

Project Summary Report

Duck Creek LiDAR Elevation Data

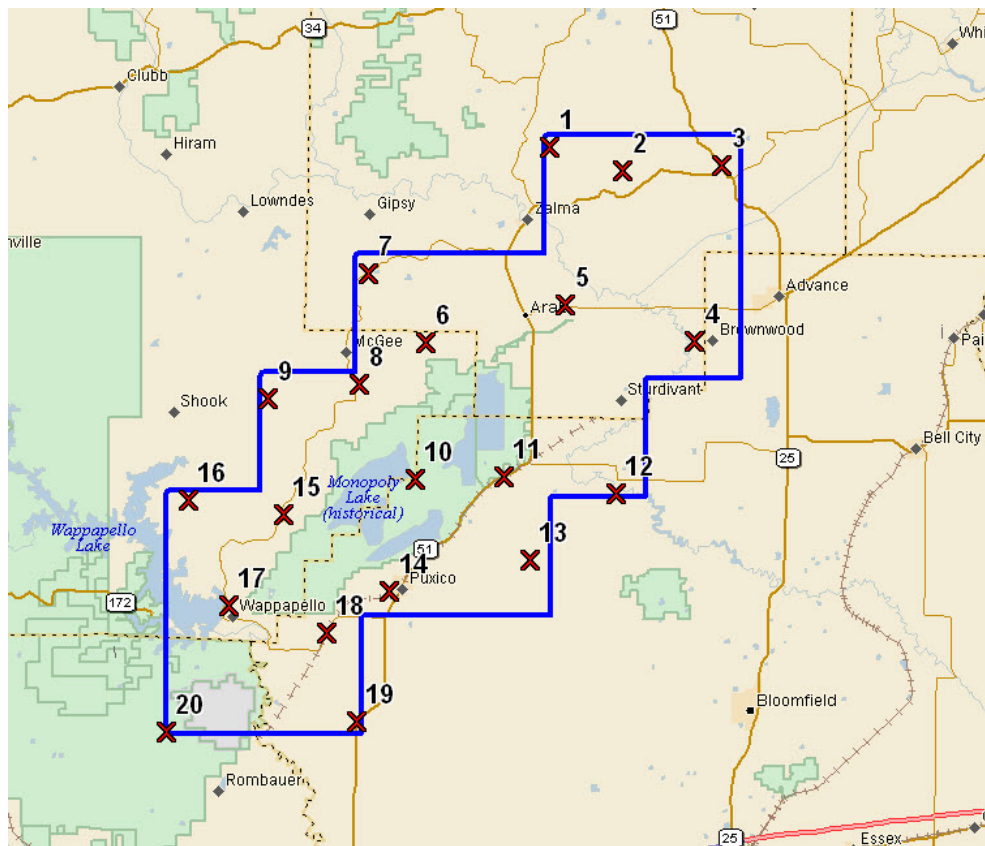
US Army Corps of Engineers Contract # W912P9-07-D-0518
November 9, 2009



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 general project layout of the project area and the primary control is provided in the graphic below.



2.0 Project Plan

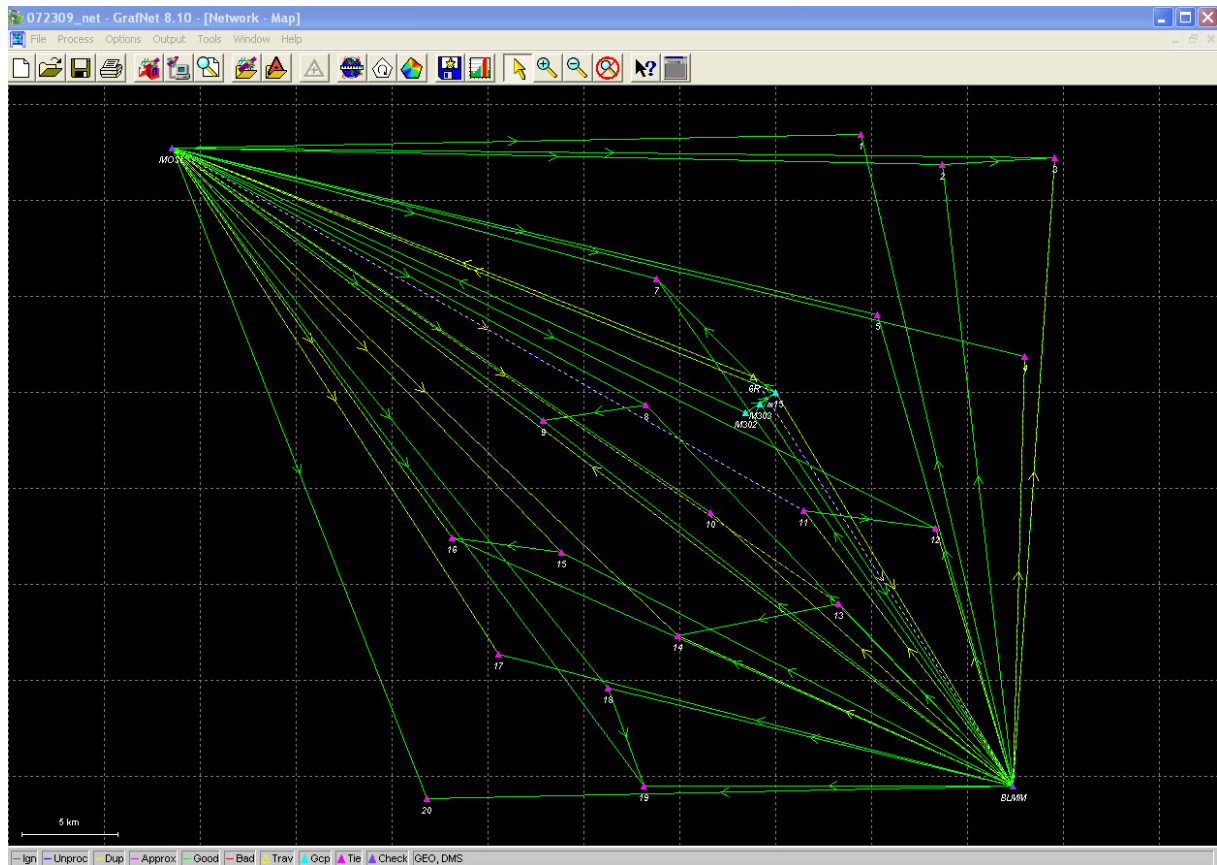
The project required deliverables which were tested for and meet vertical and horizontal accuracy as stated in the NDEP guidelines for digital elevation data for NSSDA of 95% confidence interval, for 2' contours (horizontal accuracy of 1.33 meters (4.39 feet) and vertical of 18.5 centimeters RMSE. In 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).

To accomplish this, Surdex designed a survey that would include 20 primary control points that were surveyed by rapid static GPS techniques and then a minimum of 60 LiDAR QC points that were surveyed by GPS RTK techniques from the primary control.

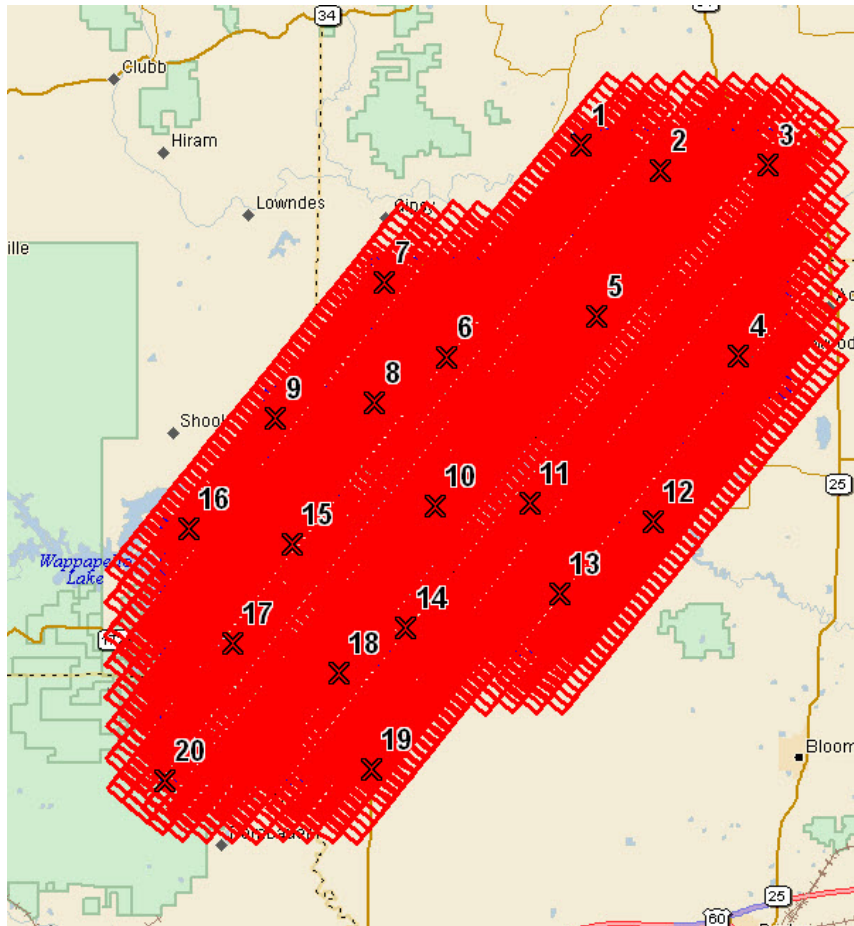
3.0 Ground Control Survey

It was determined that 20 minute observations post processed through GrafNET and tied into existing monumentation in the area should provide adequate accuracy for this project. Dual frequency Trimble 5700 GPS receivers collecting data at a 0.5-second interval were used for all data collection. Field data observations were performed on July 23 and 24, 2009. The RTK check surveys were performed on July 28 and 29, 2009.



4.0 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. The flight graphic presented previously displays the date of LiDAR acquisition. The graphic below presents the LiDAR flight line coverage.



Review of this graphic shows that the LiDAR data collection covers the project area.

5.0 LiDAR elevation data

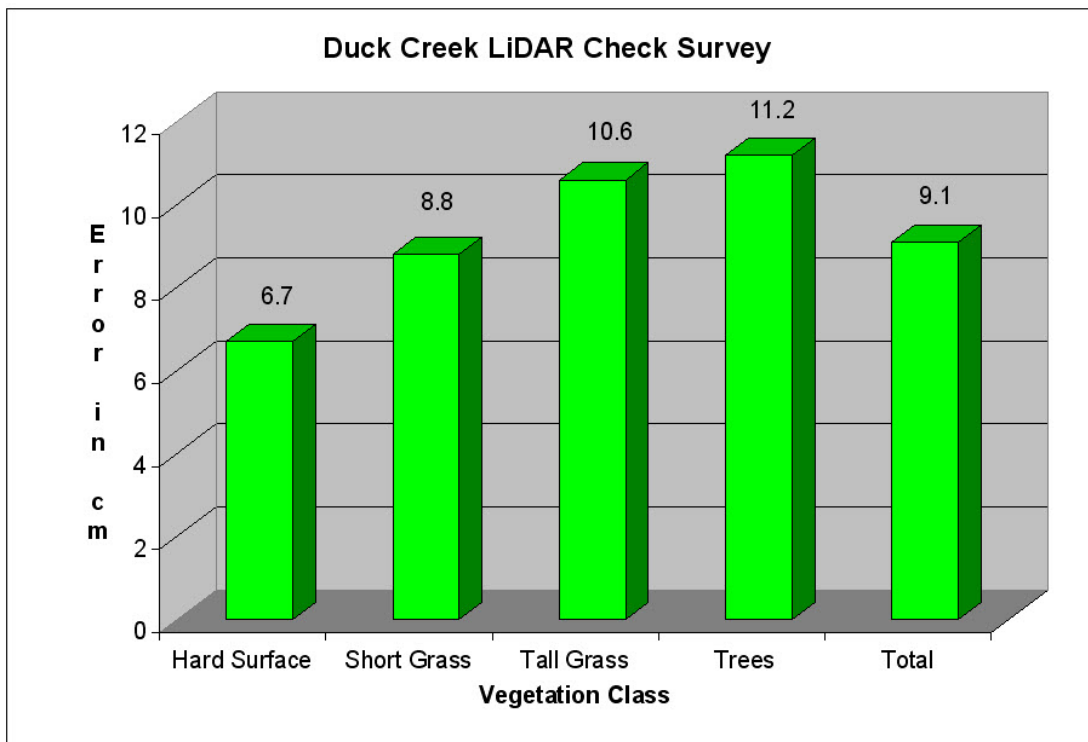
Elevation data was generated from the LiDAR system and enhanced with hydrographic breaklines. The final elevation datasets were developed in ESRI and Microstation format. Visual inspections were made to assure that the LiDAR elevation data covered the entire project area.

6.0 Elevation Data Evaluation

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.

7.0 Project Evaluation

After review of the project data it has been determined that the geospatial data provided to the USACE under this contract is consistent with the project SOW and meets all the required accuracy standards.

Respectfully submitted,

A handwritten signature in cursive script that reads "Steve Kasten".

Steve Kasten CP, PLS