

LiDAR Elevation Data Accuracy Report

Duck Creek LiDAR Mapping Project

US Army Corps of Engineers Contract # W912P9-07-D-0518
November 9, 2009



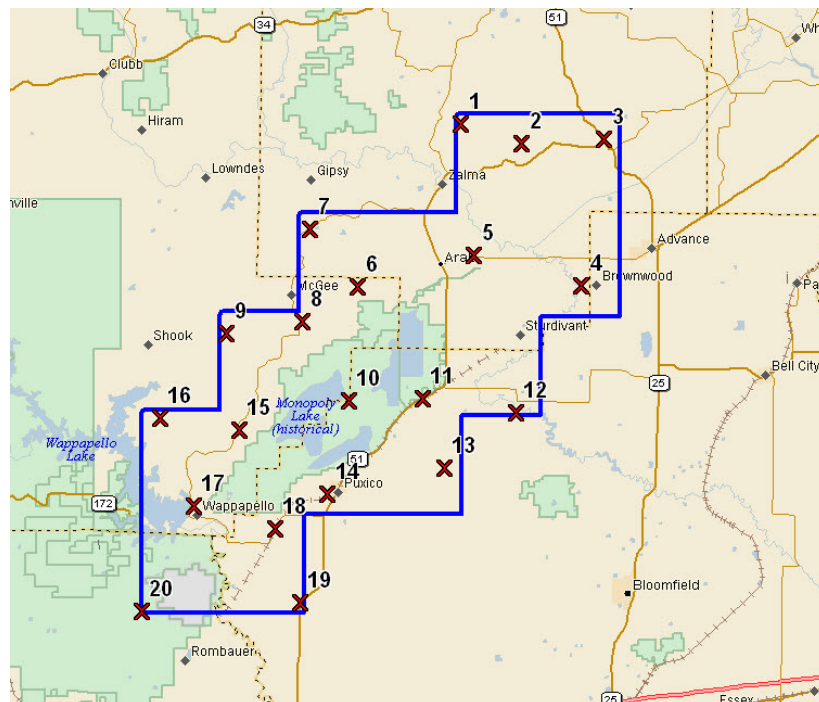
1.0 Project Overview

The Missouri Department of Conservation, U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) required high-resolution digital elevation data be developed from an aerial LiDAR sensor to cover portions of Bollinger, Butler, Stoddard and Wayne counties in Missouri to the quarter-quad tile resolution. These data were then to be used to generate digital elevation models for use in hydrologic and wetland models for the purposes of conservation planning activities, environmental assessments and improved public use. To accomplish this mapping goal, Surdex was hired by the USACE to complete this mapping project under its task order contract with the St. Louis District in the spring of 2009.

The project required deliverables which were tested for and meet vertical and horizontal accuracy as stated in the NDEP guidelines for digital elevation data for NSSDA of 95% confidence interval, for 2' contours (horizontal accuracy of 1.33 meters (4.39 feet) and vertical of 18.5 centimeters RMSE). In addition, the Contractor was to process the LiDAR data and produce a "bare earth" model with vertical accuracy on flat, bare ground of 15 centimeters or better and 40 centimeters or better in vegetation or on hillsides (overall accuracy meeting NDEP guidelines of 18.5 centimeters RMSE).

2.0 Project Area

The general project area is presented along with the survey control point locations in the graphic below:



3.0 LiDAR Data Collection Scenario

The LiDAR elevation data for this project was collected with a Leica ALS-50II MPIA aerial LiDAR sensor system. The project design called for acquisition of LiDAR data with flight lines aligned with the length of the project area. The nominal collection scenario called for the acquisition of 1 point per meter on the ground.

4.0 Duck Creek LiDAR Evaluation

The field survey for this project consisted of 110 check points distributed over the project area. These points consisted of various types of ground cover including asphalt, gravel, shot grass, tall grass and trees. Examples to the types of points surveyed are included below.



lcp27



lcp28



142



135

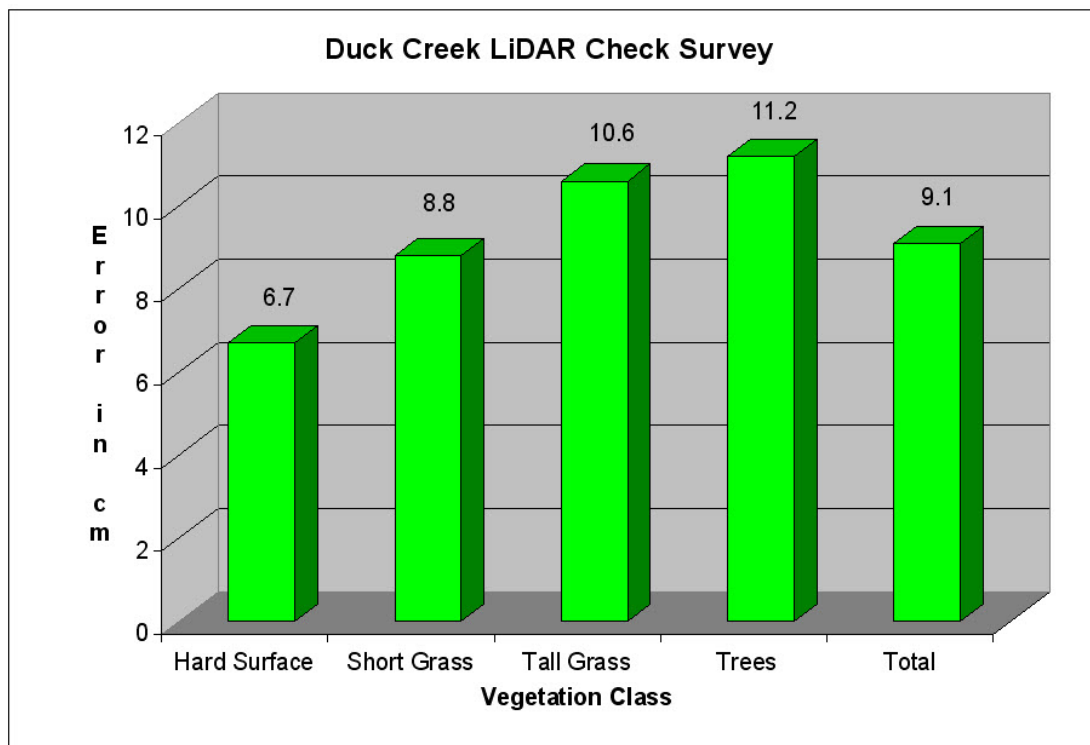
The required LiDAR elevation data values were derived within the Global Mapper software from the bare earth .las files. For each control point location a LiDAR elevation value was derived and exported. These derived values were imported into Excel and comparisons were performed to generate statistics by ground cover type and for the overall dataset.

5.0 Results

The table below presents the results of the accuracy analysis for Duck Creek. All values are in US survey feet.

Count	110	31.00	39.00	17.00	23.00
min	-0.62	-0.31	-0.62	-0.37	-0.59
max	0.70	0.52	0.58	0.67	0.70
average	0.05	0.00	-0.03	0.18	0.16
sd	0.30	0.22	0.29	0.31	0.34
RMSE	0.30	0.22	0.29	0.35	0.37

The final table presents the RMSE values by ground cover type converted to centimeters to be consistent with the project objectives.



From the tables and graphs presented above you can see that the data is well within the project limits of 15 cm vertical RMSE for hard surfaces and 40 cm vertical RMSE in

trees. Therefore, the Duck Creek elevation data has been statistically validated to meet the project specifications, i.e. topographic feature points have an overall RMSE of 9.1 cm which is below the project limit of 18.5 cm.

Respectfully submitted,

A handwritten signature in black ink that reads "Steve Kasten". The signature is written in a cursive style with a large, stylized 'S' and 'K'.

Steve Kasten CP, PLS
November 9, 2009