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# LiDAR Project Report

G15PD00280, BAA

Suwannee Gaps

QL2 LiDAR

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Prepared For:

United States Geological Survey



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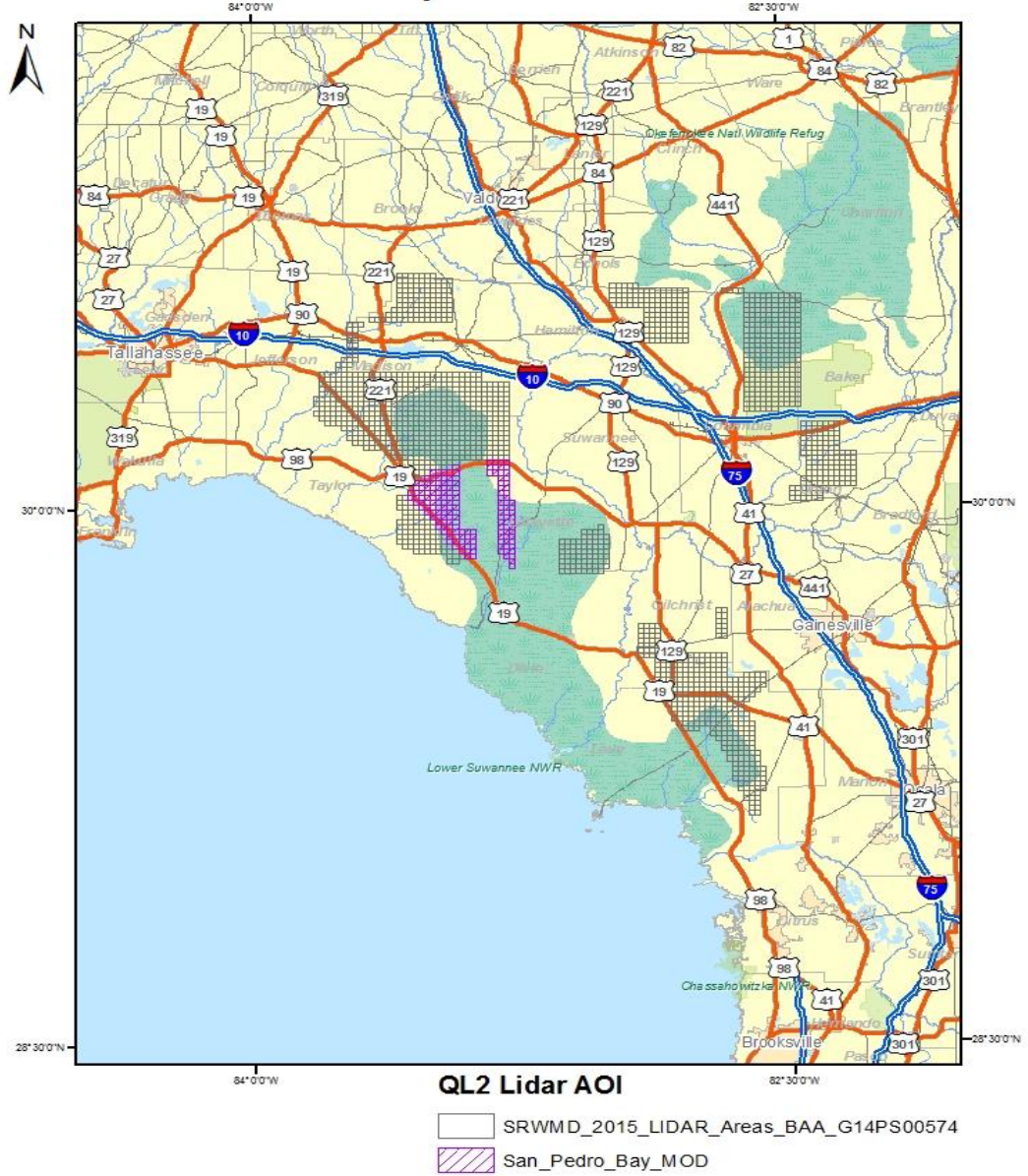
TASK ORDER: # G15PD00280

Project Report  
LiDAR Collection, Processing, and QA/QC  
G15PD00280, BAA Suwannee  
Gaps QL2 LiDAR

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# SRWMD Lidar Gaps in North Central Florida



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## 1 Introduction and Specifications

Digital Aerial Solutions, LLC (DAS) was tasked to collect and process a Light Detection And Ranging (LiDAR) derived elevation dataset for the G15PD00280, BAA Suwannee Gaps QL2 LiDAR. The area encompasses approximately 1689 square miles. Aerial LiDAR data was collected utilizing an ALS60 and ALS80. The ALS80 is a discrete return topographic LiDAR mapping system manufactured by Leica Geosystems.

LiDAR data collected for the G15PD00280, BAA Suwannee Gaps QL2 LiDAR survey has a nominal pulse spacing of 0.7 meters, and includes up to 4 discrete returns per pulse, along with intensity values for each return.

LiDAR datasets were post processed to generate elevation point cloud swaths for each flight line. Deliverables include the point cloud swaths, tiled point clouds classified by land cover type, breaklines to support hydro-flattening of digital elevation models (DEM)s, intensity tiles, and bare-earth DEM tiles. Point cloud deliverables are stored in the LAS version 1.4 format, point data record format 6. The tiling scheme for tiled deliverables is a 5000 ft x 5000 ft grid. Tile number is the appropriate cell number values found in the 2013 Florida state grid index. All deliverables were generated in conformance with the *U.S. Geological Survey National Geospatial Program Guidelines and Base Specifications, Version 1.2*.

## 2 Spatial Reference System

The spatial reference of the data is as follows.

### Horizontal Spatial Reference

- Datum: NAD83 HARN 2007 -
- Coordinates: Florida State Plane North (FIPS 903) US Survey Feet

### Vertical Spatial Reference

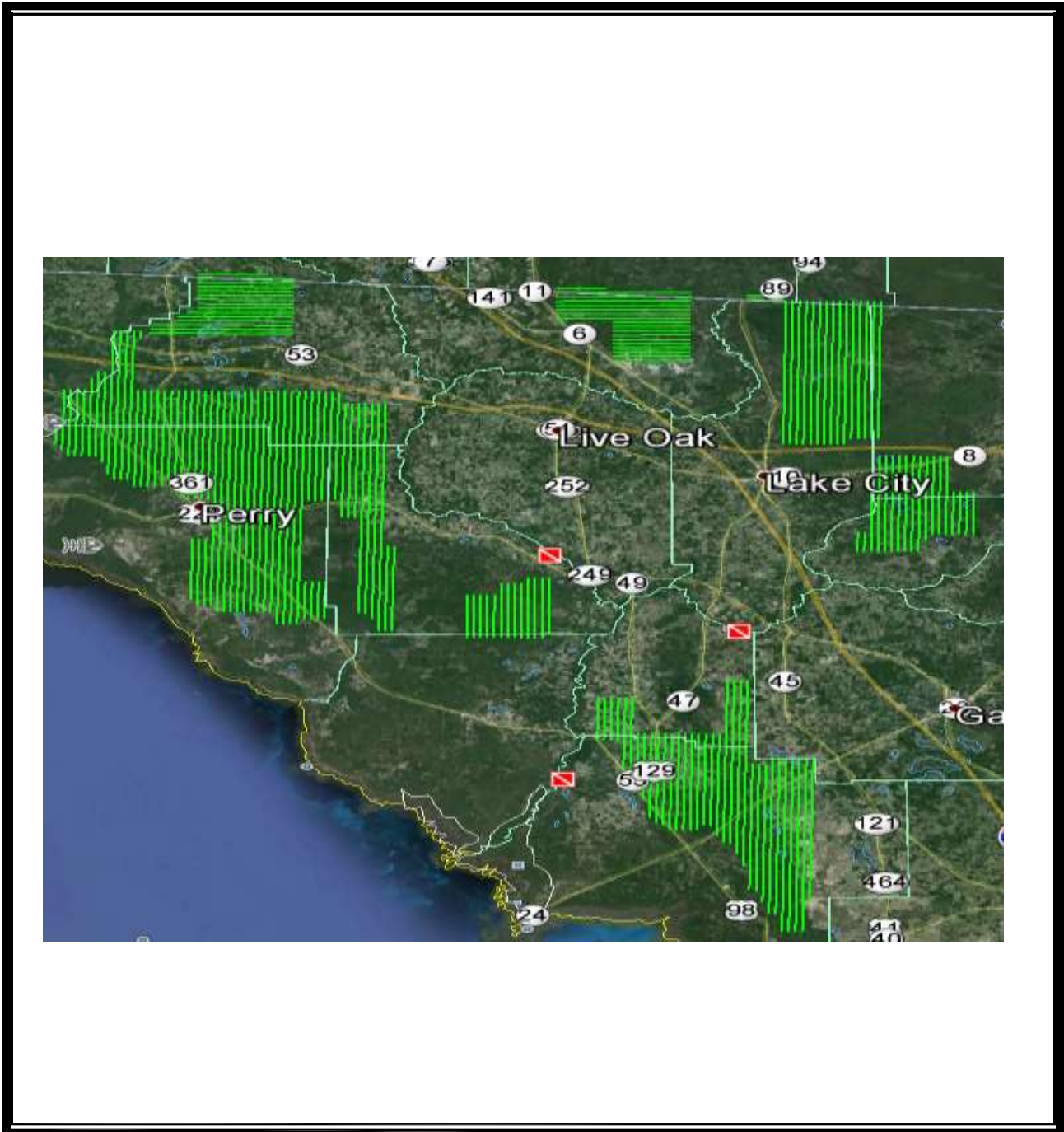
*All datasets are available with orthometric elevation; point cloud datasets are also available with ellipsoid heights*

- Datum: North American Vertical Datum of 1988 (GEOID12A)

### 3 LiDAR Acquisition

#### 3.1 Survey Area

The G15PD00280, BAA Suwannee Gaps QL2 LiDAR survey covers approximately 1689 square miles. The flight plan consisted of 179 survey lines and 16 control lines.



### 3.2 Acquisition Parameters

Acquisition parameters include the sensor configuration and the flight plan characteristics, and are selected based on a number of project specific criteria. Criteria reviewed include the required accuracies for the final dataset, the land cover types within the project survey area, and the required nominal pulse spacing. Acquisition parameters selected for the G15PD00280, BAA Suwannee Gaps QL2 LiDAR project are summarized below.

Parameter	Value
Flying Height Above Ground Level	6230 feet
Nominal Sidelap	30%
Nominal Speed Over Ground	155 knots
Field of View	36°
Laser Rate	132 kHz
Scan Rate	66.2 hz
Maximum Cross Track Spacing	0.78 meters
Maximum Along Track Spacing	0.82 meters
Average Spacing	0.7 meters

### 3.3 Acquisition Mission

The acquisition mission for G15PD00280, BAA Suwannee Gaps QL2 LiDAR survey was coordinated to be acquired in 2 weeks, due to weather conditions and related reflights the completion of acquisition was not until end of January. Collection began on Dec. 10<sup>th</sup> 2015 and was completed on Jan 14<sup>th</sup>, 2016.

### 3.4 Airborne GPS/IMU

Airborne global positioning system (GPS) and inertial measurement unit (IMU) data was collected on the aircraft during the acquisition mission, providing sensor position and orientation information for geo-referencing the LiDAR data. Airborne GPS observations were collected at a frequency of 2Hz, and IMU observations are collected at a frequency of 200Hz.

Aircraft	Sensor	GPS Lever Arm (m)	IMU Lever Arm (m)
C421 - N112MJ	ALS80 - SN8235	x: -0.210, y: -0.060, z: -1.370	x: -0.450, y: -0.159, z: -0.169

In addition, GPS data was collected with ground base stations during the acquisition mission, providing corrections to support differential post-processing of the airborne GPS. One ground base station was setup at an NGS Benchmark (Keyport) as the base of operation. The additional ground base station were selected and placed throughout the project to ensure complete coverage. Ground GPS observations were collected at a frequency of 2Hz.



## 4 LiDAR Processing

### 4.1 Acquisition Post-Processing

Once the acquisition was completed, initial post-processing was performed to generate geo-referenced LiDAR elevation point clouds.

The airborne GPS dataset was differentially corrected using the ground base station GPS datasets collected by DAS in Leica's InertialExplorer software. InertialExplorer computes the GPS dataset corrections in both forward and reverse chronological sequence, obtaining two solutions for the GPS trajectory. The differences between these two solutions were reviewed to ensure a consistent result, and agree within +/- 3cm. The forward and reverse solutions also show good fit between the two different base stations used in the post-processing.

Differentially corrected airborne GPS data was merged with the airborne IMU data in InertialExplorer software through Kalman filtering techniques. InertialExplorer applies the reference lever arms for the GPS and IMU measurement systems during processing to determine the trajectory (position and orientation) of the LiDAR sensor during the acquisition mission. Estimated lever arm values reported posteriori validate the measurements made during sensor installation in the aircraft.

Raw LiDAR data and the final sensor trajectory from InertialExplorer processed in Leica's CloudPro software to produce the LiDAR elevation point cloud swaths for each flightline, stored in LAS version 1.4 file format. Quality control of the swath point clouds was performed to validate proper function of the sensor systems, full coverage of the project AOI, and point density consistent with the planned nominal pulse spacing.

Swath point clouds were assigned a unique File Source ID within the LAS file format before further processing. Swath files for the G15PD00280, BAA Suwannee Gaps QL2 LiDAR project were numbered in chronological order of acquisition.

### 4.2 Geometric Calibration

Geometric and positional accuracy of the LiDAR swath point clouds is highly dependent on accurate calibration of the various subsystems within the LiDAR sensor system. Sensor calibration parameters fall into two categories, one being those parameters proprietary to the manufacturer's sensor design, and the other being parameters common to most commercial airborne LiDAR sensors, the IMU to laser reference system alignment angles (bore-site), and mirror deformation constants (scaling).

The manufacturer specific calibration parameters are applied in Leica's Cloud Pro software for the ALS80 sensor system. Terrasolid's Terramatch software was used to calculate the IMU bore-site and mirror scale parameters for the G15PD00280, BAA Suwannee Gaps QL2 LiDAR. Within the TerraMatch software, the Tie-line workflow was used to solve for the parameters. The Tie-line workflow involves automated selection of numerous 'tie-lines', which represent a linear segment fit to the data that should have the same slope, azimuth, position and elevation, within the overlap sections of the survey lines and control lines. The tie-lines provide observations for algorithms within TerraMatch to solve for the bore-site and mirror scale parameters for the lift.

The Tie-line workflow is dependent upon well distributed tie-lines throughout the swath point clouds to effectively solve for bore-site and mirror scale parameters with the automated algorithms.

survey and control lines. Manual estimation of the bore-site and mirror scale parameters was performed using the observed tie-lines in overlap areas.

The final step of geometric calibration is to determine elevation (z) offset corrections to be applied to the swath point clouds. Z values calculated during the course of the acquisition mission can vary at the centimeter level as the GPS satellite constellation observed in the survey area changes with satellites moving through their orbits over the course of the mission. Baseline length from the ground base station GPS to the airborne GPS can also impact the z values calculated for the swath point clouds. Z offset corrections are calculated in two steps; a relative step, where individual lines are corrected one to another using the adjusted tie-lines from the bore-site and mirror scale calculation step; and an absolute step, where groups of lines are leveled to project ground control.

For the G15PD00280, BAA Suwannee Gaps QL2 LiDAR, the control lines were used to determine relative z offset corrections in areas of discernible ground. The base station operated by DAS in the survey area provided for minimal baseline lengths, resulting in generally good z agreement between the survey lines and control lines.

The final geometrically calibrated swath point clouds were compared to the bare-earth profile survey data. The data fit the profile surveys within the vertical accuracy tolerance specified for the project. Full documentation of the vertical accuracy checks may be found in section 5.1.

### 4.3 Point Cloud Classification

Georeference information was applied to the swath point cloud LAS files. Geometrically calibrated swath point clouds were cut into 2013 Florida state grid index, 5000 feet x 5000 ft LAS 1.4 format tiles for point cloud classification and derived product creation.

Tiled point cloud data was processed in Terrasolid's Terrascan software to assign initial classification values. The Terrascan software provides a number of routines to algorithmically detect and assign points to their appropriate class. Points left unclassified by the algorithmic routine remain as Class 1 – Processed, but unclassified. Automated classification routines assigned points to one of the following classes:

- Class 1 – Processed, but unclassified
- Class 2 – Bare-earth ground
- Class 7 – Low Noise (low, manually identified, if necessary)
- Class 9 — Water
- Class 10 — Ignored Ground (Breakline Proximity)
- Class 17 — Bridge Decks
- Class 18 – High Noise (high, manually identified, if necessary)

Automated classification results were reviewed for each tiled point cloud, and manual edits made where necessary to correct for misclassified points. Points remaining in Class 1 after the automated classification routines were run were left in Class 1. Points falling outside of a 100 meter buffer of the project AOI polygon were excluded from the tiled point clouds.

## 4.4 Breakline Collection

Manual breakline collection was performed to support the hydro-flattening requirements of the project's DEM deliverables. Breaklines were collected directly from the classified point clouds and from triangulated irregular network (TIN) surface models built from the classified point clouds, in Terrasolids's Terrascan and Terramodeler software. Breakline features were collected as design file elements in Bentley's Microstation software. Breaklines were converted to ESRI 3D shapefile format for the breakline deliverable, and tiled to USNG index.

The data collected for the G15PD00280, BAA Suwannee Gaps survey maintained significant point density in the water, limiting the usefulness of point density as guiding factor in breakline placement.

Points classified as Class 2 – Bare-earth ground, falling within a one meter buffer of the collected breaklines, were reassigned to Class 10 – Ignored Ground. These points are excluded from the surface model during DEM generation to preserve the hydro-flattening characteristics of the breaklines.

## 4.5 DEM Generation

The final classified point clouds and collected breaklines were reviewed for completeness and conformance to the task order scope of work. Within the Terramodeler software, points in Class 2 – Bare-earth ground and the breaklines were combined to generate TIN elevation models for each tile, from which the bare-earth DEM tiles were interpolated and exported as 32 bit raster IMG format.

# 5 Quality Control

## 5.1 Point Clouds

Accuracy and completeness of the LiDAR point clouds directly impacts the quality of all other derived LiDAR derived products. Ensuring a quality LiDAR dataset begins with proper mission planning and execution. Ground GPS base stations are located such that GPS baselines between the ground and airborne receivers do not exceed 30km. For the G15PD00280, BAA Suwannee Gaps QL2 LiDAR project, two base stations were run to meet this requirement, one at the field operations airport and one within the survey area. Static alignment is performed both before take-off and after landing to allow for GPS integer ambiguity resolution. Sensor operators carefully monitor the LiDAR unit and its various subsystems during the acquisition mission to ensure proper function. Airborne GPS positional dilution of precision (PDOP) estimates are monitored to ensure they remain less than 3. The optical system is monitored to ensure there are no ranging errors encountered during the flight lines.

During acquisition post-processing estimates of the trajectory data accuracy are reviewed to ensure they will support the required accuracies of the point cloud data. The trajectory accuracy is a function of the differentially corrected GPS data and the IMU data.

The raw swath point clouds generated from CloudPro are reviewed as another check for proper sensor function. The point clouds are reviewed for full coverage of the AOI, required point density and nominal pulse spacing, clustering, proper intensity values, full swath coverage within the planned field of view, and planned survey line overlap.

Geometric calibration quality control validates that the positional accuracy requirements of the project are met, and includes relative accuracy assessments for intra-swath (within) and inter-swath (between) accuracy, along with absolute accuracy assessments against project ground control.

Relative vertical accuracy assessments are normally made using the tie-lines generated in the Terramatch software, as these lines provide positional observations throughout the extent of individual swaths, and between neighboring swaths.

There is not a systematic method of testing when testing horizontal accuracy in LiDAR. The estimated Horizontal accuracy at one sigma based on the flying height for the project, is between 10cm and 20cm according to manufacturer specifications.

Absolute vertical accuracy assessments for the point cloud data are made against ground check point data. For the G15PD00280, BAA Suwannee Gaps QL2 LiDAR, ground check point data consisted of the ground GPS base station, and real-time kinematic (RTK) GPS techniques.

Check point locations were collected at 1 – second intervals during the RTK survey. Points collected during the static pre-initialization and post-initialization were removed from the assessment so as not to bias the assessment.

Local TIN models of the elevation points are built around each ground check points. The tin model elevation is sampled at the horizontal position of the ground check point. The TIN model elevation and ground check point survey elevation values were used to calculate the fundamental vertical accuracy (FVA) of the swath point clouds. The NVA of the TIN tested RMSEz 0.22 feet and 0.432 ft at the 95% confidence level in open terrain. NVA of the DEM tested at an RMSEz of 0.222 feet and 0.435 feet at the 95% confidence level in open terrain. The full calculations for all check points can be found in Appendix B.

FVA of TIN

RMSE <sub>z</sub> =	0.22	Feet
NSSDA=	0.432	Feet

FVA of DEM

RMSE <sub>z</sub> =	0.222	Feet
NSSDA=	0.435	Feet

The tiled point cloud products were reviewed for full coverage of the AOI and proper classification. As part of the QC process, TINs are built in the Terramodeler software for each tile using the ground class and the hydro-flattening breaklines. The TINs are reviewed for non-ground features, and edited where necessary to remove any remaining non-ground features. Points were also reviewed for absolute elevation, and points falling below the selected orthometric elevation for water were removed from the ground class.

## 5.2 Breaklines

The final breaklines in ESRI 3D shapefile format were reviewed for topological consistency and correct elevation. Breaklines features are continuous and do not have overlaps or dangles.

### 5.3 Digital Elevation Models

Digital elevation models (DEMs) were reviewed for conformance with the SOW and the Base Mapping Specification version 1.2 guidelines. DEM files were loaded in the Global Mapper software and inspected visually for edge matching between tiles, void areas within the project AOI, and proper coding of the NODATA values. DEM file naming was verified for consistency with the USNG index.

## Appendix A. Flight Logs

## SRWMD North Central, FL

1210A	Flight Number	ALS80_N13RF	Start Time	End Time	Revised Flight Number
1	22	151210_133215	13:32	13:44	8022
2	23	151210_134903	13:49	14:01	8023
3	24	151210_140522	14:05	14:17	8024
4	25	151210_142135	14:21	14:34	8025
5	26	151210_143727	14:37	14:50	8026
6	27	151210_145352	14:53	15:06	8027
7	28	151210_150923	15:09	15:22	8028
8	29	151210_152515	15:25	15:38	8029
9	30	151210_154110	15:41	15:54	8030
10	X03	151210_160103	16:01	16:06	Xstrip
11	31	151210_161257	16:12	16:25	8031
12	X05	151210_163137	16:31	16:34	Xstrip
<b>1210B</b>					
1	32	151211_001932	:19	:32	
2	33	151211_003704	:37	:49	
3	34	151211_005356	:53	1:07	
4	35	151211_011139	1:11	1:25	
5	36	151211_012900	1:29	1:42	
6	37	151211_014604	1:46	1:59	
7	38	151211_020341	2:03	2:16	
8	39	151211_022156	2:21	2:35	
9	40	151211_023834	2:38	2:52	
10	41	151211_025658	2:56	3:10	
11	X05	151211_031650	3:16	3:21	
12	42	151211_032818	3:28	3:41	
13	X03	151211_034756	3:47	3:52	
<b>1211A</b>					
1	43	151211_152109	15:21	15:27	
2	44	151211_153136	15:31	15:38	
3	45	151211_154156	15:41	15:48	
4	46	151211_155301	15:53	15:59	
5	X04	151211_160720	16:07	16:10	
6	X03	151211_161646	16:16	16:20	
7	50	151211_162630	16:26	16:39	
8	49	151211_164417	16:44	16:56	
9	48	151211_170124	17:01	17:14	
10	X05	151211_171931	17:19	17:21	
11	47	151211_172557	17:25	17:38	
12	21	151211_174614	17:46	17:52	
13	20	151211_175725	17:57	18:03	
14	19	151211_180659	18:06	18:13	
15	X04	151211_182128	18:21	18:23	

## SRWMD North Central, FL

16	18	151211_182828	18:28	18:34	
17	X03	151211_183958	18:39	18:42	
<b>1211B</b>					
1	51	151211_195706	19:57	20:06	
2	52	151211_200943	20:09	20:19	
3	53	151211_202241	20:22	20:32	
4	54	151211_203604	20:36	20:45	
5	55	151211_204859	20:49	20:59	
6	56	151211_210250	21:02	21:13	
7	57	151211_211741	21:17	21:28	
8	58	151211_213129	21:31	21:42	
9	59	151211_214627	21:46	21:57	
10	71	151211_220249	22:02	22:09	
11	70	151211_221315	22:13	22:20	
12	X06	151211_222543	22:25	22:32	
13	72	151211_224013	22:40	22:47	
14	X05	151211_225406	22:54	23:00	
<b>1215A</b>					
1	17	151215_171552	17:15	17:21	
2	16	151215_172606	17:26	17:31	
3	15	151215_173750	17:37	17:43	
4	14	151215_174820	17:48	17:54	
5	13	151215_175916	17:59	18:08	
6	12	151215_181258	18:12	18:21	
7	11	151215_182656	18:26	18:35	
8	10	151215_184034	18:40	18:49	
9	X04	151215_185544	18:55	18:58	
10	9	151215_190419	19:04	19:12	
11	8	151215_191657	19:16	19:22	
12	7	151215_192638	19:26	19:31	
13	6	151215_193635	19:36	19:41	
14	5	151215_194530	19:45	19:49	
15	4	151215_195415	19:54	19:58	
16	3	151215_200249	20:02	20:06	
17	2	151215_201046	20:10	20:14	
18	1	151215_201824	20:18	20:20	
19	1	151215_202353	20:23	20:25	
20	X03	151215_203024	20:30	20:35	
<b>1215B</b>					
1	126	151215_220006	22:00	22:05	
2	125	151215_220929	22:09	22:14	
3	124	151215_221825	22:18	22:23	
4	123	151215_222841	22:28	22:33	
5	122	151215_223705	22:37	22:41	
6	121	151215_224508	22:45	22:49	
7	120	151215_225230	22:52	22:56	

## SRWMD North Central, FL

8	119	151215_225934	22:59	23:03	
9	118	151215_230653	23:06	23:10	
10	117	151215_231431	23:14	23:18	
11	116	151215_232202	23:22	23:25	
12	115	151215_232923	23:29	23:33	
13	114	151215_233635	23:36	23:40	
14	113	151215_234327	23:43	23:47	
15	112	151215_235106	23:51	23:53	
16	X01	151215_235803	23:58	:2	
17	X02	151216_000632	:6	:10	
<b>0111A</b>					
1	X06	160111_212816	21:28	21:33	
2	60	160111_214055	21:40	21:51	
3	61	160111_215528	21:55	22:04	
4	62	160111_220848	22:08	22:17	
5	63	160111_222151	22:21	22:30	
6	64	160111_223510	22:35	22:44	
7	65	160111_224813	22:48	22:57	
8	66	160111_230131	23:01	23:10	
9	67	160111_231434	23:14	23:23	
10	68	160111_232800	23:28	23:36	
11	69	160111_234215	23:42	23:49	
12	73	160111_235314	23:53	:	
13	74	160112_000520	:5	:12	
14	75	160112_001707	:17	:23	
15	X05	160112_002833	:28	:33	
16	76	160112_004039	:40	:43	
17	77	160112_004835	:48	:51	
18	78	160112_005546	:55	:58	
19	79	160112_010609	1:06	1:08	
20	80	160112_011332	1:13	1:16	
21	81	160112_012058	1:20	1:23	
22	X07	160112_012858	1:28	1:30	
23	82	160112_013621	1:36	1:38	
<b>0112A</b>					
1	90	160112_165649	16:56	17:02	
2	91	160112_170741	17:07	17:13	
3	92	160112_171755	17:17	17:23	
4	93	160112_172823	17:28	17:33	
5	94	160112_173828	17:38	17:43	
6	95	160112_174847	17:48	17:54	
7	96	160112_175852	17:58	18:04	
8	97	160112_180857	18:08	18:14	
9	98	160112_181931	18:19	18:25	
10	99	160112_183016	18:30	18:39	
11	100	160112_184345	18:43	18:52	



## SRWMD North Central, FL

12	101	160112_185713	18:57	19:06	
13	102	160112_191128	19:11	19:21	
14	X09	160112_192648	19:26	19:28	
15	103	160112_193405	19:34	19:41	
16	104	160112_194604	19:46	19:53	
17	105	160112_195751	19:57	20:05	
18	X08	160112_201056	20:10	20:16	
19	83	160112_202207	20:22	20:26	
20	84	160112_203053	20:30	20:35	
21	85	160112_204117	20:41	20:45	
22	X07	160112_205146	20:51	20:56	
<b>0112B</b>					
1	X13	160112_232315	23:23	23:27	
2	159	160112_233353	23:33	23:41	
3	158	160112_234608	23:46	23:53	
4	157	160112_235936	23:59	:7	
5	156	160113_001104	:11	:18	
6	155	160113_002334	:23	:31	
7	154	160113_003548	:35	:43	
8	153	160113_004748	:47	:55	
9	152	160113_005945	:59	1:07	
10	151	160113_011158	1:11	1:19	
11	150	160113_012421	1:24	1:32	
12	149	160113_013656	1:36	1:44	
13	148	160113_014848	1:48	1:56	
14	147	160113_020152	2:01	2:09	
15	146	160113_021336	2:13	2:21	
16	145	160113_022628	2:26	2:34	
17	160	160113_023915	2:39	2:41	
18	X16	160113_024622	2:46	2:47	
19	161	160113_025235	2:52	2:54	
20	X12	160113_030204	3:02	3:05	
<b>0113A</b>					
1	X15	160113_155823	15:58	16:02	
2	179	160113_160740	16:07	16:10	
3	178	160113_161446	16:14	16:17	
4	177	160113_162134	16:21	16:24	
5	176	160113_162906	16:29	16:31	
6	175	160113_163538	16:35	16:40	
7	174	160113_164415	16:44	16:48	
8	173	160113_165247	16:52	16:57	
9	172	160113_170138	17:01	17:06	
10	171	160113_171010	17:10	17:15	
11	170	160113_171915	17:19	17:24	
12	169	160113_172854	17:28	17:34	
13	168	160113_173846	17:38	17:44	

## SRWMD North Central, FL

14	167	160113_174845	17:48	17:54	
15	166	160113_175838	17:58	18:04	
16	165	160113_180832	18:08	18:14	
17	164	160113_181742	18:17	18:23	
18	163	160113_182742	18:27	18:29	
19	162	160113_183300	18:33	18:34	
20	X14	160113_184157	18:41	18:44	
21	141	160113_185848	18:58	19:01	
22	140	160113_190614	19:06	19:09	
23	139	160113_191418	19:14	19:17	
24	X10	160113_192238	19:22	19:24	
25	138	160113_192908	19:29	19:32	
26	X11	160113_193714	19:37	19:39	
27	137	160113_194413	19:44	19:47	
28	136	160113_195100	19:51	19:53	
<b>0113B</b>					
1	X11	160114_001641	:16	:21	
2	128	160114_002559	:25	:30	
3	127	160114_003634	:36	:38	
4	X10	160114_004341	:43	:47	
5	144	160114_005309	:53	:56	
6	143	160114_010045	1:00	1:03	
7	142	160114_010826	1:08	1:11	
8	135	160114_011551	1:15	1:18	
9	134	160114_012517	1:25	1:30	
10	133	160114_013441	1:34	1:39	
11	132	160114_014350	1:43	1:48	
12	131	160114_015254	1:52	1:57	
13	130	160114_020212	2:02	2:07	
14	129	160114_021131	2:11	2:16	
15	X14	160114_023157	2:31	2:33	
16	166	160114_023834	2:38	2:44	
17	165	160114_024833	2:48	2:54	
18	164	160114_025755	2:57	3:03	
19	X15	160114_030832	3:08	3:09	
<b>0114A</b>					
1	X07	160114_165537	16:55	16:57	
2	106	160114_170254	17:02	17:11	
3	107	160114_171601	17:16	17:24	
4	108	160114_172922	17:29	17:38	
5	109	160114_174319	17:43	17:52	
6	110	160114_175732	17:57	18:07	
7	111	160114_181129	18:11	18:21	
8	112	160114_182529	18:25	18:33	
9	X09	160114_183905	18:39	18:41	
10	89	160114_184559	18:45	18:51	

## SRWMD North Central, FL

11	88	160114_185549	18:55	19:00	
12	87	160114_190506	19:05	19:09	
13	86	160114_191415	19:14	19:18	
14	X08	160114_192245	19:22	19:29	

## Appendix B. Vertical Accuracy Calculations



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## Project Information

Prepared By: Kenneth L. Coffey  
Project Name: Suwannee River FL 2015  
Sensor Info: ALS80 SN#8235  
Required Nominal Pulse Spacing: 2.297  
Vendor Name: Digital Aerial Solutions .LLC  
Units: US Survey Feet  
Percent of Extent Tolerance: Extents Not Checked  
Date of Aquisition: Start: 12/10/2015 Finish: 1/14/2016

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## Metadata Information

### Tile Index:

Path: Z:\Accuracy\_Reports\LiDAR\_Suwannee\_River\Index\Final\Updated\_Clip\_330ft\_Extent\_SRWMD\_2016\_L

Number of Polys: 0

### Intensity:

Tile Index Attribute: Not Specified

Path to Data: Not Specified

### DEM:

Tile Index Attribute: Tile\_Name

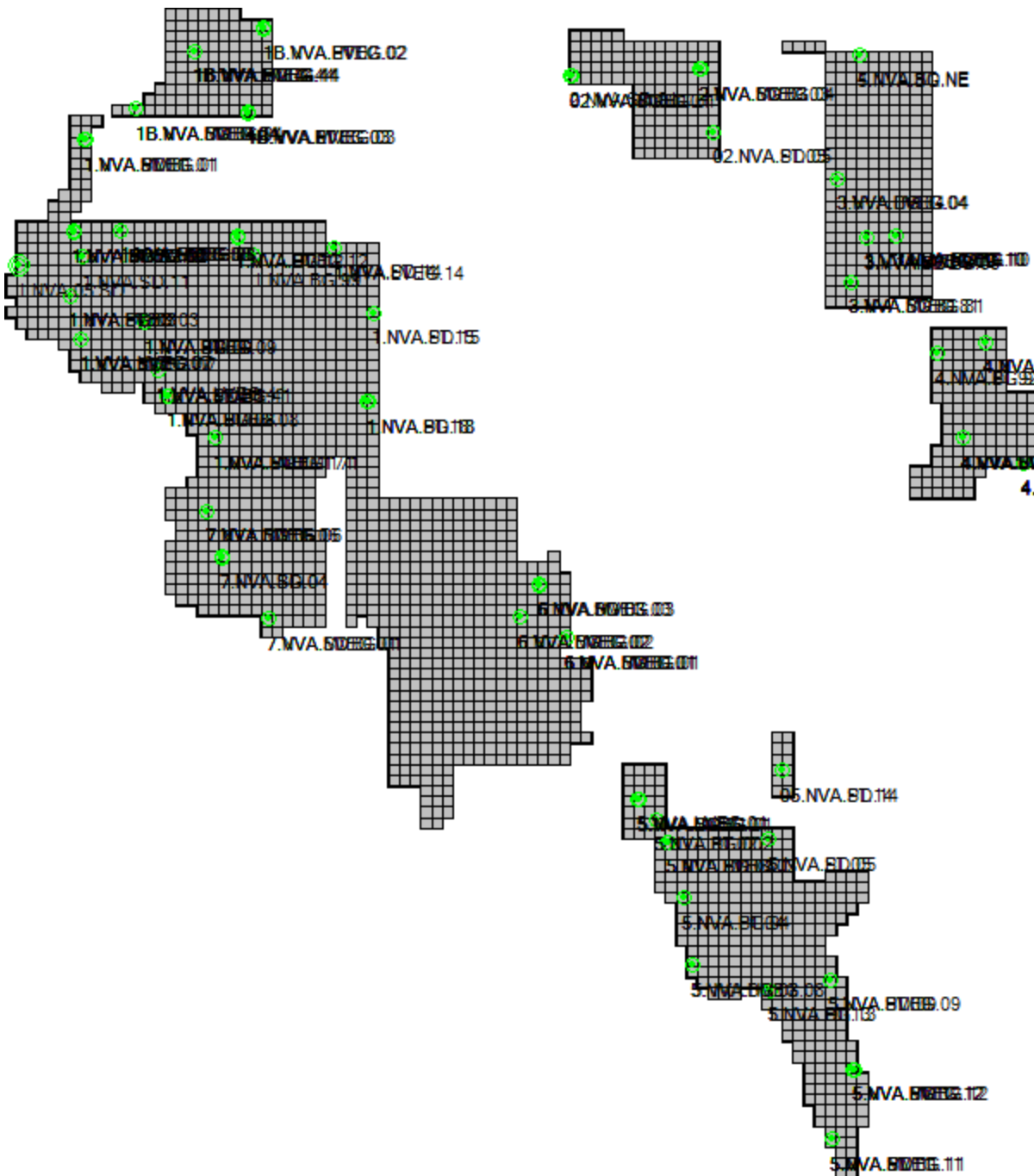
Path to Data: Not Specified

### LAS:

Tile Index Attribute: Tile\_Name

Path to Data: Z:\Accuracy\_Reports\LiDAR\_Suwannee\_River\LAS

## Tiled-Data Area



## LiDAR Accuracy Assessment Summary

LC Type	# of Points	NVA		
LAS				
NVA	95	0.432		
Total	95			

Units: US Survey Feet

## Coordinates and Offsets of Analyzed Locations

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
1)	<input checked="" type="checkbox"/>	1.NVA.05.SD					
		2185921.395	484617.887	52.185	NaN	51.668	
				NVA	NaN	-0.517	
2)	<input checked="" type="checkbox"/>	1.NVA.BG.02					
		2211577.995	500635.245	77.815	NaN	77.684	
				NVA	NaN	-0.131	
3)	<input checked="" type="checkbox"/>	1.NVA.BG.03					
		2210200.243	470427.39	55.191	NaN	54.969	
				NVA	NaN	-0.222	
4)	<input checked="" type="checkbox"/>	1.NVA.BG.08					
		2256057.306	423374.556	48.94	NaN	48.828	
				NVA	NaN	-0.112	
5)	<input checked="" type="checkbox"/>	1.NVA.BG.09					
		2245404.096	457764.584	82.135	NaN	82.117	
				NVA	NaN	-0.018	
6)	<input checked="" type="checkbox"/>	1.NVA.BG.12					
		2288854.795	498044.265	115.747	NaN	115.929	
				NVA	NaN	0.182	
7)	<input checked="" type="checkbox"/>	1.NVA.BG.18					
		2350152.786	420651.083	83.808	NaN	84.038	
				NVA	NaN	0.23	



Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
8)	<input checked="" type="checkbox"/>	1.NVA.BG.99					
		2296203.871	489163.595	100.672	NaN	100.81	
				NVA	NaN	0.138	
9)	<input checked="" type="checkbox"/>	1.NVA.BG.171					
		2278149.095	403325.42	61.768	NaN	61.778	
				NVA	NaN	0.01	
10)	<input checked="" type="checkbox"/>	1.NVA.D.88					
		2233891.241	501270.827	89.095	NaN	89.746	
				NVA	NaN	0.651	
11)	<input checked="" type="checkbox"/>	1.NVA.PT.01					
		2217302.591	543402.395	83.286	NaN	83.823	
				NVA	NaN	0.537	
12)	<input checked="" type="checkbox"/>	1.NVA.PT.02					
		2211645.334	500588.73	77.348	NaN	77.08	
				NVA	NaN	-0.268	
13)	<input checked="" type="checkbox"/>	1.NVA.PT.03					
		2210154.502	470407.47	57.177	NaN	56.656	
				NVA	NaN	-0.521	
14)	<input checked="" type="checkbox"/>	1.NVA.PT.08					
		2256081.557	423420.899	49.779	NaN	49.463	
				NVA	NaN	-0.316	

Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
15)	1.NVA.PT.09					
	2245388.116	457653.981	82.237	NaN	82.234	
			NVA	NaN	-0.003	
16)	1.NVA.PT.12					
	2288736.37	497993.827	113.266	NaN	113.477	
			NVA	NaN	0.211	
17)	1.NVA.PT.14					
	2334415.557	492790.646	96.321	NaN	96.548	
			NVA	NaN	0.227	
18)	1.NVA.PT.15					
	2352589.66	462085.524	81.347	NaN	81.902	
			NVA	NaN	0.555	
19)	1.NVA.PT.18					
	2350064.472	420678.017	82.46	NaN	82.549	
			NVA	NaN	0.089	
20)	1.NVA.PT.41					
	2251453.528	435268.646	61.585	NaN	61.107	
			NVA	NaN	-0.478	
21)	1.NVA.PT.88					
	2234031.101	501135.785	89.54	NaN	89.652	
			NVA	NaN	0.112	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID						
		Survey X	Survey Y	Z1	Z DEM	Z LAS	
				LC Type	ΔZ DEM	ΔZ LAS	
22)	<input checked="" type="checkbox"/>	1.NVA.PT.171					
		2278170.488	403333.072	62.34	NaN	62.227	
				NVA	NaN	-0.113	
23)	<input checked="" type="checkbox"/>	1.NVA.SD.01					
		2217205.32	543420.647	82.968	NaN	83.534	
				NVA	NaN	0.566	
24)	<input checked="" type="checkbox"/>	1.NVA.SD.02					
		2211652.73	500526.549	76.747	NaN	76.84	
				NVA	NaN	0.093	
25)	<input checked="" type="checkbox"/>	1.NVA.SD.03					
		2210107.719	470471.711	52.343	NaN	52.068	
				NVA	NaN	-0.275	
26)	<input checked="" type="checkbox"/>	1.NVA.SD.07					
		2215273.874	449828.659	43.582	NaN	43.684	
				NVA	NaN	0.102	
27)	<input checked="" type="checkbox"/>	1.NVA.SD.08					
		2255968.538	423343.035	49.426	NaN	49.331	
				NVA	NaN	-0.095	
28)	<input checked="" type="checkbox"/>	1.NVA.SD.09					
		2245404.638	457680.468	81.998	NaN	81.886	
				NVA	NaN	-0.112	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
29)	<input checked="" type="checkbox"/>	1.NVA.SD.11					
		2216394.94	488333.961	78.142	NaN	77.956	
				NVA	NaN	-0.186	
30)	<input checked="" type="checkbox"/>	1.NVA.SD.14					
		2334308.624	492786.256	95.987	NaN	96.203	
				NVA	NaN	0.216	
31)	<input checked="" type="checkbox"/>	1.NVA.SD.15					
		2352563.355	462052.76	80.922	NaN	81.42	
				NVA	NaN	0.498	
32)	<input checked="" type="checkbox"/>	1.NVA.SD.18					
		2349985.413	420671.143	82.101	NaN	81.952	
				NVA	NaN	-0.149	
33)	<input checked="" type="checkbox"/>	1.NVA.SD.41					
		2251416.094	435270.367	60.549	NaN	60.143	
				NVA	NaN	-0.406	
34)	<input checked="" type="checkbox"/>	1.VVA.HVEG.01					
		2217173.523	543421.373	82.912	NaN	96.821	
				VVA	NaN	13.909	
35)	<input checked="" type="checkbox"/>	1.VVA.HVEG.02					
		2211678.561	500487.498	76.233	NaN	119.159	
				VVA	NaN	42.926	

Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
36)	<input checked="" type="checkbox"/> 1.VVA.HVEG.07					
	2215330.921	449991.107	43.236	NaN	43.462	
			VVA	NaN	0.226	
37)	<input checked="" type="checkbox"/> 1.VVA.HVEG.08					
	2256087.859	423338.584	49.948	NaN	49.829	
			VVA	NaN	-0.119	
38)	<input checked="" type="checkbox"/> 1.VVA.HVEG.09					
	2245431.201	457705.072	82.497	NaN	89.197	
			VVA	NaN	6.7	
39)	<input checked="" type="checkbox"/> 1.VVA.HVEG.12					
	2288832.521	497851.746	112.913	NaN	113.114	
			VVA	NaN	0.201	
40)	<input checked="" type="checkbox"/> 1.VVA.HVEG.88					
	2234182.87	501087.091	89.071	NaN	90.156	
			VVA	NaN	1.085	
41)	<input checked="" type="checkbox"/> 1.VVA.LVEG.03					
	2210194.258	470469.11	53.215	NaN	55.322	
			VVA	NaN	2.107	
42)	<input checked="" type="checkbox"/> 1.VVA.LVEG.07					
	2215294.076	449938.269	42.802	NaN	42.754	
			VVA	NaN	-0.048	

Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
43)	<input checked="" type="checkbox"/> 1.VVA.LVEG.14					
	2334277.733	492761.181	94.89	NaN	95.471	
			VVA	NaN	0.581	
44)	<input checked="" type="checkbox"/> 1.VVA.LVEG.41					
	2251313.67	435313.781	58.056	NaN	58.359	
			VVA	NaN	0.303	
45)	<input checked="" type="checkbox"/> 1.VVA.LVEG.88					
	2234105.862	501108.747	88.631	NaN	89.914	
			VVA	NaN	1.283	
46)	<input checked="" type="checkbox"/> 1.VVA.LVEG.171					
	2278104.831	403302.263	61.349	NaN	61.583	
			VVA	NaN	0.234	
47)	<input checked="" type="checkbox"/> 1.VVA.MVEG.01					
	2217137.46	543391.696	83.105	NaN	83.479	
			VVA	NaN	0.374	
48)	<input checked="" type="checkbox"/> 1.VVA.MVEG.02					
	2211694.978	500455.112	74.007	NaN	81.032	
			VVA	NaN	7.025	
49)	<input checked="" type="checkbox"/> 1.VVA.MVEG.07					
	2215252.452	449827.105	43.757	NaN	44.381	
			VVA	NaN	0.624	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
50)	<input checked="" type="checkbox"/>	1.VVA.MVEG.41					
		2251415.273	435256.632	59.389	NaN	62.47	
				VVA	NaN	3.081	
51)	<input checked="" type="checkbox"/>	1.VVA.MVEG.88					
		2234081.475	501115.691	88.684	NaN	89.719	
				VVA	NaN	1.035	
52)	<input checked="" type="checkbox"/>	1.VVA.MVEG.171					
		2278128.707	403289.538	61.311	NaN	61.543	
				VVA	NaN	0.232	
53)	<input checked="" type="checkbox"/>	1B.NVA.BG.04					
		2241313.106	558126.7	105.646	NaN	105.671	
				NVA	NaN	0.025	
54)	<input checked="" type="checkbox"/>	1B.NVA.BG.44					
		2268832.194	585318.439	151.804	NaN	151.904	
				NVA	NaN	0.1	
55)	<input checked="" type="checkbox"/>	1B.NVA.PT.02					
		2301244.618	595909.305	132.8	NaN	132.485	
				NVA	NaN	-0.315	
56)	<input checked="" type="checkbox"/>	1B.NVA.PT.03					
		2293722.215	556311.873	102.917	NaN	103.132	
				NVA	NaN	0.215	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
57)	<input checked="" type="checkbox"/>	1B.NVA.PT.04					
		2268838.684	585271.857	150.465	NaN	150.508	
				NVA	NaN	0.043	
58)	<input checked="" type="checkbox"/>	1B.NVA.SD.04					
		2241294.097	558150.392	105.344	NaN	105.343	
				NVA	NaN	-0.001	
59)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.02					
		2301306.992	595986.077	126.903	NaN	126.539	
				VVA	NaN	-0.364	
60)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.03					
		2293602.043	556485.157	98.229	NaN	98.402	
				VVA	NaN	0.173	
61)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.04					
		2241313.008	558047.435	103.294	NaN	103.616	
				VVA	NaN	0.322	
62)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.44					
		2268906.046	585297.813	153.43	NaN	153.792	
				VVA	NaN	0.362	
63)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.02					
		2301317.602	596139.246	123.02	NaN	122.809	
				VVA	NaN	-0.211	



Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
64)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.03					
		2293765.138	556364.343	99.908	NaN	100.474	
				VVA	NaN	0.566	
65)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.04					
		2241304.651	558170.14	105.246	NaN	106.243	
				VVA	NaN	0.997	
66)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.44					
		2268637.54	585392.037	146.718	NaN	147.608	
				VVA	NaN	0.89	
67)	<input checked="" type="checkbox"/>	1B.VVA.MVEG.03					
		2293795.771	556344.47	100.868	NaN	101.19	
				VVA	NaN	0.322	
68)	<input checked="" type="checkbox"/>	1B.VVA.MVEG.04					
		2241291.202	558092.365	104.414	NaN	104.781	
				VVA	NaN	0.367	
69)	<input checked="" type="checkbox"/>	1B.VVA.MVEG.44					
		2268430.222	585371.917	144.302	NaN	149.794	
				VVA	NaN	5.492	
70)	<input checked="" type="checkbox"/>	02.NVA.BG.01					
		2445639.461	573646.493	108.791	NaN	108.871	
				NVA	NaN	0.08	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
71)	<input checked="" type="checkbox"/>	2.NVA.BG.03					
		2506403.768	576682.198	129.039	NaN	129.034	
				NVA	NaN	-0.005	
72)	<input checked="" type="checkbox"/>	02.NVA.PT.05					
		2512631.167	547373.596	127.605	NaN	127.332	
				NVA	NaN	-0.273	
73)	<input checked="" type="checkbox"/>	2.NVA.SD.01					
		2445436.534	573774.004	103.994	NaN	103.882	
				NVA	NaN	-0.112	
74)	<input checked="" type="checkbox"/>	2.NVA.SD.03					
		2506295.76	576637.219	128.524	NaN	128.662	
				NVA	NaN	0.138	
75)	<input checked="" type="checkbox"/>	02.NVA.SD.05					
		2512581.382	547254.151	127.085	NaN	127.24	
				NVA	NaN	0.155	
76)	<input checked="" type="checkbox"/>	02.VVA.LVEG.01					
		2445428.528	573680.135	104.691	NaN	104.614	
				VVA	NaN	-0.077	
77)	<input checked="" type="checkbox"/>	2.VVA.LVEG.03					
		2506399.499	576648.71	128.549	NaN	128.579	
				VVA	NaN	0.03	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID						
		Survey X	Survey Y	Z1	Z DEM	Z LAS	
				LC Type	ΔZ DEM	ΔZ LAS	
78)	<input checked="" type="checkbox"/>	02.VVA.MVEG.01					
		2445477.089	573669.843	105.777	NaN	108.22	
				VVA	NaN	2.443	
79)	<input checked="" type="checkbox"/>	2.VVA.MVEG.04					
		2506410.95	576648.106	128.526	NaN	132.695	
				VVA	NaN	4.169	
80)	<input checked="" type="checkbox"/>	3.NVA.BG.04					
		2570751.217	525313.591	126.88	NaN	127.057	
				NVA	NaN	0.177	
81)	<input checked="" type="checkbox"/>	3.NVA.BG.81					
		2577085.58	476738.937	140.026	NaN	140.25	
				NVA	NaN	0.224	
82)	<input checked="" type="checkbox"/>	3.NVA.BG10					
		2597865.44	498524.071	131.658	NaN	131.616	
				NVA	NaN	-0.042	
83)	<input checked="" type="checkbox"/>	3.NVA.SD.09					
		2584325.275	497597.366	121.51	NaN	121.639	
				NVA	NaN	0.129	
84)	<input checked="" type="checkbox"/>	3.NVA.SD.10					
		2597876.441	498506.014	131.699	NaN	131.87	
				NVA	NaN	0.171	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
85)	<input checked="" type="checkbox"/>	3.NVA.SD.81					
		2577051.667	476787.815	140.817	NaN	140.962	
				NVA	NaN	0.145	
86)	<input checked="" type="checkbox"/>	3.VVA.HVEG.04					
		2570918.516	525238.5	122.817	NaN	123.142	
				VVA	NaN	0.325	
87)	<input checked="" type="checkbox"/>	3.VVA.HVEG.09					
		2584260.803	497650.225	121.127	NaN	137.6	
				VVA	NaN	16.473	
88)	<input checked="" type="checkbox"/>	3.VVA.HVEG.10					
		2597846.9	498547.781	130.514	NaN	130.43	
				VVA	NaN	-0.084	
89)	<input checked="" type="checkbox"/>	3.VVA.LVEG.04					
		2570918.696	525268.98	123.463	NaN	123.89	
				VVA	NaN	0.427	
90)	<input checked="" type="checkbox"/>	3.VVA.LVEG.09					
		2584279.975	497634.655	120.927	NaN	121.823	
				VVA	NaN	0.896	
91)	<input checked="" type="checkbox"/>	3.VVA.LVEG.10					
		2597847.62	498517.862	131.695	NaN	131.74	
				VVA	NaN	0.045	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
92)	<input checked="" type="checkbox"/>	3.VVA.LVEG.81					
		2577054.421	476713.472	140.773	NaN	140.992	
				VVA	NaN	0.219	
93)	<input checked="" type="checkbox"/>	3.VVA.MVEG.09					
		2584369.435	497571.439	121.251	NaN	124.911	
				VVA	NaN	3.66	
94)	<input checked="" type="checkbox"/>	3.VVA.MVEG.10					
		2597832.59	498545.229	130.333	NaN	131.569	
				VVA	NaN	1.236	
95)	<input checked="" type="checkbox"/>	3.VVA.MVEG.81					
		2577100.922	476721.527	139.856	NaN	140.494	
				VVA	NaN	0.638	
96)	<input checked="" type="checkbox"/>	4.NVA.BG.02					
		2640231.039	448307.202	166.316	NaN	166.307	
				NVA	NaN	-0.009	
97)	<input checked="" type="checkbox"/>	4.NVA.BG.06					
		2629786.803	403537.022	153.106	NaN	153.005	
				NVA	NaN	-0.101	
98)	<input checked="" type="checkbox"/>	4.NVA.BG.92					
		2617654.023	443075.574	166.463	NaN	166.413	
				NVA	NaN	-0.05	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID						
		Survey X	Survey Y	Z1	Z DEM	Z LAS	
				LC Type	ΔZ DEM	ΔZ LAS	
99)	<input checked="" type="checkbox"/>	4.NVA.BG.9798					
		2657945.343	391608.572	144.511	NaN	144.523	
				NVA	NaN	0.012	
100)	<input checked="" type="checkbox"/>	4.NVA.PT.02					
		2640235.925	448388.345	167.041	NaN	167.104	
				NVA	NaN	0.063	
101)	<input checked="" type="checkbox"/>	4.NVA.PT.92					
		2617640.178	443106.052	166.643	NaN	166.725	
				NVA	NaN	0.082	
102)	<input checked="" type="checkbox"/>	4.NVA.PT.97					
		2657850.906	391506.717	144.669	NaN	144.608	
				NVA	NaN	-0.061	
103)	<input checked="" type="checkbox"/>	4.NVA.SD.02					
		2640185.93	448285.596	166.875	NaN	166.792	
				NVA	NaN	-0.083	
104)	<input checked="" type="checkbox"/>	4.NVA.SD.06					
		2629701.195	403552.535	154.189	NaN	154.222	
				NVA	NaN	0.033	
105)	<input checked="" type="checkbox"/>	4.NVA.SD.97					
		2657873.701	391583.786	144.467	NaN	144.355	
				NVA	NaN	-0.112	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
106)	<input checked="" type="checkbox"/>	4.NVA.SD.NE					
		2581041.856	583498.509	124.419	NaN	124.376	
				NVA	NaN	-0.043	
107)	<input checked="" type="checkbox"/>	4.VVA.HVEG.06					
		2629747.8	403529.33	153.156	NaN	153.38	
				VVA	NaN	0.224	
108)	<input checked="" type="checkbox"/>	4.VVA.HVEG.97					
		2657966.022	391601.021	144.67	NaN	144.657	
				VVA	NaN	-0.013	
109)	<input checked="" type="checkbox"/>	4.VVA.LVEG.06					
		2629798.592	403566.904	152.426	NaN	152.716	
				VVA	NaN	0.29	
110)	<input checked="" type="checkbox"/>	4.VVA.LVEG.97					
		2657916.31	391530.774	145.708	NaN	145.922	
				VVA	NaN	0.214	
111)	<input checked="" type="checkbox"/>	4.VVA.MVEG.02					
		2640187.547	448399.239	167.07	NaN	173.76	
				VVA	NaN	6.69	
112)	<input checked="" type="checkbox"/>	4.VVA.MVEG.06					
		2629820.471	403511.728	152.849	NaN	155.205	
				VVA	NaN	2.356	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
113)	<input checked="" type="checkbox"/>	4.VVA.MVEG.97					
		2657902.304	391518.207	146.263	NaN	146.231	
				VVA	NaN	-0.032	
114)	<input checked="" type="checkbox"/>	5.NVA.BG.002					
		2485626.968	224300.484	45.035	NaN	44.947	
				NVA	NaN	-0.088	
115)	<input checked="" type="checkbox"/>	5.NVA.BG.02					
		2477342.648	233563.292	40.701	NaN	40.612	
				NVA	NaN	-0.089	
116)	<input checked="" type="checkbox"/>	5.NVA.BG.03					
		2490946.724	213576	47.224	NaN	47.243	
				NVA	NaN	0.019	
117)	<input checked="" type="checkbox"/>	5.NVA.BG.04					
		2498406.816	187120.919	44.212	NaN	43.808	
				NVA	NaN	-0.404	
118)	<input checked="" type="checkbox"/>	5.NVA.BG.08					
		2502654.571	155680.396	34.308	NaN	34.246	
				NVA	NaN	-0.062	
119)	<input checked="" type="checkbox"/>	5.NVA.BG.12					
		2578179.592	106750.708	73.936	NaN	74.196	
				NVA	NaN	0.26	



Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
120)	<input checked="" type="checkbox"/>	5.NVA.BG.13					
		2538889.55	143839.188	40.614	NaN	40.857	
				NVA	NaN	0.243	
121)	<input checked="" type="checkbox"/>	5.NVA.BG.NE					
		2581045.766	583436.535	124.185	NaN	124.156	
				NVA	NaN	-0.029	
122)	<input checked="" type="checkbox"/>	5.NVA.PT.02					
		2485612.806	224220.374	45.116	NaN	45.101	
				NVA	NaN	-0.015	
123)	<input checked="" type="checkbox"/>	5.NVA.PT.03					
		2490919.658	213486.34	48.54	NaN	48.456	
				NVA	NaN	-0.084	
124)	<input checked="" type="checkbox"/>	5.NVA.PT.04					
		2498490.093	187175.707	46.89	NaN	47.163	
				NVA	NaN	0.273	
125)	<input checked="" type="checkbox"/>	5.NVA.PT.05					
		2538538.818	214748.472	69.771	NaN	69.816	
				NVA	NaN	0.045	
126)	<input checked="" type="checkbox"/>	5.NVA.PT.09					
		2567371.198	148776.371	74.064	NaN	73.982	
				NVA	NaN	-0.082	

Coordinates and Offsets of Analyzed Locations (Continued)

		ID				
		Survey X	Survey Y	Z1	Z DEM	Z LAS
				LC Type	ΔZ DEM	ΔZ LAS
127)	<input checked="" type="checkbox"/>	5.NVA.PT.11				
		2568032.582	73932.154	44.547	NaN	44.657
				NVA	NaN	0.11
128)	<input checked="" type="checkbox"/>	5.NVA.PT.12				
		2578408.61	106795.847	71.559	NaN	71.657
				NVA	NaN	0.098
129)	<input checked="" type="checkbox"/>	5.NVA.PT.13				
		2538918.67	143833.228	41.219	NaN	41.336
				NVA	NaN	0.117
130)	<input checked="" type="checkbox"/>	05.NVA.PT.14				
		2544558.966	247220.495	83.825	NaN	83.701
				NVA	NaN	-0.124
131)	<input checked="" type="checkbox"/>	5.NVA.SD.01				
		2477601.882	233587.836	37.978	NaN	38.067
				NVA	NaN	0.089
132)	<input checked="" type="checkbox"/>	5.NVA.SD.03				
		2490896.271	213541.842	47.467	NaN	47.27
				NVA	NaN	-0.197
133)	<input checked="" type="checkbox"/>	5.NVA.SD.05				
		2538541.288	214727.013	69.548	NaN	69.626
				NVA	NaN	0.078

Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
134)	<input checked="" type="checkbox"/> 5.NVA.SD.09					
	2567363.699	148854.133	72.134	NaN	72.278	
			NVA	NaN	0.144	
135)	<input checked="" type="checkbox"/> 5.NVA.SD.11					
	2568053.693	73905.454	42.059	NaN	42.219	
			NVA	NaN	0.16	
136)	<input checked="" type="checkbox"/> 05.NVA.SD.14					
	2544617.027	247036.109	78.615	NaN	78.211	
			NVA	NaN	-0.404	
137)	<input checked="" type="checkbox"/> 5.VVA.HVEG.01					
	2477358.917	233540.716	40.647	NaN	41.614	
			VVA	NaN	0.967	
138)	<input checked="" type="checkbox"/> 5.VVA.HVEG.08					
	2502709.546	155692.276	34.629	NaN	34.431	
			VVA	NaN	-0.198	
139)	<input checked="" type="checkbox"/> 5.VVA.HVEG.09					
	2567351.849	148859.786	72.312	NaN	72.044	
			VVA	NaN	-0.268	
140)	<input checked="" type="checkbox"/> 5.VVA.HVEG.11					
	2568040.606	73880.222	42.113	NaN	42.237	
			VVA	NaN	0.124	

Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
141)	5.VVA.HVEG.12					
	2578421.272	106777.639	70.56	NaN	81.086	
			VVA	NaN	10.526	
142)	5.VVA.LVEG.01					
	2477133.512	233637.164	36.928	NaN	36.891	
			VVA	NaN	-0.037	
143)	5.VVA.LVEG.03					
	2490975.172	213608.071	47.105	NaN	47.153	
			VVA	NaN	0.048	
144)	5.VVA.LVEG.12					
	2578324.186	106687.938	71.771	NaN	72.222	
			VVA	NaN	0.451	
145)	5.VVA.MVEG.01					
	2477087.87	233605.67	36.571	NaN	36.68	
			VVA	NaN	0.109	
146)	5.VVA.MVEG.11					
	2568134.422	73981.45	41.435	NaN	46.55	
			VVA	NaN	5.115	
147)	5.VVA.MVEG.12					
	2578446.224	106840.697	69.967	NaN	70.244	
			VVA	NaN	0.277	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
148)	<input checked="" type="checkbox"/>	6.NVA.BG.01					
		2443238.294	309470.296	61.293	NaN	61.248	
				NVA	NaN	-0.045	
149)	<input checked="" type="checkbox"/>	6.NVA.BG.02					
		2421584.502	319435.855	64.828	NaN	64.892	
				NVA	NaN	0.064	
150)	<input checked="" type="checkbox"/>	6.NVA.BG.03					
		2430583.128	334482.586	65.118	NaN	65.039	
				NVA	NaN	-0.079	
151)	<input checked="" type="checkbox"/>	6.NVA.SD.01					
		2443263.857	309457.332	61.83	NaN	61.887	
				NVA	NaN	0.057	
152)	<input checked="" type="checkbox"/>	6.NVA.SD.03					
		2430512.919	334519.138	64.852	NaN	65.12	
				NVA	NaN	0.268	
153)	<input checked="" type="checkbox"/>	6.VVA.HVEG.01					
		2443299.122	309438.253	61.301	NaN	78.57	
				VVA	NaN	17.269	
154)	<input checked="" type="checkbox"/>	6.VVA.HVEG.02					
		2421584.092	319412.701	64.196	NaN	65.494	
				VVA	NaN	1.298	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
155)	<input checked="" type="checkbox"/>	6.VVA.HVEG.03					
		2430600.233	334507.26	64.211	NaN	64.791	
				VVA	NaN	0.58	
156)	<input checked="" type="checkbox"/>	6.VVA.LVEG.01					
		2443214.739	309421.531	61.208	NaN	62.113	
				VVA	NaN	0.905	
157)	<input checked="" type="checkbox"/>	6.VVA.LVEG.02					
		2421593.582	319364.904	63.787	NaN	64.365	
				VVA	NaN	0.578	
158)	<input checked="" type="checkbox"/>	6.VVA.MVEG.01					
		2443236.64	309483.218	61.896	NaN	63.951	
				VVA	NaN	2.055	
159)	<input checked="" type="checkbox"/>	6.VVA.MVEG.02					
		2421612.182	319325.929	64.626	NaN	64.95	
				VVA	NaN	0.324	
160)	<input checked="" type="checkbox"/>	6.VVA.MVEG.03					
		2430622.085	334443.088	64.061	NaN	64.701	
				VVA	NaN	0.64	
161)	<input checked="" type="checkbox"/>	7.NVA.BG.04					
		2281280.005	347384.832	47.571	NaN	47.491	
				NVA	NaN	-0.08	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
162)	<input checked="" type="checkbox"/>	7.NVA.BG.06					
		2274530.807	369016.281	50.636	NaN	50.527	
				NVA	NaN	-0.109	
163)	<input checked="" type="checkbox"/>	7.NVA.SD.01					
		2303154.002	318293.598	35.793	NaN	35.804	
				NVA	NaN	0.011	
164)	<input checked="" type="checkbox"/>	7.NVA.SD.04					
		2281327.366	347442.941	47.49	NaN	47.612	
				NVA	NaN	0.122	
165)	<input checked="" type="checkbox"/>	7.NVA.SD.06					
		2274491.49	369050.551	50.819	NaN	50.585	
				NVA	NaN	-0.234	
166)	<input checked="" type="checkbox"/>	7.VVA.HVEG.06					
		2274543.371	369066.265	49.909	NaN	49.807	
				VVA	NaN	-0.102	
167)	<input checked="" type="checkbox"/>	7.VVA.LVEG.01					
		2303185.666	318381.474	36.025	NaN	35.906	
				VVA	NaN	-0.119	
168)	<input checked="" type="checkbox"/>	7.VVA.MVEG.01					
		2303157.57	318358.445	35.716	NaN	37.364	
				VVA	NaN	1.648	

Coordinates and Offsets of Analyzed Locations (Continued)

<b>ID</b>						
		<b>Survey X</b>	<b>Survey Y</b>	<b>Z1</b>	<b>Z DEM</b>	<b>Z LAS</b>
				<b>LC Type</b>	<b>ΔZ DEM</b>	<b>ΔZ LAS</b>
169)	<input checked="" type="checkbox"/> 7.VVA.MVEG.06					
		2274568.58	369033.217	50.103	NaN	50.764
				VVA	NaN	0.661

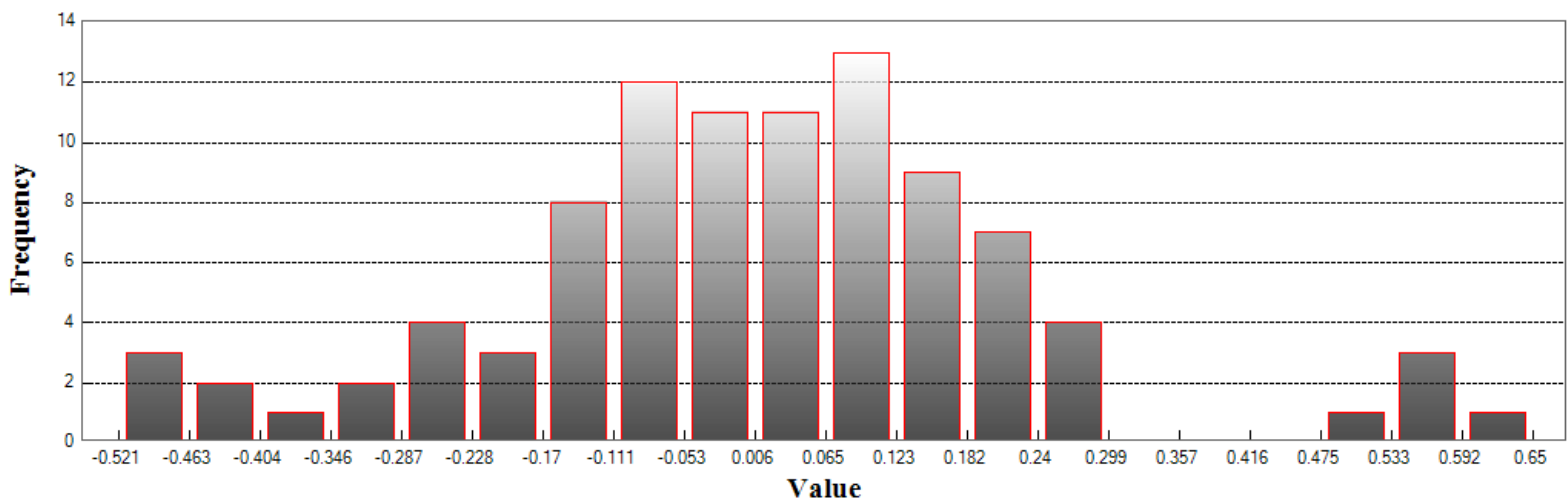


# LAS

## Fundamental Vertical Accuracy

LandCover Type: NVA  
 Minimum DZ: -0.521  
 Maximum DZ: 0.651  
 Mean DZ: 0.012  
 Mean Magnitude DZ: 0.405  
 Number Observations: 95  
 Standard Deviation DZ: 0.221  
 RMSE Z: 0.22  
 95% Confidence Level Z: 0.432  
 Units: US Survey Feet

# Histogram



Min: -0.521  
 Max: 0.651  
 Number Of Bins: 20  
 Bin Interval: 0.059



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## Project Information

Prepared By: Kenneth L. Coffey  
Project Name: Suwannee River FL 2015  
Sensor Info: ALS80 SN#8235  
Required Nominal Pulse Spacing: 2.297  
Vendor Name: Digital Aerial Solutions .LLC  
Units: US Survey Feet  
Percent of Extent Tolerance: Extents Not Checked  
Date of Aquisition: Start: 12/10/2015 Finish: 1/14/2016

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## Metadata Information

### Tile Index:

Path: Z:\Accuracy\_Reports\LiDAR\_Suwannee\_River\Index\Final\Updated\_Clip\_330ft\_Extent\_SRWMD\_2016\_L

Number of Polys: 0

### Intensity:

Tile Index Attribute: Not Specified

Path to Data: Not Specified

### DEM:

Tile Index Attribute: Tile\_Name

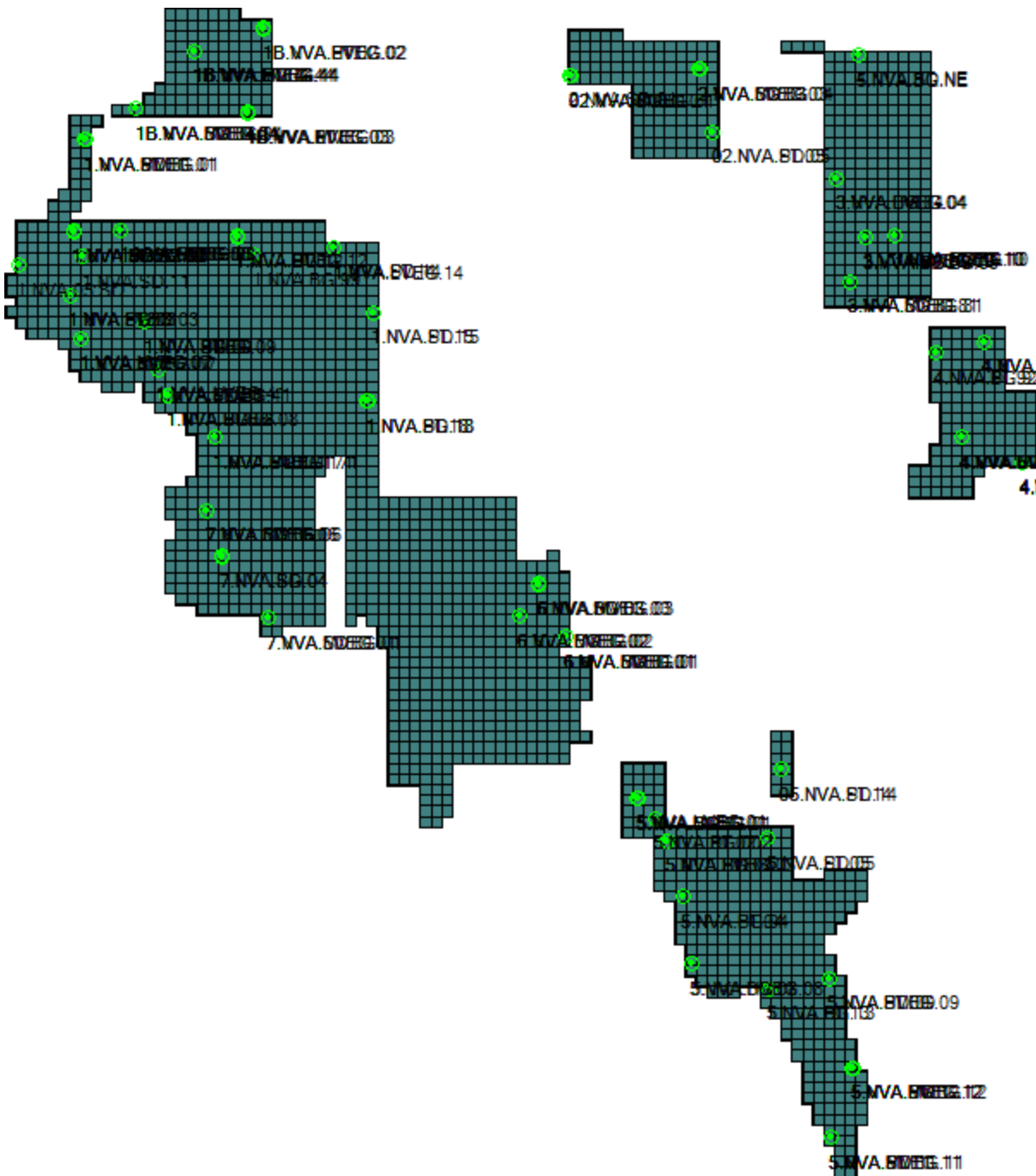
Path to Data: Z:\Accuracy\_Reports\LiDAR\_Suwannee\_River\DEM

### LAS:

Tile Index Attribute: Tile\_Name

Path to Data: Z:\Accuracy\_Reports\LiDAR\_Suwannee\_River\LAS

## Tiled-Data Area



## LiDAR Accuracy Assessment Summary

LC Type	# of Points	FVA	SVA	CVA
LAS				
ALL	169			0.737
NVA	95	0.429		
VVA	74		0.941	
Total	169			
DEM				
ALL	169			0.703
NVA	95	0.435		
VVA	74		0.932	
Total	169			

Units: US Survey Feet

## Coordinates and Offsets of Analyzed Locations

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
1)	<input checked="" type="checkbox"/>	1.NVA.05.SD					
		2185921.395	484617.887	52.185	51.725	51.668	
				NVA	-0.46	-0.517	
2)	<input checked="" type="checkbox"/>	1.NVA.BG.02					
		2211577.995	500635.245	77.815	77.773	77.701	
				NVA	-0.042	-0.114	
3)	<input checked="" type="checkbox"/>	1.NVA.BG.03					
		2210200.243	470427.39	55.191	55.034	54.969	
				NVA	-0.157	-0.222	
4)	<input checked="" type="checkbox"/>	1.NVA.BG.08					
		2256057.306	423374.556	48.94	48.853	48.861	
				NVA	-0.087	-0.079	
5)	<input checked="" type="checkbox"/>	1.NVA.BG.09					
		2245404.096	457764.584	82.135	82.074	82.117	
				NVA	-0.061	-0.018	
6)	<input checked="" type="checkbox"/>	1.NVA.BG.12					
		2288854.795	498044.265	115.747	115.899	115.929	
				NVA	0.152	0.182	
7)	<input checked="" type="checkbox"/>	1.NVA.BG.18					
		2350152.786	420651.083	83.808	84.064	84.08	
				NVA	0.256	0.272	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
8)	<input checked="" type="checkbox"/>	1.NVA.BG.99					
		2296203.871	489163.595	100.672	100.848	100.831	
				NVA	0.176	0.159	
9)	<input checked="" type="checkbox"/>	1.NVA.BG.171					
		2278149.095	403325.42	61.768	61.799	61.778	
				NVA	0.031	0.01	
10)	<input checked="" type="checkbox"/>	1.NVA.D.88					
		2233891.241	501270.827	89.095	89.729	89.746	
				NVA	0.634	0.651	
11)	<input checked="" type="checkbox"/>	1.NVA.PT.01					
		2217302.591	543402.395	83.286	83.818	83.823	
				NVA	0.532	0.537	
12)	<input checked="" type="checkbox"/>	1.NVA.PT.02					
		2211645.334	500588.73	77.348	77.07	77.1	
				NVA	-0.278	-0.248	
13)	<input checked="" type="checkbox"/>	1.NVA.PT.03					
		2210154.502	470407.47	57.177	56.758	56.697	
				NVA	-0.419	-0.48	
14)	<input checked="" type="checkbox"/>	1.NVA.PT.08					
		2256081.557	423420.899	49.779	49.436	49.463	
				NVA	-0.343	-0.316	

Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
15)	<input checked="" type="checkbox"/> 1.NVA.PT.09					
	2245388.116	457653.981	82.237	82.125	82.234	
			NVA	-0.112	-0.003	
16)	<input checked="" type="checkbox"/> 1.NVA.PT.12					
	2288736.37	497993.827	113.266	113.509	113.477	
			NVA	0.243	0.211	
17)	<input checked="" type="checkbox"/> 1.NVA.PT.14					
	2334415.557	492790.646	96.321	96.613	96.553	
			NVA	0.292	0.232	
18)	<input checked="" type="checkbox"/> 1.NVA.PT.15					
	2352589.66	462085.524	81.347	81.884	81.902	
			NVA	0.537	0.555	
19)	<input checked="" type="checkbox"/> 1.NVA.PT.18					
	2350064.472	420678.017	82.46	82.541	82.573	
			NVA	0.081	0.113	
20)	<input checked="" type="checkbox"/> 1.NVA.PT.41					
	2251453.528	435268.646	61.585	61.137	61.122	
			NVA	-0.448	-0.463	
21)	<input checked="" type="checkbox"/> 1.NVA.PT.88					
	2234031.101	501135.785	89.54	89.606	89.652	
			NVA	0.066	0.112	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
22)	<input checked="" type="checkbox"/>	1.NVA.PT.171					
		2278170.488	403333.072	62.34	62.231	62.227	
				NVA	-0.109	-0.113	
23)	<input checked="" type="checkbox"/>	1.NVA.SD.01					
		2217205.32	543420.647	82.968	83.516	83.534	
				NVA	0.548	0.566	
24)	<input checked="" type="checkbox"/>	1.NVA.SD.02					
		2211652.73	500526.549	76.747	76.851	76.84	
				NVA	0.104	0.093	
25)	<input checked="" type="checkbox"/>	1.NVA.SD.03					
		2210107.719	470471.711	52.343	52.039	52.068	
				NVA	-0.304	-0.275	
26)	<input checked="" type="checkbox"/>	1.NVA.SD.07					
		2215273.874	449828.659	43.582	43.76	43.684	
				NVA	0.178	0.102	
27)	<input checked="" type="checkbox"/>	1.NVA.SD.08					
		2255968.538	423343.035	49.426	49.374	49.331	
				NVA	-0.052	-0.095	
28)	<input checked="" type="checkbox"/>	1.NVA.SD.09					
		2245404.638	457680.468	81.998	81.968	81.912	
				NVA	-0.03	-0.086	



Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
29)	<input checked="" type="checkbox"/> 1.NVA.SD.11					
	2216394.94	488333.961	78.142	77.927	77.956	
			NVA	-0.215	-0.186	
30)	<input checked="" type="checkbox"/> 1.NVA.SD.14					
	2334308.624	492786.256	95.987	96.278	96.203	
			NVA	0.291	0.216	
31)	<input checked="" type="checkbox"/> 1.NVA.SD.15					
	2352563.355	462052.76	80.922	81.399	81.42	
			NVA	0.477	0.498	
32)	<input checked="" type="checkbox"/> 1.NVA.SD.18					
	2349985.413	420671.143	82.101	81.967	81.952	
			NVA	-0.134	-0.149	
33)	<input checked="" type="checkbox"/> 1.NVA.SD.41					
	2251416.094	435270.367	60.549	60.174	60.143	
			NVA	-0.375	-0.406	
34)	<input checked="" type="checkbox"/> 1.VVA.HVEG.01					
	2217173.523	543421.373	82.912	83.597	83.575	
			VVA	0.685	0.663	
35)	<input checked="" type="checkbox"/> 1.VVA.HVEG.02					
	2211678.561	500487.498	76.233	76.19	76.155	
			VVA	-0.043	-0.078	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
36)	<input checked="" type="checkbox"/>	1.VVA.HVEG.07					
		2215330.921	449991.107	43.236	43.467	43.437	
				VVA	0.231	0.201	
37)	<input checked="" type="checkbox"/>	1.VVA.HVEG.08					
		2256087.859	423338.584	49.948	49.814	49.829	
				VVA	-0.134	-0.119	
38)	<input checked="" type="checkbox"/>	1.VVA.HVEG.09					
		2245431.201	457705.072	82.497	82.148	82.163	
				VVA	-0.349	-0.334	
39)	<input checked="" type="checkbox"/>	1.VVA.HVEG.12					
		2288832.521	497851.746	112.913	113.1	113.083	
				VVA	0.187	0.17	
40)	<input checked="" type="checkbox"/>	1.VVA.HVEG.88					
		2234182.87	501087.091	89.071	89.91	89.885	
				VVA	0.839	0.814	
41)	<input checked="" type="checkbox"/>	1.VVA.LVEG.03					
		2210194.258	470469.11	53.215	53.414	53.525	
				VVA	0.199	0.31	
42)	<input checked="" type="checkbox"/>	1.VVA.LVEG.07					
		2215294.076	449938.269	42.802	42.784	42.838	
				VVA	-0.018	0.036	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
43)	<input checked="" type="checkbox"/>	1.VVA.LVEG.14					
		2334277.733	492761.181	94.89	95.398	95.471	
				VVA	0.508	0.581	
44)	<input checked="" type="checkbox"/>	1.VVA.LVEG.41					
		2251313.67	435313.781	58.056	58.731	58.359	
				VVA	0.675	0.303	
45)	<input checked="" type="checkbox"/>	1.VVA.LVEG.88					
		2234105.862	501108.747	88.631	89.767	89.767	
				VVA	1.136	1.136	
46)	<input checked="" type="checkbox"/>	1.VVA.LVEG.171					
		2278104.831	403302.263	61.349	61.631	61.583	
				VVA	0.282	0.234	
47)	<input checked="" type="checkbox"/>	1.VVA.MVEG.01					
		2217137.46	543391.696	83.105	83.46	83.479	
				VVA	0.355	0.374	
48)	<input checked="" type="checkbox"/>	1.VVA.MVEG.02					
		2211694.978	500455.112	74.007	74.291	74.082	
				VVA	0.284	0.075	
49)	<input checked="" type="checkbox"/>	1.VVA.MVEG.07					
		2215252.452	449827.105	43.757	43.544	43.556	
				VVA	-0.213	-0.201	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
50)	<input checked="" type="checkbox"/>	1.VVA.MVEG.41					
		2251415.273	435256.632	59.389	59.725	59.535	
				VVA	0.336	0.146	
51)	<input checked="" type="checkbox"/>	1.VVA.MVEG.88					
		2234081.475	501115.691	88.684	89.306	89.444	
				VVA	0.622	0.76	
52)	<input checked="" type="checkbox"/>	1.VVA.MVEG.171					
		2278128.707	403289.538	61.311	61.625	61.588	
				VVA	0.314	0.277	
53)	<input checked="" type="checkbox"/>	1B.NVA.BG.04					
		2241313.106	558126.7	105.646	105.666	105.671	
				NVA	0.02	0.025	
54)	<input checked="" type="checkbox"/>	1B.NVA.BG.44					
		2268832.194	585318.439	151.804	151.912	151.904	
				NVA	0.108	0.1	
55)	<input checked="" type="checkbox"/>	1B.NVA.PT.02					
		2301244.618	595909.305	132.8	132.442	132.485	
				NVA	-0.358	-0.315	
56)	<input checked="" type="checkbox"/>	1B.NVA.PT.03					
		2293722.215	556311.873	102.917	103.156	103.143	
				NVA	0.239	0.226	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
57)	<input checked="" type="checkbox"/>	1B.NVA.PT.04					
		2268838.684	585271.857	150.465	150.525	150.508	
				NVA	0.06	0.043	
58)	<input checked="" type="checkbox"/>	1B.NVA.SD.04					
		2241294.097	558150.392	105.344	105.383	105.405	
				NVA	0.039	0.061	
59)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.02					
		2301306.992	595986.077	126.903	126.425	126.552	
				VVA	-0.478	-0.351	
60)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.03					
		2293602.043	556485.157	98.229	98.319	98.424	
				VVA	0.09	0.195	
61)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.04					
		2241313.008	558047.435	103.294	103.57	103.625	
				VVA	0.276	0.331	
62)	<input checked="" type="checkbox"/>	1B.VVA.HVEG.44					
		2268906.046	585297.813	153.43	153.872	153.807	
				VVA	0.442	0.377	
63)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.02					
		2301317.602	596139.246	123.02	122.834	122.817	
				VVA	-0.186	-0.203	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
64)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.03					
		2293765.138	556364.343	99.908	100.482	100.474	
				VVA	0.574	0.566	
65)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.04					
		2241304.651	558170.14	105.246	105.627	106.243	
				VVA	0.381	0.997	
66)	<input checked="" type="checkbox"/>	1B.VVA.LVEG.44					
		2268637.54	585392.037	146.718	147.741	147.704	
				VVA	1.023	0.986	
67)	<input checked="" type="checkbox"/>	1B.VVA.MVEG.03					
		2293795.771	556344.47	100.868	101.303	101.264	
				VVA	0.435	0.396	
68)	<input checked="" type="checkbox"/>	1B.VVA.MVEG.04					
		2241291.202	558092.365	104.414	104.662	104.811	
				VVA	0.248	0.397	
69)	<input checked="" type="checkbox"/>	1B.VVA.MVEG.44					
		2268430.222	585371.917	144.302	145.182	145.242	
				VVA	0.88	0.94	
70)	<input checked="" type="checkbox"/>	02.NVA.BG.01					
		2445639.461	573646.493	108.791	108.794	108.871	
				NVA	0.003	0.08	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
71)	<input checked="" type="checkbox"/>	2.NVA.BG.03					
		2506403.768	576682.198	129.039	129.038	129.034	
				NVA	-0.001	-0.005	
72)	<input checked="" type="checkbox"/>	02.NVA.PT.05					
		2512631.167	547373.596	127.605	127.361	127.332	
				NVA	-0.244	-0.273	
73)	<input checked="" type="checkbox"/>	2.NVA.SD.01					
		2445436.534	573774.004	103.994	103.916	103.882	
				NVA	-0.078	-0.112	
74)	<input checked="" type="checkbox"/>	2.NVA.SD.03					
		2506295.76	576637.219	128.524	128.652	128.662	
				NVA	0.128	0.138	
75)	<input checked="" type="checkbox"/>	02.NVA.SD.05					
		2512581.382	547254.151	127.085	127.209	127.24	
				NVA	0.124	0.155	
76)	<input checked="" type="checkbox"/>	02.VVA.LVEG.01					
		2445428.528	573680.135	104.691	104.607	104.614	
				VVA	-0.084	-0.077	
77)	<input checked="" type="checkbox"/>	2.VVA.LVEG.03					
		2506399.499	576648.71	128.549	128.564	128.579	
				VVA	0.015	0.03	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID						
		Survey X	Survey Y	Z1	Z DEM	Z LAS	
				LC Type	ΔZ DEM	ΔZ LAS	
78)	<input checked="" type="checkbox"/>	02.VVA.MVEG.01					
		2445477.089	573669.843	105.777	105.973	105.922	
				VVA	0.196	0.145	
79)	<input checked="" type="checkbox"/>	2.VVA.MVEG.04					
		2506410.95	576648.106	128.526	128.752	128.773	
				VVA	0.226	0.247	
80)	<input checked="" type="checkbox"/>	3.NVA.BG.04					
		2570751.217	525313.591	126.88	127.017	127.057	
				NVA	0.137	0.177	
81)	<input checked="" type="checkbox"/>	3.NVA.BG.81					
		2577085.58	476738.937	140.026	140.217	140.231	
				NVA	0.191	0.205	
82)	<input checked="" type="checkbox"/>	3.NVA.BG10					
		2597865.44	498524.071	131.658	131.625	131.559	
				NVA	-0.033	-0.099	
83)	<input checked="" type="checkbox"/>	3.NVA.SD.09					
		2584325.275	497597.366	121.51	121.633	121.639	
				NVA	0.123	0.129	
84)	<input checked="" type="checkbox"/>	3.NVA.SD.10					
		2597876.441	498506.014	131.699	131.724	131.869	
				NVA	0.025	0.17	



Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
85)	<input checked="" type="checkbox"/>	3.NVA.SD.81					
		2577051.667	476787.815	140.817	140.956	140.962	
				NVA	0.139	0.145	
86)	<input checked="" type="checkbox"/>	3.VVA.HVEG.04					
		2570918.516	525238.5	122.817	123.223	123.273	
				VVA	0.406	0.456	
87)	<input checked="" type="checkbox"/>	3.VVA.HVEG.09					
		2584260.803	497650.225	121.127	121.842	121.83	
				VVA	0.715	0.703	
88)	<input checked="" type="checkbox"/>	3.VVA.HVEG.10					
		2597846.9	498547.781	130.514	130.564	130.479	
				VVA	0.05	-0.035	
89)	<input checked="" type="checkbox"/>	3.VVA.LVEG.04					
		2570918.696	525268.98	123.463	123.854	123.89	
				VVA	0.391	0.427	
90)	<input checked="" type="checkbox"/>	3.VVA.LVEG.09					
		2584279.975	497634.655	120.927	122.017	121.871	
				VVA	1.09	0.944	
91)	<input checked="" type="checkbox"/>	3.VVA.LVEG.10					
		2597847.62	498517.862	131.695	131.706	131.731	
				VVA	0.011	0.036	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
92)	<input checked="" type="checkbox"/>	3.VVA.LVEG.81					
		2577054.421	476713.472	140.773	141.191	140.985	
				VVA	0.418	0.212	
93)	<input checked="" type="checkbox"/>	3.VVA.MVEG.09					
		2584369.435	497571.439	121.251	122.045	122.181	
				VVA	0.794	0.93	
94)	<input checked="" type="checkbox"/>	3.VVA.MVEG.10					
		2597832.59	498545.229	130.333	130.141	130.416	
				VVA	-0.192	0.083	
95)	<input checked="" type="checkbox"/>	3.VVA.MVEG.81					
		2577100.922	476721.527	139.856	140.866	140.438	
				VVA	1.01	0.582	
96)	<input checked="" type="checkbox"/>	4.NVA.BG.02					
		2640231.039	448307.202	166.316	166.342	166.349	
				NVA	0.026	0.033	
97)	<input checked="" type="checkbox"/>	4.NVA.BG.06					
		2629786.803	403537.022	153.106	153.096	153.072	
				NVA	-0.01	-0.034	
98)	<input checked="" type="checkbox"/>	4.NVA.BG.92					
		2617654.023	443075.574	166.463	166.44	166.376	
				NVA	-0.023	-0.087	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
99)	<input checked="" type="checkbox"/>	4.NVA.BG.9798					
		2657945.343	391608.572	144.511	144.509	144.523	
				NVA	-0.002	0.012	
100)	<input checked="" type="checkbox"/>	4.NVA.PT.02					
		2640235.925	448388.345	167.041	167.127	167.104	
				NVA	0.086	0.063	
101)	<input checked="" type="checkbox"/>	4.NVA.PT.92					
		2617640.178	443106.052	166.643	166.605	166.725	
				NVA	-0.038	0.082	
102)	<input checked="" type="checkbox"/>	4.NVA.PT.97					
		2657850.906	391506.717	144.669	144.652	144.658	
				NVA	-0.017	-0.011	
103)	<input checked="" type="checkbox"/>	4.NVA.SD.02					
		2640185.93	448285.596	166.875	166.835	166.792	
				NVA	-0.04	-0.083	
104)	<input checked="" type="checkbox"/>	4.NVA.SD.06					
		2629701.195	403552.535	154.189	154.261	154.222	
				NVA	0.072	0.033	
105)	<input checked="" type="checkbox"/>	4.NVA.SD.97					
		2657873.701	391583.786	144.467	144.366	144.355	
				NVA	-0.101	-0.112	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
106)	<input checked="" type="checkbox"/>	4.NVA.SD.NE					
		2581041.856	583498.509	124.419	124.377	124.343	
				NVA	-0.042	-0.076	
107)	<input checked="" type="checkbox"/>	4.VVA.HVEG.06					
		2629747.8	403529.33	153.156	153.441	153.38	
				VVA	0.285	0.224	
108)	<input checked="" type="checkbox"/>	4.VVA.HVEG.97					
		2657966.022	391601.021	144.67	144.639	144.657	
				VVA	-0.031	-0.013	
109)	<input checked="" type="checkbox"/>	4.VVA.LVEG.06					
		2629798.592	403566.904	152.426	152.644	152.716	
				VVA	0.218	0.29	
110)	<input checked="" type="checkbox"/>	4.VVA.LVEG.97					
		2657916.31	391530.774	145.708	146.041	145.995	
				VVA	0.333	0.287	
111)	<input checked="" type="checkbox"/>	4.VVA.MVEG.02					
		2640187.547	448399.239	167.07	167.176	167.153	
				VVA	0.106	0.083	
112)	<input checked="" type="checkbox"/>	4.VVA.MVEG.06					
		2629820.471	403511.728	152.849	152.871	152.934	
				VVA	0.022	0.085	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID						
		Survey X	Survey Y	Z1	Z DEM	Z LAS	
				LC Type	ΔZ DEM	ΔZ LAS	
113)	<input checked="" type="checkbox"/>	4.VVA.MVEG.97					
		2657902.304	391518.207	146.263	146.225	146.231	
				VVA	-0.038	-0.032	
114)	<input checked="" type="checkbox"/>	5.NVA.BG.002					
		2485626.968	224300.484	45.035	44.993	44.947	
				NVA	-0.042	-0.088	
115)	<input checked="" type="checkbox"/>	5.NVA.BG.02					
		2477342.648	233563.292	40.701	40.636	40.612	
				NVA	-0.065	-0.089	
116)	<input checked="" type="checkbox"/>	5.NVA.BG.03					
		2490946.724	213576	47.224	47.197	47.262	
				NVA	-0.027	0.038	
117)	<input checked="" type="checkbox"/>	5.NVA.BG.04					
		2498406.816	187120.919	44.212	43.854	43.868	
				NVA	-0.358	-0.344	
118)	<input checked="" type="checkbox"/>	5.NVA.BG.08					
		2502654.571	155680.396	34.308	34.139	34.261	
				NVA	-0.169	-0.047	
119)	<input checked="" type="checkbox"/>	5.NVA.BG.12					
		2578179.592	106750.708	73.936	74.302	74.196	
				NVA	0.366	0.26	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
120)	<input checked="" type="checkbox"/>	5.NVA.BG.13					
		2538889.55	143839.188	40.614	40.897	40.857	
				NVA	0.283	0.243	
121)	<input checked="" type="checkbox"/>	5.NVA.BG.NE					
		2581045.766	583436.535	124.185	124.233	124.156	
				NVA	0.048	-0.029	
122)	<input checked="" type="checkbox"/>	5.NVA.PT.02					
		2485612.806	224220.374	45.116	45.096	45.101	
				NVA	-0.02	-0.015	
123)	<input checked="" type="checkbox"/>	5.NVA.PT.03					
		2490919.658	213486.34	48.54	48.436	48.456	
				NVA	-0.104	-0.084	
124)	<input checked="" type="checkbox"/>	5.NVA.PT.04					
		2498490.093	187175.707	46.89	47.222	47.172	
				NVA	0.332	0.282	
125)	<input checked="" type="checkbox"/>	5.NVA.PT.05					
		2538538.818	214748.472	69.771	69.826	69.816	
				NVA	0.055	0.045	
126)	<input checked="" type="checkbox"/>	5.NVA.PT.09					
		2567371.198	148776.371	74.064	74.069	74.034	
				NVA	0.005	-0.03	

Coordinates and Offsets of Analyzed Locations (Continued)

ID						
	Survey X	Survey Y	Z1	Z DEM	Z LAS	
			LC Type	ΔZ DEM	ΔZ LAS	
127)	5.NVA.PT.11					
	2568032.582	73932.154	44.547	44.661	44.657	
			NVA	0.114	0.11	
128)	5.NVA.PT.12					
	2578408.61	106795.847	71.559	71.689	71.657	
			NVA	0.13	0.098	
129)	5.NVA.PT.13					
	2538918.67	143833.228	41.219	41.334	41.336	
			NVA	0.115	0.117	
130)	05.NVA.PT.14					
	2544558.966	247220.495	83.825	83.786	83.701	
			NVA	-0.039	-0.124	
131)	5.NVA.SD.01					
	2477601.882	233587.836	37.978	38.106	38.118	
			NVA	0.128	0.14	
132)	5.NVA.SD.03					
	2490896.271	213541.842	47.467	47.222	47.27	
			NVA	-0.245	-0.197	
133)	5.NVA.SD.05					
	2538541.288	214727.013	69.548	69.723	69.672	
			NVA	0.175	0.124	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
134)	<input checked="" type="checkbox"/>	5.NVA.SD.09					
		2567363.699	148854.133	72.134	72.354	72.287	
				NVA	0.22	0.153	
135)	<input checked="" type="checkbox"/>	5.NVA.SD.11					
		2568053.693	73905.454	42.059	42.399	42.219	
				NVA	0.34	0.16	
136)	<input checked="" type="checkbox"/>	05.NVA.SD.14					
		2544617.027	247036.109	78.615	78.21	78.211	
				NVA	-0.405	-0.404	
137)	<input checked="" type="checkbox"/>	5.VVA.HVEG.01					
		2477358.917	233540.716	40.647	40.36	40.356	
				VVA	-0.287	-0.291	
138)	<input checked="" type="checkbox"/>	5.VVA.HVEG.08					
		2502709.546	155692.276	34.629	34.508	34.431	
				VVA	-0.121	-0.198	
139)	<input checked="" type="checkbox"/>	5.VVA.HVEG.09					
		2567351.849	148859.786	72.312	72.078	72.044	
				VVA	-0.234	-0.268	
140)	<input checked="" type="checkbox"/>	5.VVA.HVEG.11					
		2568040.606	73880.222	42.113	42.606	42.245	
				VVA	0.493	0.132	



Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
141)	<input checked="" type="checkbox"/>	5.VVA.HVEG.12					
		2578421.272	106777.639	70.56	70.695	70.773	
				VVA	0.135	0.213	
142)	<input checked="" type="checkbox"/>	5.VVA.LVEG.01					
		2477133.512	233637.164	36.928	36.974	36.9	
				VVA	0.046	-0.028	
143)	<input checked="" type="checkbox"/>	5.VVA.LVEG.03					
		2490975.172	213608.071	47.105	47.215	47.153	
				VVA	0.11	0.048	
144)	<input checked="" type="checkbox"/>	5.VVA.LVEG.12					
		2578324.186	106687.938	71.771	72.249	72.222	
				VVA	0.478	0.451	
145)	<input checked="" type="checkbox"/>	5.VVA.MVEG.01					
		2477087.87	233605.67	36.571	36.895	36.68	
				VVA	0.324	0.109	
146)	<input checked="" type="checkbox"/>	5.VVA.MVEG.11					
		2568134.422	73981.45	41.435	41.664	41.757	
				VVA	0.229	0.322	
147)	<input checked="" type="checkbox"/>	5.VVA.MVEG.12					
		2578446.224	106840.697	69.967	70.187	70.244	
				VVA	0.22	0.277	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
148)	<input checked="" type="checkbox"/>	6.NVA.BG.01					
		2443238.294	309470.296	61.293	61.354	61.267	
				NVA	0.061	-0.026	
149)	<input checked="" type="checkbox"/>	6.NVA.BG.02					
		2421584.502	319435.855	64.828	64.949	64.902	
				NVA	0.121	0.074	
150)	<input checked="" type="checkbox"/>	6.NVA.BG.03					
		2430583.128	334482.586	65.118	65.021	65.039	
				NVA	-0.097	-0.079	
151)	<input checked="" type="checkbox"/>	6.NVA.SD.01					
		2443263.857	309457.332	61.83	61.939	61.887	
				NVA	0.109	0.057	
152)	<input checked="" type="checkbox"/>	6.NVA.SD.03					
		2430512.919	334519.138	64.852	65.129	65.12	
				NVA	0.277	0.268	
153)	<input checked="" type="checkbox"/>	6.VVA.HVEG.01					
		2443299.122	309438.253	61.301	61.448	61.557	
				VVA	0.147	0.256	
154)	<input checked="" type="checkbox"/>	6.VVA.HVEG.02					
		2421584.092	319412.701	64.196	64.608	64.666	
				VVA	0.412	0.47	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
155)	<input checked="" type="checkbox"/>	6.VVA.HVEG.03					
		2430600.233	334507.26	64.211	64.772	64.791	
				VVA	0.561	0.58	
156)	<input checked="" type="checkbox"/>	6.VVA.LVEG.01					
		2443214.739	309421.531	61.208	62.098	62.113	
				VVA	0.89	0.905	
157)	<input checked="" type="checkbox"/>	6.VVA.LVEG.02					
		2421593.582	319364.904	63.787	64.191	64.171	
				VVA	0.404	0.384	
158)	<input checked="" type="checkbox"/>	6.VVA.MVEG.01					
		2443236.64	309483.218	61.896	62.025	62.211	
				VVA	0.129	0.315	
159)	<input checked="" type="checkbox"/>	6.VVA.MVEG.02					
		2421612.182	319325.929	64.626	65.016	64.965	
				VVA	0.39	0.339	
160)	<input checked="" type="checkbox"/>	6.VVA.MVEG.03					
		2430622.085	334443.088	64.061	64.508	64.568	
				VVA	0.447	0.507	
161)	<input checked="" type="checkbox"/>	7.NVA.BG.04					
		2281280.005	347384.832	47.571	47.488	47.491	
				NVA	-0.083	-0.08	

Coordinates and Offsets of Analyzed Locations (Continued)

	ID			Z1	Z DEM	Z LAS	
		Survey X	Survey Y				
			LC Type				ΔZ DEM
162)	<input checked="" type="checkbox"/>	7.NVA.BG.06					
		2274530.807	369016.281	50.636	50.46	50.527	
				NVA	-0.176	-0.109	
163)	<input checked="" type="checkbox"/>	7.NVA.SD.01					
		2303154.002	318293.598	35.793	35.697	35.804	
				NVA	-0.096	0.011	
164)	<input checked="" type="checkbox"/>	7.NVA.SD.04					
		2281327.366	347442.941	47.49	47.617	47.612	
				NVA	0.127	0.122	
165)	<input checked="" type="checkbox"/>	7.NVA.SD.06					
		2274491.49	369050.551	50.819	50.605	50.585	
				NVA	-0.214	-0.234	
166)	<input checked="" type="checkbox"/>	7.VVA.HVEG.06					
		2274543.371	369066.265	49.909	49.885	49.868	
				VVA	-0.024	-0.041	
167)	<input checked="" type="checkbox"/>	7.VVA.LVEG.01					
		2303185.666	318381.474	36.025	35.892	35.91	
				VVA	-0.133	-0.115	
168)	<input checked="" type="checkbox"/>	7.VVA.MVEG.01					
		2303157.57	318358.445	35.716	36.022	36.092	
				VVA	0.306	0.376	

Coordinates and Offsets of Analyzed Locations (Continued)

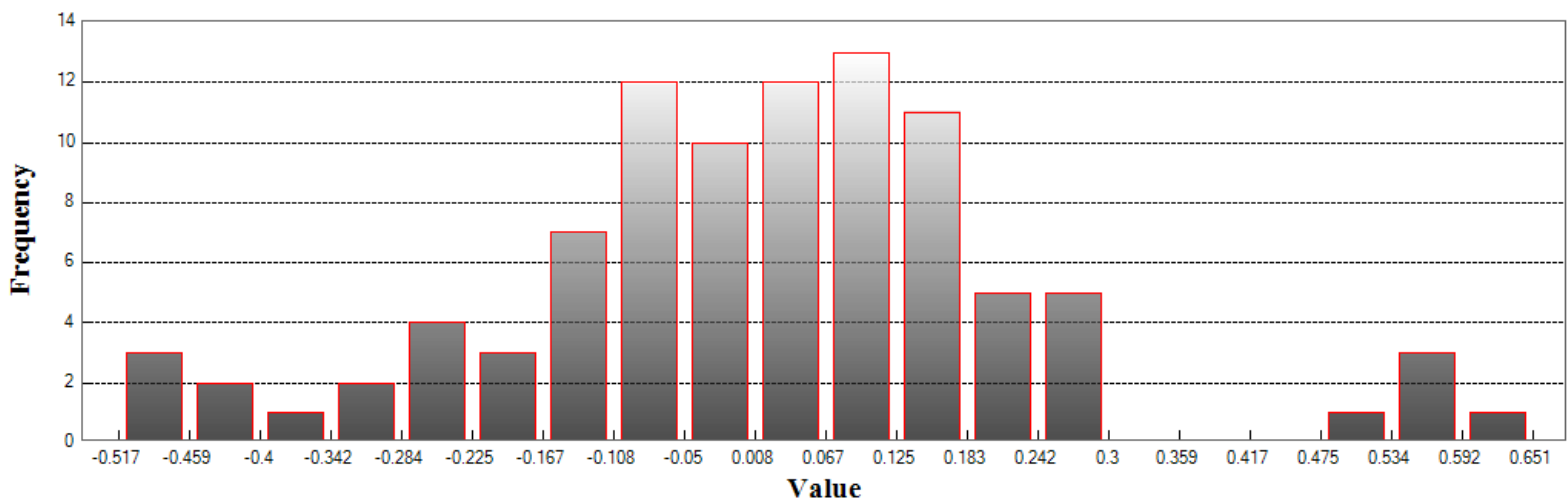
	<b>ID</b>					
		<b>Survey X</b>	<b>Survey Y</b>	<b>Z1</b>	<b>Z DEM</b>	<b>Z LAS</b>
				<b>LC Type</b>	<b>ΔZ DEM</b>	<b>ΔZ LAS</b>
169)	<input checked="" type="checkbox"/>	7.VVA.MVEG.06				
		2274568.58	369033.217	50.103	50.117	50.036
				VVA	0.014	-0.067

# LAS

## Fundamental Vertical Accuracy

LandCover Type: NVA  
 Minimum DZ: -0.517  
 Maximum DZ: 0.651  
 Mean DZ: 0.018  
 Mean Magnitude DZ: 0.406  
 Number Observations: 95  
 Standard Deviation DZ: 0.219  
 RMSE Z: 0.219  
 95% Confidence Level Z: 0.429  
 Units: US Survey Feet

# Histogram



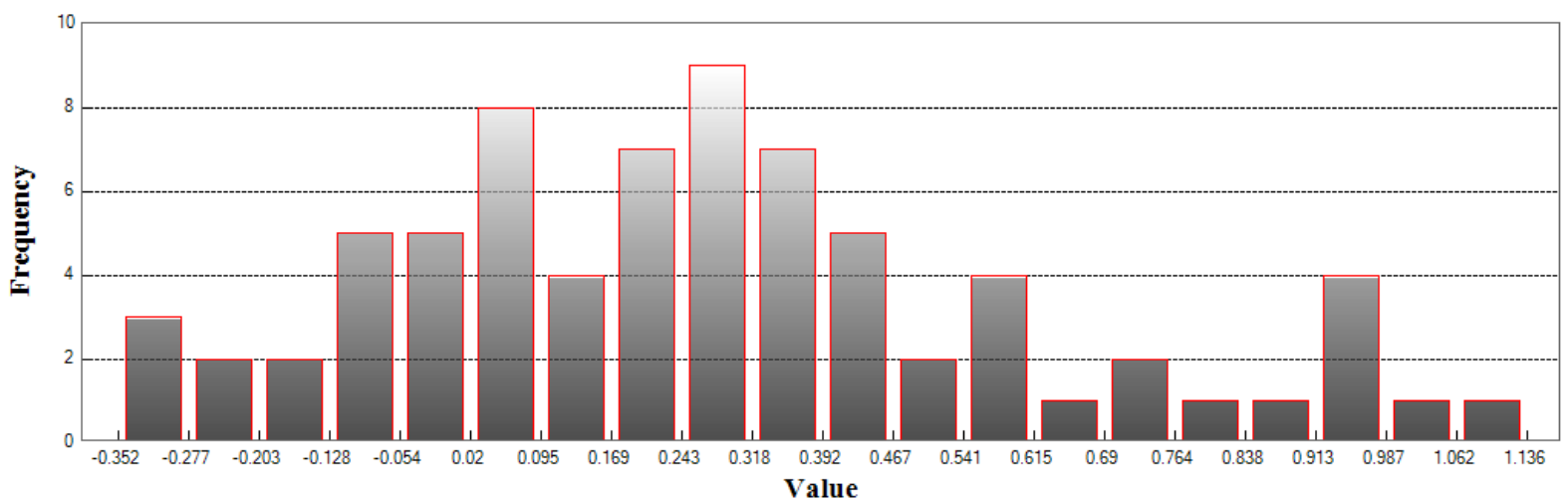
Min: -0.517  
 Max: 0.651  
 Number Of Bins: 20  
 Bin Interval: 0.058

## LAS (Continued)

### Supplemental Vertical Accuracy

LandCover Type: VVA  
 Minimum DZ: -0.351  
 Maximum DZ: 1.136  
 Mean DZ: 0.274  
 Mean Magnitude DZ: 0.583  
 Number Observations: 74  
 Standard Deviation DZ: 0.345  
 RMSE Z: 0.438  
 95th Percentile: 0.941  
 Units: US Survey Feet

## Histogram



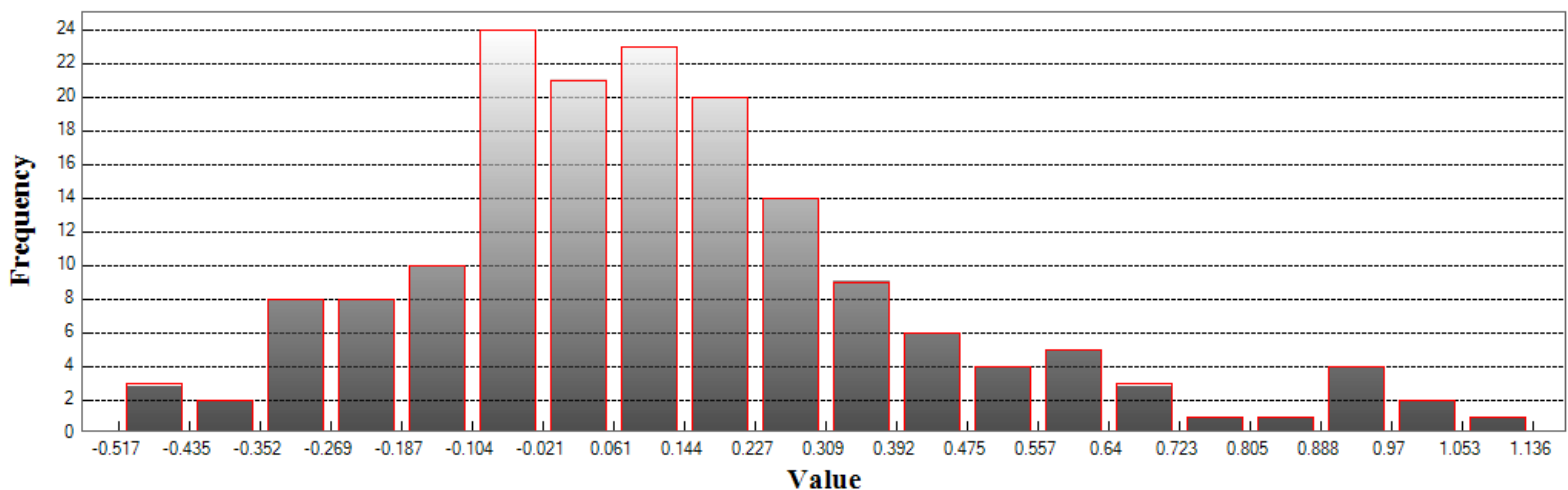
Min: -0.351  
 Max: 1.136  
 Number Of Bins: 20  
 Bin Interval: 0.074

## LAS (Continued)

### Consolidated Vertical Accuracy

LandCover Type: ALL  
 Minimum DZ: -0.517  
 Maximum DZ: 1.136  
 Mean DZ: 0.13  
 Mean Magnitude DZ: 0.491  
 Number Observations: 169  
 Standard Deviation DZ: 0.308  
 RMSE Z: 0.333  
 95th Percentile: 0.737  
 Units: US Survey Feet

## Histogram



Min: -0.517

Max: 1.136

Number Of Bins: 20

Bin Interval: 0.083

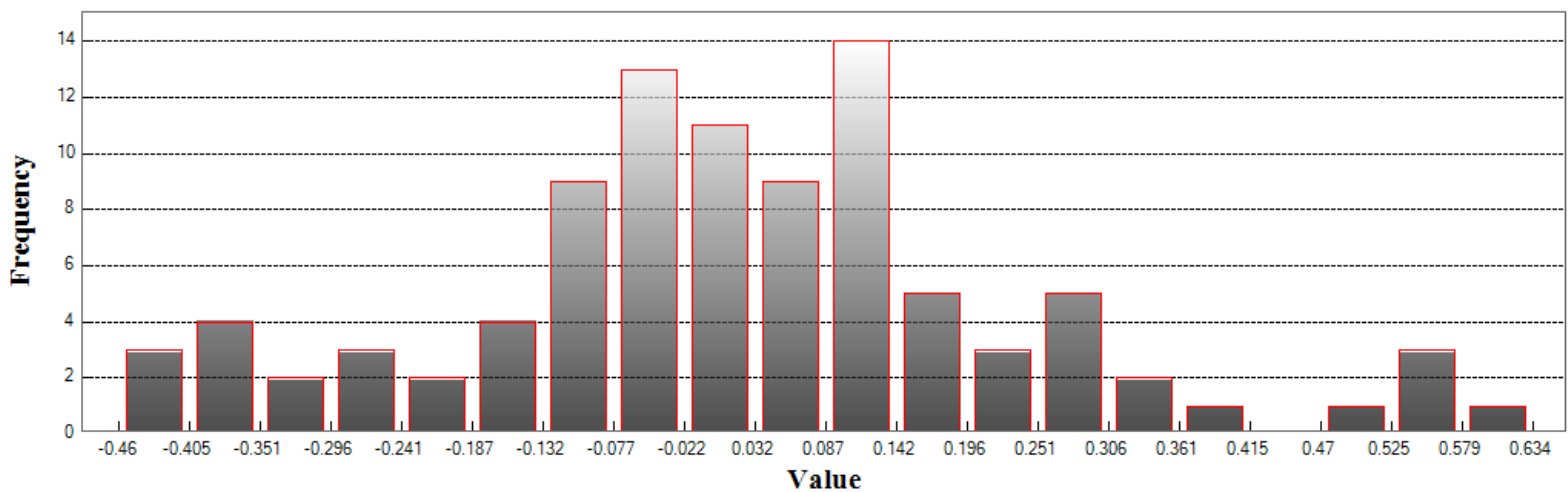


## DEM

### Fundamental Vertical Accuracy

LandCover Type: NVA  
 Minimum DZ: -0.46  
 Maximum DZ: 0.634  
 Mean DZ: 0.025  
 Mean Magnitude DZ: 0.409  
 Number Observations: 95  
 Standard Deviation DZ: 0.222  
 RMSE Z: 0.222  
 95% Confidence Level Z: 0.435  
 Units: US Survey Feet

## Histogram



Min: -0.46

Max: 0.634

Number Of Bins: 20

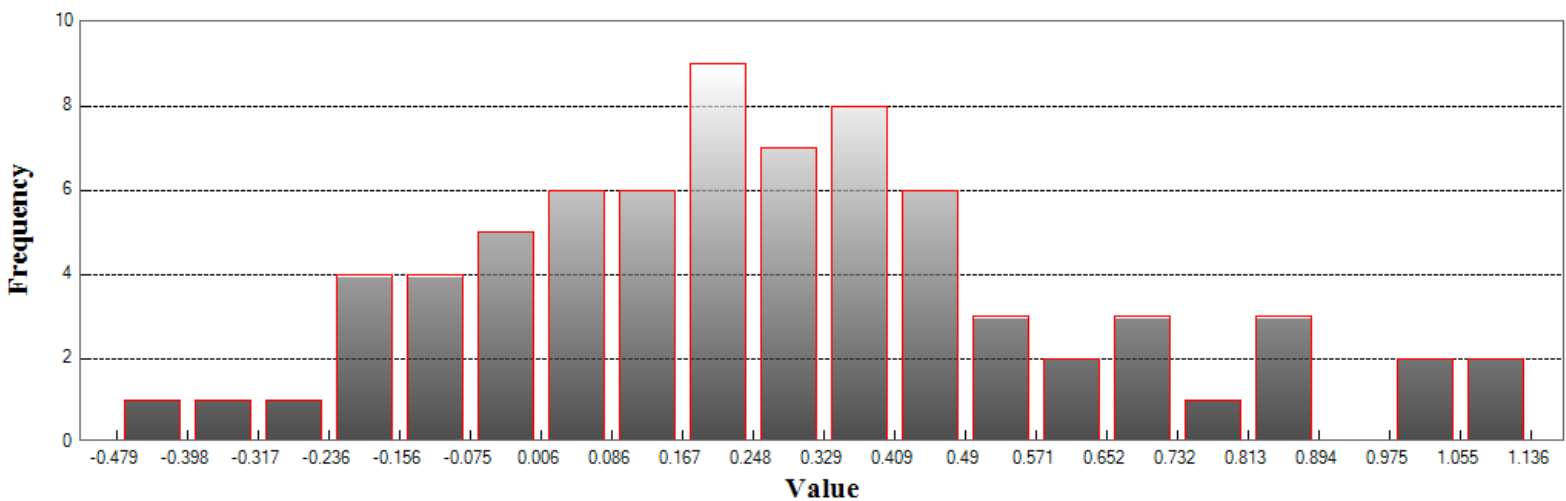
Bin Interval: 0.055

## DEM (Continued)

### Supplemental Vertical Accuracy

LandCover Type: VVA  
 Minimum DZ: -0.478  
 Maximum DZ: 1.136  
 Mean DZ: 0.276  
 Mean Magnitude DZ: 0.588  
 Number Observations: 74  
 Standard Deviation DZ: 0.348  
 RMSE Z: 0.443  
 95th Percentile: 0.932  
 Units: US Survey Feet

## Histogram



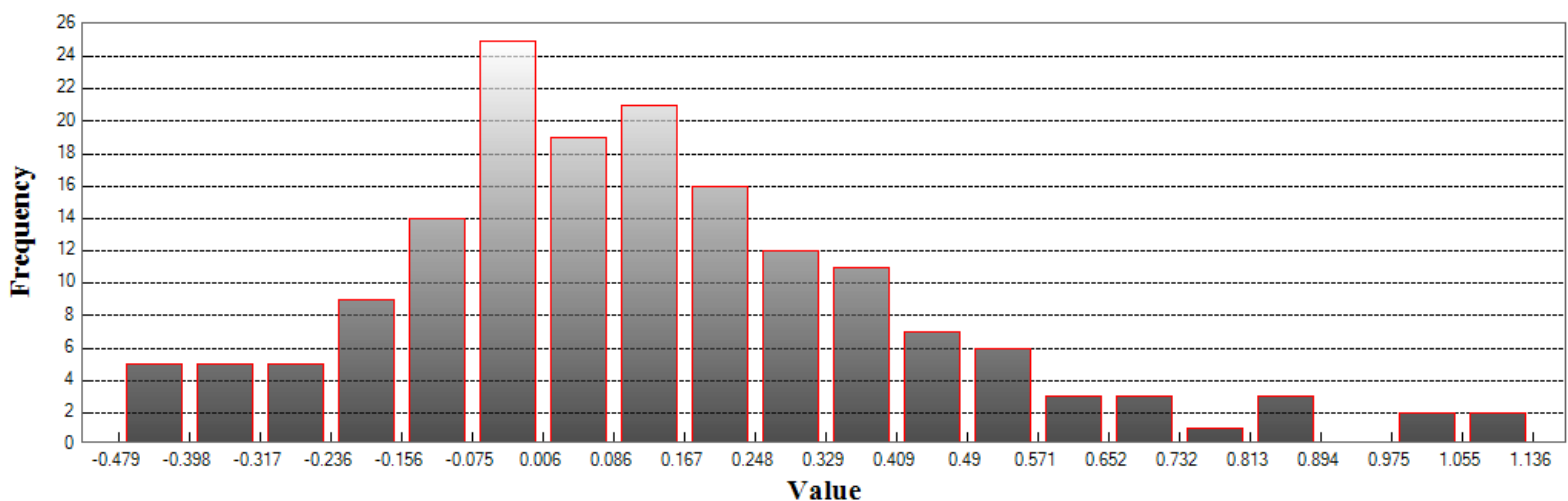
Min: -0.478  
 Max: 1.136  
 Number Of Bins: 20  
 Bin Interval: 0.081

## DEM (Continued)

### Consolidated Vertical Accuracy

LandCover Type: ALL  
 Minimum DZ: -0.478  
 Maximum DZ: 1.136  
 Mean DZ: 0.135  
 Mean Magnitude DZ: 0.495  
 Number Observations: 169  
 Standard Deviation DZ: 0.31  
 RMSE Z: 0.337  
 95th Percentile: 0.703  
 Units: US Survey Feet

## Histogram



Min: -0.478

Max: 1.136

Number Of Bins: 20

Bin Interval: 0.081