



Lidar Accuracy Report

USGS CONTRACT: G16PC00029
CONTRACTOR: Merrick-Surdex JV
TASK ORDER NUMBER: G17PD00008
TASK NAME: NE Sandhills Lidar Project

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Project Overview

United States Geological Survey (USGS) contracted with Merrick-Surdex Joint Venture in December of 2016 to collect high resolution Lidar elevation data over multiple counties in the Sandhills Region of north-central Nebraska. The total project area covers over 18,111 square miles. Processing of the Lidar data and bare-earth model followed USGS Base Lidar Specifications V1.2 standards. Surdex tested that the deliverables meet or exceed accuracy as stated in NDEP Guidelines for digital elevation data, Version 1.0 for NSSDA of 95% confidence for 1' contours and ASPRS Class I Standards. Non-vegetated (bare earth) survey control points were collected by CompassData, Inc. in order to calibrate the swath LAS data, these values are listed in the table on page 3. In addition, independent survey check points were also collected on non-vegetated (NVA) features such as concrete, asphalt and gravel along with vegetated (VVA) points in tall grass, brush & trees for each delivery area. The survey check points were compared to both the unclassified swath LAS Lidar data & bare-earth DEM and the differences have been outlined on page 6.

In order to meet the project specifications the NVA of bare-earth check points for swath and the DEM will meet or exceed 10.0 centimeters RMSEz or less. The RMSEz was calculated as the square root of the average of the set of squared differences between the bare-earth and the survey points collected for the NVA features. Also, 95 percent of the NVA features should be $\leq 1.96 \times \text{RMSEz}$, which equals 19.6 centimeters or less NSSDA. The VVA measured against the DEM data will be $\leq 29.4\text{cm}$ @ the 95th percentile. The final results for this delivery area are listed on the last page of this report.

Block-3 Delivery Area

This report covers the collection and processing of Lidar elevation data over Custer & Sherman Counties. The project area consisted of approximately 2,763 square miles of elevation data. The project limits are presented in the graphics below.

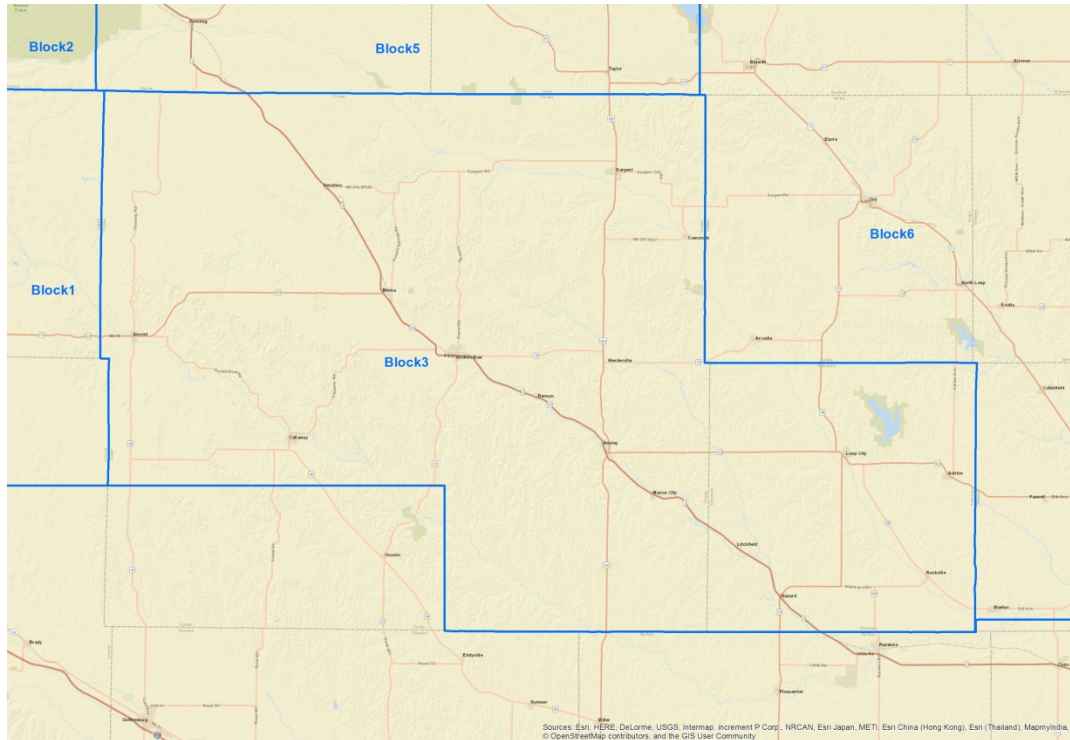


Figure 1 **Block3** Delivery Area

Lidar Data Collection

The Lidar elevation data for this project was collected with an Optech Galaxy Aerial Lidar sensor system. The project design for acquisition of the Lidar data has lines flown east-west. The nominal collection scenario called for the acquisition of nominal point spacing of 0.71 meter on the ground.

Swath Lidar Control

The field survey control for this delivery consisted of 23 NVA control points used for calibrating the unclassified Lidar swath data. The graphic below presents these control points on the delivery area map.

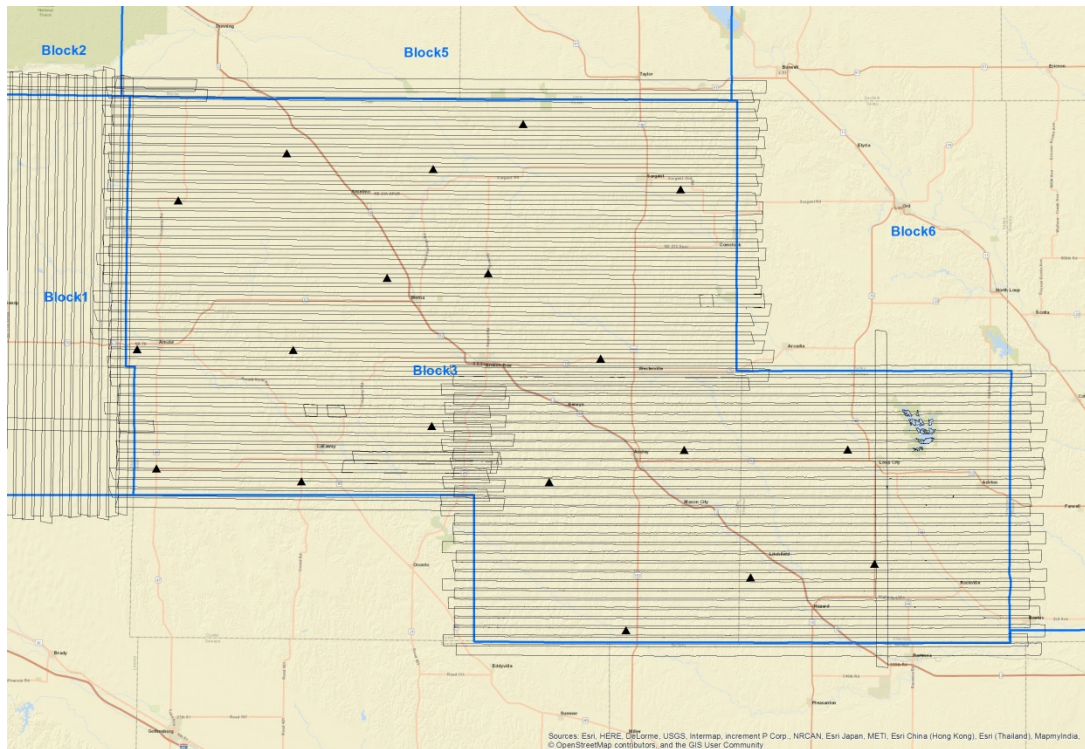


Figure 2 **Block3** Swath Lidar Control

Swath Lidar Control Accuracy Results

The table below presents the results of the control accuracy analysis for the Block3 unclassified swath LAS data.

Stat	NVA
Count	23
RMSEz (meters)	0.027
95% Confidence Level (meters)	0.053

Lidar QC Check

An additional set of survey check points were collected for an independent QC of the unclassified swath LAS & DEM deliverable tiles. The following check points were collected: 39 non-vegetated & 30 vegetated. The graphic below presents these QC check points on the delivery area map.

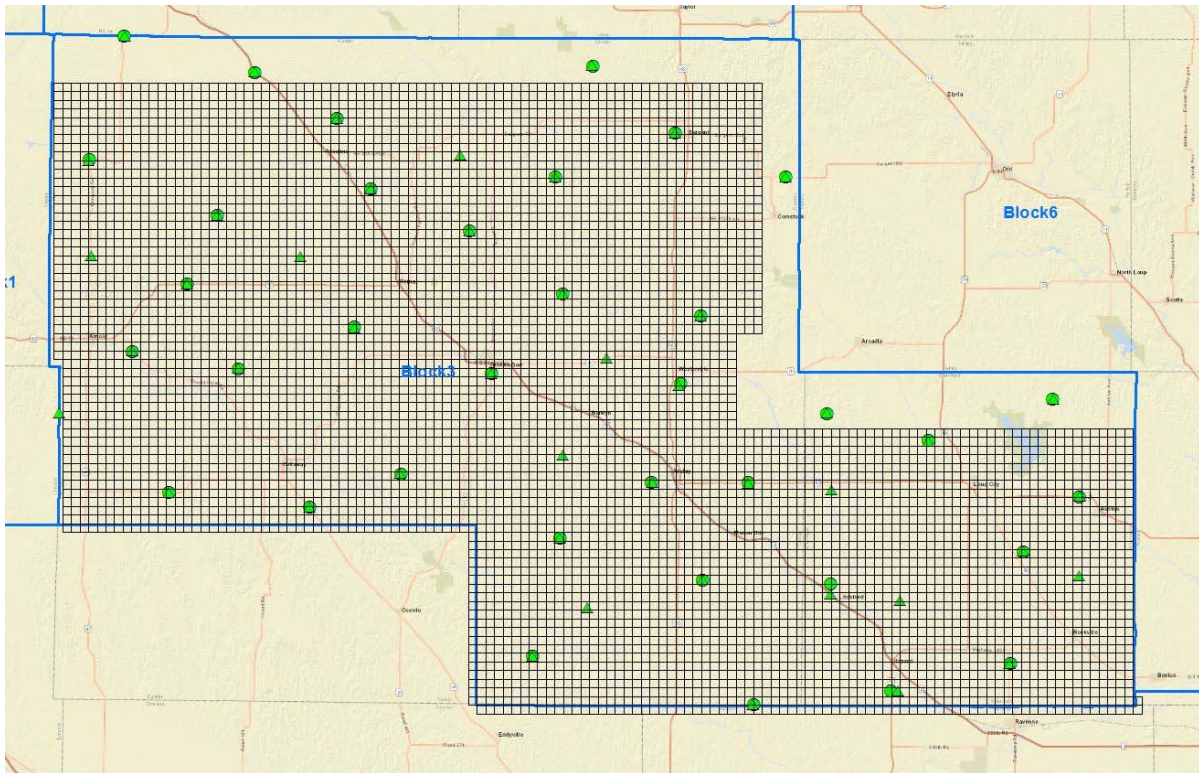
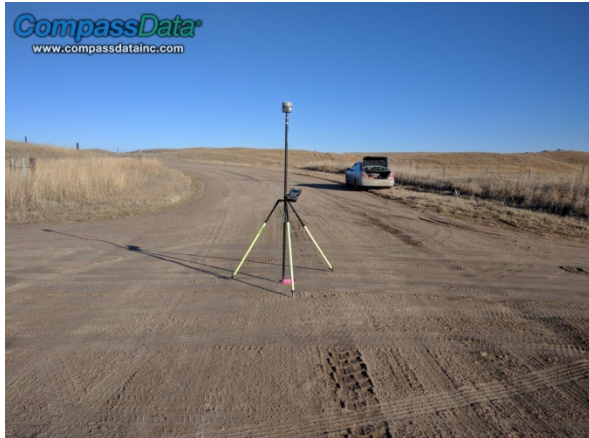


Figure 3 **Block3a** Lidar QC Check

These points consisted of various types of ground cover including asphalt, gravel, short grass, tall grass and trees. Examples to the types of points surveyed are included below.



The required Lidar elevation data values were derived within ArcGIS from the bare earth LAS files. For each control point location a Lidar elevation value was derived and exported and the surface value subtracted from the survey elevation. These derived values were imported into Excel and comparisons were performed to generate statistics by ground cover type and for the overall dataset.

Unclassified Swath LAS QC Accuracy Results

The table below presents the results of the QC accuracy analysis for the unclassified swath LAS data.

Stat	NVA (Bare Earth, Short Grass)
Count	38
RMSEz (meters)	0.033
95% Confidence Level (meters)	0.064

As indicated above the LAS Lidar surface meets Non-vegetated Vertical Accuracy (NVA) project specifications of RMSEz less than or equal to 10.0 cm, with an RMSEz of 3.3cm. The 95% confidence level of 19.6cm or less was also met with a value of 6.4cm.

DEM QC Accuracy Results

The table below presents the results of the QC accuracy analysis for the derived bare-earth DEM data.

Stat	Overall	NVA (Bare Earth, Short Grass)	VVA (tall grass, brush, trees)
Count	68	38	30
RMSEz (meter)	0.048	0.031	0.063
95% Confidence Level (meter)	0.093	0.061	0.123
95 th Percentile (meter)	0.101	0.061	0.147

As indicated above the derived DEM Lidar surface meets NVA of 10.0 cm, with an RMSEz of 3.10cm & VVA project specifications of 95th Percentile less than or equal to 29.4 cm.