

AIRBORNE TOPOGRAPHIC LIDAR REPORT

NORTH CAROLINA - SANDY LIDAR

Contract No. G10PC00026
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Task Order No. G14PD00182

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Completed by Photo Science, Inc.



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1. SUMMARY / SCOPE

1.1. SUMMARY

This report contains a summary of the North Carolina - SANDY LiDAR acquisition task order, issued by the United States Geological Survey's (USGS) National Geospatial Technical Operations Center (NGTOC), under their Geospatial Products and Services Contract (GPSC) on February 12, 2014. The combined task orders yielded one study area covering the North Carolina counties of Beaufort, Bertie, Camden, Carteret, Chowan, Craven, Currituck, Dare, Gates, Hertford, Hyde, Jones, Martin, Onslow, Pamlico, Pasquotank, Perquimans, Pitt, Tyrell, and Washington. The intent of this document is to only provide specific validation information for the LiDAR data acquisition/collection work completed for the USGS project.

1.2. SCOPE

The scope of the North Carolina - SANDY LiDAR task order included the acquisition of aerial topographic LiDAR using state of the art technology, along with necessary surveyed ground control points (GCPs) and airborne GPS and inertial navigation systems, for the North Carolina – SANDY LiDAR Area of Interest. The aerial data collection was designed with the following specifications listed in Table 1 below.

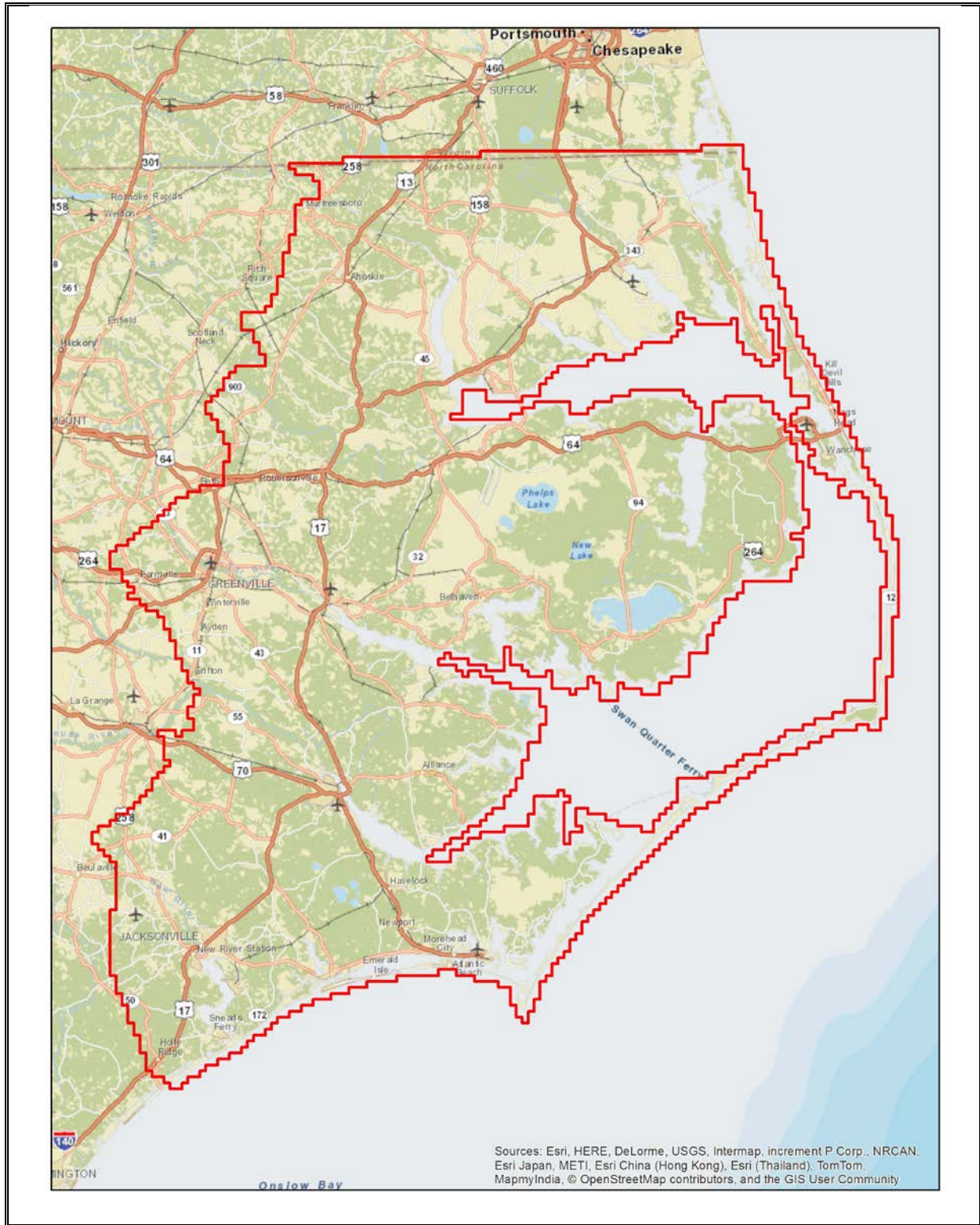
Table 1. Originally Planned LiDAR Specifications

Collection Area	Average Point Density	Flight Altitude (AGL)	Field of View	Minimum Side Overlap	RMSEz
Center South	2.0 pts / m ²	5,499 ft	34.0 degrees	12.49%	9.25 cm or better
East	4.06 pts / m ²	4,600 ft	34.0 degrees	13.71%	9.25 cm or better

1.3. LOCATION / COVERAGE

The North Carolina - SANDY LiDAR project boundary consists of an area in Coastal North Carolina. The project area totals approximately 9,396 square miles as shown in Figure 1 on the following page.

Figure 1. North Carolina - SANDY LiDAR Project Boundary



1.4. DURATION

The first mission was flown on January 26, 2014 and it took 104 total lifts to complete coverage of the area. See section 2.4 for more details.

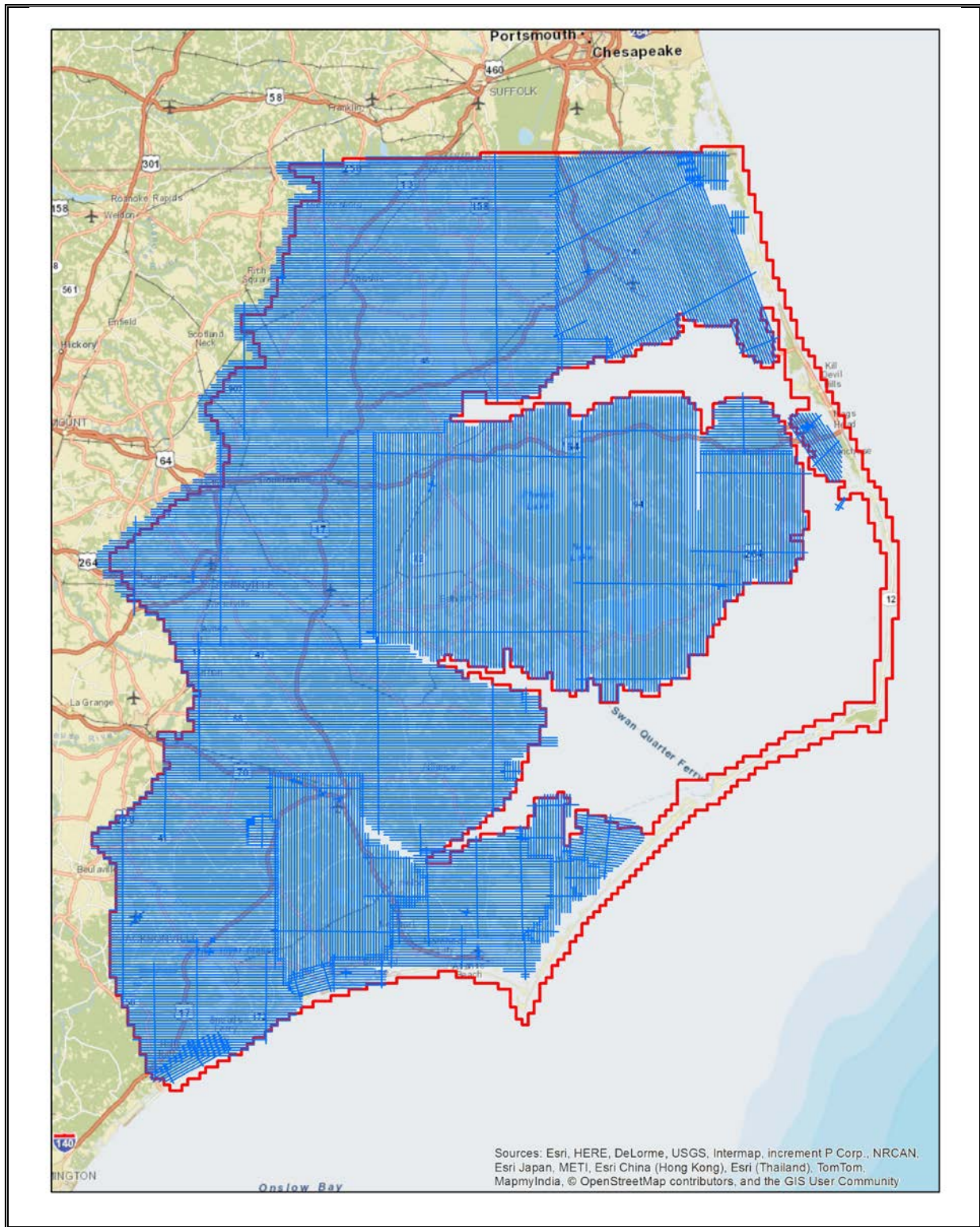
1.5. ISSUES

During the collection of mission 302314B using sensor 7226, two flightlines did not collect properly causing voids to be present within the dataset. A reflight was not scheduled until the following leaf-off conditions.

2. PLANNING / EQUIPMENT

The entire target area was comprised of 1107 planned flight lines and approximately 42400 flight line kilometers. Please refer to Figure 2 on the following pages.

Figure 2. Originally Planned Flight Lines



Detailed project flight planning calculations were performed for the North Carolina – SANDY LiDAR project using Leica Mission Pro planning software. Flight planning was based on the unique project requirements and characteristics of the project site. The basis of planning included: required accuracies, type of development, amount / type of vegetation within project area, required data posting, and potential altitude restrictions for flights in project vicinity. Please note that certain values in the table below are listed as “Variable” due to the various flight plans used, as described in Section 1.5 of this document. A brief summary of the aerial acquisition parameters for the project are shown in the LiDAR System Specification Table 2 below:

Table 2. LiDAR System Specifications

		North East	Center South
Terrain and Aircraft	Flying Height AGL	4600'	5499'
	Recommended Ground Speed (GS)	110 kts	150 kts
Scanner	Field of View (FOV)	34°	34°
	Scan Rate Setting used (SR)	32.4 Hz	31.7 Hz
Laser	Laser Pulse Rate used	197,000 Hz	165,600
	Multi Pulse in Air Mode	Disabled	Disabled
Coverage	Full Swath Width	857.27 m	1024.81 m
	Line Spacing	739.70 m	896.83 m
Point Spacing and Density	Maximum Point Spacing Across Track	0.87 m	1.22 m
	Maximum Point Spacing Along Track	0.87 m	1.22 m
	Average Point Density	0.50 m	0.69 m

2.1. EQUIPMENT: AIRCRAFT

All flights for the North Carolina – SANDY LiDAR project were accomplished through the use of a customized Piper Navajos, (Tail Numbers: N812TB, N22GE, and N262AS); a Cessna 206 (Tail Numbers: N799AC); and a Cessna 210 (Tail Number: N69WA). This aircraft provided an ideal, stable aerial base for LiDAR acquisition. This aerial platform has relatively fast cruise speeds which are beneficial for project mobilization / demobilization while maintaining relatively slow stall speeds which proved ideal for collection of high-density, consistent data posting using a state-of-the-art Leica LiDAR systems.

2.2. LIDAR SENSOR

Photo Science utilized a Leica LiDAR sensor (see Figure 3), serial number 7161, 7169, 7170, 7178, 7220, and 7226 during the project. The system is capable of collecting data at a maximum frequency of 500 kHz, which affords elevation data collection of up to 500,000 points per second. The system utilizes a Multi-Pulse in the Air option (MPIA). The sensor is also equipped with the ability to measure up to 4 returns per outgoing pulse from the laser and these come in the form of 1st, 2nd, 3rd and last returns. The intensity of the returns is also captured during aerial acquisition.

Figure 3. Leica ALS70 LiDAR System



2.3. BASE STATION INFORMATION

GPS base stations were utilized during all phases of flight (see Table 3 below). The base station locations were verified using NGS OPUS service and subsequent surveys.

Table 3. Base Station Locations

Base Station	Latitude	Longitude	Ellipsoid Height (m)
LOY2	36 45 50.43174	-76 14 16.0679	-23.439
LOYZ	36 51 48.91932	-76 34 24.8079	-19.502
LS03	36 47 19.43630	-75 57 34.3299	-22.006
NBR5	35 10 30.52469	-77 03 00.0884	-23.291
NBR6	35 10 29.89815	-77 02 59.3351	-23.517
NCBE	34 43 08.50895	-76 40 18.9914	-27.858
NCBI	35 50 44.35730	-75 33 48.9420	-33.046
NCBX	35 15 58.08197	-75 33 06.8289	-25.445
NCCH	34 20 40.22860	-77 52 29.8989	-22.806
NCCI	35 01 03.76013	-76 18 55.2849	-30.613
NCCR	35 54 56.93091	-76 28 25.2918	-28.22
NCDU	36 10 54.01098	-75 45 04.7952	-24.775
NCEC	35 36 18.30987	-77 21 55.4795	4.907
NCEL	36 20 28.79075	-76 15 29.2739	-29.75
NCGA	36 26 12.65517	-76 43 16.5166	-20.472
NCGO	35 25 16.86893	-78 03 30.5756	-14.068
NCJA	36 24 30.56335	-77 26 15.3088	13.257
NCJL	35 46 52.49646	-79 02 03.9277	45.996
NCJV	34 44 46.81575	-77 27 11.7179	-26.125
NCKI	35 19 18.56730	-77 36 49.2704	-3.126
NCKN	34 56 30.49763	-77 58 49.9453	15.56
NCNB	35 06 45.99769	-77 06 14.2978	-16.105
NCRD	35 45 49.50795	-78 34 44.3945	51.789
NCSL	33 58 57.20129	-78 23 24.3066	-10.002
NCSQ	35 23 40.86368	-76 19 33.3788	-30.398
NCWA	35 33 34.78484	-77 03 31.4419	-25.416
NCWM	35 49 49.75739	-77 02 06.2097	-21.901
PSI Base 1-29-14	38 10 54.38789	-84 54 10.5317	201.943
PSI Base 2-07-14A	36 15 12.83044	-76 10 21.8474	-35.875
PSI Base 2-10-14A	36 15 12.83063	-76 10 21.8472	-35.868
SNFD	35 28 24.67784	-79 09 28.9844	95.45

2.4. TIME PERIOD

Project specific flights were conducted over several months. 104 sorties, or aircraft lifts were completed. Accomplished sorties are listed below:

- 012614A_7161
- 012614B_7161
- 012714A_7161
- 012714B_7161
- 012614A_7161
- 012914A_7170
- 020214A_7170
- 020614A_7220
- 020714A_7170
- 020714A_7220
- 020714B_7170
- 020914A_7161
- 020914A_7220
- 020914B_7161
- 020914B_7220
- 021014A_7170
- 021414A_7220
- 021614A_7178
- 021614A_7220
- 021614B_7220
- 021714A_7178
- 021714A_7220
- 021714B_7178
- 021714B_7220
- 021814A_7178
- 021814B_7161
- 021814B_7178
- 022014A_7161
- 022014A_7178
- 022014A_7220
- 022214A_7161
- 022214A_7178
- 022214A_7220
- 022214B_7161
- 022214B_7178
- 022214B_7220
- 022214C_7178
- 022314A_7161
- 022314A_7178
- 022314A_7220
- 022314B_7161
- 022314B_7178
- 022314B_7220
- 022314C_7178
- 022414A_7169
- 022414A_7178
- 022414A_7220
- 022414B_7178
- 022514A_7169
- 022514A_7220
- 022614A_7169
- 022614A_7170
- 022714A_7178
- 022714A_7220
- 022714B_7178
- 022814A_7169
- 022814A_7178
- 022814A_7220
- 022814B_7178
- 030114A_7170
- 030114B_7170
- 030214A_7170
- 030214A_7178
- 030214A_7220
- 030214B_7170
- 030214B_7178
- 030214C_7170
- 030814A_7170
- 030814B_7170
- 030914A_7170
- 030914A_7220
- 030914B_7170
- 031014A_7170
- 031014A_7220
- 031014B_7170
- 031114A_7170
- 031114A_7220
- 031414A_7170
- 031414B_7220
- 031514A_7170
- 031514A_7220
- 031514B_7170
- 031514B_7220
- 031514C_7170
- 031614A_7170
- 032014A_7170
- 032014A_7178
- 032014A_7220
- 032014B_7220
- 032114A_7170
- 032114A_7220
- 032114B_7170
- 032114C_7170
- 032214A_7178
- 032214A_7220
- 032214B_7178
- 032214B_7220
- 032214C_7178
- 032314A_7226
- 032314B_7226
- 032414A_7226
- 032514B_7226
- 040314B_7178
- 040614A_7178

3. PROCESSING SUMMARY

Applanix + POSPac Mobile Mapping Suite software was used for post-processing of airborne GPS and inertial data (IMU), which is critical to the positioning and orientation of the LiDAR sensor during all flights. POSPac combines aircraft raw trajectory data with stationary GPS base station data yielding a "Smoothed Best Estimate Trajectory (SBET) necessary for additional post processing software to develop the resulting geo-referenced point cloud from the LiDAR missions.

During the sensor trajectory processing (combining GPS & IMU datasets) certain statistical graphs and tables are generated within the Applanix POSPac processing environment which are commonly used as indicators of processing stability and accuracy. This data for analysis include: Max horizontal / vertical GPS variance, separation plot, altitude plot, PDOP plot, base station baseline length, processing mode, number of satellite vehicles, and mission trajectory. All relevant graphs produced in the POSPac processing environment for each sortie during the Photo Science project mobilization are available in Appendix A.

The generated point cloud is the mathematical three dimensional composite of all returns from all laser pulses as determined from the aerial mission. Laser point data are imported into TerraScan and a manual calibration is performed to assess the system offsets for pitch, roll, heading and scale. At this point this data is ready for analysis, classification, and filtering to generate a bare earth surface model in which the above-ground features are removed from the data set. Point clouds were created using the Leica ALS Post Processor software. GeoCue distributive processing software was used in the creation of some files needed in downstream processing, as well as in the tiling of the dataset into more manageable file sizes. TerraScan and TerraModeler software packages were then used for the automated data classification, manual cleanup, and bare earth generation. Project specific macros were developed to classify the ground and remove side overlap between parallel flight lines.

All data will manually be reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. Global Mapper will be used as a final check of the bare earth dataset. GeoCue was used to create the deliverable industry-standard LAS files for both the All Point Cloud Data and the Bare Earth. In-house software will then used to perform final statistical analysis of the classes in the LAS files.

Metadata was generated for the project on a lot and deliverable level.

3.1. FLIGHT LOGS

Flight logs were completed by LIDAR sensor technicians for each mission during acquisition. These logs depict a variety of information, including:

- Job / Project #
- Flight Date / Lift Number
- FOV (Field of View)
- Scan Rate (HZ)
- Pulse Rate Frequency (Hz)
- Ground Speed
- Altitude
- Base Station
- PDOP avoidance times
- Flight Line #
- Flight Line Start and Stop Times
- Flight Line Altitude (AMSL)
- Heading
- Speed
- Returns
- Crab

Notes: (Visibility, winds, ride, weather, temperature, dew point, pressure, etc). Project specific flight logs for each sortie are available in Appendix B.

3.2. LAS CLASSIFICATION SCHEME

The classification classes are determined by the USGS Version 1.0 specifications and are an industry standard for the classification of LIDAR point clouds. All data starts the process as Class 1 (Unclassified), and then through automated classification routines, the classifications are determined using TerraScan macro processing.

The classes used in the dataset are as follows and have the following descriptions:

- Class 1 – Processed, but Unclassified – These points would be the catch all for points that do not fit any of the other deliverable classes. This would cover features such as vegetation, cars, etc.
- Class 2 – Bare earth ground – This is the bare earth surface
- Class 7 – Noise – Low or high points, manually identified above or below the surface that could be noise points in point cloud.
- Class 9 – In-land Water – Points found inside of inland lake/ponds
- Class 10 – Ignored Ground – Points found to be close to breakline features. Points are moved to this class from the Class 2 dataset. This class is ignored during the DEM creation process in order to provide smooth transition between the ground surface and hydro flattened surface.
- Class 17 – Overlap Default (Unclassified) – Points found in the overlap between flight lines. These points are created through automated processing methods and not cleaned up during processing.
- Class 18 – Overlap Bare-earth ground – Points found in the overlap between flight lines. These points are created through automated processing, matching the specifications determined during the automated process, that are close to the Class 2 dataset (when analyzed using height from ground analysis)

- Class 25 – Overlap Water – Points found in the overlap between flight lines that are located inside hydro features. These points are created through automated processing methods and not cleaned up during processing.

3.3. CLASSIFIED LAS PROCESSING

The bare earth surface is then manually reviewed to ensure correct classification on the Class 2 (Ground) points. After the bare-earth surface is finalized; it is then used to generate all hydro-breaklines through heads-up digitization.

All ground (ASPRS Class 2) LiDAR data inside of the Lake Pond and Double Line Drain hydro flattening breaklines were then classified to water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 3 feet was also used around each hydro flattened feature to classify these ground (ASPRS Class 2) points to Ignored ground (ASPRS Class 10). All Lake Pond Island and Double Line Drain Island features were checked to ensure that the ground (ASPRS Class 2) points were reclassified to the correct classification after the automated classification was completed.

All overlap data was processed through automated functionality provided by TerraScan to classify the overlapping flight line data to approved classes by USGS. The overlap data was classified to Class 17 (Overlap Default) and Class 18 (Overlap Ground). These classes were created through automated processes only and were not verified for classification accuracy. Due to software limitations within TerraScan, these classes were used to trip the withheld bit within various software packages. These processes were reviewed and accepted by USGS through numerous conference calls and pilot study areas.

All data was manually reviewed and any remaining artifacts removed using functionality provided by TerraScan and TerraModeler. Global Mapper is used as a final check of the bare earth dataset. GeoCue was then used to create the deliverable industry-standard LAS files for all point cloud data. Photo Science proprietary software was used to perform final statistical analysis of the classes in the LAS files, on a per tile level to verify final classification metrics and full LAS header information.

3.4. HYDRO FLATTENING BREAKLINE PROCESS

Class 2 LiDAR was used to create a bare earth surface model. The surface model was then used to heads-up digitize 2D breaklines of Inland Streams and Rivers with a 100 foot nominal width and Inland Ponds and Lakes of 2 acres or greater surface area.

Elevation values were assigned to all Inland Ponds and Lakes, Inland Pond and Lake Islands, Inland Streams and Rivers and Inland Stream and River Islands using TerraModeler functionality.

Elevation values were assigned to all Inland streams and rivers using Photo Science proprietary software.

All ground (ASPRS Class 2) LiDAR data inside of the collected inland breaklines were then classified to water (ASPRS Class 9) using TerraScan macro functionality. A buffer of 3 feet was also used around each hydro flattened feature. These points were moved from ground (ASPRS Class 2) to Ignored Ground (ASPRS Class 10).

The breakline files were then translated to ESRI File GeoDatabase format using ESRI conversion tools.

3.5. HYDRO FLATTENING RASTER DEM PROCESS

Class 2 LiDAR in conjunction with the hydro breaklines were used to create a 5.0 foot Raster DEM. Using automated scripting routines within ArcMap, an ERDAS Imagine IMG file was created for each tile. Each surface is reviewed using Global Mapper to check for any surface anomalies or incorrect elevations found within the surface.

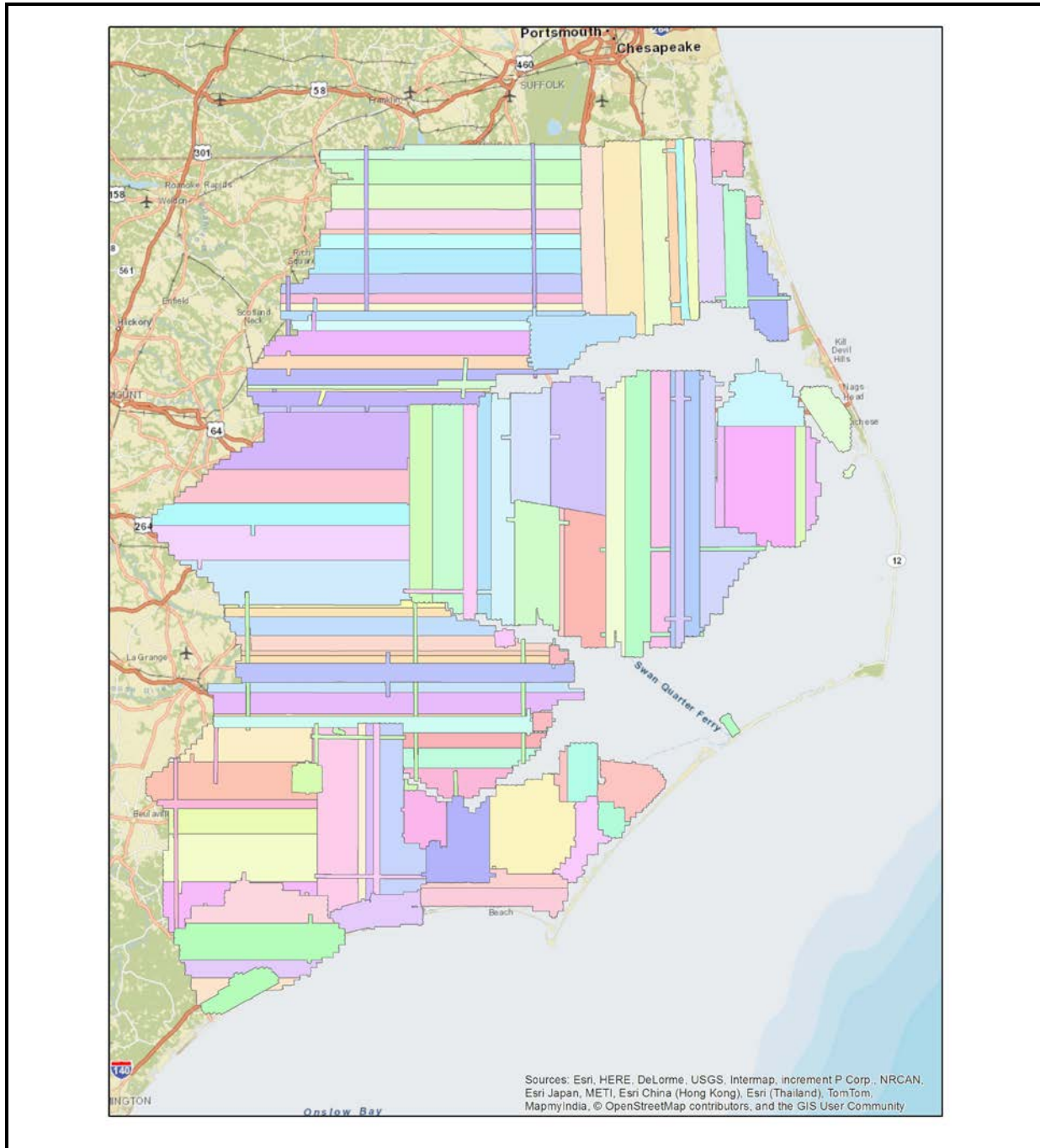
4. DELIVERABLES

- Calibrated, unclassified raw point cloud swath LAS in version 1.3 format
- Classified point cloud tiled LAS in version 1.3 format
- Hydro flattened raster DEM in ERDAS .IMG format
- Hydro flattened breaklines in File GeoDatabase format
- Ground control points in shape file format
- As-flown flightlines in shape file format
- Tile index in shape file format
- Lot, project and deliverable level metadata in XML format
- Accuracy Assessment in XLS format

5. PROJECT COVERAGE VERIFICATION

The North Carolina – SANDY project area coverage verification was performed by comparing coverage of processed .LAS files captured during project collection to generate project shape files depicting boundaries of specified project areas. Please refer to Figure 4.

Figure 4. Flightline Swath LAS File Coverage



6. GROUND CONTROL AND CHECK POINT COLLECTION

Photo Science completed a field survey of 161 ground control (calibration) points along with 282 QA points in 5 different land cover classifications as an independent test of the accuracy of this project. The land cover classifications were selected from the dominant classifications for this project area. These included:

- Bare earth and low grass
- Forested, fully covered by trees
- Tall weeds and crops
- Swamp/Wetlands
- Urban areas

A combination of precise GPS surveying methods, including static and RTK observations were used to establish the 3D position of ground calibration points and QA points for the point classes above. GPS was not an appropriate methodology for surveying in the forested areas during the leaf-on conditions for the actual field survey (which was accomplished after the LiDAR acquisition). Therefore the 3D positions for the forested points were acquired using a GPS-derived offset point located out in the open near the forested area, and using precise offset surveying techniques to derive the 3D position of the forested point from the open control point. The explicit goal for these surveys was to develop 3D positions that were three times greater than the accuracy requirement for the elevation surface.

Figure 6 shows the location of each calibration point for the project area. Table 4 depicts the Control Report for the LiDAR calibration points shown in Figure 6, as computed in TerraScan as a quality assurance check. Note that these results of the surface calibration are not an independent assessment of the accuracy of these project deliverables, but the statistical results do provide additional feedback as to the overall quality of the elevation surface.

The project was delivered using the following horizontal projection(s): NAD83 (2011), North Carolina State Plane, survey feet.

The required accuracy testing was performed on the LiDAR dataset (both the LiDAR point cloud and derived DEM's) according to the USGS LiDAR Base Specification Version 1.0 (2012). The locations for all tested QA points are shown in Figure 7. The summary below provides the results of this testing:

Point Cloud Testing

- Raw Fundamental Vertical Accuracy (Raw FVA): The tested Raw FVA for the dataset was found to be 0.197 feet in terms of the RMSEz. The resulting FVA stated as the 95% confidence level (RMSEz x 1.96) is 0.386 feet. This dataset **meets** the required FVA of 0.595 feet (18.13 cm) at the 95% confidence level (according to the National Standard for Spatial Database Accuracy (NSSDA)), based on TINs derived from the final calibrated and controlled LiDAR swath data. This is summarized in Table 5.

Digital Elevation Model (DEM) Testing

- Fundamental Vertical Accuracy (FVA): The tested FVA for the dataset captured from the DEM using bi-linear interpolation to derive the DEM elevations was found to be 0.207 feet in terms of the RMSEz. The resulting accuracy stated as the 95% confidence level (RMSEz x 1.96) is 0.405 feet. This dataset **meets** the required FVA of 0.595 feet (18.13 cm) at the 95% confidence level (based on NSSDA). This is summarized in Table 6.

- Supplemental Vertical Accuracy (SVA): The tested SVA accuracies for the dataset for each of the land cover classes other than open ground are summarized below. These results are stated in terms of the 95th percentile error (based on ASPRS guidelines) for each of the land cover classes other than open ground.

The following land cover classes were tested and the resulting 95th percentile error values are listed below:

- Forested, Fully Covered by Trees: 0.813 feet (Table 7)
 - Tall Weeds and Crops: 0.680 feet (Table 8)
 - Swamp/Wetlands: 0.868 feet (Table 9)
 - Urban Areas: 0.293 feet (Table 10)
- Consolidated Vertical Accuracy (CVA): The tested CVA for the dataset captured from the DEM using bi-linear interpolation for all classes (including the bare earth class) was found to be 0.777 feet, which is stated in terms of the 95th percentile error. Therefore the data *meets* the required CVA of 0.8825 feet (26.9 cm). This test was based on the 95th percentile error (based on ASPRS guidelines) across all land cover categories

This is also summarized in Table 11.

Figure 5 LiDAR Ground Control Points Used in Calibration



Figure 6. All Final LiDAR QA Point Locations



Figure 7. Bare Earth (BE) QA Point Locations



Figure 8. Forested (FO) QA Point Locations

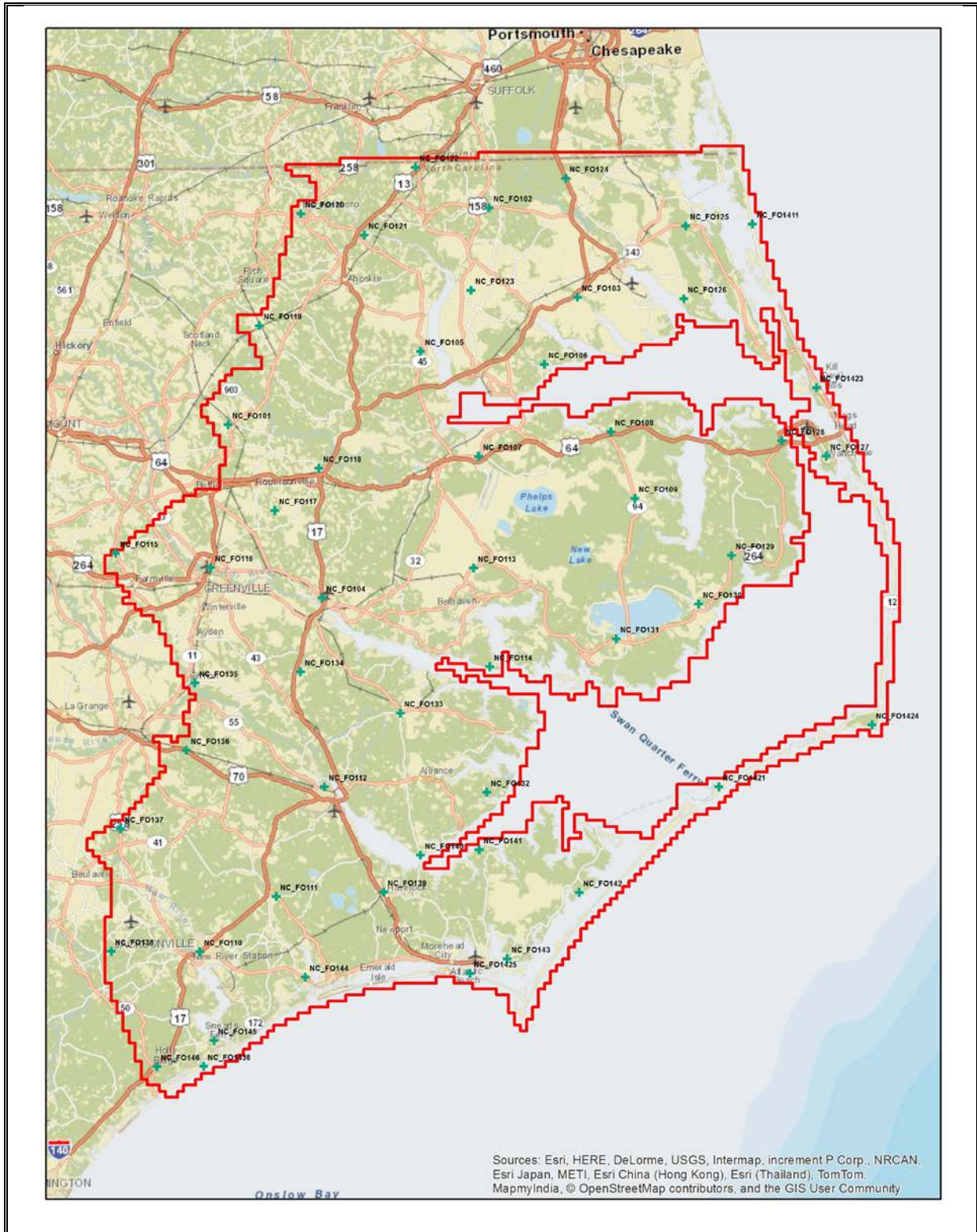


Figure 9. Swamp/Wetlands (SW) QA Point Locations

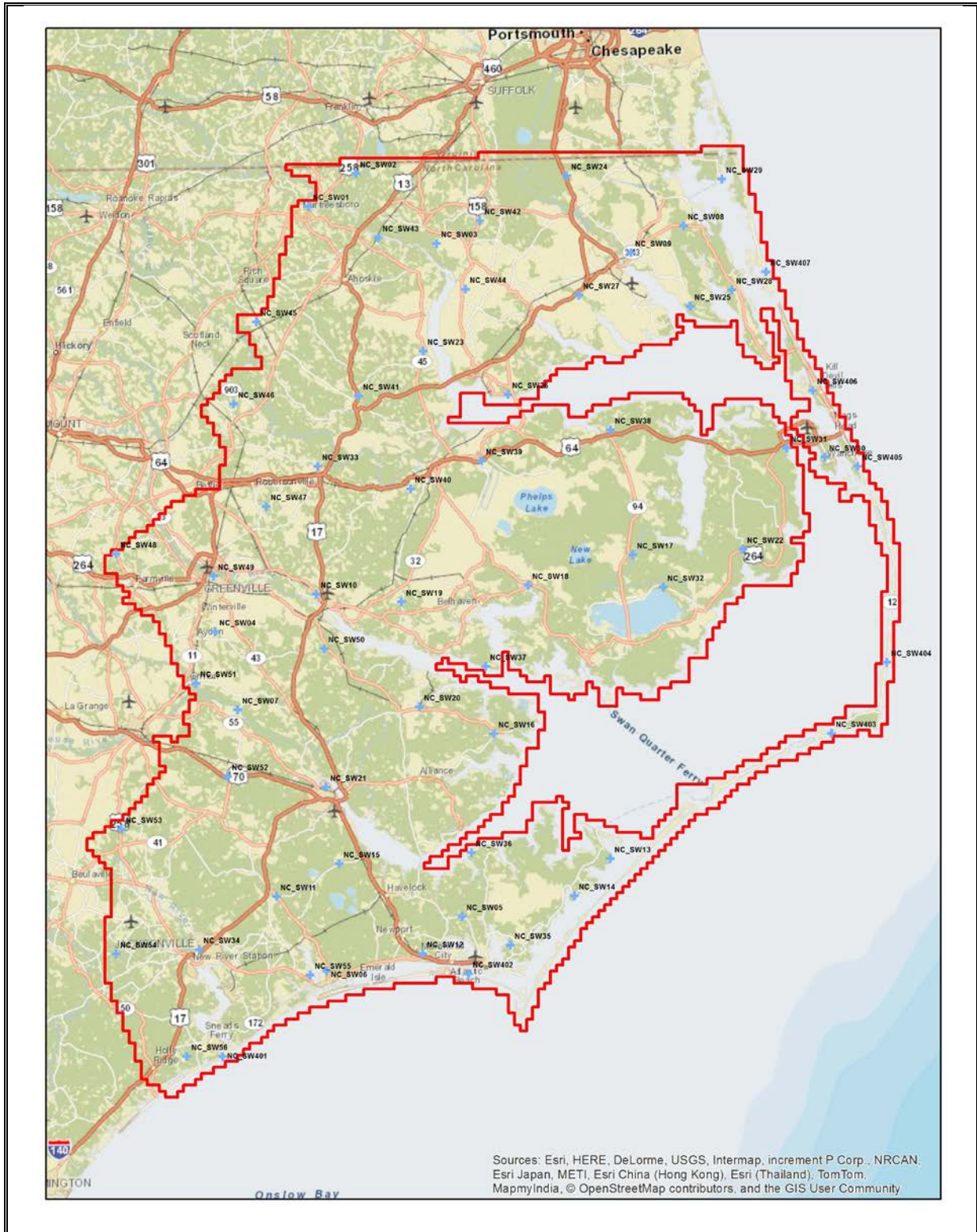


Figure 10. Tall Weeds/Crops (TW) QA Point Locations

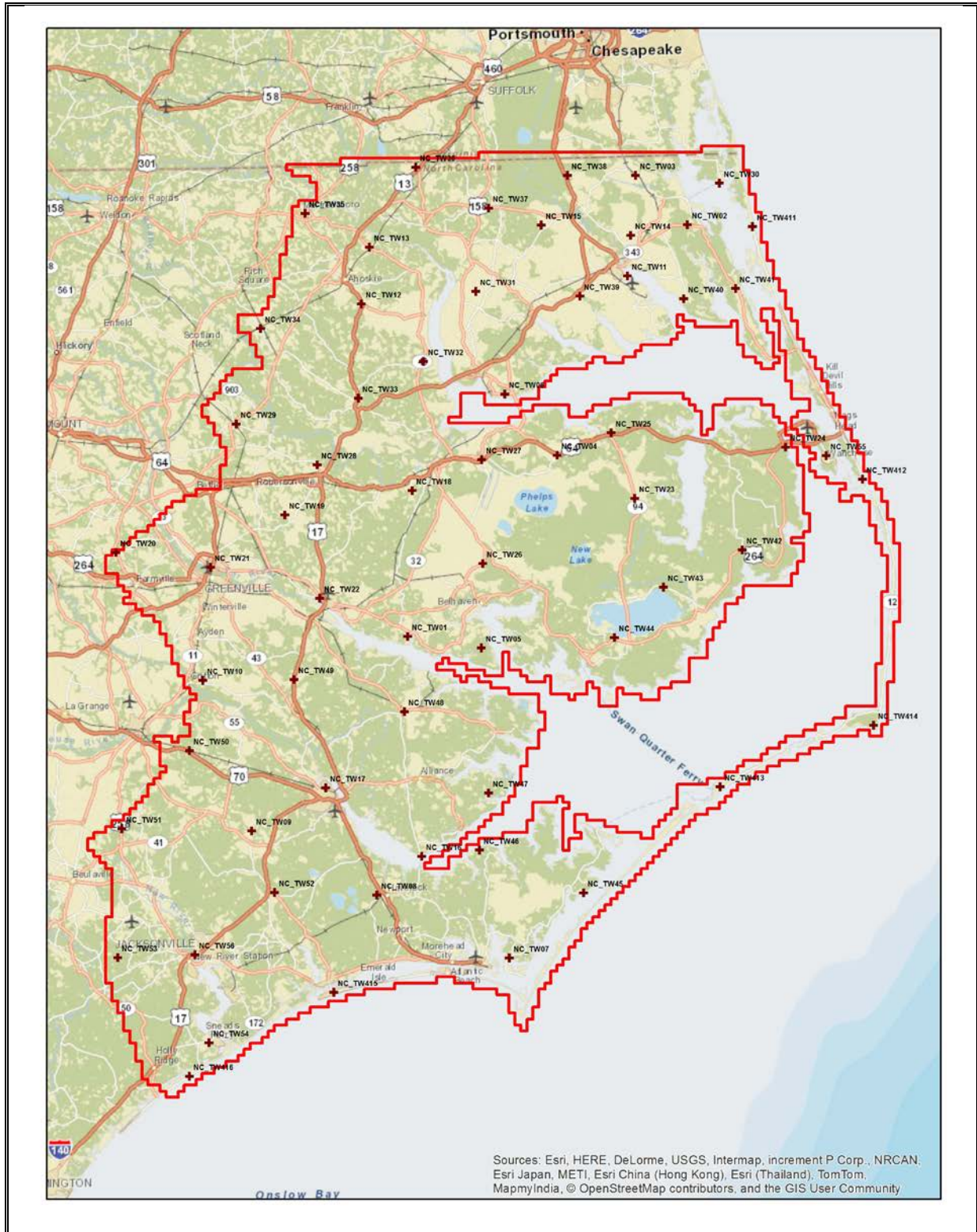


Figure 11. Urban Area (UA) QA Point Locations

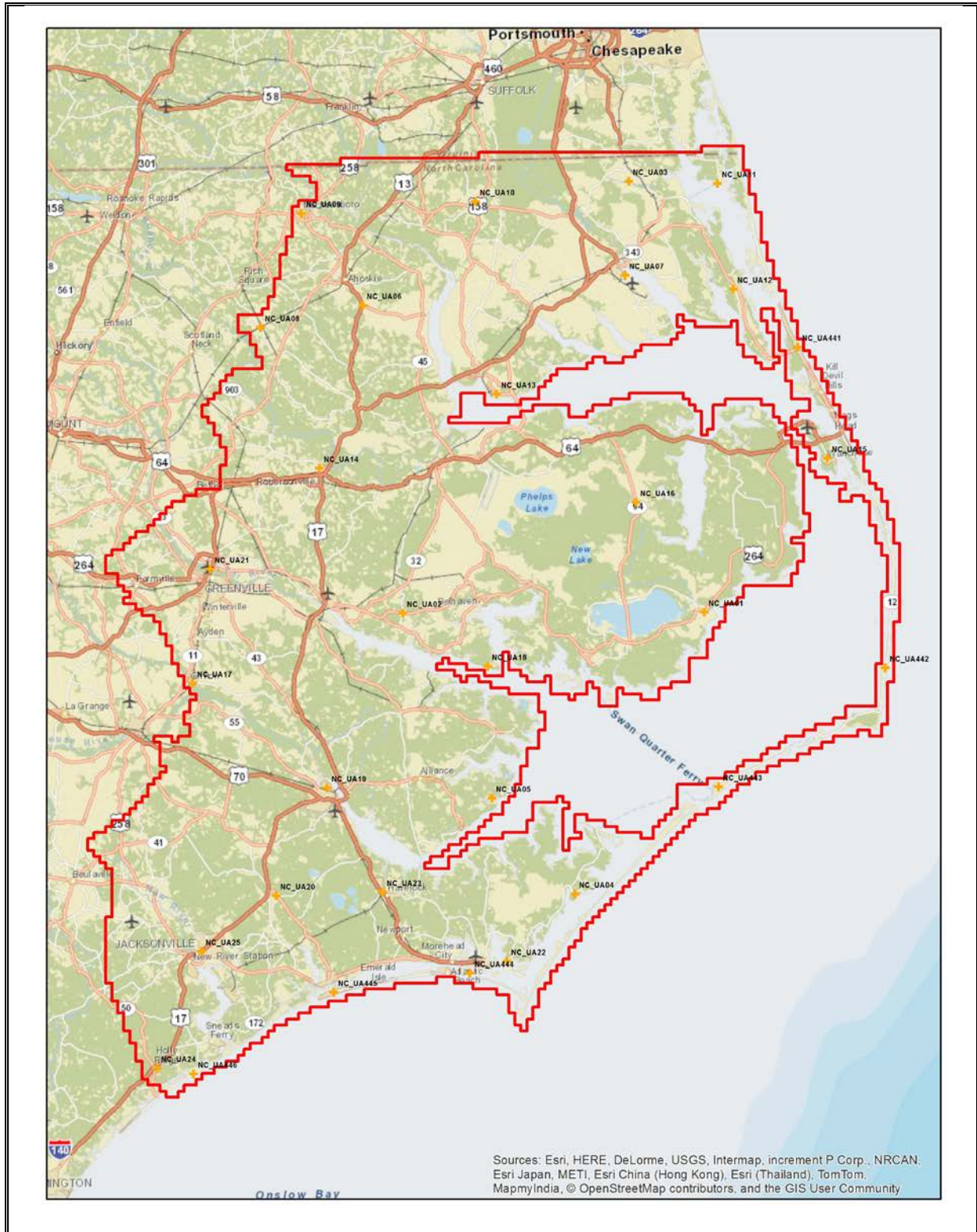


Table 4. LiDAR Ground Control Point Report (Units = Survey Feet)

Number	Easting	Northing	Known Z	Laser Z	Dz
NC_LC001	2664549.14	544790.57	12.43	12.32	0.11
NC_LC002	2401764.42	410725.30	91.24	91.12	0.12
NC_LC003	2458849.28	467928.62	55.87	55.80	0.07
NC_LC004	2683121.37	691264.34	13.09	13.14	-0.05
NC_LC005	2834811.33	876722.45	4.36	4.26	0.10
NC_LC006	2800180.56	977930.94	11.03	10.88	0.15
NC_LC007	2613171.76	996250.87	29.95	29.84	0.11
NC_LC008	2709783.80	872137.19	17.19	17.30	-0.11
NC_LC009	2741165.62	948329.10	13.38	13.27	0.11
NC_LC010	2742937.25	813155.06	18.19	18.36	-0.17
NC_LC011	2615763.05	411391.58	27.28	27.19	0.09
NC_LC012	2541601.77	416918.64	28.34	28.24	0.10
NC_LC013	2620994.7	365190.72	28.44	28.52	-0.08
NC_LC014	2815518.9	450247.38	8.18	8.03	0.15
NC_LC015	2763582.3	394328.89	3.24	3.6	-0.36
NC_LC016	2556736.1	740930.61	66.08	65.99	0.09
NC_LC017	2544663.8	838853.64	39.43	39.4	0.03
NC_LC018	2679947.3	826923.58	19.51	19.55	-0.04
NC_LC019	2575126.4	968494.51	85.72	85.72	0.00
NC_LC020	2663799.4	1001351.3	35.69	35.77	-0.08
NC_LC021	2624636.2	951966.89	44.83	44.73	0.10
NC_LC022	2905395.7	1011704.4	6.38	6.56	-0.18
NC_LC023	2854969.6	1015130.9	4.91	4.98	-0.07
NC_LC024	2804526.4	943370.67	12.06	11.77	0.29
NC_LC025	2908982.8	761082.95	2.6	2.83	-0.23
NC_LC026	2821265.1	773544.39	5.36	5.22	0.14
NC_LC027	2735402.1	741237.6	16.84	16.75	0.09
NC_LC028	2904956.1	672001.84	4.82	4.86	-0.04
NC_LC029	2727261.9	642407.19	5.24	5.4	-0.16
NC_LC030	2662452.2	659820.28	13.96	13.71	0.25
NC_LC031	2628041	629592.85	2.6	2.56	0.04
NC_LC032	2599776.1	726047.88	37.17	37.11	0.06
NC_LC033	2532325.6	543515.15	42.43	42.42	0.01
NC_LC034	2457660.1	308609.4	58	58.41	-0.41
NC_LC035	2446755.4	259444.73	3.52	3.59	-0.07
NC_LC036	2580514.6	353356.04	17.92	17.55	0.37
NC_LC037	2630526.4	388085.67	16.23	16.21	0.02
NC_LC038	2721169.1	389190.66	4.88	5.05	-0.17
NC_LC039	2655613.9	439479.9	16.57	16.66	-0.09
NC_LC040	2680028.9	398101.36	7.33	7.51	-0.18
NC_LC041	2497581.3	395760.44	40.13	39.99	0.14
NC_LC042	2676667.9	491691.78	8.78	8.66	0.12
NC_LC043	2690104.2	523417.22	7.85	7.78	0.07
NC_LC044	2546175.4	343614.25	30	30.16	-0.16
NC_LC045	2417632.7	324716.71	45.53	45.64	-0.11
NC_LC046	2707409.6	494208.76	2.16	2.32	-0.16
NC_LC047	2657151.2	451265.84	22.71	22.58	0.13
NC_LC048	2563631.6	514607.66	27.08	27.05	0.03

Number	Easting	Northing	Known Z	Laser Z	Dz
NC_LC049	2467381.3	538984.77	61.08	60.95	0.13
NC_LC050	2476258.6	366592.56	19.94	19.93	0.01
NC_LC051	2449065.1	418089.16	47.24	47.02	0.22
NC_LC052	2406543	469394.45	76.29	76.53	-0.24
NC_LC053	2532402	465530.86	28.86	28.86	0.00
NC_LC054	2607657.5	449213.06	26.97	26.82	0.15
NC_LC055	2651847.8	369133.83	15.32	15.38	-0.06
NC_LC056	2803341.7	472025.45	4.39	4.57	-0.18
NC_LC057	2780884.2	425116.11	7.05	7.5	-0.45
NC_LC058	2693359	407882.63	8.46	8.49	-0.03
NC_LC059	2742188.4	350178.67	7.48	7.65	-0.17
NC_LC060	2641981.6	416670.41	15.49	15.36	0.13
NC_LC061	2584267.1	336769.22	13.26	13.3	-0.04
NC_LC062	2536834.8	383964.37	26.04	25.95	0.09
NC_LC063	2405917.5	372528.78	80.28	80.26	0.02
NC_LC064	2493221.6	284108.6	5.01	5.26	-0.25
NC_LC065	2431208.9	268484.58	60.37	60.64	-0.27
NC_LC066	2918786.6	925377.18	11.87	11.8	0.07
NC_LC067	2924039.4	709179.52	4.5	4.65	-0.15
NC_LC068	2968935	723306.85	1.38	1.38	0.00
NC_LC069	2876650.7	919581.75	7.3	7.5	-0.20
NC_LC070	2505735.5	433426.08	38.63	38.6	0.03
NC_LC071	2634508.7	496012.55	25.37	25.22	0.15
NC_LC072	2830115.6	701575.19	1.43	1.32	0.11
NC_LC073	2550382.2	700009.49	33.5	33.64	-0.14
NC_LC074	2606791.4	503743.75	15.27	15.11	0.16
NC_LC075	2714485.4	607783.99	4.79	5.01	-0.22
NC_LC076	2718432.2	574998.16	3.26	3.18	0.08
NC_LC077	2732132.5	553390.93	1.51	1.7	-0.19
NC_LC078	2715273.8	546716.25	5.42	5.37	0.05
NC_LC079	2643745	523780.86	43.1	43.06	0.04
NC_LC080	2665928	567104.71	6.28	6.42	-0.14
NC_LC081	2599895.7	556050.14	30.4	30.53	-0.13
NC_LC082	2618528.4	592927.37	34.44	34.45	-0.01
NC_LC083	2557659.9	616889.2	62.38	62.47	-0.09
NC_LC084	2601488.1	627017.18	31.87	31.76	0.11
NC_LC085	2685315.2	595135.55	4.04	4	0.04
NC_LC086	2581179.4	662917.06	10.66	10.81	-0.15
NC_LC087	2631769.5	684003	40.01	39.85	0.16
NC_LC088	2725217.5	689761.79	8.17	8.07	0.10
NC_LC089	2679185.3	634143.57	8.85	8.71	0.14
NC_LC090	2828511.5	627391.75	3.98	4	-0.02
NC_LC091	2866897.9	618430.07	4.79	4.81	-0.02
NC_LC092	2801210.5	608776.37	2.23	2.2	0.03
NC_LC093	2795540.2	638816.37	3.56	3.74	-0.18
NC_LC094	2823293.2	679990.02	1.42	1.38	0.04
NC_LC095	2892273.4	653615.72	0.91	0.78	0.13
NC_LC096	2913814.6	686069.23	2.52	2.31	0.21
NC_LC097	2844695.6	737939.36	3.09	3.03	0.06
NC_LC098	2761718.2	769408.01	6.46	6.64	-0.18
NC_LC099	2757745.9	724566.82	15.35	15.72	-0.37

Number	Easting	Northing	Known Z	Laser Z	Dz
NC_LC100	2671442.8	740594.34	24.41	24.39	0.02
NC_LC101	2619547.6	756547.23	46.06	45.97	0.09
NC_LC102	2588483.7	790683.34	19.16	19.17	-0.01
NC_LC103	2573215	757613.49	67.02	66.99	0.03
NC_LC104	2603767.6	969523.83	47.94	47.82	0.12
NC_LC105	2647997.9	887080.87	55.51	55.67	-0.16
NC_LC106	2665111.8	862246.97	52.23	52.14	0.09
NC_LC107	2611376.2	821557.02	6.34	6.45	-0.11
NC_LC108	2577841.5	843407.22	51.4	51.43	-0.03
NC_LC109	2649624.2	800995.25	30.77	30.88	-0.11
NC_LC110	2704870.5	781800.73	12.35	12.39	-0.04
NC_LC111	2792348.6	800302.73	6.27	6.23	0.04
NC_LC112	2855401.4	798604.18	4.22	4.35	-0.13
NC_LC113	2929862.8	784087.05	3.6	3.72	-0.12
NC_LC114	2992021.2	781316.26	4.61	4.53	0.08
NC_LC115	2979723.3	805753.68	8.61	8.6	0.01
NC_LC116	2794827.9	903999.33	9.62	9.39	0.23
NC_LC117	2834788.5	971730.88	9.69	9.68	0.01
NC_LC118	2767596.9	997405.9	11.17	11.1	0.07
NC_LC119	2723818.1	983749.17	48.19	48.03	0.16
NC_LC120	2575903.3	904723.59	64.85	64.77	0.08
NC_LC121	2609403.4	864887.88	63.04	63.08	-0.04
NC_LC122	2617787.6	912655.12	53.44	53.46	-0.02
NC_LC123	2658021.4	937668.1	66.48	66.47	0.01
NC_LC124	2674533.5	893118.99	18.01	18.17	-0.16
NC_LC125	2719627.3	909797.23	15.98	15.99	-0.01
NC_LC126	2750317	875389.3	12.15	12.24	-0.09
NC_LC127	2719883.3	834575.29	14.95	15.23	-0.28
NC_LC128	2880750.7	1030942.6	8.78	8.83	-0.05
NC_LC129	2889975.7	973462.25	10.86	10.9	-0.04
NC_LC130	2940065.1	873418.33	6.45	6.39	0.06
NC_LC131	2838048.7	916423.41	6.83	6.6	0.23
NC_LC132	2821488.1	870155.84	7.61	7.65	-0.04
NC_LC133	2769674.7	931457.24	11.72	11.89	-0.17
NC_LC134	2824840.9	1030048	13.99	13.42	0.57
NC_LC135	2684847.5	950363.58	17.34	17.32	0.02
NC_LC136	2633052.9	979284.41	18.58	18.45	0.13
NC_LC137	2699634.1	997929.77	32.8	32.71	0.09
NC_LC138	2716735.7	1026379	39.8	39.85	-0.05
NC_LC139	2642160.4	1024973.6	55.66	55.72	-0.06
NC_LC140	2546483.2	1020717.3	36.99	37.14	-0.15
NC_LC141	2579793.7	1009961.7	81.25	81.33	-0.08
NC_LC142	2575548.3	934719.92	44.39	44.44	-0.05
NC_LC143	2549280.1	972706.03	79.71	79.78	-0.07
NC_LC144	2522984.5	901533.44	97.4	97.25	0.15
NC_LC145	2544457.5	864980.98	79.43	79.41	0.02
NC_LC146	2479713.1	815898.01	86.59	86.81	-0.22
NC_LC147	2506952.2	801895.1	74.73	74.87	-0.14
NC_LC148	2546241.3	770842.67	67.36	67.39	-0.03
NC_LC149	2513716.7	724079.28	47.87	47.93	-0.06
NC_LC150	2525817.9	646648.45	39.95	39.91	0.04

Number	Easting	Northing	Known Z	Laser Z	Dz
NC_LC151	2482465.7	752541.16	65.73	65.73	0.00
NC_LC152	2451191	736919.23	38.56	38.42	0.14
NC_LC153	2482637.3	679477.79	45.94	45.82	0.12
NC_LC154	2417484.9	719097.08	74.35	74.29	0.06
NC_LC155	2414960.1	671403.45	80.04	79.93	0.11
NC_LC156	2466776.9	623569.58	67.42	67.25	0.17
NC_LC157	2552845.5	570597.08	21.1	21.1	0.00
NC_LC158	2517246.1	584443.28	26.79	26.74	0.05
NC_LC159	2478931.9	487300.62	41.02	40.95	0.07
NC_LC160	2699232.8	378125.88	5.06	5.44	-0.38
NC_LC161	2742135.1	376997.25	5.63	5.69	-0.06
Average dz	-0.01 ft				
Minimum dz	-0.450 ft				
Maximum dz	0.570 ft				
Root Mean Square	0.147 ft				
Std Deviation	0.148 ft				

Table 5 Raw FVA - Bare Earth and Low Grass QA - Unclassified Points (Units = Survey Feet)

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_BE01	2600739.26	534109.56	26.85	26.55	-0.30
NC_BE02	2641803.12	651856.58	19.40	19.18	-0.22
NC_BE03	2438136.23	274851.91	50.85	51.07	0.22
NC_BE04	2652607.11	1022423.72	74.96	74.92	-0.04
NC_BE05	2593670.06	1017401.68	42.16	42.28	0.13
NC_BE06	2557863.03	984312.83	87.10	86.92	-0.18
NC_BE07	2614202.55	965529.99	37.52	37.53	0.01
NC_BE08	2567046.23	934222.59	57.96	57.86	-0.10
NC_BE09	2524260.54	889123.90	92.41	92.45	0.04
NC_BE10	2608464.37	907750.64	63.48	63.54	0.06
NC_BE11	2647724.08	936763.83	46.92	46.77	-0.15
NC_BE12	2703361.21	917591.76	40.40	40.29	-0.11
NC_BE13	2666878.77	966260.86	21.71	21.51	-0.20
NC_BE14	2713130.11	988506.66	39.86	39.82	-0.04
NC_BE15	2766435.13	970802.56	15.63	15.71	0.08
NC_BE16	2777229.37	1013975.16	17.93	17.93	0.00
NC_BE17	2833916.78	1009605.82	9.82	9.76	-0.06
NC_BE18	2905122.44	1009390.24	1.96	2.28	0.32
NC_BE19	2878434.35	974598.01	9.65	9.55	-0.10
NC_BE20	2916660.47	921186.20	12.81	12.99	0.18
NC_BE21	2879038.72	913756.39	2.90	2.82	-0.08
NC_BE22	2826668.38	932761.35	7.20	6.56	-0.64
NC_BE23	2789271.33	914483.78	3.09	2.60	-0.49
NC_BE24	2759784.24	858536.19	9.45	9.56	0.11
NC_BE25	2661323.44	870432.23	57.45	57.22	-0.23
NC_BE26	2690854.96	847564.03	17.09	17.19	0.10
NC_BE27	2604826.92	831107.26	10.95	10.89	-0.06
NC_BE28	2500537.22	808390.37	80.58	80.64	0.06
NC_BE29	2572873.33	773956.40	45.50	45.26	-0.24
NC_BE30	2649973.13	752777.73	39.50	39.25	-0.25
NC_BE31	2535759.60	737844.11	45.32	45.07	-0.25
NC_BE32	2403739.13	702363.14	108.21	108.13	-0.08
NC_BE33	2482091.58	689425.54	23.70	23.80	0.10
NC_BE34	2575366.02	665105.38	11.57	11.52	-0.05
NC_BE35	2702262.88	689556.69	7.19	7.31	0.12
NC_BE36	2707561.54	781327.66	12.53	12.38	-0.15
NC_BE37	2770407.37	781801.22	7.45	7.40	-0.05
NC_BE38	2814891.15	801488.12	1.61	1.55	-0.06
NC_BE39	2830774.83	763824.82	1.91	1.98	0.07
NC_BE40	2970051.76	808705.62	4.22	4.23	0.01
NC_BE41	2999037.82	779409.87	5.51	5.46	-0.05
NC_BE42	2956753.35	795051.44	5.44	4.84	-0.60
NC_BE43	2915162.86	699873.20	2.67	2.70	0.03
NC_BE44	2879033.25	664565.89	4.13	3.90	-0.23
NC_BE45	2814855.87	628300.43	4.88	4.84	-0.04
NC_BE46	2711880.53	607883.35	2.77	2.72	-0.05
NC_BE47	2559493.81	603121.17	40.55	40.53	-0.02

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_BE48	2471351.64	597724.18	30.34	30.28	-0.06
NC_BE49	2466724.33	536650.08	61.67	61.64	-0.03
NC_BE50	2411733.13	468489.28	66.41	66.78	0.37
NC_BE51	2408159.66	357125.82	81.48	81.33	-0.15
NC_BE52	2473433.63	370593.05	2.80	2.91	0.11
NC_BE53	2536948.31	417097.12	24.14	24.28	0.14
NC_BE54	2513954.60	471062.33	24.91	24.96	0.05
NC_BE55	2578548.55	507242.11	5.05	5.21	0.16
NC_BE56	2639954.06	569212.32	45.37	45.47	0.10
NC_BE57	2716654.75	501361.53	1.64	1.73	0.09
NC_BE58	2657195.27	451112.63	22.13	22.04	-0.09
NC_BE59	2626358.07	420184.24	20.53	20.45	-0.08
NC_BE60	2705540.29	456887.52	5.39	5.81	0.43
NC_BE61	2814630.67	450885.04	10.58	10.56	-0.02
NC_BE62	2788138.78	420178.19	2.93	3.14	0.21
NC_BE63	2693460.48	399902.85	7.08	7.28	0.20
NC_BE64	2729033.59	364083.12	6.12	5.93	-0.19
NC_BE65	2661317.30	369135.94	14.91	15.07	0.16
NC_BE66	2561736.52	347952.41	31.33	31.56	0.23
NC_BE67	2482159.26	296528.90	24.89	25.39	0.50
NC_BE431	2937523.70	954985.59	13.65	13.77	0.12
NC_BE432	2982952.09	837365.73	7.36	7.44	0.08
NC_BE433	3030454.30	751987.06	5.48	5.62	0.15
NC_BE434	3034295.46	558815.89	6.47	6.58	0.11
NC_BE435	2900548.41	507572.44	3.27	3.28	0.01
NC_BE436	2696896.21	352294.97	3.88	3.90	0.02
NC_BE437	2474277.41	274092.48	1.94	2.13	0.20
Average dz	-0.01 ft				
Minimum dz	-0.642 ft				
Maximum dz	0.502 ft				
Root Mean Square	0.197 ft				
95% Confidence	0.386 ft				

Table 6. FVA - Bare Earth and Low Grass QA – Derived DEMs Classified (Units = Survey Feet)

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_BE01	2600739.26	534109.56	26.85	26.62	-0.23
NC_BE02	2641803.12	651856.58	19.40	19.00	-0.41
NC_BE03	2438136.23	274851.91	50.85	51.10	0.25
NC_BE04	2652607.11	1022423.72	74.96	74.94	-0.02
NC_BE05	2593670.06	1017401.68	42.16	42.26	0.10
NC_BE06	2557863.03	984312.83	87.10	86.91	-0.19
NC_BE07	2614202.55	965529.98	37.52	37.65	0.13
NC_BE08	2567046.23	934222.59	57.96	57.88	-0.08
NC_BE09	2524260.54	889123.90	92.41	92.44	0.03
NC_BE10	2608464.37	907750.64	63.48	63.49	0.01
NC_BE11	2647724.07	936763.83	46.92	46.94	0.02
NC_BE12	2703361.21	917591.75	40.40	40.45	0.06
NC_BE13	2666878.77	966260.86	21.71	21.50	-0.21
NC_BE14	2713130.11	988506.66	39.86	39.79	-0.07
NC_BE15	2766435.13	970802.56	15.63	15.70	0.08
NC_BE16	2777229.36	1013975.16	17.93	17.96	0.03
NC_BE17	2833916.78	1009605.82	9.82	9.73	-0.09
NC_BE18	2905122.44	1009390.24	1.96	2.30	0.34
NC_BE19	2878434.35	974598.01	9.65	9.54	-0.11
NC_BE20	2916660.47	921186.20	12.81	12.98	0.17
NC_BE21	2879038.72	913756.39	2.90	2.86	-0.04
NC_BE22	2826668.38	932761.34	7.20	6.46	-0.74
NC_BE23	2789271.33	914483.78	3.08	2.61	-0.48
NC_BE24	2759784.2	858536.19	9.4515	9.5285	0.08
NC_BE25	2661323.4	870432.23	57.448	57.186	-0.26
NC_BE26	2690855	847564.03	17.094	17.191	0.10
NC_BE27	2604826.9	831107.26	10.9485	10.887	-0.06
NC_BE28	2500537.2	808390.37	80.5825	80.609	0.03
NC_BE29	2572873.3	773956.4	45.4975	45.264	-0.23
NC_BE30	2649973.1	752777.73	39.4965	39.242	-0.25
NC_BE31	2535759.6	737844.11	45.3195	45.083	-0.24
NC_BE32	2403739.1	702363.14	108.205	108.13	-0.08
NC_BE33	2482091.6	689425.54	23.7035	23.807	0.10
NC_BE34	2575366	665105.38	11.573	11.551	-0.02
NC_BE35	2702262.9	689556.69	7.1855	7.2894	0.10
NC_BE36	2707561.5	781327.66	12.5275	12.369	-0.16
NC_BE37	2770407.4	781801.22	7.4515	7.3776	-0.07
NC_BE38	2814891.1	801488.12	1.606	1.569	-0.04
NC_BE39	2830774.8	763824.82	1.906	2.0109	0.10
NC_BE40	2970051.8	808705.62	4.2235	4.1847	-0.04
NC_BE41	2999037.8	779409.87	5.5125	5.5324	0.02
NC_BE42	2956753.3	795051.44	5.44	4.8939	-0.55
NC_BE43	2915162.9	699873.2	2.6715	2.7066	0.04
NC_BE44	2879033.2	664565.89	4.126	3.9568	-0.17
NC_BE45	2814855.9	628300.43	4.877	4.812	-0.07
NC_BE46	2711880.5	607883.35	2.77	2.6531	-0.12
NC_BE47	2559493.8	603121.17	40.5465	40.411	-0.14
NC_BE48	2471351.6	597724.18	30.342	30.319	-0.02

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_BE49	2466724.3	536650.08	61.67	61.628	-0.04
NC_BE50	2411733.1	468489.28	66.4135	66.77	0.36
NC_BE51	2408159.7	357125.82	81.4785	81.333	-0.15
NC_BE52	2473433.6	370593.04	2.8035	2.9202	0.12
NC_BE53	2536948.3	417097.12	24.138	24.191	0.05
NC_BE54	2513954.6	471062.33	24.9065	24.969	0.06
NC_BE55	2578548.6	507242.11	5.048	5.2274	0.18
NC_BE56	2639954.1	569212.32	45.37	45.538	0.17
NC_BE57	2716654.7	501361.53	1.644	1.689	0.04
NC_BE58	2657195.3	451112.63	22.134	22.008	-0.13
NC_BE59	2626358.1	420184.24	20.53	20.446	-0.08
NC_BE60	2705540.3	456887.52	5.385	5.8663	0.48
NC_BE61	2814630.7	450885.04	10.5795	10.543	-0.04
NC_BE62	2788138.8	420178.19	2.929	3.1471	0.22
NC_BE63	2693460.5	399902.85	7.0805	7.2738	0.19
NC_BE64	2729033.6	364083.12	6.124	5.8739	-0.25
NC_BE65	2661317.3	369135.94	14.9085	15.016	0.11
NC_BE66	2561736.5	347952.41	31.325	31.584	0.26
NC_BE67	2482159.3	296528.9	24.888	25.429	0.54
NC_BE431	2937523.7	954985.59	13.6535	13.772	0.12
NC_BE432	2982952.1	837365.73	7.3585	7.4119	0.05
NC_BE433	3030454.3	751987.06	5.4745	5.622	0.15
NC_BE434	3034295.5	558815.89	6.4655	6.4926	0.03
NC_BE435	2900548.4	507572.44	3.266	3.3932	0.13
NC_BE436	2696896.2	352294.97	3.879	4.0062	0.13
NC_BE437	2474277.4	274092.48	1.935	2.101	0.17
Average dz	-0.01 ft				
Minimum dz	-0.744 ft				
Maximum dz	0.541 ft				
Root Mean Square	0.207 ft				
95% Confidence	0.405 ft				

Table 7. SVA Forested, Fully Covered by Trees QA – Derived DEMs (Units = Survey Feet)

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_FO101	2497131.49	808448.61	79.89	80.46	0.57
NC_FO102	2714020.19	988709.29	41.30	42.08	0.78
NC_FO103	2787309.22	914442.68	10.81	11.00	0.19
NC_FO104	2575369.92	664891.71	7.09	7.33	0.24
NC_FO105	2657099.93	869530.44	54.32	55.44	1.12
NC_FO106	2759828.96	858837.17	9.87	10.48	0.61
NC_FO107	2705309.35	782175.86	9.25	9.66	0.41
NC_FO108	2815003.20	802788.07	2.08	2.38	0.30
NC_FO109	2834932.38	747450.00	3.47	3.78	0.31
NC_FO110	2473406.85	370797.71	1.18	1.42	0.24
NC_FO111	2537027.19	416806.68	20.92	21.01	0.09
NC_FO112	2577116.48	507989.94	4.96	5.54	0.58
NC_FO113	2700990.5	689465.87	10.27	11.023	0.75
NC_FO114	2714533.8	607682.97	3.49	3.6307	0.14
NC_FO115	2403651.5	701826.47	98.15	98.267	0.12
NC_FO116	2482638.4	690036.77	20.87	20.922	0.05
NC_FO117	2535782.9	737422.26	42.46	42.877	0.42
NC_FO118	2572489	772518.2	54.47	54.772	0.30
NC_FO119	2523100.2	890728.14	86.26	87.311	1.05
NC_FO120	2557718.3	984007.79	83.12	83.975	0.85
NC_FO121	2610304.7	966219.24	42.85	42.999	0.15
NC_FO122	2652725.7	1022468.1	74.08	74.688	0.61
NC_FO123	2698978.5	920351.98	24.31	24.755	0.45
NC_FO124	2777409.1	1013157.3	16.68	16.889	0.21
NC_FO125	2877197	973797.24	6.87	7.3248	0.45
NC_FO126	2875571.4	913133.81	4.04	4.4719	0.43
NC_FO127	2994020.5	782589.94	2.19	2.0224	-0.17
NC_FO128	2956981.8	795183.69	5.43	4.3481	-1.08
NC_FO129	2915146.1	699866.57	1.52	2.1552	0.64
NC_FO130	2887922	659780.91	1.83	1.2963	-0.53
NC_FO131	2819412.4	630978.12	2.26	2.1819	-0.08
NC_FO132	2711951	503279.21	5.36	5.6258	0.27
NC_FO133	2640110.8	569027.18	41.2	41.228	0.03
NC_FO134	2557261.4	603263.56	44.86	45.328	0.47
NC_FO135	2469551.3	594295.35	30	30.264	0.26
NC_FO136	2462535.8	538210.47	48.87	49.165	0.30
NC_FO137	2407679.5	473069.31	90.34	90.833	0.49
NC_FO138	2399945	371259.1	51.85	52.124	0.27
NC_FO139	2626327.4	420276.24	20.34	20.093	-0.25
NC_FO140	2657112.7	450950.48	21.23	21.079	-0.15
NC_FO141	2705618.1	455639.74	4.98	5.2692	0.29
NC_FO142	2788765.6	420192.71	5.82	5.794	-0.03
NC_FO143	2728855.9	365150.83	4.74	5.3188	0.58
NC_FO144	2561228	349902.26	26.12	26.824	0.70
NC_FO145	2485322.2	297047.48	26.38	26.336	-0.04
NC_FO146	2437886.2	275512.62	41.36	41.373	0.01
NC_FO1411	2932699.7	975422.21	7.62	7.9129	0.29

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_FO1421	2904650.2	508038.82	1.5	2.0103	0.51
NC_FO1423	2985760.8	839579.93	12.12	12.37	0.25
NC_FO1424	3031987	559222.43	8.12	8.3962	0.28
NC_FO1425	2697854	352936.85	3.62	4.021	0.40
NC_FO1436	2476810.1	275837.4	4.6	5.1295	0.53
Average dz	0.30 ft				
Minimum dz	-1.082 ft				
Maximum dz	1.122 ft				
Root Mean Square	0.475 ft				
95th Percentile	0.813 ft				

Table 8. SVA Tall Weeds/Crops QA – Derived DEMs (Units = Survey Feet)

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_TW01	2645925.26	632788.54	15.07	15.27	0.20
NC_TW02	2878445.07	974626.80	9.96	10.13	0.17
NC_TW03	2835464.76	1015724.68	10.07	10.27	0.20
NC_TW04	2770246	783162.46	6.763	6.9947	0.23
NC_TW05	2707154.6	623086.86	4.5215	4.9686	0.45
NC_TW06	2726652.4	834037.14	12.5645	12.586	0.02
NC_TW07	2730549.7	365674.72	3.83	3.8336	0.00
NC_TW08	2620310.8	418062.05	21.299	21.439	0.14
NC_TW09	2516434.2	471119.18	20.8145	20.942	0.13
NC_TW10	2475590.7	596268.11	29.151	29.268	0.12
NC_TW11	2828505.4	932123.15	1.7765	1.9267	0.15
NC_TW12	2607452.8	908779.54	64.6785	65.064	0.39
NC_TW13	2614328.3	956097.68	40.037	40.192	0.16
NC_TW14	2831481.1	965877.94	3.549	3.6339	0.08
NC_TW15	2757049.2	974400.67	16.761	16.904	0.14
NC_TW16	2657647.1	450078.22	5.7115	6.2175	0.51
NC_TW17	2577884.4	507024.16	9.8835	10.065	0.18
NC_TW18	2649568.1	753699.56	39.7165	39.978	0.26
NC_TW19	2543854.7	733668.95	34.0155	34.289	0.27
NC_TW20	2403441.7	702455.61	109.2705	109.27	0.00
NC_TW21	2481987.8	690134.88	19.6995	19.751	0.05
NC_TW22	2572869.5	664418.75	6.7115	7.0935	0.38
NC_TW23	2834871.5	747468.53	3.4685	3.6072	0.14
NC_TW24	2960146.1	789982.93	0.842	0.8651	0.02
NC_TW25	2815195	801811.94	1.6535	1.9502	0.30
NC_TW26	2708288.1	693152.14	2.602	3.0321	0.43
NC_TW27	2707455	779575.05	9.081	9.4167	0.34
NC_TW28	2570653.8	775106.5	62.1675	62.33	0.16
NC_TW29	2503432.6	809092.29	79.5945	80.553	0.96
NC_TW30	2905179.49	1009109.80	1.56	2.10	0.53
NC_TW31	2702690.67	919371.81	39.81	40.53	0.72
NC_TW32	2659282.55	861256.93	49.97	50.02	0.05
NC_TW33	2604932.86	830605.12	13.09	13.29	0.20
NC_TW34	2523715.49	888410.15	90.66	91.15	0.48
NC_TW35	2560539.97	984145.25	72.71	73.01	0.30
NC_TW36	2652650.99	1022419.60	74.49	75.14	0.65
NC_TW37	2713166.27	988434.39	39.80	40.26	0.46
NC_TW38	2778708.22	1015645.17	15.55	15.73	0.18
NC_TW39	2789114.80	915370.77	1.67	1.78	0.11
NC_TW40	2875481.61	913147.91	4.43	5.04	0.61
NC_TW41	2918495.51	921727.19	12.55	12.82	0.28
NC_TW42	2924042.67	704476.11	0.46	1.11	0.65
NC_TW43	2858566.80	673821.88	0.47	1.15	0.68
NC_TW44	2817888.85	631893.24	1.19	1.14	-0.05
NC_TW45	2792085.76	419816.65	5.05	5.80	0.75
NC_TW46	2705610.3	455366.08	3.5665	3.7829	0.22
NC_TW47	2713255.7	502723.55	4.1615	4.6173	0.46
NC_TW48	2643209.3	570240.42	16.207	16.354	0.15

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_TW49	2551523.8	596985.45	39.8305	40.316	0.49
NC_TW50	2464550.8	537960.63	58.51	58.883	0.37
NC_TW51	2408360.2	472939.28	86.725	86.924	0.20
NC_TW52	2535317.7	420046.04	30.3815	30.65	0.27
NC_TW53	2404845.1	365834.81	67.019	67.407	0.39
NC_TW54	2480879.5	295176.1	28.9665	29.411	0.44
NC_TW55	2993875.7	783051.8	1.554	1.7512	0.20
NC_TW56	2469099.5	368523.17	9.063	9.5974	0.53
NC_TW411	2932556	973019.47	6.5375	6.9639	0.43
NC_TW412	3024010.9	763199.64	4.5325	4.795	0.26
NC_TW413	2905787.7	507962.89	1.2065	1.6591	0.45
NC_TW414	3033342.5	559038.08	6.64	6.8574	0.22
NC_TW415	2584395.8	337112.05	13.0165	13.563	0.55
NC_TW416	2464467.3	267493.18	2.5915	2.7606	0.17
Average dz	0.3 ft				
Minimum dz	-0.047 ft				
Maximum dz	0.958 ft				
Root Mean Square	0.372 ft				
95th Percentile	0.680 ft				

Table 9. SVA Swamp/Wetland QA – Derived DEMs (Units = Survey Feet)

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_SW01	2563953.7	990100.58	12.2745	12.592	0.32
NC_SW02	2603112.2	1017128.7	31.407	31.511	0.10
NC_SW03	2670293.6	958995.32	3.3915	4.0623	0.67
NC_SW04	2486354.1	636780.41	39.6435	39.817	0.17
NC_SW05	2691488.6	400361.2	2.811	2.8505	0.04
NC_SW06	2578974.8	355089.88	1.881	1.6739	-0.21
NC_SW07	2505079.6	571919.51	10.5705	10.522	-0.05
NC_SW08	2875319.7	973833.73	2.395	2.7325	0.34
NC_SW09	2831627.2	951385.43	1.035	0.9419	-0.09
NC_SW10	2570448.7	668035.6	4.036	4.1596	0.12
NC_SW11	2537297.71	416749.58	17.30	17.15	-0.15
NC_SW12	2658887.64	369304.40	7.16	7.76	0.60
NC_SW13	2814538.97	448317.55	1.01	1.02	0.01
NC_SW14	2784849.31	417520.50	0.04	0.55	0.51
NC_SW15	2589340.96	443852.64	34.73	35.54	0.82
NC_SW16	2718014.09	552042.47	0.59	1.16	0.57
NC_SW17	2833289.70	700527.11	0.74	0.65	-0.09
NC_SW18	2746322.42	675225.52	1.29	1.60	0.31
NC_SW19	2641252.56	661499.68	17.45	17.19	-0.25
NC_SW20	2656244.61	574333.60	2.51	2.48	-0.03
NC_SW21	2578423.29	507735.39	1.38	1.85	0.47
NC_SW22	2924640.47	705348.10	0.34	1.00	0.66
NC_SW23	2659198.90	869847.29	40.84	41.45	0.61
NC_SW24	2778525.20	1015338.13	15.57	15.70	0.13
NC_SW25	2880968.53	907226.49	1.46	1.92	0.46
NC_SW26	2729500.6	833621.8	7.0725	7.8874	0.81
NC_SW27	2788579.7	916166.14	0.905	0.3885	-0.52
NC_SW28	2915430.7	920506.66	5.505	6.2402	0.74
NC_SW29	2907182.4	1012602.5	-0.25	0.9566	1.21
NC_SW30	2992793.7	781602.48	0.777	1.3172	0.54
NC_SW31	2960935.8	789338.12	0.4695	1.3383	0.87
NC_SW32	2858516.5	673793.31	0.4215	0.6517	0.23
NC_SW33	2571757.7	774156.39	22.2585	22.349	0.09
NC_SW34	2473031.3	372830.68	1.3335	2.1486	0.82
NC_SW35	2731641.9	376443.41	2.0455	3.0637	1.02
NC_SW36	2699238.8	453237.26	1.216	1.7145	0.50
NC_SW37	2711029.4	608077.16	1.51	1.3091	-0.20
NC_SW38	2814886.4	804166.77	1.294	1.4497	0.16
NC_SW39	2707759.8	778730.88	9.3585	9.7648	0.41
NC_SW40	2648790.1	755485.6	24.214	24.209	-0.01
NC_SW41	2605701.5	832377.79	6.482	7.1254	0.64
NC_SW42	2706402.5	977998.06	23.374	23.724	0.35
NC_SW43	2621825.8	964120.54	0.62	1.709	1.09
NC_SW44	2694308.8	921040.61	16.329	16.77	0.44
NC_SW45	2520610.6	894069.64	85.021	85.165	0.14
NC_SW46	2501744.4	825670.94	64.5135	65.041	0.53
NC_SW47	2528818.2	740674.61	31.0215	31.094	0.07
NC_SW48	2403907.6	701115.03	88.896	88.847	-0.05

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_SW49	2485082.8	682917.55	8.838	8.8724	0.03
NC_SW50	2576948.3	622471.24	16.874	17.39	0.52
NC_SW51	2470315.2	593953.98	28.245	28.209	-0.04
NC_SW52	2496629	516576.22	41.9195	41.833	-0.09
NC_SW53	2408668.3	472866.45	85.422	85.781	0.36
NC_SW54	2403945.7	368979.15	61.866	62.06	0.19
NC_SW55	2565360.1	351649.5	15.3815	16.246	0.86
NC_SW56	2462912	284110.46	1.354	1.423	0.07
NC_SW401	2492629	283730.57	0.903	1.6876	0.78
NC_SW402	2696842.1	352438.06	2.4575	3.065	0.61
NC_SW403	2998261.9	552214.73	3.538	3.706	0.17
NC_SW404	3044199	611202.25	2.233	2.4948	0.26
NC_SW405	3020150.6	774078.08	2.1975	3.055	0.86
NC_SW406	2982723.69	836905.77	7.50	7.78	0.28
NC_SW407	2944006.75	935644.48	4.21	4.62	0.41
Average dz	0.34 ft				
Minimum dz	-0.516 ft				
Maximum dz	1.207 ft				
Root Mean Square	0.497 ft				
95th Percentile	0.868 ft				

Table 10. SVA Urban Areas QA Points – Derived DEMs (Units – Survey Feet)

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_UA01	2892599.3	652867.07	1.429	1.3841	-0.04
NC_UA02	2641971.3	651868.33	19.7325	19.701	-0.03
NC_UA03	2829748.1	1010813.3	10.1905	9.7798	-0.41
NC_UA04	2785063.7	418939.42	3.2935	3.5628	0.27
NC_UA05	2716044.5	498526.38	4.2	4.1535	-0.05
NC_UA06	2608654.3	907833.92	62.9485	62.989	0.04
NC_UA07	2826704.5	932732.9	6.7315	6.073	-0.66
NC_UA08	2523700.3	889342.4	88.3005	88.413	0.11
NC_UA09	2557969.8	984308.74	88.12	87.964	-0.16
NC_UA10	2702318.8	994016.08	38.2045	38.091	-0.11
NC_UA11	2903681.6	1009088.3	9.142	9.4583	0.32
NC_UA12	2916682.9	921162.09	13.019	13.351	0.33
NC_UA13	2720174.7	834098.25	13.2995	13.496	0.20
NC_UA14	2572604	772402.48	56.292	56.223	-0.07
NC_UA15	2995161.4	780609.34	6.8645	6.7808	-0.08
NC_UA16	2835893.1	744025.72	5.7845	5.6303	-0.15
NC_UA17	2467373.8	593844.23	30.098	30.184	0.09
NC_UA18	2712583.8	608082.74	3.2715	3.3351	0.06
NC_UA19	2579089.4	507016.65	5.7485	5.8192	0.07
NC_UA20	2536691.3	417334.24	27.195	27.365	0.17
NC_UA21	2481851.3	688814.28	23.3555	23.427	0.07
NC_UA22	2728557.1	362916.72	5.858	5.8461	-0.01
NC_UA23	2625041.9	420278.18	21.2375	21.084	-0.15
NC_UA24	2437563.9	274209.68	64.706	64.472	-0.23
NC_UA25	2474439.5	371098.82	19.0475	19.07	0.02
NC_UA441	2970308.2	873097.44	8.7165	8.7271	0.01
NC_UA442	3043009.6	606671.2	2.43	2.5269	0.10
NC_UA443	2904427.1	508023.16	2.3515	2.4986	0.15
NC_UA444	2697808.2	353131.33	4.3975	4.4792	0.08
NC_UA445	2584462.1	337270.19	12.044	12.13	0.09
NC_UA446	2467886.8	269444.81	8.324	8.4079	0.08
Average dz 0.00 ft					
Minimum dz -0.658 ft					
Maximum dz 0.332 ft					
Root Mean Square 0.197 ft					
95th Percentile 0.293 ft					

Table 11. CVA for the 5 Classified Land Cover Classes (Units = Survey Feet)

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_BE01	2600739.26	534109.56	26.85	26.62	-0.23
NC_BE02	2641803.12	651856.58	19.40	19.00	-0.41
NC_BE03	2438136.23	274851.91	50.85	51.10	0.25
NC_BE04	2652607.11	1022423.72	74.96	74.94	-0.02
NC_BE05	2593670.06	1017401.68	42.16	42.26	0.10
NC_BE06	2557863.03	984312.83	87.10	86.91	-0.19
NC_BE07	2614202.55	965529.98	37.52	37.65	0.13
NC_BE08	2567046.23	934222.59	57.96	57.88	-0.08
NC_BE09	2524260.54	889123.90	92.41	92.44	0.03
NC_BE10	2608464.37	907750.64	63.48	63.49	0.01
NC_BE11	2647724.07	936763.83	46.92	46.94	0.02
NC_BE12	2703361.21	917591.75	40.40	40.45	0.06
NC_BE13	2666878.77	966260.86	21.71	21.50	-0.21
NC_BE14	2713130.11	988506.66	39.86	39.79	-0.07
NC_BE15	2766435.13	970802.56	15.63	15.70	0.08
NC_BE16	2777229.36	1013975.16	17.93	17.96	0.03
NC_BE17	2833916.78	1009605.82	9.82	9.73	-0.09
NC_BE18	2905122.44	1009390.24	1.96	2.30	0.34
NC_BE19	2878434.35	974598.01	9.65	9.54	-0.11
NC_BE20	2916660.47	921186.20	12.81	12.98	0.17
NC_BE21	2879038.72	913756.39	2.90	2.86	-0.04
NC_BE22	2826668.38	932761.34	7.20	6.46	-0.74
NC_BE23	2789271.33	914483.78	3.08	2.61	-0.48
NC_BE24	2759784.2	858536.19	9.4515	9.5285	0.08
NC_BE25	2661323.4	870432.23	57.448	57.186	-0.26
NC_BE26	2690855	847564.03	17.094	17.191	0.10
NC_BE27	2604826.9	831107.26	10.9485	10.887	-0.06
NC_BE28	2500537.2	808390.37	80.5825	80.609	0.03
NC_BE29	2572873.3	773956.4	45.4975	45.264	-0.23
NC_BE30	2649973.1	752777.73	39.4965	39.242	-0.25
NC_BE31	2535759.6	737844.11	45.3195	45.083	-0.24
NC_BE32	2403739.1	702363.14	108.205	108.13	-0.08
NC_BE33	2482091.6	689425.54	23.7035	23.807	0.10
NC_BE34	2575366	665105.38	11.573	11.551	-0.02
NC_BE35	2702262.9	689556.69	7.1855	7.2894	0.10
NC_BE36	2707561.5	781327.66	12.5275	12.369	-0.16
NC_BE37	2770407.4	781801.22	7.4515	7.3776	-0.07
NC_BE38	2814891.1	801488.12	1.606	1.569	-0.04
NC_BE39	2830774.8	763824.82	1.906	2.0109	0.10
NC_BE40	2970051.8	808705.62	4.2235	4.1847	-0.04
NC_BE41	2999037.8	779409.87	5.5125	5.5324	0.02
NC_BE42	2956753.3	795051.44	5.44	4.8939	-0.55
NC_BE43	2915162.9	699873.2	2.6715	2.7066	0.04
NC_BE44	2879033.2	664565.89	4.126	3.9568	-0.17
NC_BE45	2814855.9	628300.43	4.877	4.812	-0.07
NC_BE46	2711880.5	607883.35	2.77	2.6531	-0.12
NC_BE47	2559493.8	603121.17	40.5465	40.411	-0.14
NC_BE48	2471351.6	597724.18	30.342	30.319	-0.02

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_BE49	2466724.3	536650.08	61.67	61.628	-0.04
NC_BE50	2411733.1	468489.28	66.4135	66.77	0.36
NC_BE51	2408159.7	357125.82	81.4785	81.333	-0.15
NC_BE52	2473433.6	370593.04	2.8035	2.9202	0.12
NC_BE53	2536948.3	417097.12	24.138	24.191	0.05
NC_BE54	2513954.6	471062.33	24.9065	24.969	0.06
NC_BE55	2578548.6	507242.11	5.048	5.2274	0.18
NC_BE56	2639954.1	569212.32	45.37	45.538	0.17
NC_BE57	2716654.7	501361.53	1.644	1.689	0.04
NC_BE58	2657195.3	451112.63	22.134	22.008	-0.13
NC_BE59	2626358.1	420184.24	20.53	20.446	-0.08
NC_BE60	2705540.3	456887.52	5.385	5.8663	0.48
NC_BE61	2814630.7	450885.04	10.5795	10.543	-0.04
NC_BE62	2788138.8	420178.19	2.929	3.1471	0.22
NC_BE63	2693460.5	399902.85	7.0805	7.2738	0.19
NC_BE64	2729033.6	364083.12	6.124	5.8739	-0.25
NC_BE65	2661317.3	369135.94	14.9085	15.016	0.11
NC_BE66	2561736.5	347952.41	31.325	31.584	0.26
NC_BE67	2482159.3	296528.9	24.888	25.429	0.54
NC_BE431	2937523.7	954985.59	13.6535	13.772	0.12
NC_BE432	2982952.1	837365.73	7.3585	7.4119	0.05
NC_BE433	3030454.3	751987.06	5.4745	5.622	0.15
NC_BE434	3034295.5	558815.89	6.4655	6.4926	0.03
NC_BE435	2900548.4	507572.44	3.266	3.3932	0.13
NC_BE436	2696896.2	352294.97	3.879	4.0062	0.13
NC_BE437	2474277.4	274092.48	1.935	2.101	0.17
NC_TW01	2645925.26	632788.54	15.07	15.27	0.20
NC_TW02	2878445.07	974626.80	9.96	10.13	0.17
NC_TW03	2835464.76	1015724.68	10.07	10.27	0.20
NC_TW04	2770246	783162.46	6.763	6.9947	0.23
NC_TW05	2707154.6	623086.86	4.5215	4.9686	0.45
NC_TW06	2726652.4	834037.14	12.5645	12.586	0.02
NC_TW07	2730549.7	365674.72	3.83	3.8336	0.00
NC_TW08	2620310.8	418062.05	21.299	21.439	0.14
NC_TW09	2516434.2	471119.18	20.8145	20.942	0.13
NC_TW10	2475590.7	596268.11	29.151	29.268	0.12
NC_TW11	2828505.4	932123.15	1.7765	1.9267	0.15
NC_TW12	2607452.8	908779.54	64.6785	65.064	0.39
NC_TW13	2614328.3	956097.68	40.037	40.192	0.16
NC_TW14	2831481.1	965877.94	3.549	3.6339	0.08
NC_TW15	2757049.2	974400.67	16.761	16.904	0.14
NC_TW16	2657647.1	450078.22	5.7115	6.2175	0.51
NC_TW17	2577884.4	507024.16	9.8835	10.065	0.18
NC_TW18	2649568.1	753699.56	39.7165	39.978	0.26
NC_TW19	2543854.7	733668.95	34.0155	34.289	0.27
NC_TW20	2403441.7	702455.61	109.2705	109.27	0.00
NC_TW21	2481987.8	690134.88	19.6995	19.751	0.05
NC_TW22	2572869.5	664418.75	6.7115	7.0935	0.38
NC_TW23	2834871.5	747468.53	3.4685	3.6072	0.14
NC_TW24	2960146.1	789982.93	0.842	0.8651	0.02
NC_TW25	2815195	801811.94	1.6535	1.9502	0.30

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_TW26	2708288.1	693152.14	2.602	3.0321	0.43
NC_TW27	2707455	779575.05	9.081	9.4167	0.34
NC_TW28	2570653.8	775106.5	62.1675	62.33	0.16
NC_TW29	2503432.6	809092.29	79.5945	80.553	0.96
NC_TW30	2905179.49	1009109.80	1.56	2.10	0.53
NC_TW31	2702690.67	919371.81	39.81	40.53	0.72
NC_TW32	2659282.55	861256.93	49.97	50.02	0.05
NC_TW33	2604932.86	830605.12	13.09	13.29	0.20
NC_TW34	2523715.49	888410.15	90.66	91.15	0.48
NC_TW35	2560539.97	984145.25	72.71	73.01	0.30
NC_TW36	2652650.99	1022419.60	74.49	75.14	0.65
NC_TW37	2713166.27	988434.39	39.80	40.26	0.46
NC_TW38	2778708.22	1015645.17	15.55	15.73	0.18
NC_TW39	2789114.80	915370.77	1.67	1.78	0.11
NC_TW40	2875481.61	913147.91	4.43	5.04	0.61
NC_TW41	2918495.51	921727.19	12.55	12.82	0.28
NC_TW42	2924042.67	704476.11	0.46	1.11	0.65
NC_TW43	2858566.80	673821.88	0.47	1.15	0.68
NC_TW44	2817888.85	631893.24	1.19	1.14	-0.05
NC_TW45	2792085.76	419816.65	5.05	5.80	0.75
NC_TW46	2705610.3	455366.08	3.5665	3.7829	0.22
NC_TW47	2713255.7	502723.55	4.1615	4.6173	0.46
NC_TW48	2643209.3	570240.42	16.207	16.354	0.15
NC_TW49	2551523.8	596985.45	39.8305	40.316	0.49
NC_TW50	2464550.8	537960.63	58.51	58.883	0.37
NC_TW51	2408360.2	472939.28	86.725	86.924	0.20
NC_TW52	2535317.7	420046.04	30.3815	30.65	0.27
NC_TW53	2404845.1	365834.81	67.019	67.407	0.39
NC_TW54	2480879.5	295176.1	28.9665	29.411	0.44
NC_TW55	2993875.7	783051.8	1.554	1.7512	0.20
NC_TW56	2469099.5	368523.17	9.063	9.5974	0.53
NC_TW411	2932556	973019.47	6.5375	6.9639	0.43
NC_TW412	3024010.9	763199.64	4.5325	4.795	0.26
NC_TW413	2905787.7	507962.89	1.2065	1.6591	0.45
NC_TW414	3033342.5	559038.08	6.64	6.8574	0.22
NC_TW415	2584395.8	337112.05	13.0165	13.563	0.55
NC_TW416	2464467.3	267493.18	2.5915	2.7606	0.17
NC_FO101	2497131.49	808448.61	79.89	80.46	0.57
NC_FO102	2714020.19	988709.29	41.30	42.08	0.78
NC_FO103	2787309.22	914442.68	10.81	11.00	0.19
NC_FO104	2575369.92	664891.71	7.09	7.33	0.24
NC_FO105	2657099.93	869530.44	54.32	55.44	1.12
NC_FO106	2759828.96	858837.17	9.87	10.48	0.61
NC_FO107	2705309.35	782175.86	9.25	9.66	0.41
NC_FO108	2815003.20	802788.07	2.08	2.38	0.30
NC_FO109	2834932.38	747450.00	3.47	3.78	0.31
NC_FO110	2473406.85	370797.71	1.18	1.42	0.24
NC_FO111	2537027.19	416806.68	20.92	21.01	0.09
NC_FO112	2577116.48	507989.94	4.96	5.54	0.58
NC_FO113	2700990.5	689465.87	10.27	11.023	0.75
NC_FO114	2714533.8	607682.97	3.49	3.6307	0.14

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NC_FO115	2403651.5	701826.47	98.15	98.267	0.12
NC_FO116	2482638.4	690036.77	20.87	20.922	0.05
NC_FO117	2535782.9	737422.26	42.46	42.877	0.42
NC_FO118	2572489	772518.2	54.47	54.772	0.30
NC_FO119	2523100.2	890728.14	86.26	87.311	1.05
NC_FO120	2557718.3	984007.79	83.12	83.975	0.85
NC_FO121	2610304.7	966219.24	42.85	42.999	0.15
NC_FO122	2652725.7	1022468.1	74.08	74.688	0.61
NC_FO123	2698978.5	920351.98	24.31	24.755	0.45
NC_FO124	2777409.1	1013157.3	16.68	16.889	0.21
NC_FO125	2877197	973797.24	6.87	7.3248	0.45
NC_FO126	2875571.4	913133.81	4.04	4.4719	0.43
NC_FO127	2994020.5	782589.94	2.19	2.0224	-0.17
NC_FO128	2956981.8	795183.69	5.43	4.3481	-1.08
NC_FO129	2915146.1	699866.57	1.52	2.1552	0.64
NC_FO130	2887922	659780.91	1.83	1.2963	-0.53
NC_FO131	2819412.4	630978.12	2.26	2.1819	-0.08
NC_FO132	2711951	503279.21	5.36	5.6258	0.27
NC_FO133	2640110.8	569027.18	41.2	41.228	0.03
NC_FO134	2557261.4	603263.56	44.86	45.328	0.47
NC_FO135	2469551.3	594295.35	30	30.264	0.26
NC_FO136	2462535.8	538210.47	48.87	49.165	0.30
NC_FO137	2407679.5	473069.31	90.34	90.833	0.49
NC_FO138	2399945	371259.1	51.85	52.124	0.27
NC_FO139	2626327.4	420276.24	20.34	20.093	-0.25
NC_FO140	2657112.7	450950.48	21.23	21.079	-0.15
NC_FO141	2705618.1	455639.74	4.98	5.2692	0.29
NC_FO142	2788765.6	420192.71	5.82	5.794	-0.03
NC_FO143	2728855.9	365150.83	4.74	5.3188	0.58
NC_FO144	2561228	349902.26	26.12	26.824	0.70
NC_FO145	2485322.2	297047.48	26.38	26.336	-0.04
NC_FO146	2437886.2	275512.62	41.36	41.373	0.01
NC_FO1411	2932699.7	975422.21	7.62	7.9129	0.29
NC_FO1421	2904650.2	508038.82	1.5	2.0103	0.51
NC_FO1423	2985760.8	839579.93	12.12	12.37	0.25
NC_FO1424	3031987	559222.43	8.12	8.3962	0.28
NC_FO1425	2697854	352936.85	3.62	4.021	0.40
NC_FO1436	2476810.1	275837.4	4.6	5.1295	0.53
NC_UA01	2892599.3	652867.07	1.429	1.3841	-0.04
NC_UA02	2641971.3	651868.33	19.7325	19.701	-0.03
NC_UA03	2829748.1	1010813.3	10.1905	9.7798	-0.41
NC_UA04	2785063.7	418939.42	3.2935	3.5628	0.27
NC_UA05	2716044.5	498526.38	4.2	4.1535	-0.05
NC_UA06	2608654.3	907833.92	62.9485	62.989	0.04
NC_UA07	2826704.5	932732.9	6.7315	6.073	-0.66
NC_UA08	2523700.3	889342.4	88.3005	88.413	0.11
NC_UA09	2557969.8	984308.74	88.12	87.964	-0.16
NC_UA10	2702318.8	994016.08	38.2045	38.091	-0.11
NC_UA11	2903681.6	1009088.3	9.142	9.4583	0.32
NC_UA12	2916682.9	921162.09	13.019	13.351	0.33
NC_UA13	2720174.7	834098.25	13.2995	13.496	0.20

Number	Easting	Northing	Known Z	LiDAR Z	Dz
NC_UA14	2572604	772402.48	56.292	56.223	-0.07
NC_UA15	2995161.4	780609.34	6.8645	6.7808	-0.08
NC_UA16	2835893.1	744025.72	5.7845	5.6303	-0.15
NC_UA17	2467373.8	593844.23	30.098	30.184	0.09
NC_UA18	2712583.8	608082.74	3.2715	3.3351	0.06
NC_UA19	2579089.4	507016.65	5.7485	5.8192	0.07
NC_UA20	2536691.3	417334.24	27.195	27.365	0.17
NC_UA21	2481851.3	688814.28	23.3555	23.427	0.07
NC_UA22	2728557.1	362916.72	5.858	5.8461	-0.01
NC_UA23	2625041.9	420278.18	21.2375	21.084	-0.15
NC_UA24	2437563.9	274209.68	64.706	64.472	-0.23
NC_UA25	2474439.5	371098.82	19.0475	19.07	0.02
NC_UA441	2970308.2	873097.44	8.7165	8.7271	0.01
NC_UA442	3043009.6	606671.2	2.43	2.5269	0.10
NC_UA443	2904427.1	508023.16	2.3515	2.4986	0.15
NC_UA444	2697808.2	353131.33	4.3975	4.4792	0.08
NC_UA445	2584462.1	337270.19	12.044	12.13	0.09
NC_UA446	2467886.8	269444.81	8.324	8.4079	0.08
NC_SW01	2563953.7	990100.58	12.2745	12.592	0.32
NC_SW02	2603112.2	1017128.7	31.407	31.511	0.10
NC_SW03	2670293.6	958995.32	3.3915	4.0623	0.67
NC_SW04	2486354.1	636780.41	39.6435	39.817	0.17
NC_SW05	2691488.6	400361.2	2.811	2.8505	0.04
NC_SW06	2578974.8	355089.88	1.881	1.6739	-0.21
NC_SW07	2505079.6	571919.51	10.5705	10.522	-0.05
NC_SW08	2875319.7	973833.73	2.395	2.7325	0.34
NC_SW09	2831627.2	951385.43	1.035	0.9419	-0.09
NC_SW10	2570448.7	668035.6	4.036	4.1596	0.12
NC_SW11	2537297.71	416749.58	17.30	17.15	-0.15
NC_SW12	2658887.64	369304.40	7.16	7.76	0.60
NC_SW13	2814538.97	448317.55	1.01	1.02	0.01
NC_SW14	2784849.31	417520.50	0.04	0.55	0.51
NC_SW15	2589340.96	443852.64	34.73	35.54	0.82
NC_SW16	2718014.09	552042.47	0.59	1.16	0.57
NC_SW17	2833289.70	700527.11	0.74	0.65	-0.09
NC_SW18	2746322.42	675225.52	1.29	1.60	0.31
NC_SW19	2641252.56	661499.68	17.45	17.19	-0.25
NC_SW20	2656244.61	574333.60	2.51	2.48	-0.03
NC_SW21	2578423.29	507735.39	1.38	1.85	0.47
NC_SW22	2924640.47	705348.10	0.34	1.00	0.66
NC_SW23	2659198.90	869847.29	40.84	41.45	0.61
NC_SW24	2778525.20	1015338.13	15.57	15.70	0.13
NC_SW25	2880968.53	907226.49	1.46	1.92	0.46
NC_SW26	2729500.6	833621.8	7.0725	7.8874	0.81
NC_SW27	2788579.7	916166.14	0.905	0.3885	-0.52
NC_SW28	2915430.7	920506.66	5.505	6.2402	0.74
NC_SW29	2907182.4	1012602.5	-0.25	0.9566	1.21
NC_SW30	2992793.7	781602.48	0.777	1.3172	0.54
NC_SW31	2960935.8	789338.12	0.4695	1.3383	0.87
NC_SW32	2858516.5	673793.31	0.4215	0.6517	0.23
NC_SW33	2571757.7	774156.39	22.2585	22.349	0.09

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NC_SW34	2473031.3	372830.68	1.3335	2.1486	0.82
NC_SW35	2731641.9	376443.41	2.0455	3.0637	1.02
NC_SW36	2699238.8	453237.26	1.216	1.7145	0.50
NC_SW37	2711029.4	608077.16	1.51	1.3091	-0.20
NC_SW38	2814886.4	804166.77	1.294	1.4497	0.16
NC_SW39	2707759.8	778730.88	9.3585	9.7648	0.41
NC_SW40	2648790.1	755485.6	24.214	24.209	-0.01
NC_SW41	2605701.5	832377.79	6.482	7.1254	0.64
NC_SW42	2706402.5	977998.06	23.374	23.724	0.35
NC_SW43	2621825.8	964120.54	0.62	1.709	1.09
NC_SW44	2694308.8	921040.61	16.329	16.77	0.44
NC_SW45	2520610.6	894069.64	85.021	85.165	0.14
NC_SW46	2501744.4	825670.94	64.5135	65.041	0.53
NC_SW47	2528818.2	740674.61	31.0215	31.094	0.07
NC_SW48	2403907.6	701115.03	88.896	88.847	-0.05
NC_SW49	2485082.8	682917.55	8.838	8.8724	0.03
NC_SW50	2576948.3	622471.24	16.874	17.39	0.52
NC_SW51	2470315.2	593953.98	28.245	28.209	-0.04
NC_SW52	2496629	516576.22	41.9195	41.833	-0.09
NC_SW53	2408668.3	472866.45	85.422	85.781	0.36
NC_SW54	2403945.7	368979.15	61.866	62.06	0.19
NC_SW55	2565360.1	351649.5	15.3815	16.246	0.86
NC_SW56	2462912	284110.46	1.354	1.423	0.07
NC_SW401	2492629	283730.57	0.903	1.6876	0.78
NC_SW402	2696842.1	352438.06	2.4575	3.065	0.61
NC_SW403	2998261.9	552214.73	3.538	3.706	0.17
NC_SW404	3044199	611202.25	2.233	2.4948	0.26
NC_SW405	3020150.6	774078.08	2.1975	3.055	0.86
NC_SW406	2982723.69	836905.77	7.50	7.78	0.28
NC_SW407	2944006.75	935644.48	4.21	4.62	0.41
Average dz	0.20 ft				
Minimum dz	-1.082 ft				
Maximum dz	1.207 ft				
Root Mean Square	0.378 ft				
95th Percentile	0.777 ft				