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GEOSPATIAL SERVICES

LiDAR MAPPING REPORT

UTAH 3DEP – WAYNE SAN JUAN AERIAL SURVEY

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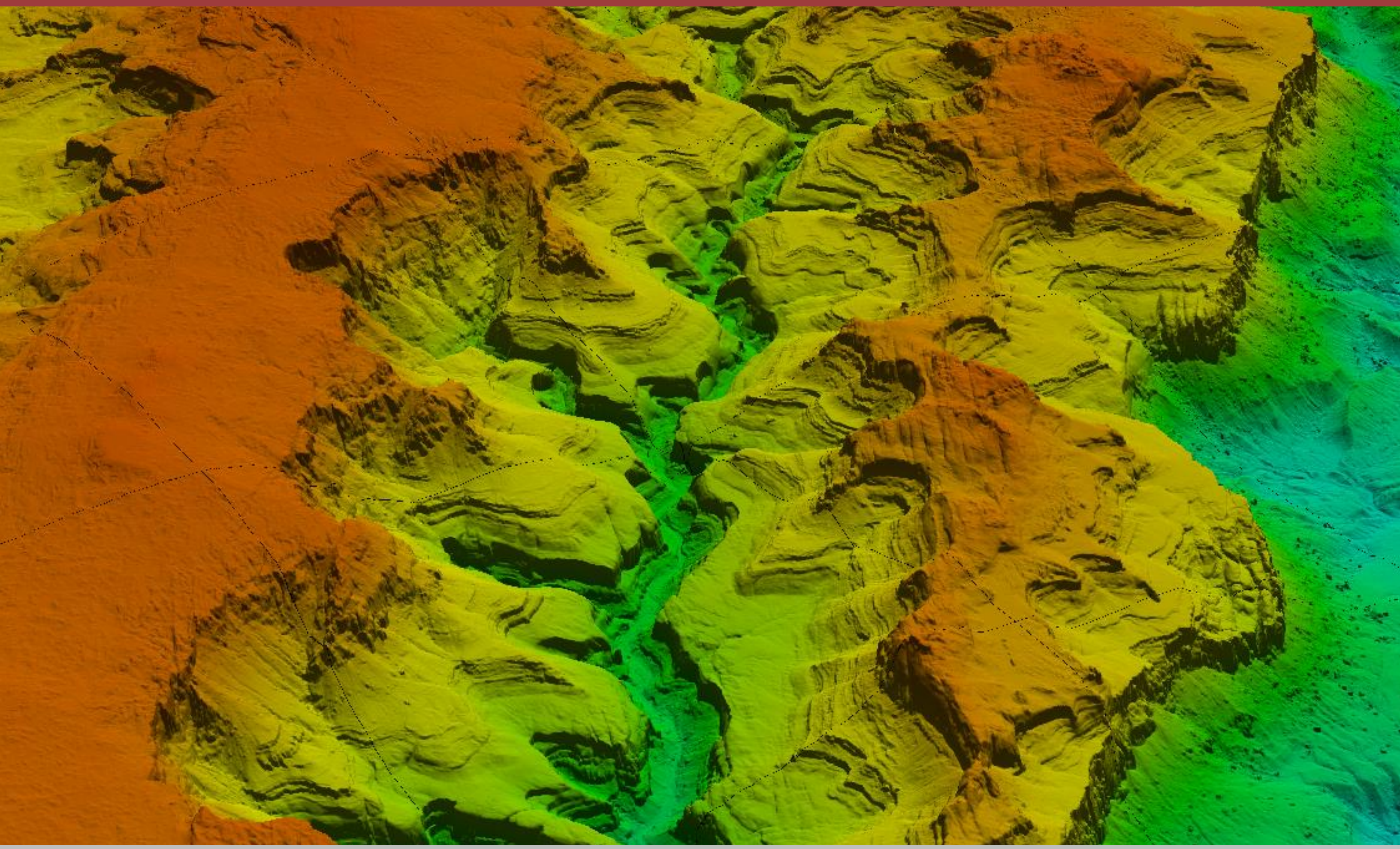

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LiDAR Mapping Report
Utah 3DEP - Wayne San Juan Aerial Survey

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1. Overview

1.1 Project Area

Aero-Graphics, Inc., a full-service geospatial firm located in Salt Lake City, Utah, was contracted by the U.S. Geological Survey (USGS) and partners to acquire, process, and deliver aerial lidar data and derivative products that adhere to U.S. Geological Survey (USGS) National Geospatial Program (NGP) Lidar Base Specification 2022, Revision A, QL2 standards. The assigned project area covers approximately 4,746 square miles in Wayne County and San Juan County, Utah. Lidar data was delivered as processed Classified LAZ 1.4 files, formatted to 12,807 individual 1000 m x 1000 m tiles, as tiled Intensity Imagery and DSMs, and as tiled bare earth DEMs; all tiled to the same 1000 m x 1000 m schema.

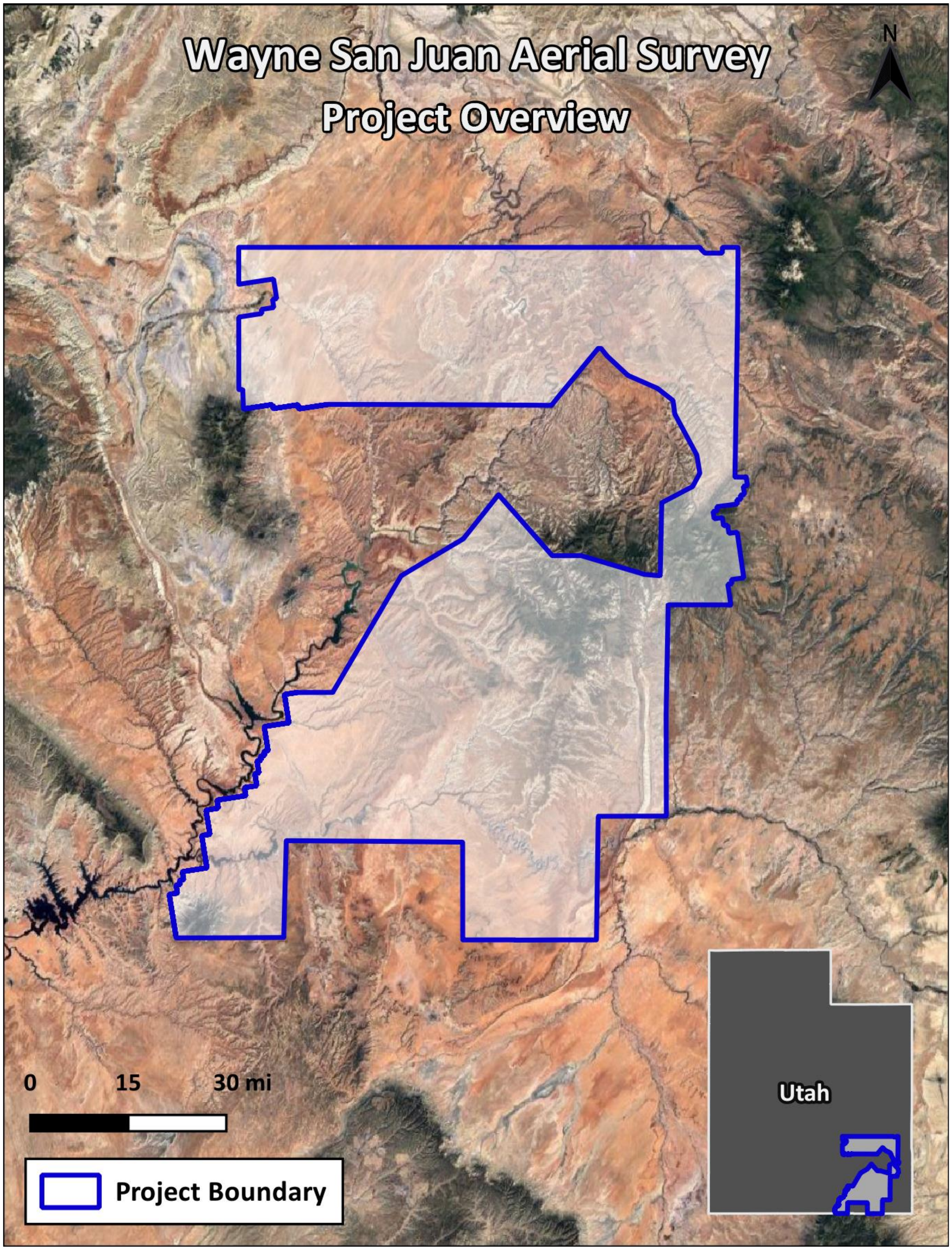
1.2 Project Deliverables

LiDAR Data	▪ Classified point cloud data in LAS v1.4 format, zipped to LAZ
Raster Data	▪ Bare-earth DEM, Digital Surface Model (DSM), Maximum surface height rasters (MSHR), and intensity imagery with a cell size of 1.0 meter in GeoTIFF format ▪ Swath separation images with a 2.0 meter resolution in GeoTIFF format
Vector Data	▪ Breaklines in geodatabase format ▪ Flight index, tile index and AOI in SHP format ▪ Surveyed GCPs and checkpoints in .gpkg format
Report of Survey	▪ Reports and metadata as described in TO

1.3 Projection, Datum, Units

Projection		UTM Zone 12N
EPSG		6341
Datum	Vertical	NAVD88 (Geoid18)
	Horizontal	NAD83 (2011)
Units		Meters

<u>Exhibit 1:</u> Utah 3DEP - Wayne San Juan project boundary



2. Acquisition

2.1 Flight Planning

Aero-Graphics Aerial Department created a unique flight plan for this project using Optech's Airborne Mission Manager (AMM) flight planning software. AMM simulates flight plans based on the project area's terrain, as well as the sensor's model, mount, and settings. These features helped ensure that all contract specifications are met in the most efficient way possible. Prior to mobilizing to the acquisition sites, Aero-Graphics' staff monitored all site conditions and potential weather hazards including wind, rain, snow, and blowing dust. Additionally, Aero-Graphics ensured all airspace clearances were secured by the proper officials before acquisition occurred. A summary of the flight parameters and sensor settings for the Utah 3DEP - Wayne San Juan Aerial Survey are outlined in **Exhibit 2**.

Exhibit 2: Summary of planned flight parameters and sensor settings

Planned Specifications		
Aircraft		Cessna 206
Altitude (ft above ground level)		6,900
Speed (kts)		135
LiDAR Sensor		Optech Galaxy Prime
PRF (kHz)		550
Scan frequency (Hz)		72
Laser power		High (Boost)
Scan Angle	Full	45°
	From nadir	± 22.5°
Planned Average Point Density (p/m²)		3.91
Post Spacing at Nadir	Cross Track (m)	0.53
	Down Track (m)	0.48
Swath Width (m)		1,718
Sidelap (%)		20
No. of Flightlines		199

2.2 Data Acquisition

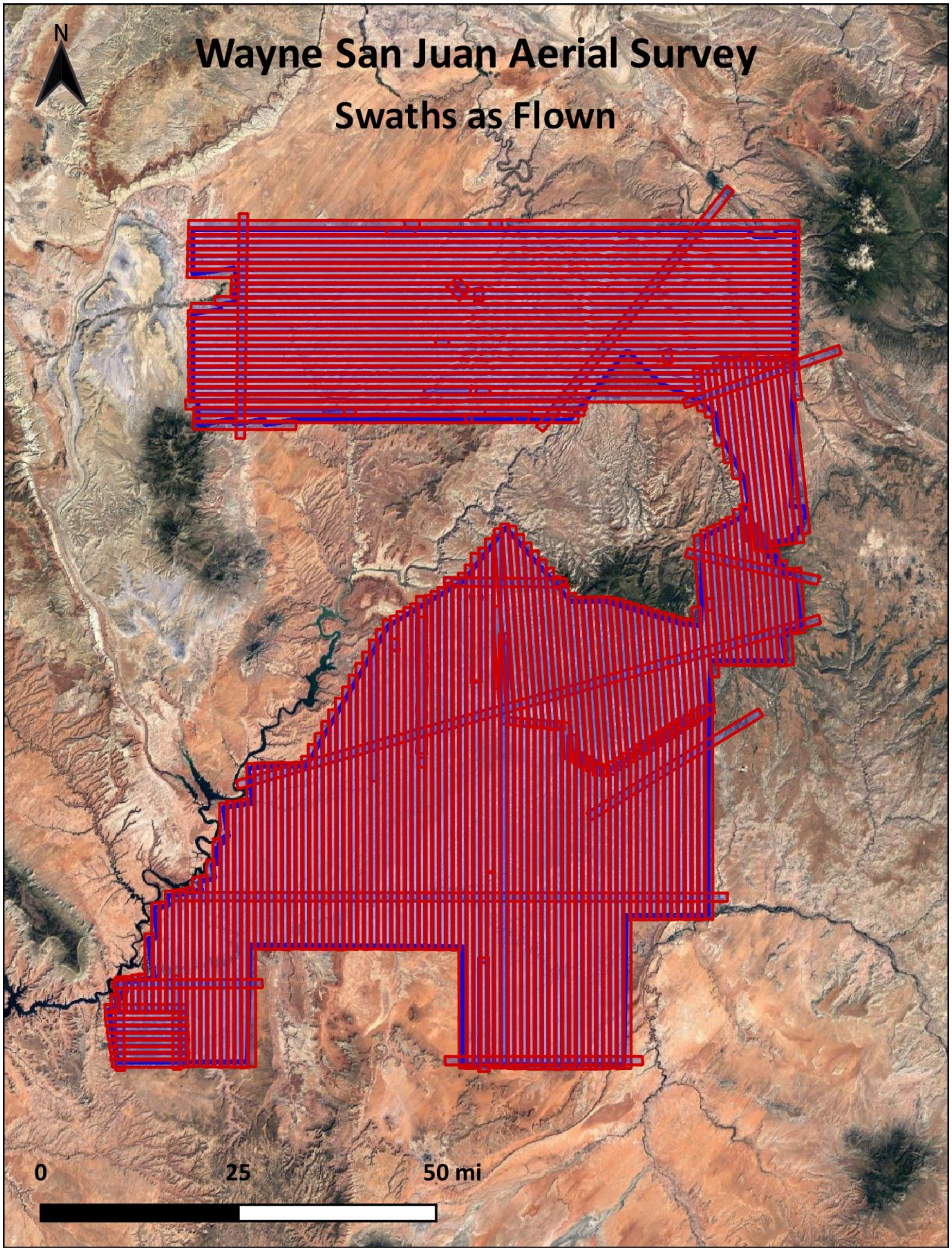
Aero-Graphics acquired LiDAR data from August to October of 2022 with a turbocharged Cessna 206 (**Exhibit 3**). The stability of this platform is ideal for efficient data collection at high and low altitudes and at a variety of airspeeds. Additionally, our Cessna 206 has been customized to house a variety of airborne sensors, and the power system and avionics have been upgraded specifically to meet aerial survey needs.

Exhibit 3: A Cessna 206 was the acquisition platform for this project

The Optech Galaxy Prime was selected for this project on account of its high accuracy and efficiency (**Exhibit 4**). This sensor uses SwathTrak technology, which dynamically adjusts the scan field of view in real time to maintain a constant swath width over a variety of terrains. It also features up to 8 returns per pulse, which increases the vertical resolution of complex terrains. The sensor is complemented with the use of FMS Nav, which allowed the system operator to monitor the point density and swath attributes of this project in real time, ensuring quality data and full coverage, as shown in **Exhibit 5**. More information about point density can be found in Section 4.4.

Exhibit 4: The Optech Galaxy PRIME was used for data acquisition

Exhibit 5: **Swath data for the Utah 3DEP - Wayne San Juan project was recorded and viewed in real-time by the sensor operator.**



2.3 Acquisition Summary

Aero-Graphics acquired LiDAR data beginning August 24, 2022 and concluded acquisition on October 18, 2022. These flights took place when ground conditions were free of snow, ice, and standing water. There were also no technical issues with the data collection such as LiDAR sensor problems.

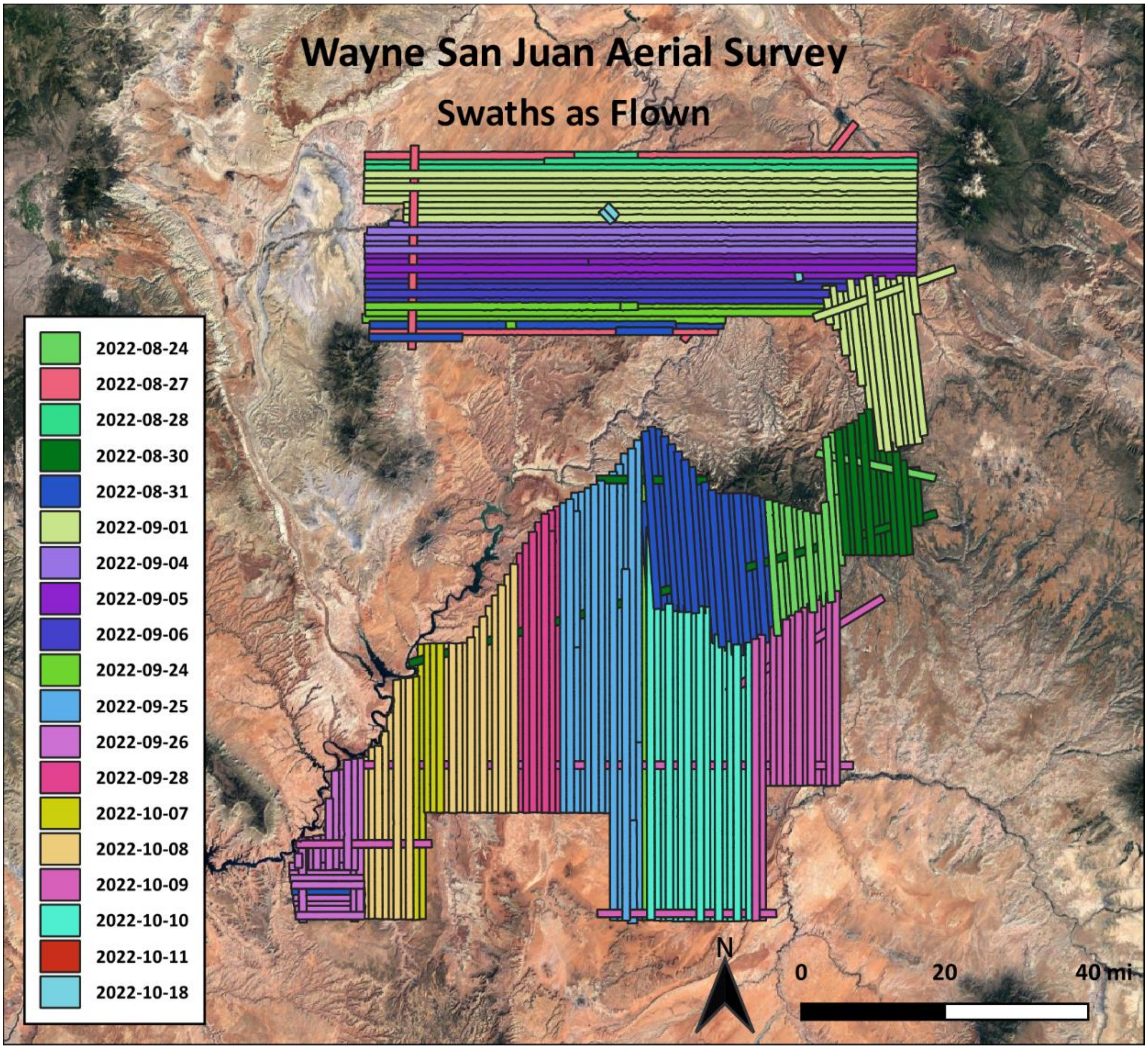


Exhibit 6: The lines flown by date for the Utah 3DEP - Wayne San Juan project

Data was acquired successfully to cover the entire project area however a single tile (12SWH0028), which is entirely inside the shoreline of the Colorado River (Exhibit 7), resulted in that tile having no Lidar points. A DEM was made for this tile from adjacent breaklines but no other project deliverables were made for this tile. A shapefile named excluded_tile.shp has been included in the metadata folder and txt files have been added to each of the folders for which that tile will be missing.

Exhibit 7: **Location of tile 12SWH0028 within the Colorado River**

2.4 Ground Control and Check Point Survey

Aero-Graphics' professional land surveyor identified, targeted, and surveyed 45 ground control points (**Exhibit 8**) for use in data calibration as well as 133 QC check points (**Exhibit 9**) in vegetated and non-vegetated land cover classification as an independent test of accuracy for this project. A combination of precise GPS surveying methods, including static and RTK observations were used to establish the 3D position of ground control points and QC check points. Ground control coordinates can be found in Appendix A. A summary of LiDAR calibration control vertical accuracy can be found in Section 4.2 with a more detailed report in Appendix B.

<u>Exhibit 8:</u> Static ground control for the Utah 3DEP - Wayne San Juan project

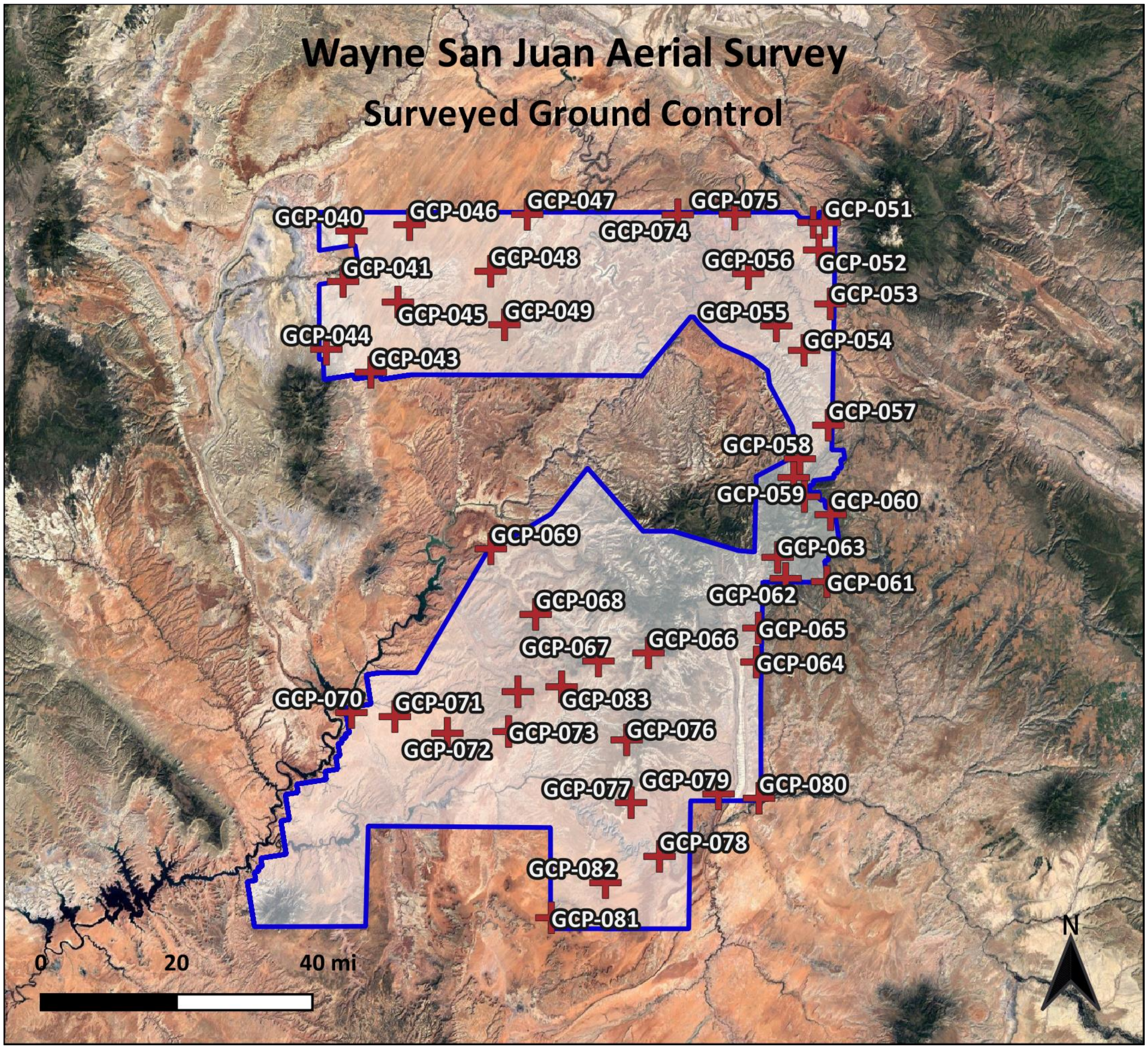
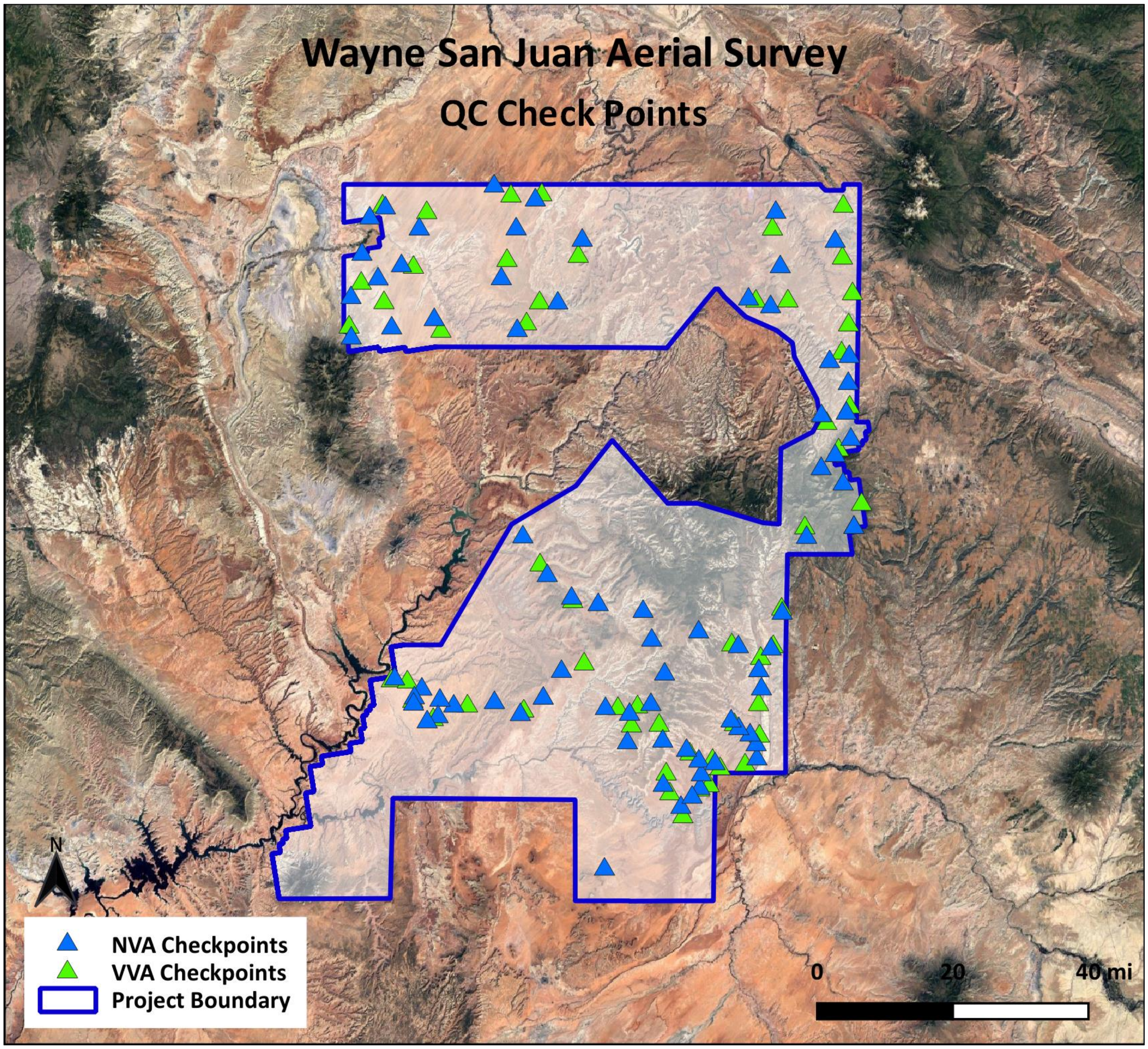


Exhibit 9: **Check Points for the Utah 3DEP - Wayne San Juan project**



3. LIDAR PROCESSING WORKFLOW

1. **Absolute Sensor Calibration**. Following sensor installation, lever arm values were surveyed. A boresight mission was flown over our fully controlled local range, and when adjusted to the surveyed ground control for roll, pitch, heading, and scale errors, boresight angles were developed for application to the POS processing in subsequent steps.
2. **Kinematic Air Point Processing.** The airborne GPS positions (collected at 1-second intervals) were post-processed using Applanix's POSPac MMS GNSS Inertial software (PP-RTX). A smoothed best estimate of trajectory (SBET) was developed by combining the corrected GPS positions with 1/200-second inertial measurement unit (IMU) data, which tracked the plane's roll, pitch, and yaw throughout the flight.
3. **Raw LiDAR Point Processing (Calibration).** The SBET and LiDAR range data were combined to solve for the real-world positions of each laser point. Point cloud data was produced by flight strip in ASPRS v1.4 LAS format. Flight strips were output in the project's coordinate system.
4. **Relative Calibration.** Performed relative calibration by correcting for roll, pitch, heading, and scale discrepancies between adjacent flightlines; tested resulting relative accuracy. The Aero-Graphics Team generated swath separation images using LP360 software. These images were created from the last return of all points except points classified as noise and/or flagged as withheld. Point Insertion was used as the Surface Method and the cell size was set to 2x the deliverable DEM cell size. The three interval bins used are bulleted above and the parameter to "Modulate source differences by Intensity" was set to 50%. The output GeoTIFF rasters were tiled to the project tile grid, clipped to the master DPA, and formatted (including defining the CRS which matches the project CRS) using GDAL software, version 2.4.0. These results are presented in Section 4.1.

    a. A **Dz Ortho Raster** was generated from Last return lidar points as part of this process (**Exhibit 10**). This raster identifies clusters of large residuals and differences in measured elevations between overlapping flightlines. These errors are usually caused by topographic relief or environmental factors and require manual adjustments to correct. In most cases, multiple iterations of the Dz ortho raster are created to aid in fine tuning relative calibration parameters.

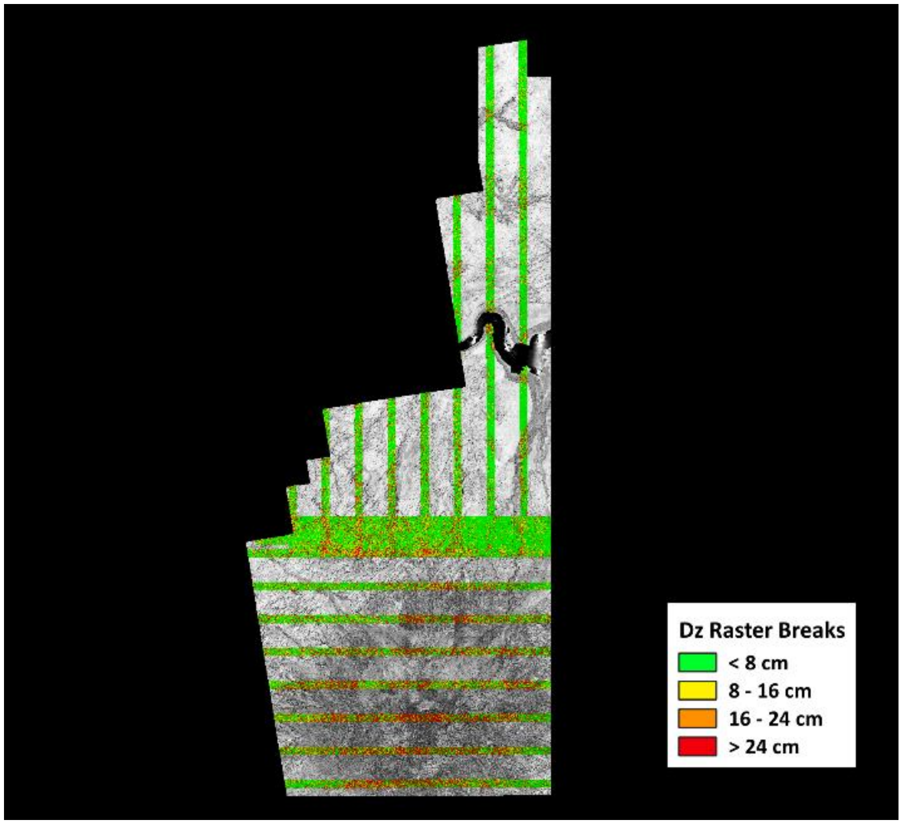


Exhibit 10: A Dz ortho raster sample generated for the Utah 3DEP - Wayne San Juan project

5. **Vertical Accuracy Assessment** Height differences between each static survey point and the laser point surface were identified through comparative tests. Results are presented in Section 4.2.

6. **Tiling & Long/Short Filtering** Extremely long and short returns were also filtered out as outliers and classified to a temporary class to be reclassified to low or high noise after completion of ground point classification.

7. **Classified LAS Processing.** The point classification was performed with the ASPRS classes described in **Exhibit 11**. The bare-earth surface is classified using a combination of TerraScan macro functionality as well as proprietary software. The bare-earth surface is then manually reviewed and corrected to ensure correct classification on the Class 2 (Ground) points. All data is then reviewed and any remaining artifacts removed using functionality provided by TerraScan. LP360 is then used as a final check of the bare-earth dataset. LP360 and TerraScan software was used to perform statistical analysis of the classes in the LAS files, on a per tile level to verify classification metrics and full LAS header information.

Class code 22 Temporal exclusion is typically used for non-favored data in intertidal zones. AGI used this class code to represent non-favored river high elevation flow. Due to fluctuations in river elevation from mission to mission during the flight season for this project AGI used Temporal exclusion class coding to exclude non-favorable high water for the more favorable lowest ground "water" elevation.

Exhibit 11: The ASPRS classes used in lidar point classification

ASPRS Version 1.4 minimum point cloud classification scheme		
CLASS #	**CLASS NAME**	**DESCRIPTION**
1	Processed, but unclassified	Points that do not fit any other classes
2	Bare earth	Bare earth surface
7	Low noise	Low points identified below surface
9	Water	Points inside of lakes/ponds
17	Bridge decks	Points on bridge decks
18	High noise	High points identified above surface
20	Ignored ground	Points near breakline features; ignored in DEM creation process
22	Temporal exclusion	Used for non-favored data in intertidal zones

8. **Hydro-Flattened Breakline Collection**. Full point cloud intensity imagery, DEMs, and bare earth terrains were used to manually digitize 3D breaklines. Breakline features were collected of inland streams and rivers with a 30-meter 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, and inland stream and river islands, using ESRI and LP360 functionality.

9. **Hydro-Flattened Raster DEM Creation.** A hydro-flattened raster digital elevation model (DEM) was created from a TIN surface generated using the ground classified LiDAR points. The hydro-flattened DEMs, clipped to the project tile grid, were generated in LP360 using the hydro breaklines collected. The tiled DEMs were reviewed at a scale of 1:5,000 to look for artifacts caused by the DEM generation process and to verify correct and complete hydro-flattening was applied. Upon correction of any outstanding issues, the DEM data was loaded into Global Mapper for its second review and to verify corrections. Final DEMs are formatted using GDAL software version 2.4.0.

a. Tile 12SWH0028 is a small clipped tile contained entirely between the banks of the Colorado River. There are no LiDAR points for this tile. There is a DEM for the tile as the area of the river as it was interpolated from the adjacent points and breaklines. There are no other deliverables other than the DEM for this tile.

10. **Maximum Surface Height Rasters Creation**. MSHRs are delivered as tiled GeoTIFFs (32-bit, floating point), with the tile size and naming convention matching the project tile grid. All points, excluding points flagged as withheld, are used to produce MSHRs. The rasters are produced with a binning method in which the highest elevation of all lidar points intersecting each pixel is applied as the pixel elevation in the resulting raster. Final MSHRs are formatted using GDAL software version 2.4.0, spatially defined to match the project CRS, and the cell size equals 2x the deliverable DEM cell size.

4. Accuracy Testing and Results

4.1 Relative Calibration Accuracy Results

Inter-swath relative accuracy is defined as the elevation difference in the overlapping area of parallel swaths. The inter-swath accuracy was tested in 787 areas across the project in a total of 491.96 square kilometers.

Utah 3DEP - Wayne San Juan project area: (225 flightlines, > 83 billion points)

- Inter-swath relative accuracy **average** of 0.038 m

Intra-swath Precision is a measure of the expected precision of the laser ranging measurement. The metric is derived by calculating the variation in elevation values across a smooth flat surface and was calculated using a kernal size of 2 meters around each control and NVA checkpoint. The intra-swath precision average was found to be 0.020 m.

4.2 Calibration Control Vertical Accuracy

Vertical absolute accuracy reports were generated as a quality assurance check. The location of each control point is displayed in the Surveyed Ground Control map in **Exhibit 8**. Detailed results for each point are included in **Appendix B**.

Exhibit 12: Calibration control vertical accuracy results summary

Calibration Control Accuracy$_Z$: Utah 3DEP - Wayne San Juan Project Area	
Average Error = +0.000 m	Average Magnitude = 0.020 m
Minimum Error = -0.151 m	RMSE = 0.041 m
Maximum Error = +0.084 m	σ = 0.041 m
Survey Sample Size: n = 45	

4.3 Point Cloud Testing

The project specifications require that only Non-Vegetated Vertical Accuracy (NVA) be computed for raw LiDAR point cloud swath files. NVA is defined as the elevation difference between the LiDAR ground surface and statically surveyed ground control points collected in open terrain (bare soil, sand, rocks, and short grass) as well as urban terrain (asphalt and concrete surfaces). The NVA for this project was tested with 77 check points. These check points were not used in the calibration or post-processing of the LiDAR point cloud data. Elevations from the unclassified LiDAR surface were measured for the xy location of each check point. Elevations interpolated from the LiDAR surface were then compared to the elevation values of the surveyed control points.

The bare-earth LiDAR dataset was designed to meet or exceed ASPRS Positional Accuracy Standards at the 10 cm vertical accuracy class. Absolute accuracy for non-vegetated areas (NVA) must be accurate within 10.0 cm (0.32 ft) RMSEz and 19.6 cm (0.64 ft) at the 95% confidence level. The tested NVA for this dataset was found to be accurate within 4.3 cm (0.14 ft) in terms of the RMSEz. The resulting NVA stated at the 95% confidence level (RMSEz x 1.96) is 8.4 cm (0.28 ft). Therefore, this dataset meets the required NVA of 10 cm (0.32 ft) at the 95% confidence level as defined by the National Standards for Spatial Data Accuracy (NSSDA).

4.4 Digital Elevation Model Testing

The project specifications require the accuracy of the derived DEM be calculated and reported in two ways: (1) Non-Vegetated Vertical Accuracy (NVA) calculated at a 95% confidence level in “bare earth” and “urban” land cover classes and (2) Vegetated Vertical Accuracy (VVA) in all vegetated land cover classes combined calculated based on the 95th percentile error. The NVA for this project was tested with 77 check points. The VVA was tested with 56 check points.

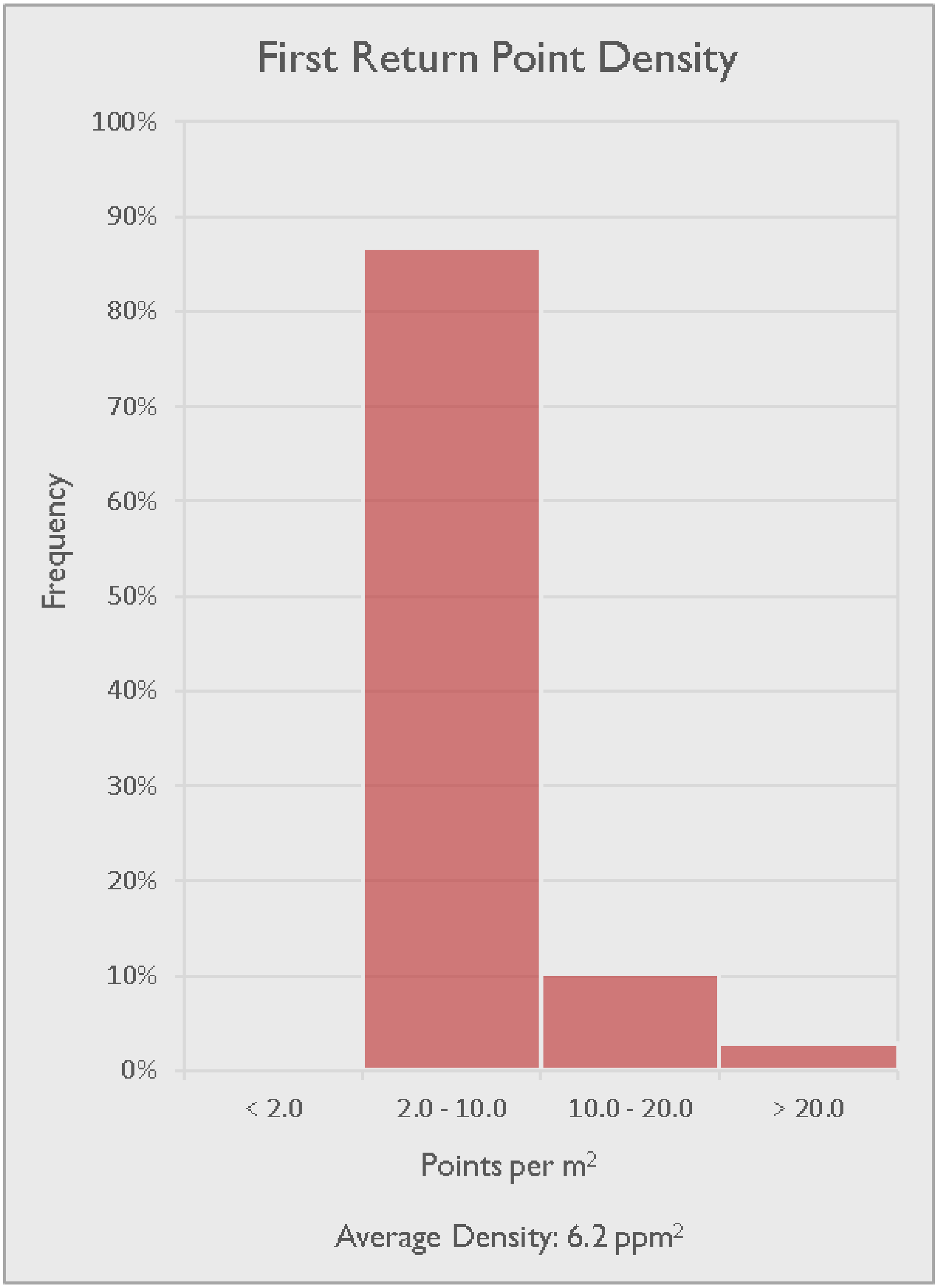
The Non-Vegetated Vertical Accuracy (NVA) for this dataset was tested by sampling the DEM elevation value at each NVA checkpoint and differencing the sampled DEM Value and the statically surveyed NVA checkpoint elevation value. The resulting RMSEz of the DEM values were found to be 4.7 cm (0.15 ft). The resulting accuracy stated as the 95% confidence level (RMSEz x 1.96) is 9.2 cm (0.3 ft). Therefore, this dataset meets the required NVA of 19.6 cm at the 95% confidence level.

The tested Vegetated Vertical Accuracy (VVA) for this dataset captured from the DEM using bi-linear interpolation for all classes was found to be 5.9 cm (0.19 ft). Therefore, this dataset meets the required VVA of 10.3 cm based on the 95th percentile error.

4.5 Data Density

The goal for this project was to achieve a minimum LiDAR point density of **2.0** points per square meter. First return density is the best representation of the quality of the acquisition because the density of first returns is independent of vegetation and other random factors that could increase the overall point density. The acquisition mission achieved an actual average of **6.2** points per square meter for first returns. Please note that ground water and other random factors could decrease the overall point density.

Exhibit 13: First returns laser point density by frequency, points/m2 . This figure displays the percentage of points in a given density range



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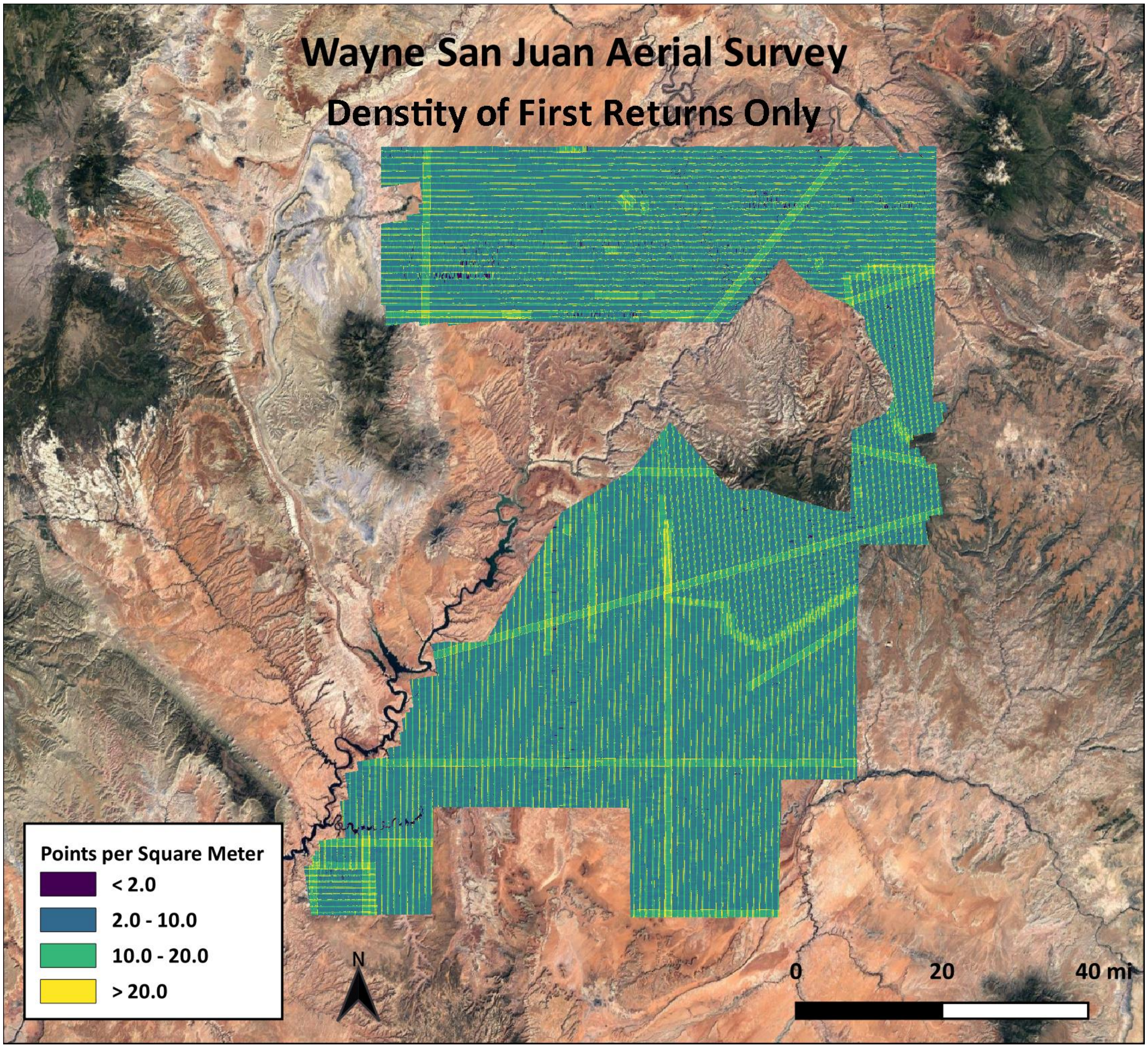

Exhibit 14: Density of first returns only in points per meter² for the Utah 3DEP - Wayne San Juan project.

APPENDIX A – CHECK POINTS

Survey Point	Utah 3DEP - Wayne San Juan Aerial Survey		
	Easting	Northing	Elevation (m)
NVA-064	526907.117	4253562.247	1362.247
NVA-065	525116.160	4245190.355	1330.228
NVA-066	522605.540	4235184.235	1456.779
NVA-067	522692.380	4225838.402	1814.164
NVA-068	528881.198	4239506.021	1385.451
NVA-069	534304.709	4242582.413	1374.966
NVA-070	532090.126	4228186.071	1459.584
NVA-071	541972.021	4230186.046	1614.831
NVA-072	530519.684	4255910.336	1445.830
NVA-073	538393.717	4251063.870	1501.823
NVA-075	555672.437	4261078.669	1728.145
NVA-076	565251.898	4257947.297	1614.173
NVA-077	560848.718	4251243.477	1747.118
NVA-078	557496.904	4239708.527	1808.942
NVA-079	570656.420	4234204.124	1974.263
NVA-080	576196.367	4248761.252	1865.749
NVA-081	561283.762	4227755.599	1906.188
NVA-083	620995.220	4255738.568	1684.481
NVA-084	620115.289	4233936.265	1940.106
NVA-085	614959.288	4235619.426	1906.998
NVA-086	622218.305	4243200.943	1872.025
NVA-087	634863.423	4249272.549	1564.609
NVA-088	638599.946	4222721.420	1852.125
NVA-089	634034.207	4221448.961	1918.657
NVA-090	638480.387	4216455.344	1889.214
NVA-091	638134.410	4209570.213	1925.759
NVA-093	632347.718	4208896.653	2025.395
NVA-094	639293.184	4203530.537	2232.785
NVA-095	635694.494	4199696.900	2430.950
NVA-096	632482.482	4196596.885	2522.126
NVA-097	637666.983	4193120.924	2566.746
NVA-098	640356.064	4183065.514	2276.129
NVA-099	629318.096	4180576.931	2292.604
NVA-100	613719.421	4154860.433	1806.965
NVA-101	604355.150	4158190.358	2166.392
NVA-102	596489.812	4148258.963	1971.051
NVA-103	593373.771	4156147.315	2030.060
NVA-104	591263.054	4162831.327	2005.504

NVA-105	580733.801	4164307.721	1785.684
NVA-106	574481.131	4165735.022	1617.751
NVA-107	562960.906	4179931.912	1438.687
NVA-108	568738.645	4170960.022	1509.189
NVA-109	572260.710	4148642.302	1579.341
NVA-110	568037.558	4142352.829	1459.397
NVA-111	556573.278	4141230.932	1638.084
NVA-112	547017.799	4140366.990	1548.825
NVA-113	543767.840	4141707.644	1463.726
NVA-114	539503.902	4144279.606	1335.369
NVA-115	533109.083	4146610.070	1271.706
NVA-117	537765.802	4142243.163	1317.932
NVA-118	537573.900	4140768.291	1323.473
NVA-119	543345.961	4137855.761	1487.163
NVA-120	540786.375	4136625.542	1438.723
NVA-121	582817.354	4102433.734	1664.084
NVA-122	600678.744	4117115.906	1378.385
NVA-123	596470.084	4122235.933	1541.775
NVA-124	596229.110	4132585.432	1983.145
NVA-125	593342.973	4141097.624	1980.809
NVA-126	588349.327	4138775.114	1894.070
NVA-127	582665.353	4140046.577	1790.363
NVA-128	587919.284	4132115.764	1902.355
NVA-129	618437.739	4128701.536	1354.773
NVA-130	605116.830	4121612.855	1350.546
NVA-131	603301.873	4119529.399	1324.086
NVA-132	605399.748	4124823.941	1423.635
NVA-133	604780.755	4128010.264	1457.770
NVA-134	601842.492	4130487.156	1542.161
NVA-135	608590.520	4127436.640	1501.533
NVA-136	618203.455	4132006.346	1359.898
NVA-137	616750.275	4134288.188	1444.641
NVA-138	614065.781	4135733.363	1525.279
NVA-139	612236.089	4137497.989	1552.141
NVA-140	621417.745	4154448.404	1599.284
NVA-141	623885.993	4162806.536	1678.621
NVA-142	618592.525	4149354.155	1455.181
NVA-143	619281.496	4145071.221	1437.477
NVA-144	562683.541	4138465.726	1420.217
VVA-043	529867.327	4256339.072	1454.964
VVA-044	540106.823	4254869.814	1529.295
VVA-045	559596.462	4258817.037	1696.918
VVA-046	566733.387	4259132.152	1593.501

VVA-047	558781.333	4243945.059	1787.319
VVA-048	566421.284	4234232.830	1909.592
VVA-049	575317.813	4245028.585	1886.993
VVA-050	522184.077	4228369.830	1638.570
VVA-051	530272.589	4234044.006	1441.689
VVA-052	524973.711	4238514.271	1406.541
VVA-053	543539.296	4227483.533	1670.875
VVA-054	537090.219	4242230.273	1444.377
VVA-055	563443.708	4229313.261	1913.509
VVA-056	616680.149	4235164.773	1918.668
VVA-057	624107.776	4235321.429	1928.242
VVA-058	620282.771	4251867.287	1719.446
VVA-060	636621.823	4257395.898	1581.288
VVA-061	636620.315	4245431.185	1707.334
VVA-062	639093.059	4237235.245	1826.498
VVA-063	636797.865	4223470.066	1874.639
VVA-064	638315.530	4230013.437	1783.753
VVA-065	638898.329	4211003.344	1924.323
VVA-066	633603.423	4207121.084	2030.339
VVA-067	636477.447	4201016.515	2365.477
VVA-068	642057.125	4188489.553	2321.893
VVA-068	598041.032	4120272.743	1478.397
VVA-069	640357.644	4183094.588	2276.187
VVA-070	628881.299	4182797.314	2392.227
VVA-071	623725.392	4163775.471	1692.498
VVA-072	621901.136	4155017.409	1616.732
VVA-073	612162.035	4155272.429	1828.104
VVA-074	618983.788	4152215.812	1476.366
VVA-075	618659.917	4141405.626	1409.607
VVA-076	618964.699	4134050.294	1379.439
VVA-077	613037.118	4136650.351	1544.856
VVA-078	615665.935	4127238.049	1432.889
VVA-079	609821.468	4126290.801	1555.856
VVA-080	607993.709	4128206.279	1486.136
VVA-081	601184.571	4114945.826	1313.384
VVA-082	605002.772	4121255.627	1354.799
VVA-083	607296.364	4122276.832	1426.249
VVA-084	602651.530	4129660.563	1512.550
VVA-085	597117.085	4124898.751	1546.452
VVA-087	595344.331	4136297.909	1986.493
VVA-088	590204.225	4140537.802	1937.655
VVA-089	585607.912	4140112.923	1841.403
VVA-090	588819.638	4136041.974	1898.782

VVA-091	563488.472	4139310.516	1422.732
VVA-092	574754.850	4164937.023	1637.810
VVA-093	542206.196	4137185.805	1470.849
VVA-094	532340.999	4146185.960	1259.299
VVA-095	536084.411	4145942.861	1268.778
VVA-096	537408.867	4141411.527	1315.678
VVA-097	550242.010	4140396.225	1595.264
VVA-098	567024.270	4173414.015	1478.469
VVA-099	577561.872	4150420.512	1689.308

Appendix B – Calibration Control Accuracy Report

Utah 3DEP - Wayne San Juan Aerial Survey			
Survey Point	**Known Z (m)**	**Laser Z (m)**	**Dz (m)**
GCP-040	1405.790	1405.780	-0.010
GCP-041	1351.140	1351.160	0.020
GCP-042	2572.150	2572.110	-0.040
GCP-043	1489.870	1489.720	-0.150
GCP-044	1586.160	1586.150	-0.010
GCP-045	1487.690	1487.650	-0.040
GCP-046	1603.610	1603.600	0.000
GCP-047	1566.140	1566.100	-0.040
GCP-048	1779.160	1779.110	-0.050
GCP-049	1909.720	1909.710	0.000
GCP-050	1501.800	1501.800	0.000
GCP-051	1558.730	1558.800	0.070
GCP-052	1679.530	1679.540	0.010
GCP-053	1802.610	1802.570	-0.040
GCP-054	1817.670	1817.660	-0.010
GCP-055	1869.380	1869.430	0.050
GCP-056	1782.230	1782.220	-0.010
GCP-057	1939.740	1939.750	0.010
GCP-058	2060.190	2060.120	-0.070
GCP-059	2133.590	2133.500	-0.090
GCP-060	2408.940	2408.870	-0.070
GCP-061	2139.180	2139.160	-0.020
GCP-062	2167.510	2167.510	0.000
GCP-063	2387.080	2387.070	-0.010
GCP-064	1664.140	1664.150	0.000
GCP-065	1742.160	1742.170	0.010
GCP-066	2098.520	2098.500	-0.020
GCP-067	1888.610	1888.680	0.070
GCP-068	1605.620	1605.600	-0.020

GCP-069	1405.340	1405.420	0.080
GCP-070	1176.030	1176.070	0.040
GCP-071	1336.850	1336.850	0.000
GCP-072	1603.780	1603.830	0.050
GCP-073	1442.160	1442.190	0.020
GCP-074	1820.430	1820.410	-0.020
GCP-075	1280.330	1280.410	0.080
GCP-076	1988.120	1988.110	0.000
GCP-077	1615.780	1615.780	0.000
GCP-078	1273.360	1273.400	0.040
GCP-079	1472.920	1472.880	-0.040
GCP-080	1340.500	1340.500	0.010
GCP-081	1613.900	1613.920	0.020
GCP-082	1530.120	1530.150	0.030
GCP-083	1706.600	1706.590	-0.010
GCP-084	1598.000	1598.030	0.030

Average Dz (m)	+0.000
Minimum Dz (m)	-0.151
Maximum Dz (m)	+0.084
Average Magnitude (m)	0.020
RMSE (m)	0.041
Std. Deviation (m)	0.041