LIDAR REMOTE SENSING DATA COLLECTION
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
MALHEUR, OREGON

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LiDAR Remote Sensing Data Collection:
DOGAMI, Malheur study area

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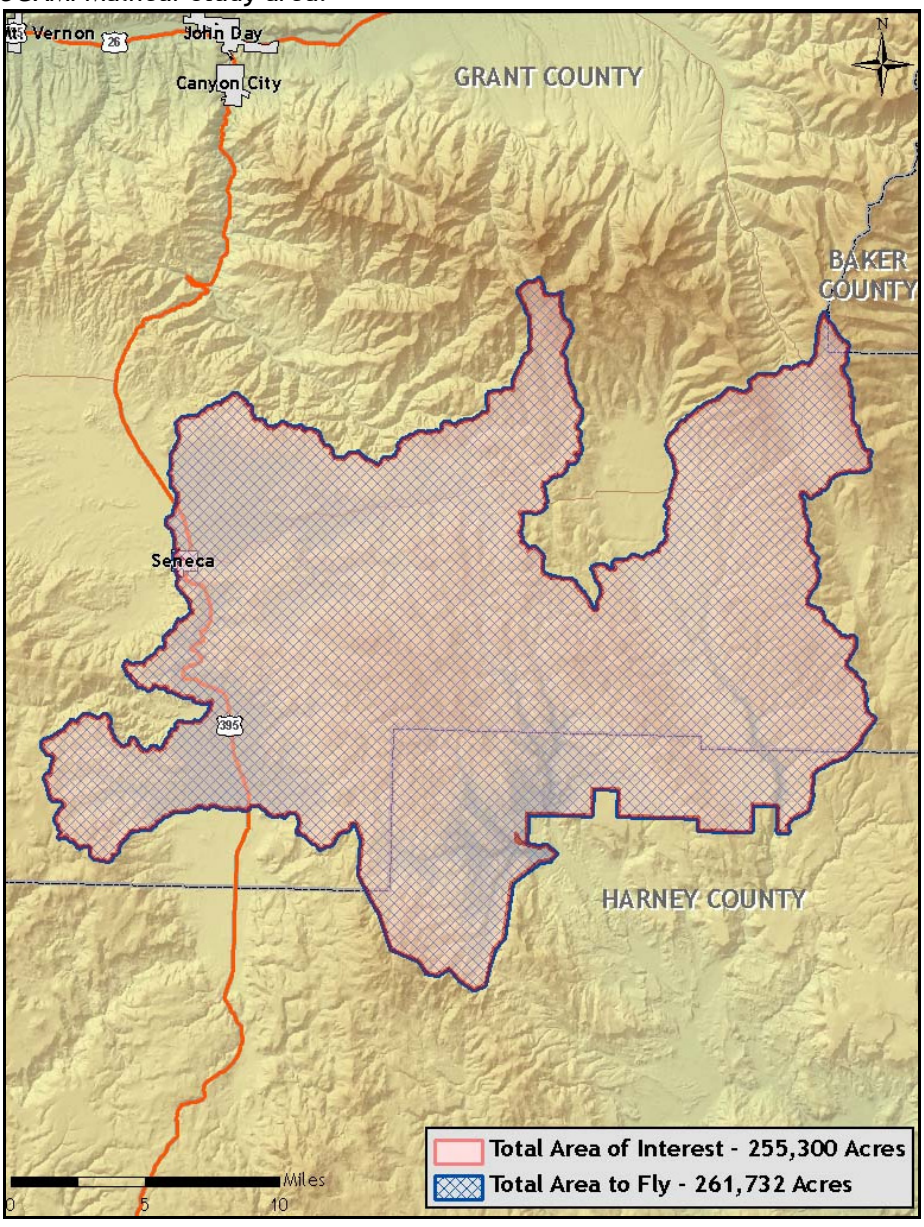
1. Overview

1.1 Study Area (Malheur)

Watershed Sciences, Inc. is currently collecting Light Detection and Ranging (LiDAR) data of the Malheur study area for the Oregon Department of Geology and Mineral Industries (DOGAMI). The area of interest (AOI) totals 399 square miles (255,300 acres) and the total area to fly (TAF) covers 409 square miles (261,732 acres). The TAF acreage is greater than the original AOI acreage due to buffering and flight planning optimization (**Figure 1.1** below). The DOGAMI study area will be acquired and processed as logistical constraints and weather allow. This report will be amended to reflect new data and cumulative statistics for the overall LiDAR survey. DOGAMI data are *delivered* in OGIC(HARN): Projection: Oregon Statewide Lambert Conformal Conic; horizontal and vertical datums: NAD83 (HARN)/NAVD88(Geoid03); Units: International Feet.

Figure 1.1. *DOGAMI Malheur study area.*



For Delivery 1 of the Malheur study area, the AOI totals 132,104 acres (206 square miles) and the TAF totals 134,922 acres (211 square miles). Figure 1.2 below displays the TAF and AOI for Delivery 1.

***Figure 1.2**. Malheur study area, illustrating the portion delivered to date.*

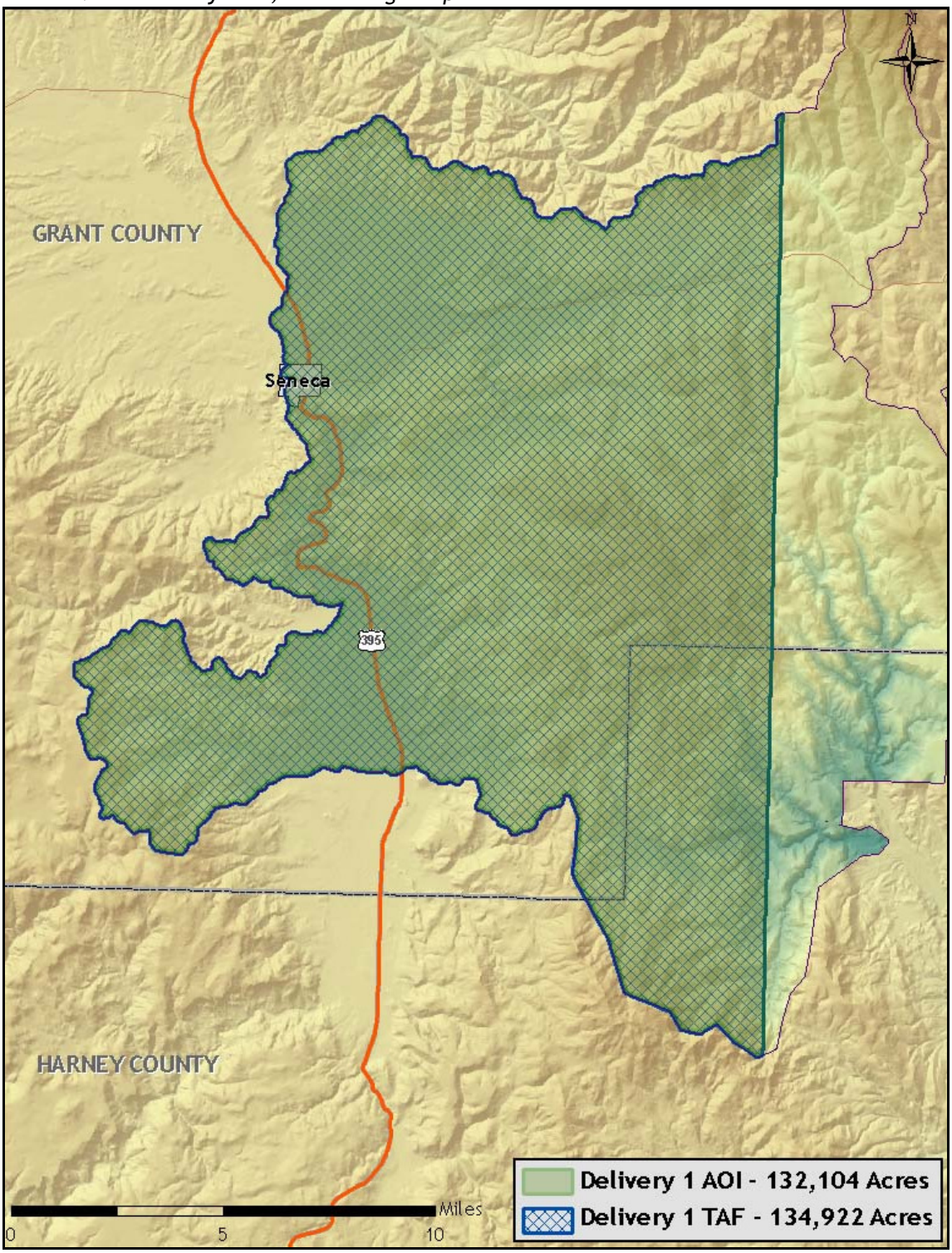


***Figure 1.3**. Malheur study area, illustrating TAF for the entire study area.*

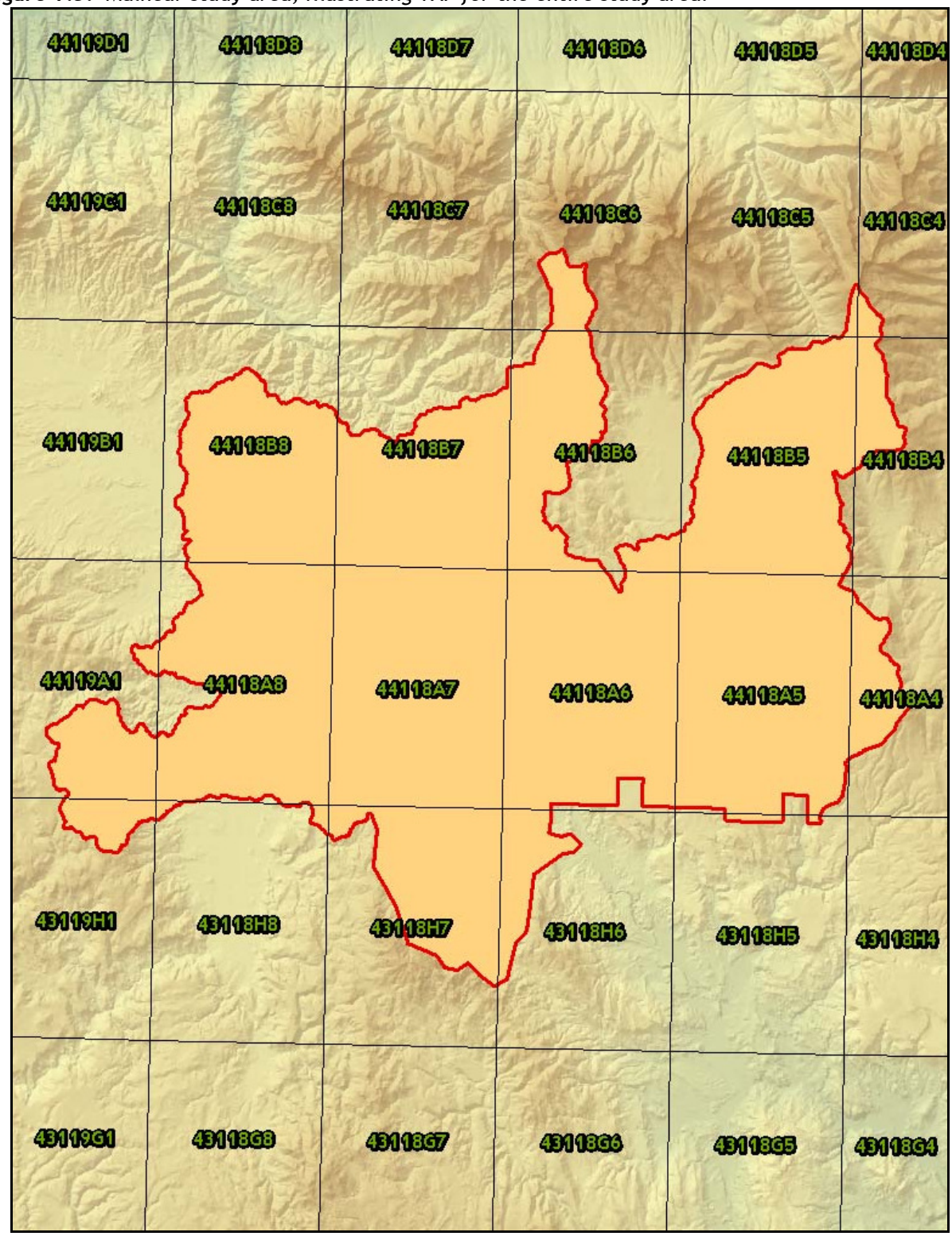


Figure 1.4. Actual flightlines for Delivery 1 including dates flown for the Malheur study area.

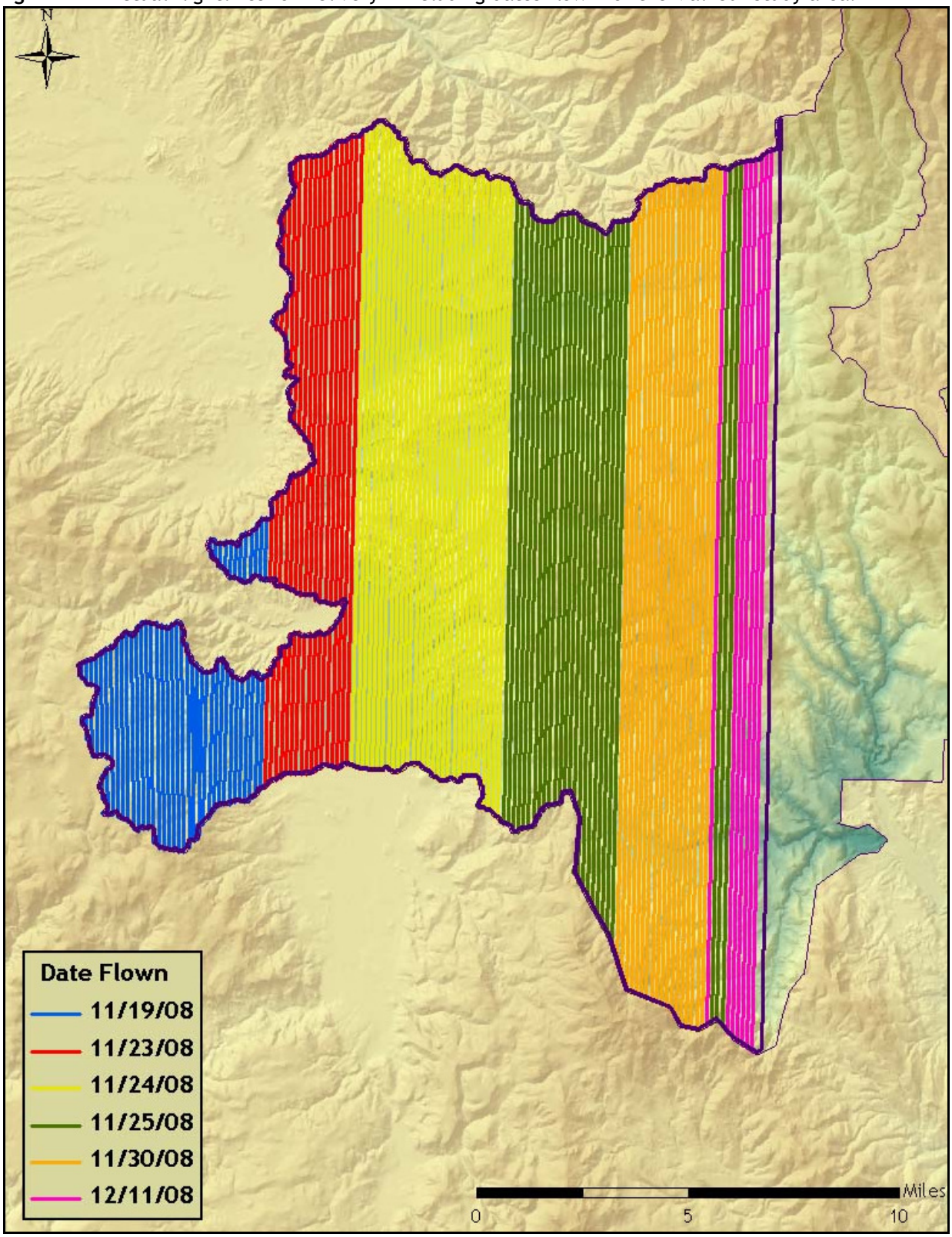


Figure 1.5*. Base station and real time kinematic locations for the Malheur study area (Delivery 1).*

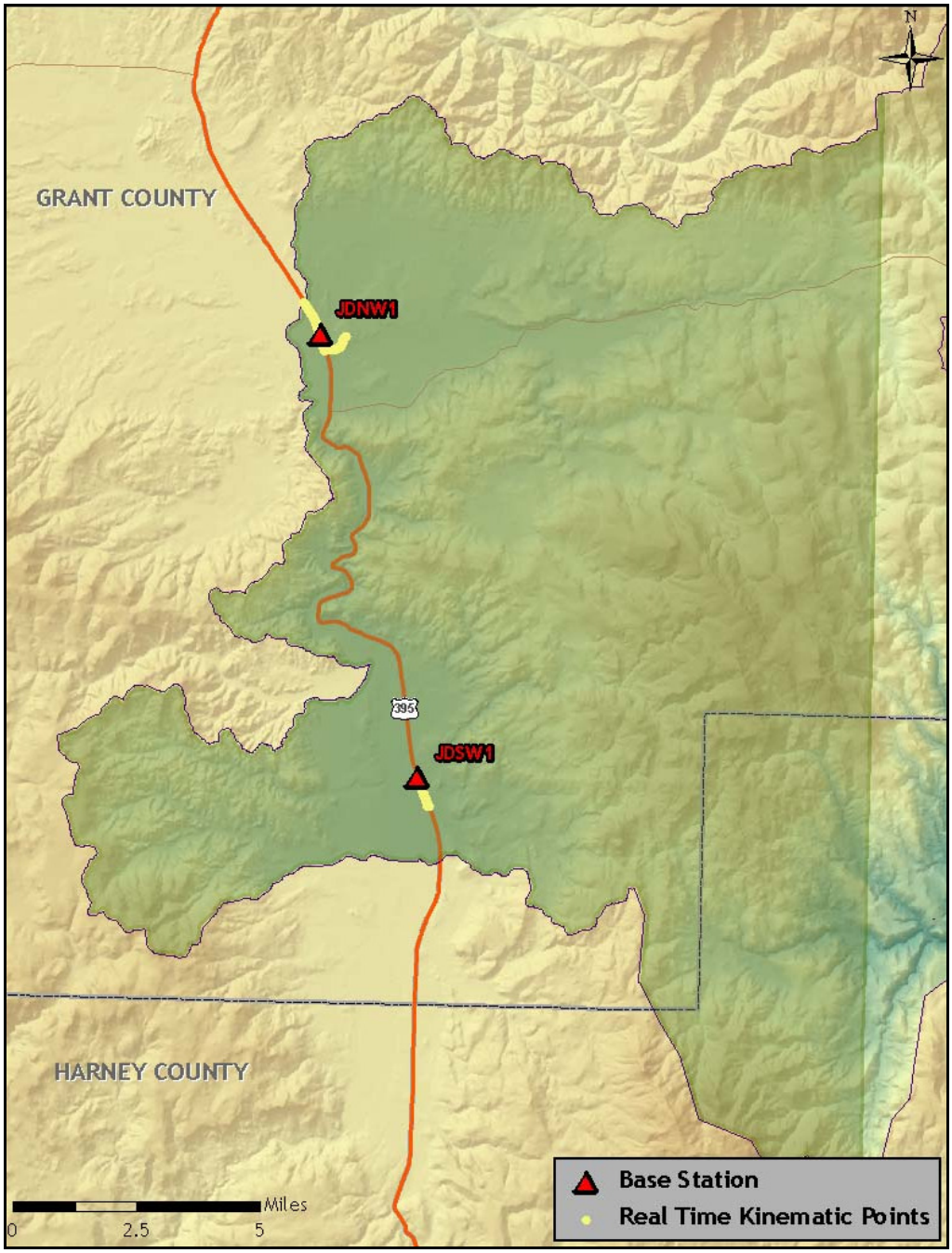


Table 1.1*. Base Station Surveyed Coordinates, (NAD83/NAVD88, OPUS corrected) used for kinematic post-processing of the aircraft GPS data for the Malheur study area.*

	Datum NAD83(HARN)		GRS80
Base Station ID	**Latitude (North)**	**Longitude (West)**	**Ellipsoid Height (m)**
JDSW1	44 01 35.70835	118 55 58.47038	1379.296
JDNW1	44 09 21.26537	118 58 36.18625	1407.882

2. Accuracy

2.1 Relative Accuracy Calibration Results

Relative accuracy statistics are based on the comparison of 201 flightlines and over 2 billion points for data acquired to date.

- Project Average = 0.07ft (0.02m)
- Median Relative Accuracy = 0.14ft (0.04m)
- 1σ Relative Accuracy = 0.15ft (0.05m)
- 2σ Relative Accuracy = 0.22ft (0.07m)

Figure 2.1. *Statistical relative accuracies, non slope-adjusted.*

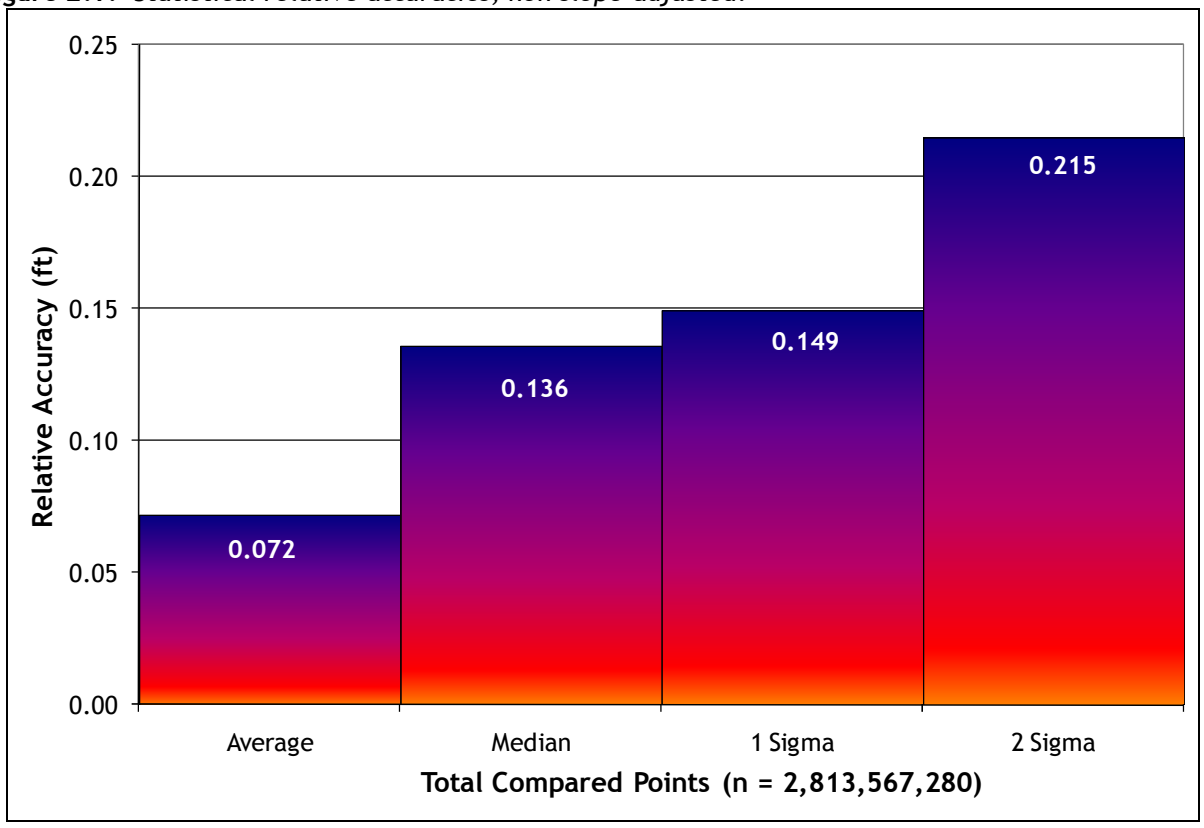
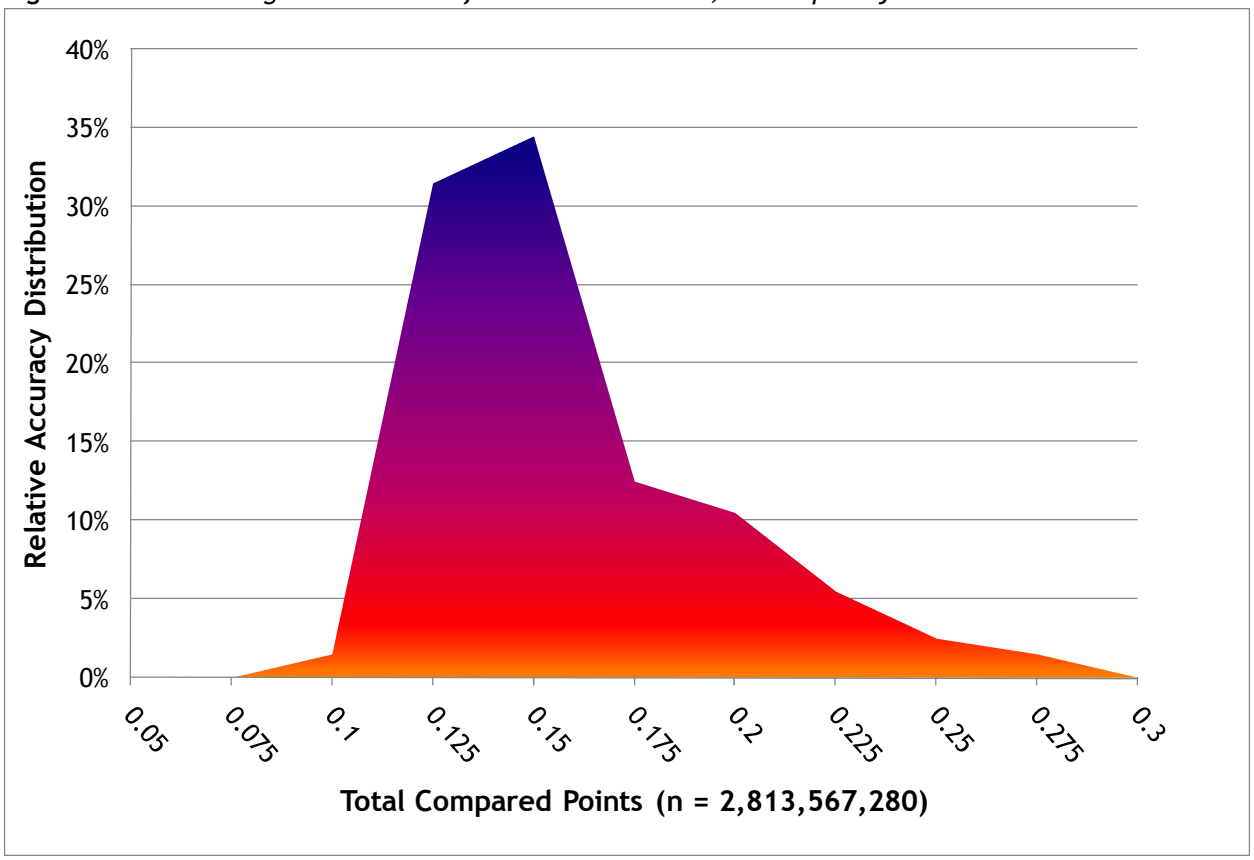


Figure 2.2. *Percentage distribution of relative accuracies, non slope-adjusted.*



2.2 Absolute Accuracy

Absolute accuracy compares known Real Time Kinematic (RTK) ground survey points to the closest laser point. For the Malheur study area, 1,619 RTK points were collected. Accuracy statistics are reported in **Table 2.1** and shown in Figures **2.3-2.4.**

Table 2.1. *Absolute Accuracy - Deviation between laser points and RTK survey points.*

Sample Size (n): 1,619	
Root Mean Square Error (RMSE): 0.10 feet	
Standard Deviations	**Deviations**
1 sigma (σ): 0.10 feet	**Minimum Δz:** -0.31 feet
2 sigma (σ): 0.19 feet	**Maximum Δz:** 0.31 feet
	Average Δz: 0.08 feet

Figure 2.3. *Malheur Study area histogram statistics*

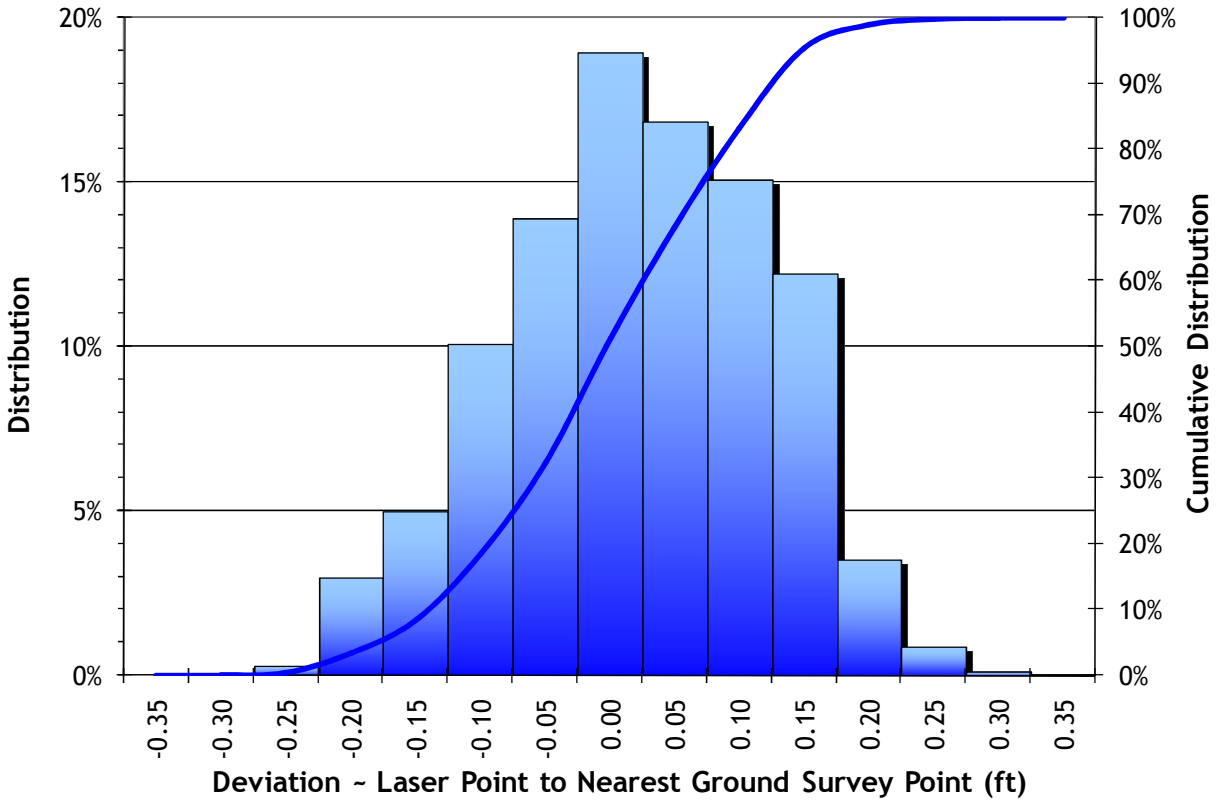
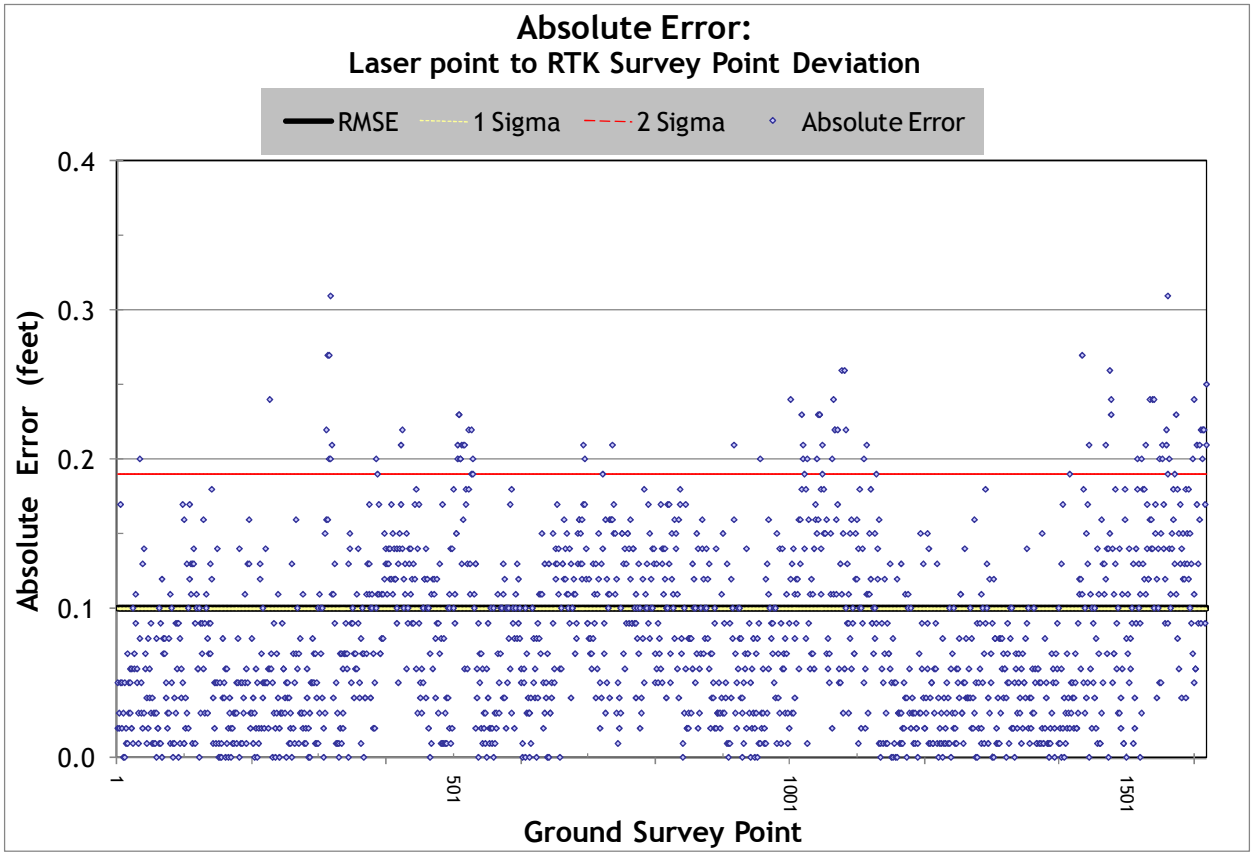


Figure 2.4. *Malheur study area point absolute deviation statistics.*



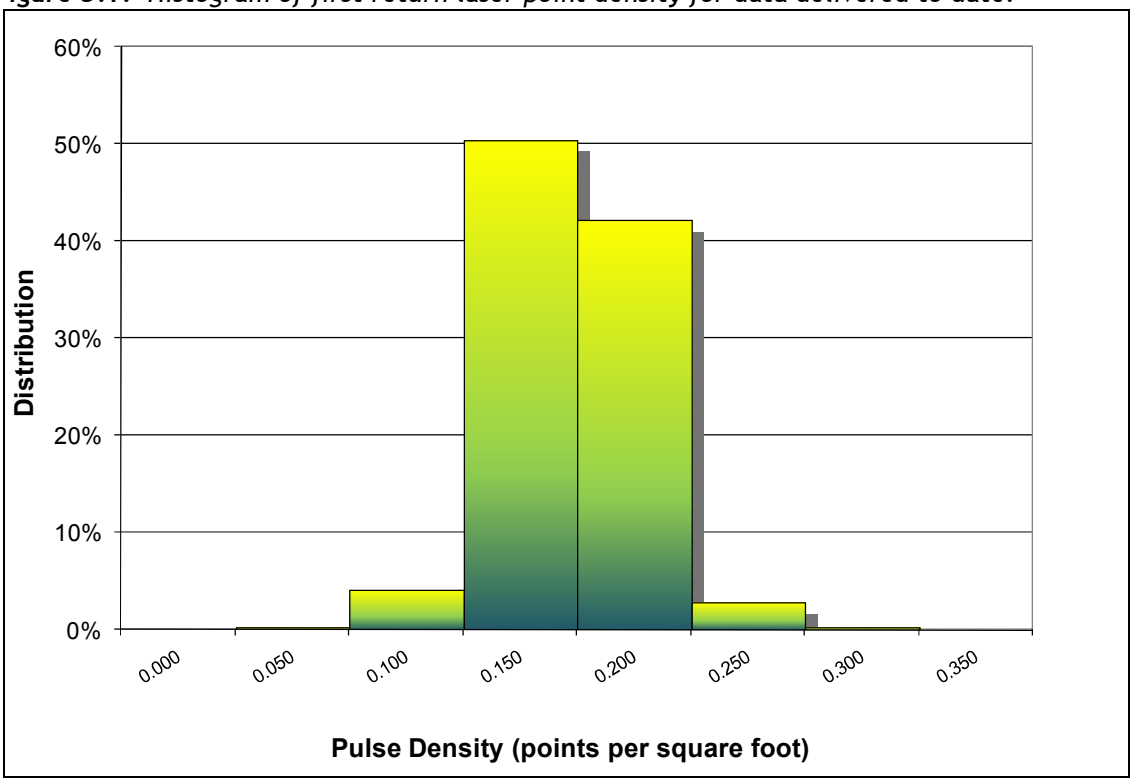
3. Data Density/Resolution

Some types of surfaces (i.e., dense vegetation or water) may return fewer pulses than the laser originally emitted. Therefore, the delivered density can be less than the native density and vary according to distributions of terrain, land cover and water bodies. Density histograms and maps (**Figures 3.1 – 3.4**) have been calculated based on first return laser point density and ground-classified laser point density.

Table 3.1*. Average density statistics for Malheur data delivered to date.*

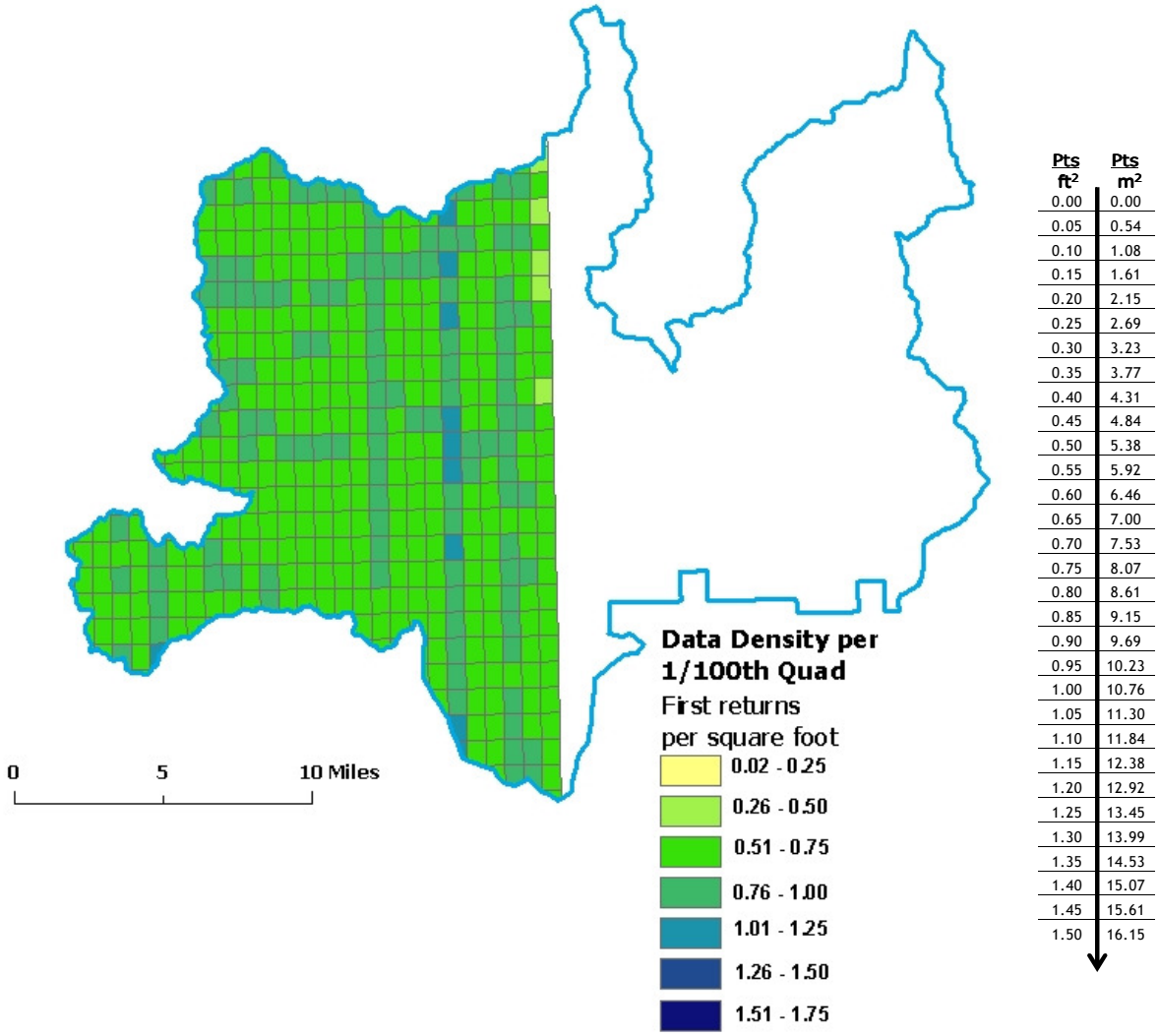
Average Pulse Density (per square ft)	Average Pulse Density (per square m)	Average Ground Density (per square ft)	Average Ground Density (per square m)
0.73	7.87	0.15	1.63

Figure 3.1*. Histogram of first return laser point density for data delivered to date.*



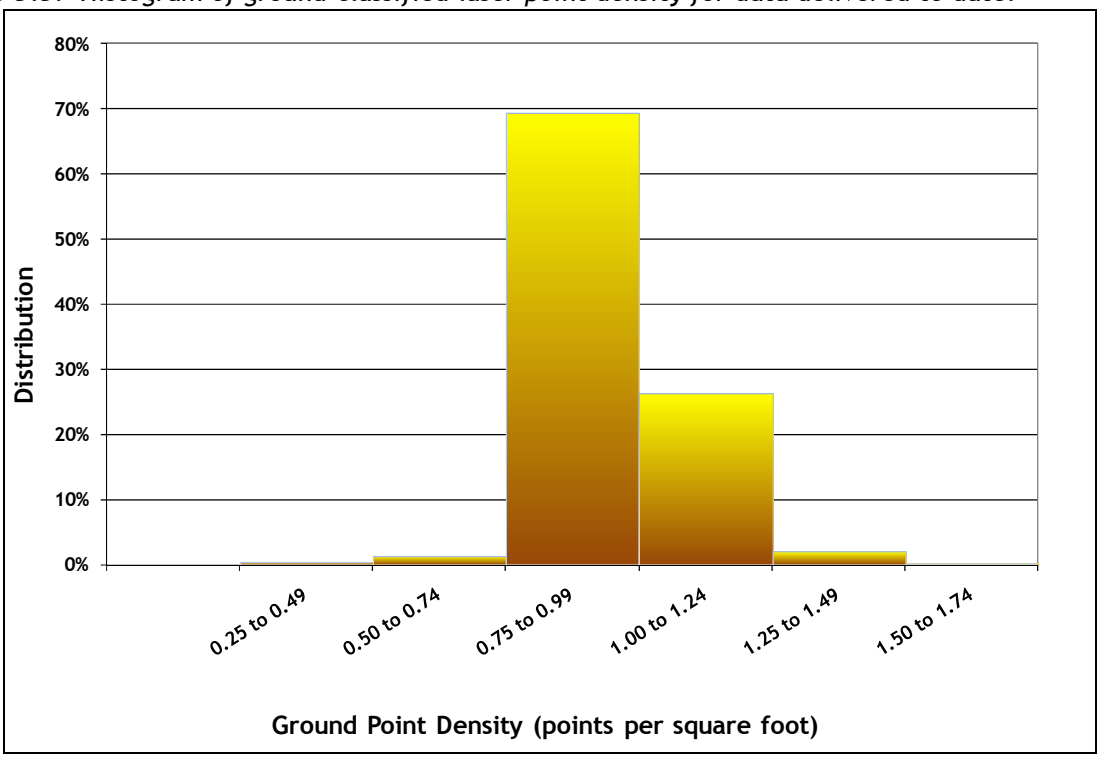
Pts ft²	Pts m²
0.00	0.00
0.05	0.54
0.10	1.08
0.15	1.61
0.20	2.15
0.25	2.69
0.30	3.23
0.35	3.77
0.40	4.31
0.45	4.84
0.50	5.38
0.55	5.92
0.60	6.46
0.65	7.00
0.70	7.53
0.75	8.07
0.80	8.61
0.85	9.15
0.90	9.69
0.95	10.23
1.00	10.76
1.05	11.30
1.10	11.84
1.15	12.38
1.20	12.92
1.25	13.45
1.30	13.99
1.35	14.53
1.40	15.07
1.45	15.61
1.50	16.15

Figure 3.2. *Image shows first return laser point per 0.75' USGS Quad for data delivered to date.*



Ground classifications were derived from ground surface modeling. Supervised classifications were performed by reseeding of the ground model where it was determined that the ground model failed, usually under dense vegetation and/or at breaks in terrain, steep slopes and at bin boundaries.

***Figure 3.3**. Histogram of ground-classified laser point density for data delivered to date.*



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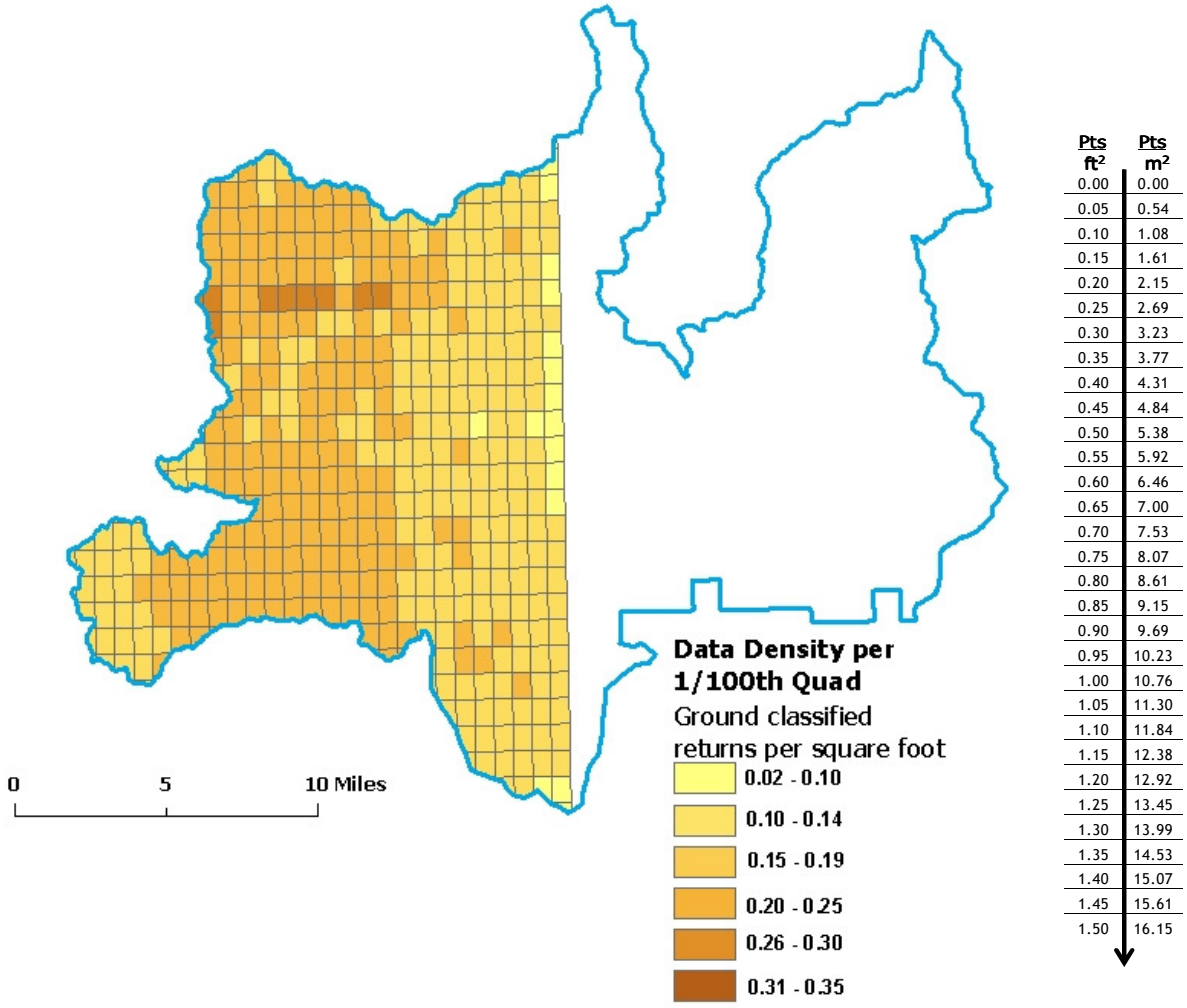
0.35	3.77
0.40	4.31
0.45	4.84
0.50	5.38
0.55	5.92
0.60	6.46
0.65	7.00
0.70	7.53
0.75	8.07
0.80	8.61
0.85	9.15
0.90	9.69
0.95	10.23
1.00	10.76
1.05	11.30
1.10	11.84
1.15	12.38
1.20	12.92
1.25	13.45
1.30	13.99
1.35	14.53
1.40	15.07
1.45	15.61
1.50	16.15

Figure 3.4. *Ground-classified laser point density per 0.75' USGS Quad for data delivered to date.*



4. Selected Imagery

Selected imagery for the Malheur study area will be provided in the final data report.