LiDAR Quality Assurance (QA) Report
2010 South Carolina Consortium Project
Lexington County
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Submitted to:
South Carolina Department of Natural Resources

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Executive Summary

The following LiDAR quality assurance report documents Dewberry's review of LiDAR data and derived products for Lexington County, South Carolina. This is the first review of the Lexington data. The data was flown by Sanborn for the 2010 SC LiDAR Consortium Project. The figure below shows Lexington County and the adjoining South Carolina counties (Figure 1).

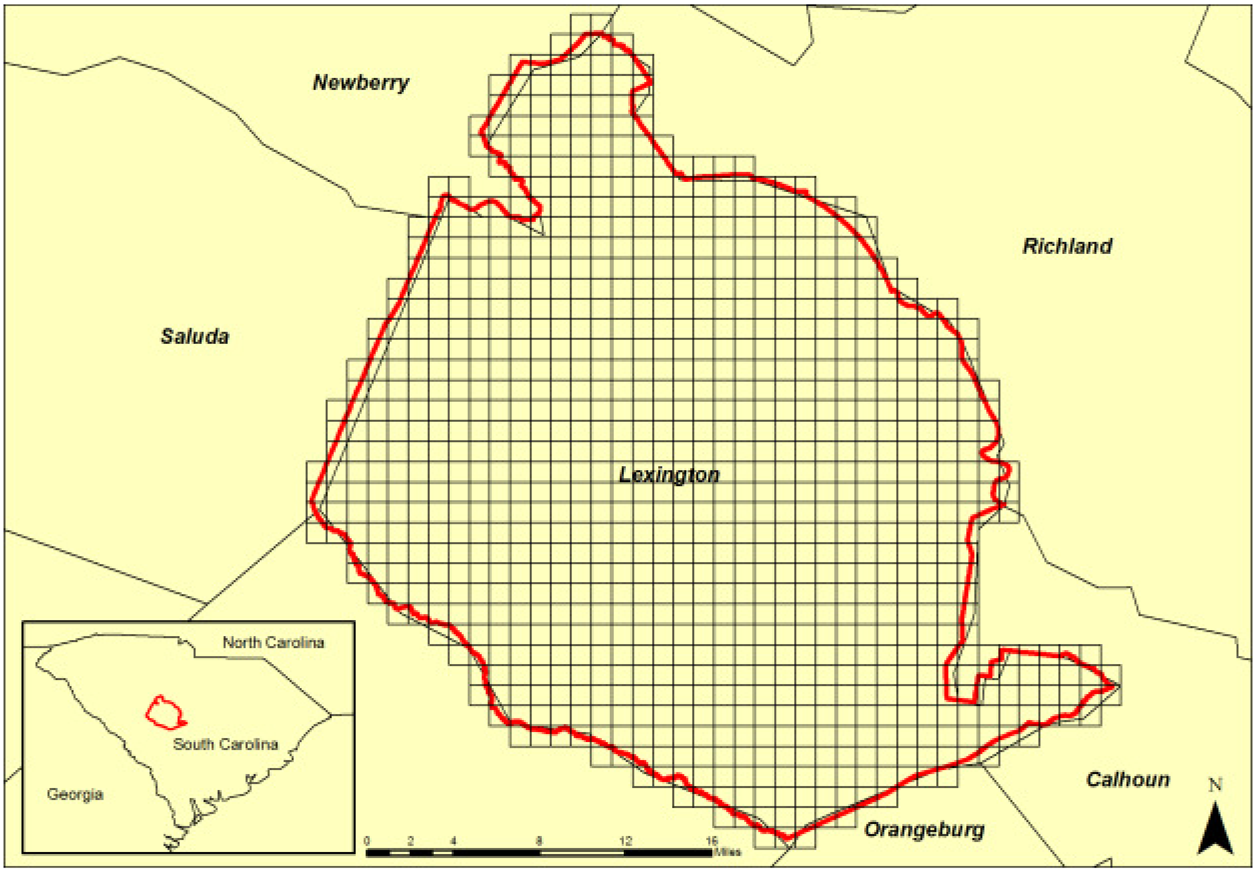

Figure 1 - Location of Lexington County overlaid by delivered LAS grid.

Lexington County is approximately 759 square miles which amounts to 940 LAS tiles (5000' x 5000'). The delivered LAS files provide full coverage to the extent of the county as illustrated in the figure above. Each tile contains LAS point cloud data classified according to the ASPRS classification scheme.

The final deliverables also include an ESRI Geodatabase containing hydrographic breaklines and terrain, a DEM in Arc GRID format, and individual intensity images per tile.

The LiDAR data has been classified to contain the appropriate classes:

Required Classes
- Class 1 (Unclassified)
- Class 2 (Bare Earth)
- Class 7 (Noise)
- Class 8 (Model Key Points)
- Class 9 (Water)
- Class 10 (Points removed from Bridges and Culverts)
- Class 11 (Ignored Ground)

LiDAR Quantitative Review

One of the first steps in assessing the quality of the LiDAR is a vertical accuracy analysis of the ground models in comparison to surveyed checkpoints. South Carolina Geodetic Survey provided 138 checkpoints for the county area.

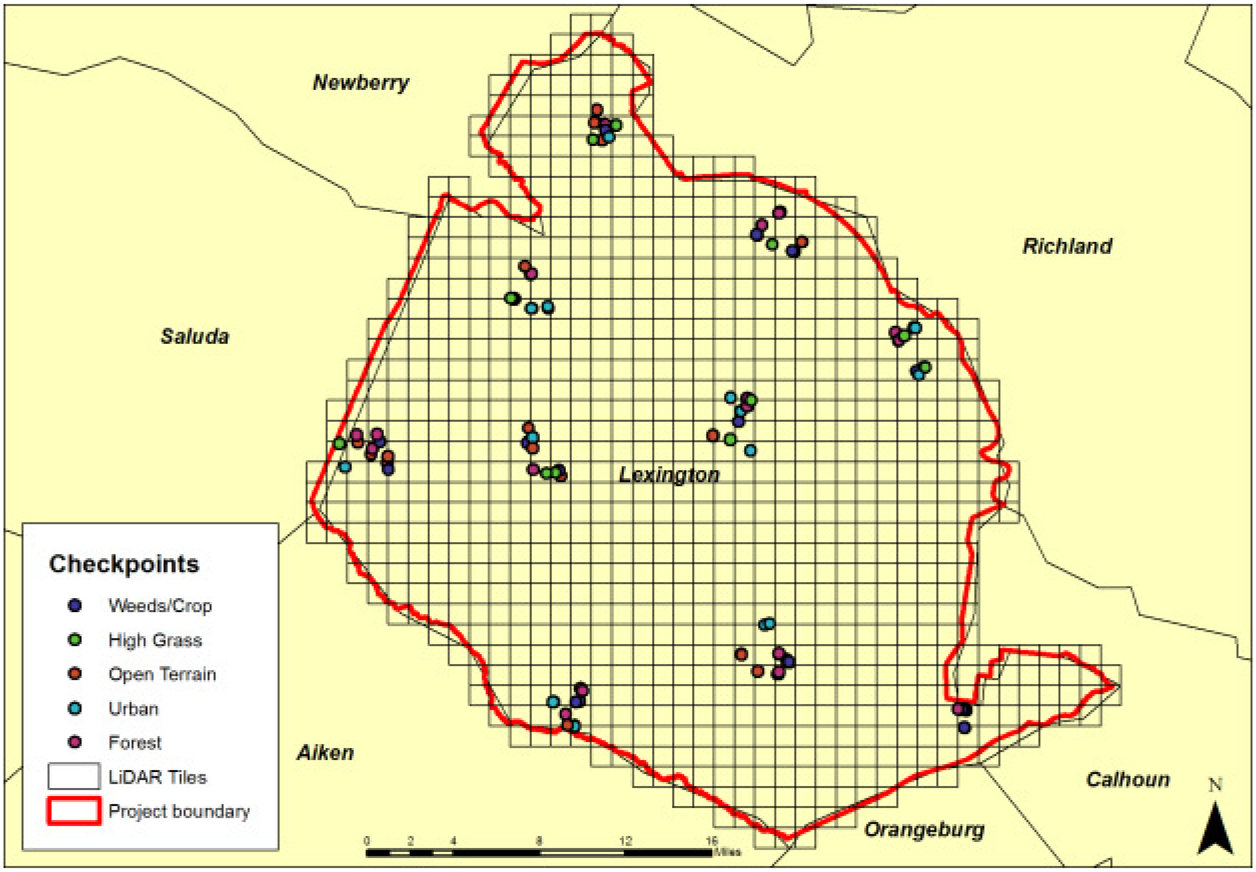

Figure 3 - Checkpoint Distribution of Lexington County, SC.

The vertical accuracy assessment compares the measured survey checkpoint elevations with those of the TIN as generated from the bare-earth LiDAR. The X/Y locations of the survey checkpoints are overlaid on the TIN and the interpolated Z values of the LiDAR are recorded. These interpolated Z values are then compared with the survey checkpoint Z values and this difference represents the amount of error between the measurements. Once all the Z values are recorded, the Root Mean Square Error (RMSE) is calculated and the vertical accuracy scores are interpolated from the RMSE value. The RMSE equals the square root of the average of the set of squared differences between the dataset coordinate values and the coordinate values from the survey checkpoints.

The first method of evaluating vertical accuracy uses the FEMA specification which follows the methodology set forth by the National Standard for Spatial Data Accuracy. The accuracy is reported at the 95% confidence level using the Root Mean Square Error (RMSE) which is valid when errors follow a normal distribution. By this method, vertical accuracy at the 95% confidence level equals $RMSE_Z$ x 1.9600.

The second method of testing vertical accuracy, endorsed by the National Digital Elevation Program (NDEP) and American Society for Photogrammetry and Remote Sensing (ASPRS) uses the same (RMSEZ x 1.9600) method in open terrain only; an alternative method uses the 95th percentile to report vertical accuracy in each of the other land cover categories (defined as Supplemental Vertical Accuracy – SVA) and all land cover categories combined (defined as Consolidated Vertical Accuracy – CVA). The 95th percentile method is used when vertical errors may not follow a normal error distribution, as in vegetated terrain.

The Fundamental Vertical Accuracy (FVA) is calculated in the same way when implementing FEMA/NSSDA and NDEP/ASPRS methodologies; both methods utilize the 95% confidence level (RMSEZ x 1.9600) in open terrain where there is no reason for LiDAR errors to depart from a normal error distribution.

Table 1 outlines the calculated RMSEz and associated statistics while Table 2 outlines vertical accuracy and the statistics of the associated errors as computed by the different methods.

100 % of Totals	$RMSE_Z$ (ft) Spec=0.6 ft	Mean (ft)	Median (ft)	Skew	Std Dev (ft)	# of Points	Min (ft)	Max (ft)
Consolidated	0.43	0.01	0.07	-1.41	0.43	138	-1.93	0.86
Open Terrain	0.45	0.01	0.14	-1.51	0.45	43	-1.66	0.86
Brush	0.36	0.20	0.24	-1.36	0.30	20	-0.69	0.65
High Grass	0.36	0.03	0.02	0.45	0.37	24	-0.57	0.82
Forest	0.53	-0.26	-0.10	-2.11	0.47	30	-1.93	0.26
Urban	0.38	0.12	0.18	0.37	0.37	21	-0.83	0.59

Table 1: The table shows the calculated RMSEz values for both CVA and FVA as well as associated statistics of the errors for Lexington.

Land Cover Category	# of Points	FVA — Fundamental Vertical Accuracy ($RMSE_Z$ x 1.9600) Spec=1.20 ft	CVA — Consolidated Vertical Accuracy (95th Percentile) Spec=1.20 ft	SVA — Supplemental Vertical Accuracy (95th Percentile) Spec=1.20 ft
Consolidated	138		0.82	
Open Terrain	43	0.88		0.81
High Grass	20			0.65
Brush	24			0.76
Forest	30			1.06
Urban	21			0.73

Table 2: The table shows the calculated Accuracyz of the FVA using FEMA/NSSDA guidelines (RMSEz x 1.9600) and the Accuracyz of the CVA using NDEP/ASPRS guidelines (95th percentile) for Lexington.