the 3-D water edge breaklines resulting in the final hydroflattened model.

LiDAR Density

The acquisition parameters were designed to acquire an average first-return density of 8 points/m^2 (0.74 points/ft^2). First return density describes the density of pulses emitted from the laser that return at least one echo to the system. Multiple returns from a single pulse were not considered in first return density analysis. Some types of surfaces (e.g., breaks in terrain, water and steep slopes) may have returned fewer pulses than originally emitted by the laser. First returns typically reflect off the highest feature on the landscape within the footprint of the pulse. In forested or urban areas the highest feature could be a tree, building or power line, while in areas of unobstructed ground, the first return will be the only echo and represents the bare earth surface.

The density of ground-classified LiDAR returns was also analyzed for this project. Terrain character, land cover, and ground surface reflectivity all influenced the density of ground surface returns. In vegetated areas, fewer pulses may penetrate the canopy, resulting in lower ground density.

The average first-return density of LiDAR data for the Eagle River Greenbelt project was 1.42 points/ft^2 (15.23 points/m^2) while the average ground classified density was 0.21 points/ft^2 (2.27 points/m^2) (Table 7). The statistical and spatial distributions of first return densities and classified ground return densities per 100 m x 100 m cell are portrayed in Figure 3 through Figure 5.

Table 7: Average LiDAR point densities

Classification	Point Density
First-Return	1.42 points/ft^2 15.23 points/m^2

Classification	Point Density
Ground Classified	0.21 points/ft^2 2.27 points/m^2

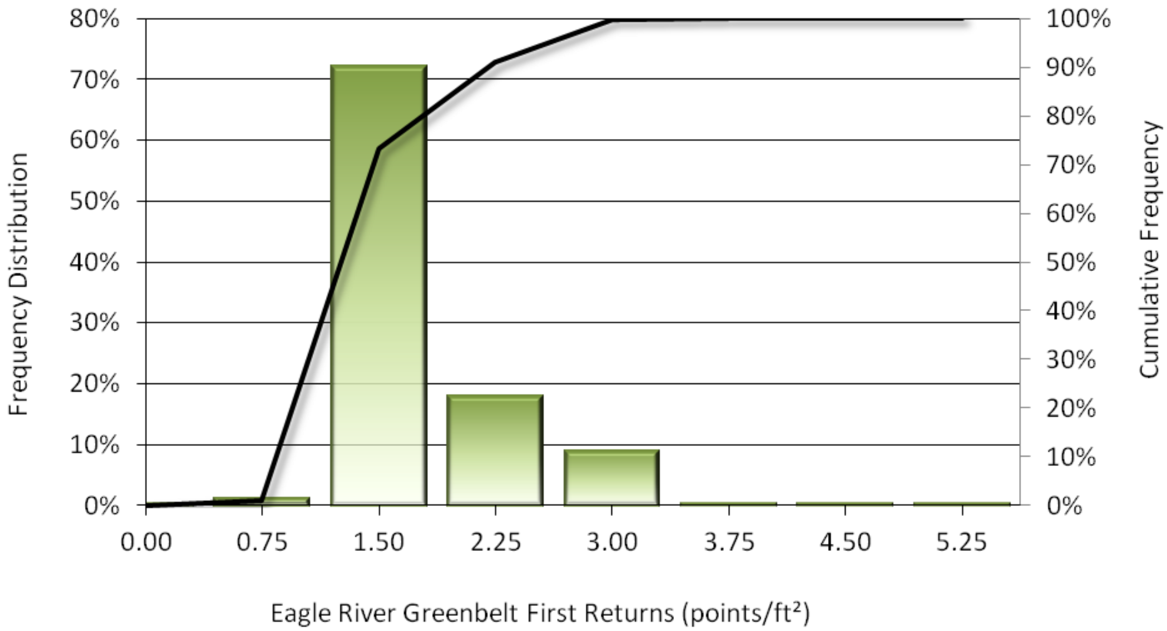


Figure 3: Frequency distribution of first return densities per 100 x 100 m cell

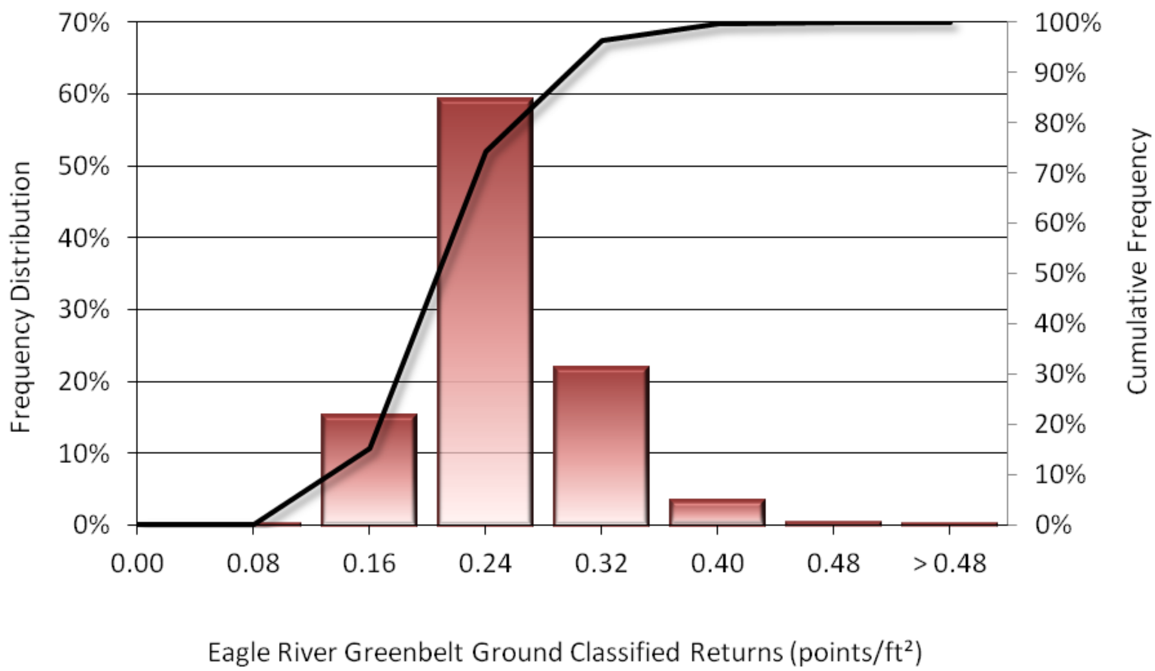


Figure 4: Frequency distribution of ground return densities per 100 x 100 m cell

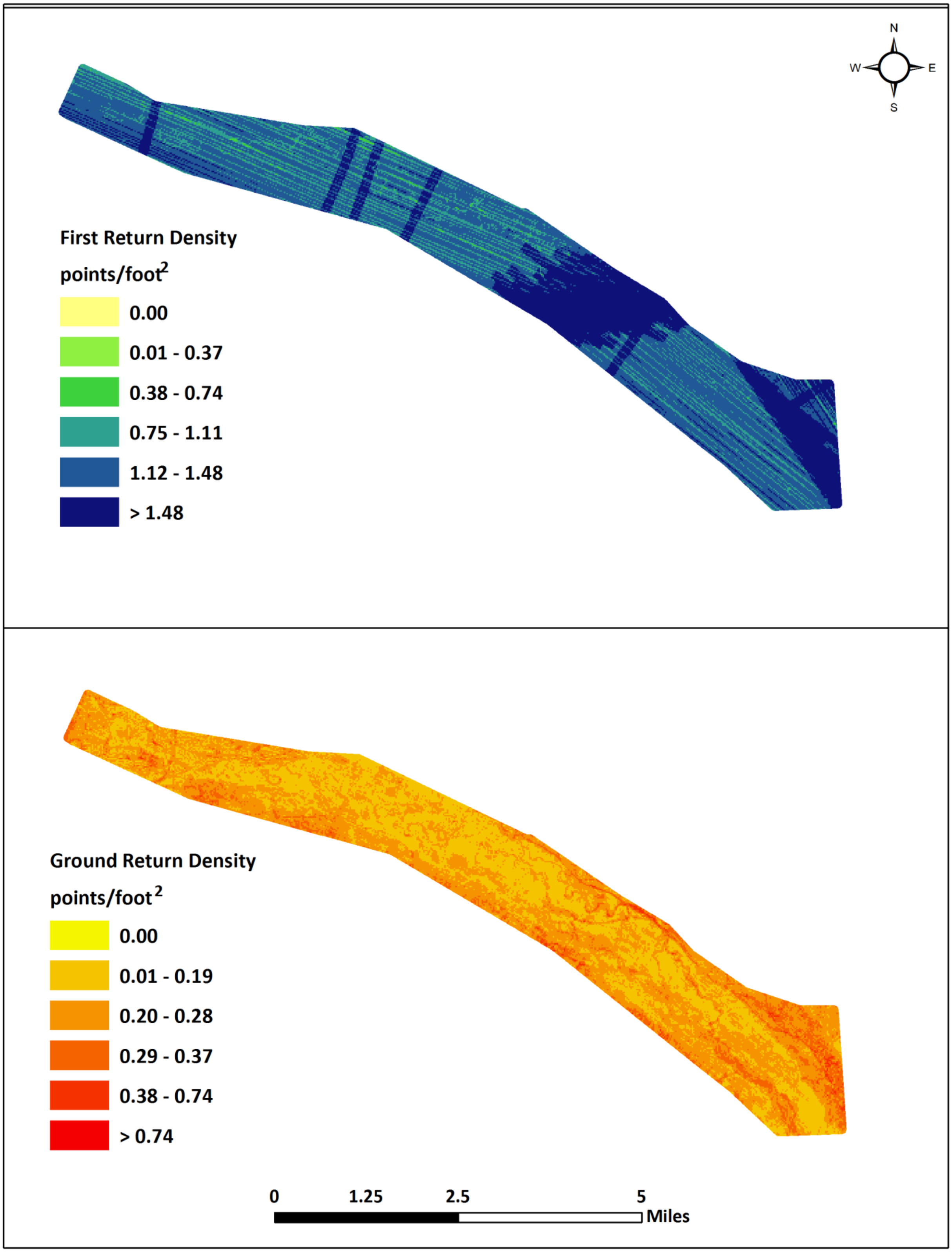


Figure 5: First return and ground density map for the Eagle River Greenbelt site (100 m x 100 m cells)

LiDAR Accuracy Assessments

The accuracy of the LiDAR data collection can be described in terms of absolute accuracy (the consistency of the data with external data sources) and relative accuracy (the consistency of the dataset with itself). See Appendix A for further information on sources of error and operational measures used to improve relative accuracy.

LiDAR Absolute Accuracy

Absolute accuracy compares known ground control point data collected on open, bare earth surfaces with level slope (<20°) to the triangulated surface generated by the LiDAR points. Absolute accuracy is a measure of the accuracy of LiDAR point data in open areas where the LiDAR system has a high probability of measuring the ground surface and is evaluated at the 95% confidence interval (1.96 * RMSE), as shown in Table 8.

The mean and standard deviation (sigma σ) of divergence of the ground surface model from ground survey point coordinates are also considered during accuracy assessment. These statistics assume the error for x, y and z is normally distributed, and therefore the skew and kurtosis of distributions are also considered when evaluating error statistics. For the Eagle River Greenbelt survey, 21 ground survey points were collected in total resulting in an average accuracy of 0.004 feet (0.001 meters) (Figure 6).

Table 8: Absolute accuracy

Absolute Accuracy	
Sample	21 points
Average	0.004 ft 0.001 m
Median	0.011 ft 0.003 m
RMSE	0.093 ft 0.028 m
Standard Deviation (1σ)	0.095 ft 0.056 m
(1.96*RMSE)	0.182 ft 0.056 m

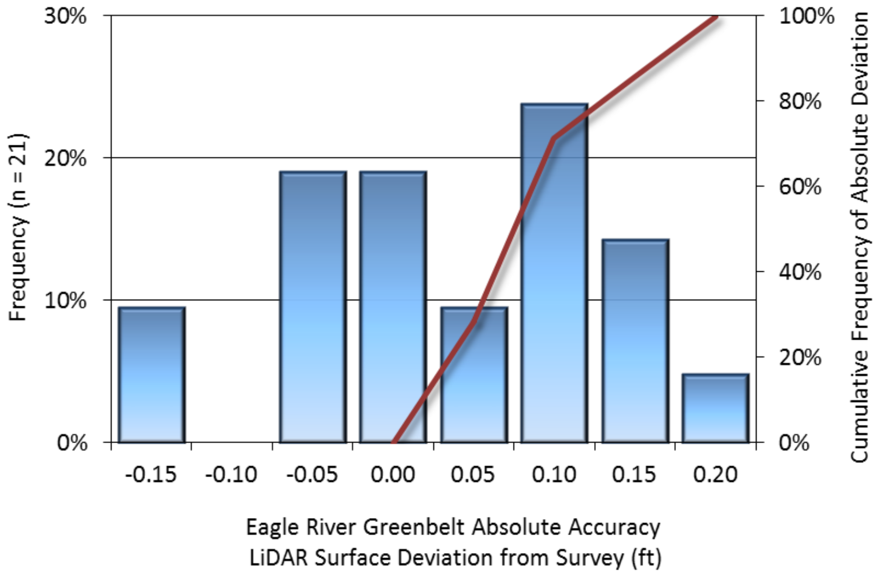


Figure 6: Frequency histogram for LiDAR surface deviation from ground survey point values

LiDAR Vertical Relative Accuracy

Relative vertical accuracy refers to the internal consistency of the data set as a whole: the ability to place an object in the same location given multiple flight lines, GPS conditions, and aircraft attitudes. When the LiDAR system is well calibrated, the swath-to-swath vertical divergence is low (<0.10 meters). The relative vertical accuracy was computed by comparing the ground surface model of each individual flight line with its neighbors in overlapping regions. The average (mean) line to line relative vertical accuracy for the Eagle River Greenbelt LiDAR project was 0.099 feet (0.040 meters) (Table 9, Figure 7).

Table 9: Relative accuracy

Relative Accuracy	
Sample	94 surfaces
Average	0.099 ft 0.030 m
Median	0.092 ft 0.028 m
RMSE	0.104 ft 0.032 m
Standard Deviation (1σ)	0.035 ft 0.011 m
1.96σ	0.069 ft 0.021 m

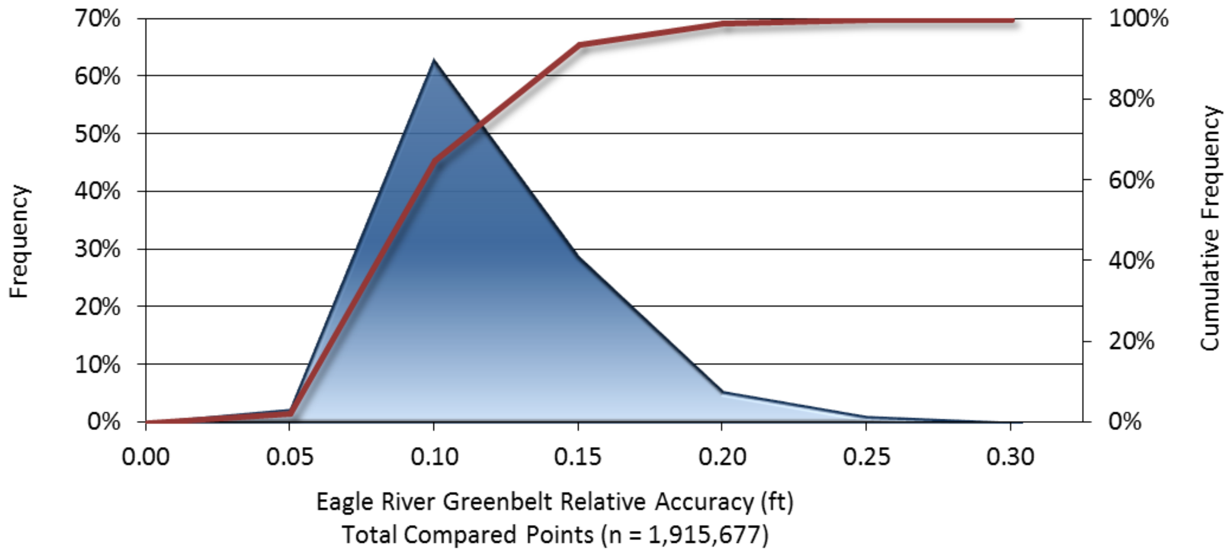


Figure 7: Frequency plot for relative vertical accuracy between flight lines

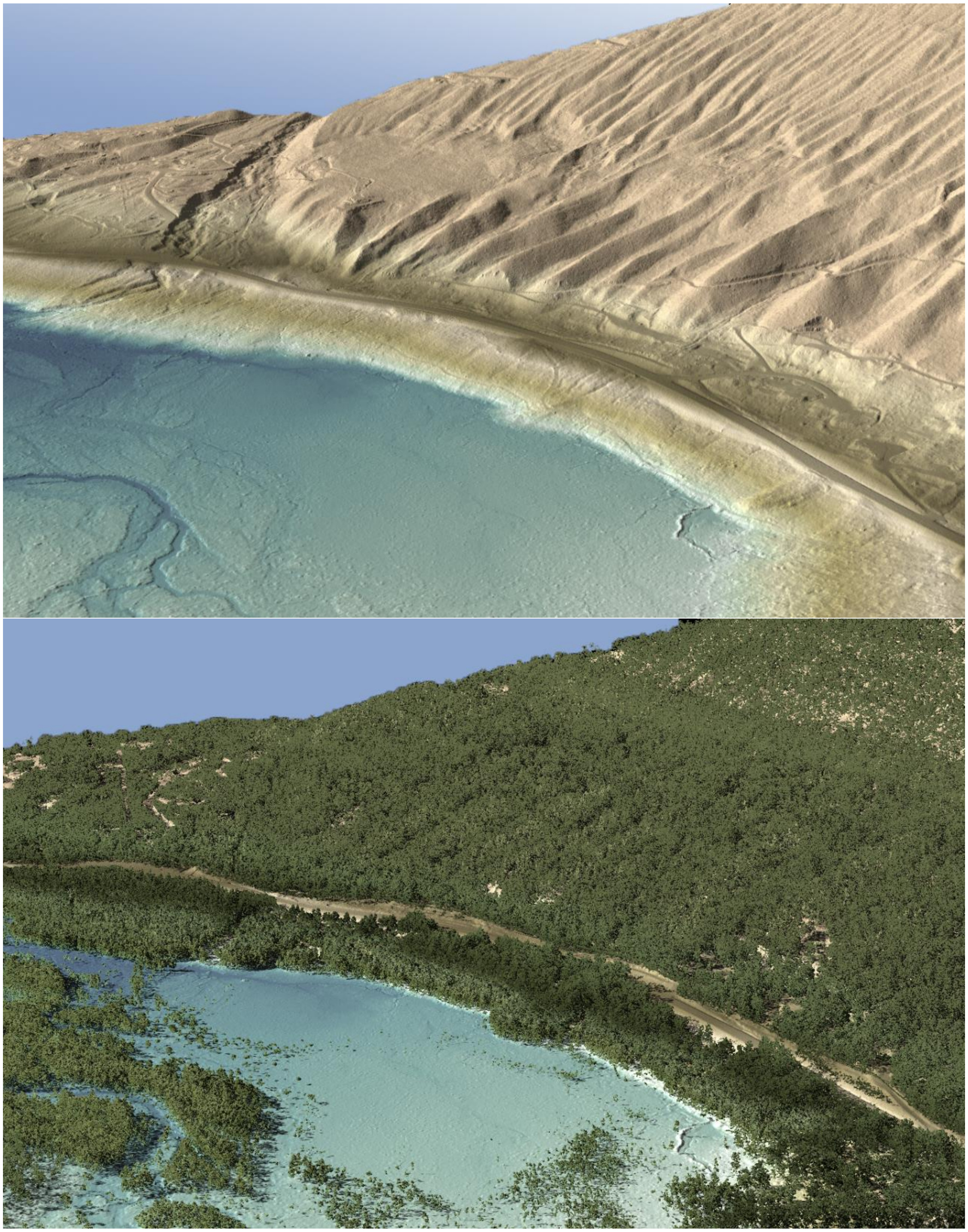


Figure 8: View looking North at a stretch of Eagle River Road in the southwest corner of the Eagle River Greenbelt AOI. The top image was created from the LiDAR bare earth surface colored by elevation, while the bottom image is overlaid by the 3D LiDAR point cloud.

Figure 9: View looking southeast over Briggs Bridge located South of Eagle River, Alaska. The image was created from the LiDAR bare earth surface colored by elevation and overlaid with the 3-D LiDAR point cloud.

Glossary

1-sigma (σ) Absolute Deviation: Value for which the data are within one standard deviation (approximately 68th percentile) of a normally distributed data set.

1.96 * RMSE Absolute Deviation: Value for which the data are within two standard deviations (approximately 95th percentile) of a normally distributed data set, based on the FGDC standards for Fundamental Vertical Accuracy (FVA) reporting.

Accuracy: The statistical comparison between known (surveyed) points and laser points. Typically measured as the standard deviation (sigma σ) and root mean square error (RMSE).

> **Absolute Accuracy:** The vertical accuracy of LiDAR data is described as the mean and standard deviation (sigma σ) of divergence of LiDAR point coordinates from ground survey point coordinates. To provide a sense of the model predictive power of the dataset, the root mean square error (RMSE) for vertical accuracy is also provided. These statistics assume the error distributions for x, y and z are normally distributed, and thus we also consider the skew and kurtosis of distributions when evaluating error statistics.
>
> **Relative Accuracy:** Relative accuracy refers to the internal consistency of the data set; i.e., the ability to place a laser point in the same location over multiple flight lines, GPS conditions and aircraft attitudes. Affected by system attitude offsets, scale and GPS/IMU drift, internal consistency is measured as the divergence between points from different flight lines within an overlapping area. Divergence is most apparent when flight lines are opposing. When the LiDAR system is well calibrated, the line-to-line divergence is low (<10 cm).
>
> **Root Mean Square Error (RMSE):** A statistic used to approximate the difference between real-world points and the LiDAR points. It is calculated by squaring all the values, then taking the average of the squares and taking the square root of the average.

Data Density: A common measure of LiDAR resolution, measured as points per square meter.

Digital Elevation Model (DEM): File or database made from surveyed points, containing elevation points over a contiguous area. Digital terrain models (DTM) and digital surface models (DSM) are types of DEMs. DTMs consist solely of the bare earth surface (ground points), while DSMs include information about all surfaces, including vegetation and man-made structures.

Intensity Values: The peak power ratio of the laser return to the emitted laser, calculated as a function of surface reflectivity.

Nadir: A single point or locus of points on the surface of the earth directly below a sensor as it progresses along its flight line.

Overlap: The area shared between flight lines, typically measured in percent. 100% overlap is essential to ensure complete coverage and reduce laser shadows.

Pulse Rate (PR): The rate at which laser pulses are emitted from the sensor; typically measured in thousands of pulses per second (kHz).

Pulse Returns: For every laser pulse emitted, the number of wave forms (i.e., echos) reflected back to the sensor. Portions of the wave form that return first are the highest element in multi-tiered surfaces such as vegetation. Portions of the wave form that return last are the lowest element in multi-tiered surfaces.

Real-Time Kinematic (RTK) Survey: A type of surveying conducted with a GPS base station deployed over a known monument with a radio connection to a GPS rover. Both the base station and rover receive differential GPS data and the baseline correction is solved between the two. This type of ground survey is accurate to 1.5 cm or less.

Post-Processed Kinematic (PPK) Survey: GPS surveying is conducted with a GPS rover collecting concurrently with a GPS base station set up over a known monument. Differential corrections and precisions for the GNSS baselines are computed and applied after the fact during processing. This type of ground survey is accurate to 1.5 cm or less.

Scan Angle: The angle from nadir to the edge of the scan, measured in degrees. Laser point accuracy typically decreases as scan angles increase.

Native LiDAR Density: The number of pulses emitted by the LiDAR system, commonly expressed as pulses per square meter.

Relative Accuracy Calibration Methodology:

Manual System Calibration: Calibration procedures for each mission require solving geometric relationships that relate measured swath-to-swath deviations to misalignments of system attitude parameters. Corrected scale, pitch, roll and heading offsets were calculated and applied to resolve misalignments. The raw divergence between lines was computed after the manual calibration was completed and reported for each survey area.

Automated Attitude Calibration: All data were tested and calibrated using TerraMatch automated sampling routines. Ground points were classified for each individual flight line and used for line-to-line testing. System misalignment offsets (pitch, roll and heading) and scale were solved for each individual mission and applied to respective mission datasets. The data from each mission were then blended when imported together to form the entire area of interest.

Automated Z Calibration: Ground points per line were used to calculate the vertical divergence between lines caused by vertical GPS drift. Automated Z calibration was the final step employed for relative accuracy calibration.

LiDAR accuracy error sources and solutions:

Type of Error	Source	Post Processing Solution
GPS (Static/Kinematic)	Long Base Lines	None
	Poor Satellite Constellation	None
	Poor Antenna Visibility	Reduce Visibility Mask
Relative Accuracy	Poor System Calibration	Recalibrate IMU and sensor offsets/settings
	Inaccurate System	None
Laser Noise	Poor Laser Timing	None
	Poor Laser Reception	None
	Poor Laser Power	None
	Irregular Laser Shape	None

Operational measures taken to improve relative accuracy:

Low Flight Altitude: Terrain following was employed to maintain a constant above ground level (AGL). Laser horizontal errors are a function of flight altitude above ground (about 1/3000th AGL flight altitude).

Focus Laser Power at narrow beam footprint: A laser return must be received by the system above a power threshold to accurately record a measurement. The strength of the laser return (i.e., intensity) is a function of laser emission power, laser footprint, flight altitude and the reflectivity of the target. While surface reflectivity cannot be controlled, laser power can be increased and low flight altitudes can be maintained.

Reduced Scan Angle: Edge-of-scan data can become inaccurate. The scan angle was reduced to a maximum of $\pm 4^{o}$ from nadir, creating a narrow swath width and greatly reducing laser shadows from trees and buildings.

Quality GPS: Flights took place during optimal GPS conditions (e.g., 6 or more satellites and PDOP [Position Dilution of Precision] less than 3.0). Before each flight, the PDOP was determined for the survey day. During all flight times, a dual frequency DGPS base station recording at 1 second epochs was utilized and a maximum baseline length between the aircraft and the control points was less than 13 nm at all times.

Ground Survey: Ground survey point accuracy (<1.5 cm RMSE) occurs during optimal PDOP ranges and targets a minimal baseline distance of 4 miles between GPS rover and base. Robust statistics are, in part, a function of sample size (n) and distribution. Ground survey points are distributed to the extent possible throughout multiple flight lines and across the survey area.

50% Side-Lap (100% Overlap): Overlapping areas are optimized for relative accuracy testing. Laser shadowing is minimized to help increase target acquisition from multiple scan angles. Ideally, with a 50% side-lap, the nadir portion of one flight line coincides with the swath edge portion of overlapping flight lines. A minimum of 50% side-lap with terrain-followed acquisition prevents data gaps.

Opposing Flight Lines: All overlapping flight lines have opposing directions. Pitch, roll and heading errors are amplified by a factor of two relative to the adjacent flight line(s), making misalignments easier to detect and resolve.

APPENDIX B – TIN CERTIFICATION

Please see attached TIN Certification document from McClintock Land Associates, Inc.

TIN CERTIFICATION

Date Prepared: 12/17/2014

Eagle River Greenbelt – TIN Surface Model

Prepared by: McClintock Land Associates, Inc.
Prepared for: Quantum Spatial, Inc.

I hereby certify that an independent ground survey was performed under my supervision to obtain sampling data to be used to test the reliability of the electronic Triangular Irregular Network (TIN) surface model for the Eagle River Greenbelt, Eagle River, Alaska. This TIN is based on the Model Key Points Method. For ease of manipulation the surface model was divided into 32 cells as defined by the .dwg files shown on the attached listing.

These files were produced by Quantum Spatial, Inc. from a LiDAR survey they flew between October 15 and October 28, 2014 . The LiDAR data was calibrated and processed by Quantum Spatial, Inc. and completed on December 16, 2014.

The independent ground survey was performed by McClintock Land Associates, Inc. October 19 through October 23, 2014 using Static and RTK GPS methods as well as conventional optical methods. Topcon Data Collectors, along with Topcon HiPer GA and GR-3 GNSS receivers were used as well as a Topcon GPT-3005LW Reflectorless Electronic Total Station. Topcon Magnet Field v2.0.1 data collection software was used for the field data collection and Topcon Magnet Office Tools v2.0.1 office software was used for post-processing and adjustments.

The survey data was collected in Alaska State Plane Coordinates, Zone 4 (NAD83) in US Survey Feet. The vertical datum is NAVD88 in feet and elevations were determined as approximate orthometric heights using Geoid Model 2012A. Ties to the NSRS were made utilizing Alaska Dept. of Transportation & Public Facilities existing control points as described in the *Pre-Construction Survey Report for Eagle River Road Rehabilitation MP 5.3 to 12.6 AKSAS 53943*.

This TIN was checked using 86 independent QC check points which had been withheld from the TIN producer. The RMS error standard for ASPRS Class 1 Maps for Vertical Accuracy for a 3.28 foot (1 meter) contour interval map is 1/3 of the contour interval or 1.09 feet. The RMS error between the elevations returned from the TIN and the actual check points was 0.23 feet. This map meets and exceeds that standard.

STATE OF ALASKA
49TH
William McClintock
WILLIAM McCLINTOCK
LS 5480
12-17-14
REGISTERED PROFESSIONAL LAND SURVEYOR

William McClintock
Professional Land Surveyor
McClintock Land Associates, Inc.

12-17-2014
Date

Eagle River Greenbelt – TIN Surface Model

File Names of TIN Surface:

ERG_T13NR1E03.DWG
ERG_T13NR1E04.DWG
ERG_T13NR1E05.DWG
ERG_T13NR1E06.DWG
ERG_T13NR1E08.DWG
ERG_T13NR1E09.DWG
ERG_T13NR1E10.DWG
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ERG_T14NR2W11.DWG
ERG_T14NR2W12.DWG
ERG_T14NR2W13.DWG
ERG_T14NR2W14.DWG
ERG_T14NR2W24.DWG