



Accuracy Report – LiDAR

CPRA LADOTD Lidar 2019 | Louisiana

Block 5

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Version 01

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Document Control

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Client Information

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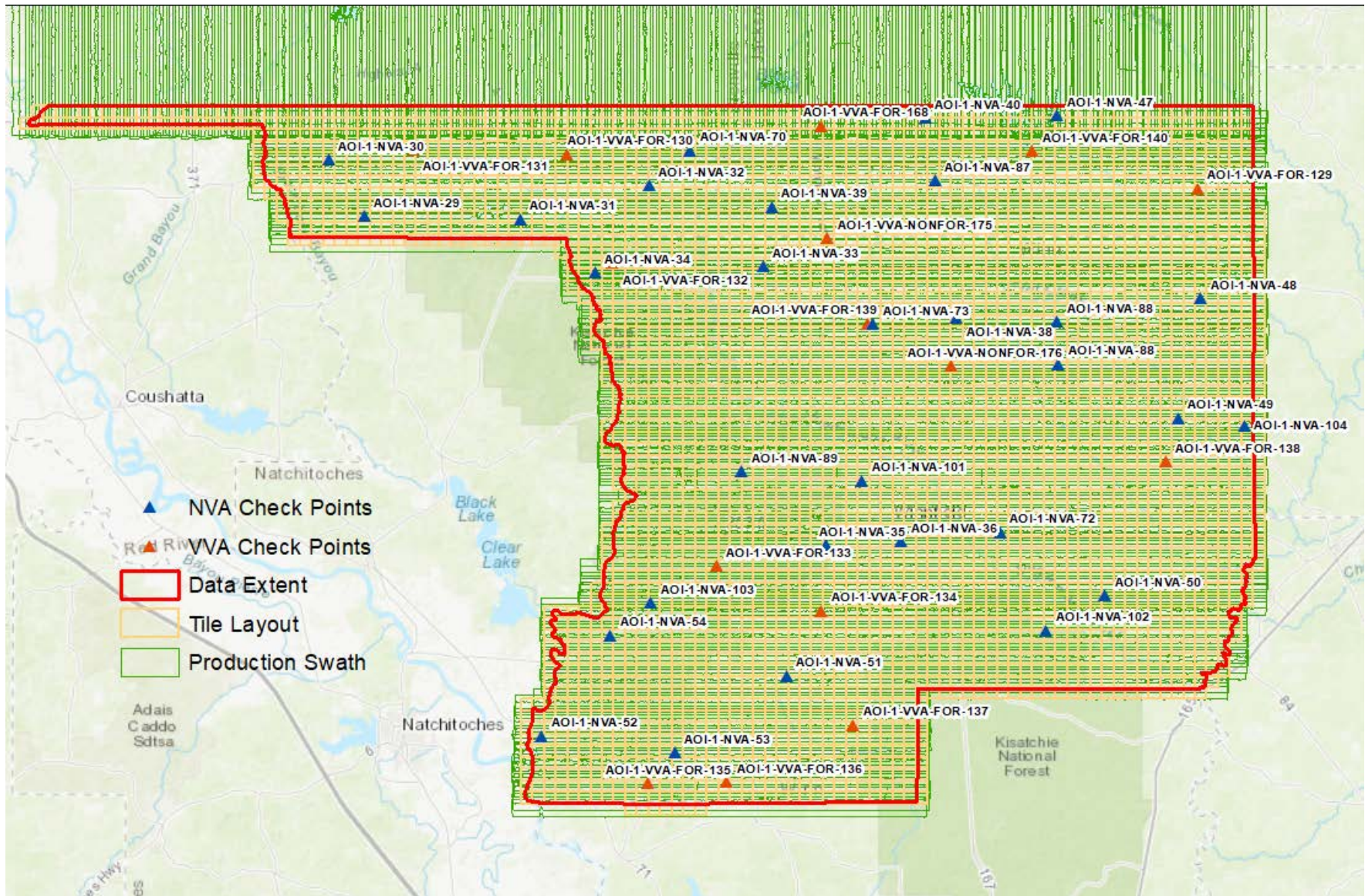
Revision History

Issue	Date	Status	Comments on Content	Prepared By	Reviewed By
01	date	For Review	Awaiting client comments	JW, JH	KS

Project Team

Initials	Name	Role
KS	Katie Springman	Project Manager
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JH	Jonathan Helta	Technical Lead - Terrain

CPRA Block 5 – LiDAR Check Points



1. Accuracy reporting

Data collected under this Task Order meets the National Standard for Spatial Database Accuracy (NSSDA) accuracy standards. The NSSDA standards specify that vertical accuracy be reported at the 95 percent confidence level for data tested by an independent source of higher accuracy.

1.1 Positional Accuracy

Before classification and development of derivative products from the point cloud, the absolute and relative vertical accuracies of the point cloud were verified.

1.2 Absolute Vertical Accuracy

Unclassified Lidar Point Cloud Data: The Non-Vegetated Vertical Accuracy (NVA) of the Lidar Point Cloud data was calculated against TINs derived from the final calibrated and controlled swath data. The required accuracy (ACCZ) is: 19.6 cm at a 95% confidence level, derived according to NSSDA, i.e., based on RMSEz of 10 cm in the "open terrain" and/or "Urban" land cover categories. This is a required accuracy. Please refer to the table below for the achieved accuracies. The raw swath point cloud data met the required accuracy levels before point cloud classification and derivative product generation.

Table 1: Accuracy of the Lidar Point Cloud Data (Block 5)

Raw Flight Lines	RMSEz (non-vegetated)	NVA at 95-percent confidence level
Specification (cm)	≤ 10	≤ 19.6
Calculated Values (cm)	4.5	8.9
Specification (m)	≤ 0.100	≤ 0.196
Calculated Values (m)	0.045	0.089
Number of points	30	30

Bare Earth Surface: The accuracy (ACCZ) of the derived DEM was calculated and is being reported in three (3) ways:

1. **RMSEZ (Non-Vegetated):** The required RMSEZ is ≤ 10 cm.
2. **Non-Vegetated Vertical Accuracy (NVA):** The required NVA is: ≤ 19.6 cm at a 95% confidence level, derived according to NSSDA, i.e., based on RMSEZ of 10 cm in the "open terrain" and/or "Urban" land cover categories. This is a required accuracy.
3. **Vegetated Vertical Accuracy (VVA):** The required VVA is: ≤ 29.4 cm at a 95th percentile level, derived according to ASPRS Guidelines, Vertical Accuracy for Reporting LiDAR Data, i.e. based on the 95th percentile error in Vegetated land cover categories combined (Tall Grass, Brush, Forested Areas). This is a required accuracy.

Please refer to the table below for the achieved accuracies.

Table 2: Accuracy of the Derived DEM (Block 5)

DEM	RMSEz (non-vegetated)	NVA at 95-percent confidence level	VVA at 95th percentiles
Specification (cm)	≤ 10	≤ 19.6	≤ 29.4
Calculated Values (cm)	4.8	95	18.2
Specification (m)	≤ 0.100	≤ 0.196	≤ 0.294
Calculated Values (m)	0.048	0.095	0.182
Number of points	31	31	15

1.3 Relative Accuracy

Smooth Surface Repeatability: In ideal theoretical conditions, smooth surface repeatability is a measure of variations documented on a surface that would be expected to be flat and without variation. Users of lidar technology commonly refer to these variations as "noise." Single-swath data was assessed using only single returns in non-vegetated areas. Repeatability was evaluated by measuring departures from planarity of single returns from hard planar surfaces, normalizing for actual variation in the surface elevation. Repeatability of only single returns was then assessed at multiple locations within hard surfaced areas (for example, parking lots or large rooftops).

Each sample area was evaluated using a signed difference raster (maximum elevation – minimum elevation) at a cell size equal to twice the ANPS, rounded up to the next integer. Sample areas were larger than 50 square meters (m²). The maximum acceptable variations within sample areas for this project is 6 cm. Isolated noise is expected within the sample areas and was disregarded.

The evaluation was done on 37 flat open sample areas over Block 5 AOI. The results are shown in the table below, please also refer to:

CPR_A_Block5_Lidar_Relative_Accuracy_Smooth_Surface_Repeatability_UTM15.shp

Table 3: Relative Vertical Accuracy, Smooth Surface Repeatability (Block 5)

Area (square meters)	RMSDz (meters)
50	0.026335
50	0.022739
50	0.047845
50	0.025724
50	0.026916
50	0.024297
50	0.031143
50	0.042490
50	0.020218
50	0.034508
50	0.028424
50	0.021171
50	0.019755
50	0.027031
50	0.036621
50	0.033991
50	0.055897
50	0.025282
50	0.031496
50	0.054496
50	0.047081
50	0.032185
50	0.045836
50	0.031489
50	0.057062
50	0.021767
50	0.056887
50	0.041447
50	0.048252
50	0.045223
50	0.027041
50	0.029298
50	0.028982
50	0.032706
50	0.036410
50	0.045606
50	0.058954

Overlap Consistency: Overlap consistency is a measure of geometric alignment of two overlapping swaths; the principles used with swaths can be applied to overlapping lifts and projects as well. Overlap consistency is the fundamental measure of the quality of the calibration or boresight adjustment of the data from each lift and is of particular importance as the match between the swaths of a single lift is a strong indicator of the overall geometric quality of the data, establishing the quality and accuracy limits of all downstream data and products.

Overlap consistency was assessed at multiple locations within overlap in non-vegetated areas of only single returns.

Each overlap area was evaluated using a signed difference raster with a cell size equal to twice the ANPS, rounded up to the next integer. The difference rasters are visually examined using a bicolored ramp from the negative acceptable limit to the positive acceptable limit. Although isolated excursions beyond the limits are expected and accepted, differences in the overlaps shall not exceed the following limits:

1. Swath overlap difference, $RMSDz \leq 8$ cm
2. Swath overlap difference, maximum ± 16 cm

The difference rasters are also statistically summarized to verify that root mean square difference in z (RMSDz) values do not exceed the project specifications. Consideration will be given for the effect of the expected isolated excursions over limits.

The result of the evaluation over 29 samples throughout Block 5 AOI is shown in the table below, please also refer to:

CPRA_Block5_Lidar_Relative_Accuracy_Swath_Overlap_UTM15.shp

Table 4: Relative Vertical Accuracy, Overlap Consistency (Block 5)

Area (square meters)	RMSDz (meters)	Maximum DZ (meters)	Minimum DZ (meters)
450	0.0208	0.0588	-0.0424
450	0.0302	0.0514	-0.0724
450	0.0518	0.1250	-0.0147
450	0.0242	0.0574	-0.0628
450	0.0414	0.0099	-0.0890
450	0.0342	0.0827	-0.0193
450	0.0185	0.0553	-0.0486
450	0.0266	0.0794	-0.0349
450	0.0164	0.0406	-0.0400
450	0.0148	0.0509	-0.0361
450	0.0216	0.0205	-0.0515

450	0.0155	0.0374	-0.0415
450	0.0182	0.0287	-0.0617
450	0.0241	0.0479	-0.0673
450	0.0284	0.0733	-0.0244
450	0.0231	0.0512	-0.0630
450	0.0266	0.0413	-0.0766
450	0.0172	0.0491	-0.0369
450	0.0332	0.1025	-0.0634
450	0.0354	0.0564	-0.0822
450	0.0164	0.0264	-0.0786
450	0.0335	0.1085	-0.0444
450	0.0296	0.1185	-0.0504
450	0.0590	-0.0038	-0.1122
450	0.0515	0.0906	0.0064
450	0.0279	0.0750	-0.0394
450	0.0210	0.0485	-0.0592
450	0.0356	0.0129	-0.0857
450	0.0249	0.1014	-0.0369