Lidar Mapping and Project Report

USGS CONTRACT: G16PC00029

CONTRACTOR: Merrick-Surdex JV

TASK ORDER NUMBER: G16PD00386

TASK NAME: NE_Hat Creek - White River Lidar_2016 D16

GOVERNMENT POINT-OF-CONTACT (POC):

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TOTAL AWARD: $1,828,793.60 (Fixed Price)

Contractor Project Manager:

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Contractor Job Number: J65219206

SUMMARY

Merrick-Surdex Joint Venture (Merrick-Surdex JV) was contracted by the USGS to provide lidar (light detection and ranging) terrain mapping for all or portions of Sioux, Dawes, Box Butte, Cherry, Keya Paha, Boyd, Holt and Antelope counties in the state of Nebraska. The total project area encompasses approximately 9,208 square miles. The purpose of the project is to produce accurate high-resolution digital elevation data developed from airborne lidar to be used by the USDA-NRCS to generate digital elevation models and contours for use in dam safety assessments, engineering design and design reviews, conservation planning, research, delivery, floodplain mapping, and hydrologic modeling utilizing lidar technology.

Unless otherwise stated, the lidar mapping requirements and deliverables will meet the Quality Level Two (QL2) standards as outlined in the *USGS-NGP Lidar Base Specifications, Techniques and Methods 11–B4, Version 1.2, November 2014* (TM11-B4) (http://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf). QL2 lidar specifications suggest a point density of greater than or equal to two points per square meter (≥2ppsm), or less than or equal to seven-tenths of a meter (≤0.71m) Aggregate Nominal Pulse Density (ANPD).

The vertical accuracy requirements of the lidar data will meet or exceed the following:

Vertical accuracy (absolute for the Non-vegetated Vertical Accuracy [NVA])

- ≤10cm RMSEz
- ≤19.6cm at the 95% confidence level ($Accuracy_Z$)
- Vegetated Vertical Accuracy (VVA) ≤29.4cm at the 95% percentile

Relative accuracy

- ≤6cm Smooth surface repeatability
- ≤8cm RMSDz
- ±16cm maximum difference

CONTACT INFORMATION

Questions regarding this report should be addressed to:

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PROJECT REPORT

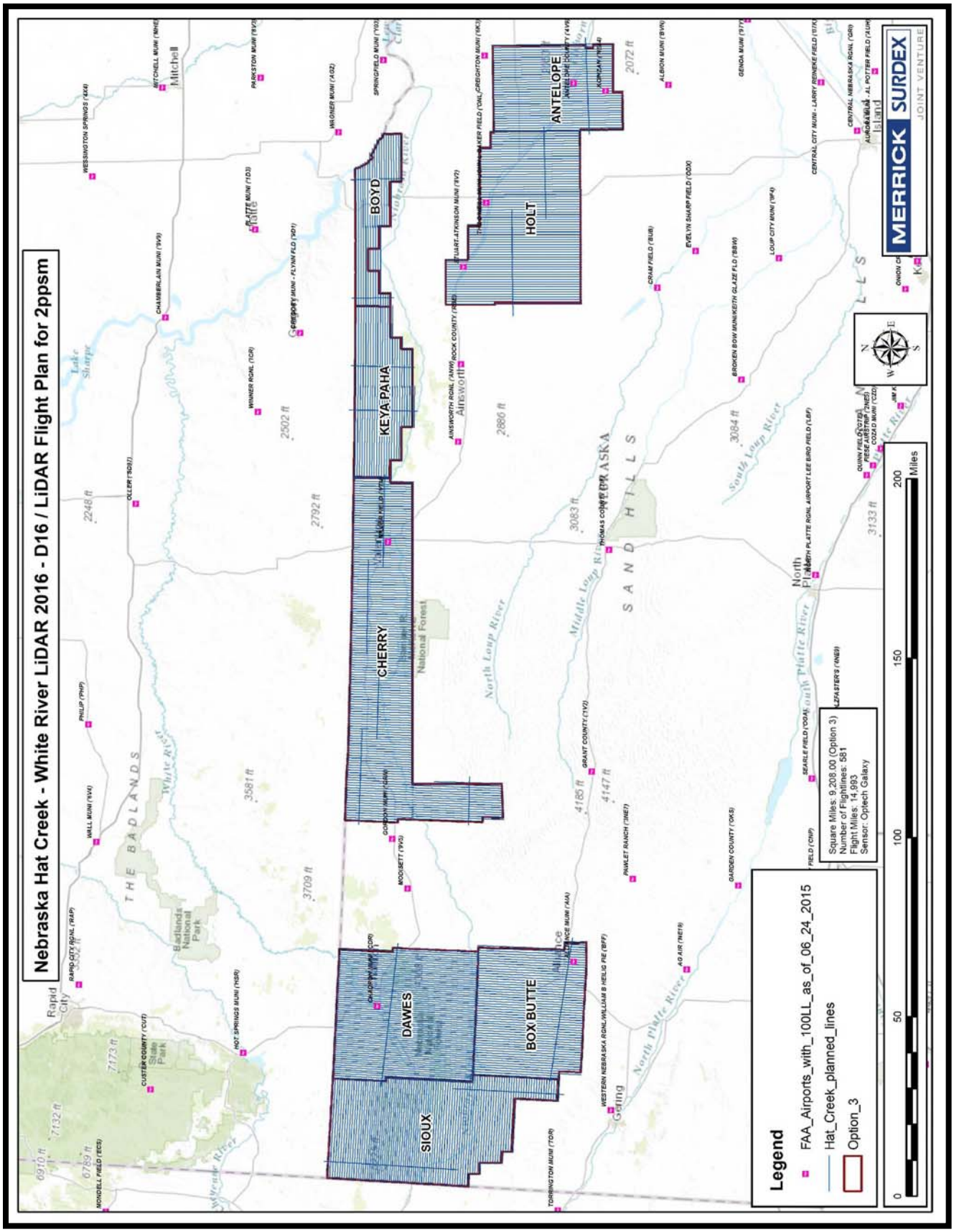
The contents of this report summarize the methods that Merrick-Surdex JV used to collect lidar data, post- process lidar data, establish global navigation satellite system (GNSS) base stations, and collect survey control and lidar checkpoints for the USGS NE Hat Creek – White River Lidar project, as well as the results of these methods.

LIDAR FLIGHT INFORMATION

Project Location

The acquisition area for the NE_Hat Creek-White River Lidar project is defined by the client-provided Esri shapefile *Option_3.shp*. All of Dawes and Box Butte counties were collected and portions of Sioux, Cherry, Keya Paha, Boyd, Holt and Antelope counties were collected. See image below for project planned flight lines.

Planned Flight Line Diagram

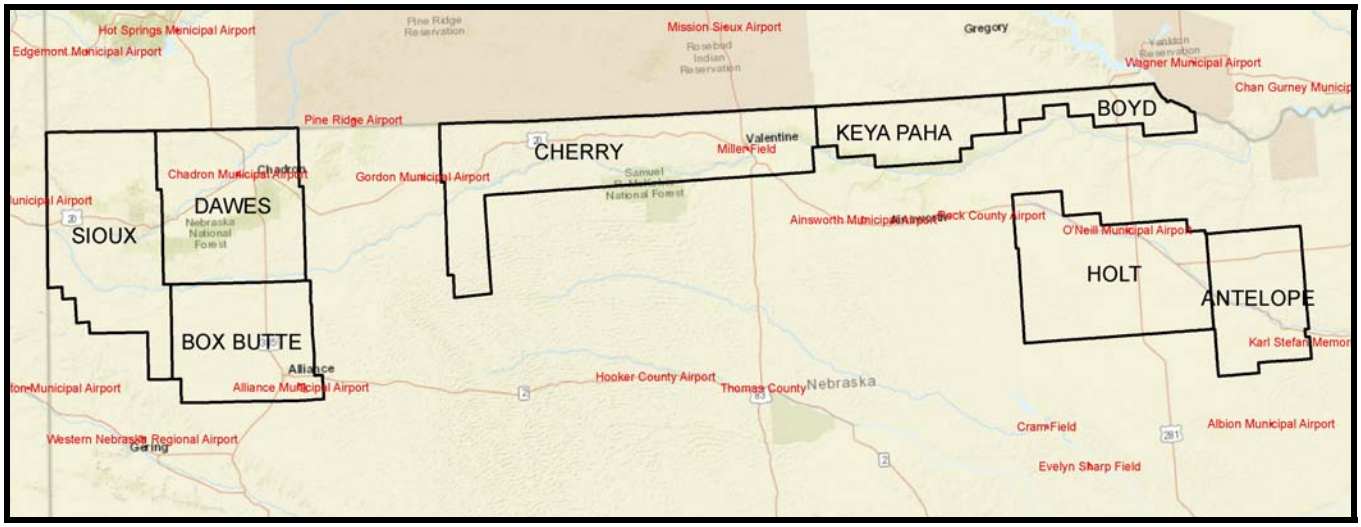


Airports of Operation

Several airports were used for the collection of this project. See below for a list of the airports used as well as an image of the project area with all the regional airports displayed.

Ainsworth Municipal (ANW)
Alliance Municipal (AIA)
Chadron Municipal (CDR)
Gordon Municipal (GRN)
Miller Field (VTN)
O'Neil Municipal (ONL)
Rock County (RBE)

Regional Airports Shown with Project County Boundaries



Duration/Time Period

Lidar data collection for the project was accomplished between November 9, 2016 and May 12, 2017 by two Optech Galaxy sensors. Each mission represents a lift, of the aircraft and system on the ground, takes off, collects data, and lands again. Multiple lifts within a day are represented by Mission A, B, C, D. The table below relates each mission to the date collected, the sensor and serial number used, the start/end time and number of global navigation satellite system (GNSS) records taken. The time is shown in Global Positioning System (GPS) seconds of the week.

Flight Mission Date and Times by Sensor

Mission	Date	Sensor	Sensor SN	Start Time GPS sec.	End Time GPS sec.	Number of GNSS Solution Records
161109_A	November 9, 2016	Galaxy_1	SN5060382	315736	332957	17218
161109_B	November 9, 2016	Galaxy_1	SN5060382	338668	350589	11922
161110_B	November 10, 2016	Galaxy_1	SN5060382	354878	370890	16013
161110_C	November 10, 2016	Galaxy_1	SN5060382	399998	411852	11855
161110_D	November 10, 2016	Galaxy_1	SN5060382	416371	431719	15349
161111_A	November 11, 2016	Galaxy_1	SN5060382	487433	495056	7624
161111_B	November 11, 2016	Galaxy_1	SN5060382	513615	527719	14105
161112_A	November 12, 2016	Galaxy_1	SN5060382	575225	590789	15565
161112_B	November 12, 2016	Galaxy_1	SN5060382	601549	615045	13497
161112_C	November 12, 2016	Galaxy_1	SN5060382	13012	17685	4674
161113_A	November 13, 2016	Galaxy_1	SN5060382	51731	67101	15371
161113_B	November 13, 2016	Galaxy_1	SN5060382	84603	97832	13230
161114_A	November 14, 2016	Galaxy_1	SN5060382	141790	151442	9653
161114_B	November 14, 2016	Galaxy_1	SN5060382	159336	163643	4308
161114_C	November 14, 2016	Galaxy_1	SN5060382	172963	183476	10514
161115_A	November 15, 2016	Galaxy_1	SN5060382	225646	241104	15459
161115_B	November 15, 2016	Galaxy_1	SN5060382	245057	260389	15333
161115_C	November 15, 2016	Galaxy_1	SN5060382	264235	283359	19125
161116_A	November 16, 2016	Galaxy_1	SN5060382	312160	322941	10782
161116_B	November 16, 2016	Galaxy_1	SN5060382	345008	364122	19115
161126_A	November 26, 2016	Galaxy_1	SN5060382	576321	592081	15761
161126_B	November 26, 2016	Galaxy_1	SN5060382	596287	610448	14162
161128_A	November 28, 2016	Galaxy_1	SN5060382	140889	150458	9570
161130_A	November 30, 2016	Galaxy_1	SN5060382	319767	334701	14935
161130_B	November 30, 2016	Galaxy_1	SN5060382	338686	349979	11294
161201_A	December 1, 2016	Galaxy_1	SN5060382	400313	408229	7917
161202_A	December 2, 2016	Galaxy_1	SN5060382	486062	500759	14698
161203_A	December 3, 2016	Galaxy_1	SN5060382	571780	587739	15960
161204_A	December 4, 2016	Galaxy_1	SN5060382	53492	69212	15721
161204_B	December 4, 2016	Galaxy_1	SN5060382	73388	87672	14285
161206_A	December 6, 2016	Galaxy_1	SN5060382	229153	244895	15743
161206_B	December 6, 2016	Galaxy_1	SN5060382	247463	258970	11508
170330_A	March 30, 2017	Galaxy_2	12SEN314	422329	428664	6336
170401_A	April 1, 2017	Galaxy_2	12SEN314	594134	606509	12376
170405_A	April 5, 2017	Galaxy_2	12SEN314	319203	324262	5060
170406_A	April 6, 2017	Galaxy_2	12SEN314	396809	403658	6850
170406_B	April 6, 2017	Galaxy_2	12SEN314	410350	414343	3994

170406_C	April 6, 2017	Galaxy_2	12SEN314	431852	438802	6951
170407_A	April 7, 2017	Galaxy_2	12SEN314	518639	525707	7069
170408_A	April 8, 2017	Galaxy_2	12SEN314	579831	597263	17433
170408_B	April 8, 2017	Galaxy_2	12SEN314	602919	612265	9347
170411_A	April 11, 2017	Galaxy_2	12SEN314	222321	239089	16769
170413_A	April 13, 2017	Galaxy_1	SN5060382	413209	428000	14792
170414_A	April 14, 2017	Galaxy_1	SN5060382	502169	524024	21856
170416_A	April 16, 2017	Galaxy_1	SN5060382	67206	87631	20426
170417_A	April 17, 2017	Galaxy_1	SN5060382	135576	152769	17194
170418_A	April 18, 2017	Galaxy_1	SN5060382	228174	247312	19139
170420_A	April 20, 2017	Galaxy_1	SN5060382	404621	417575	12955
170422_A	April 22, 2017	Galaxy_1	SN5060382	569526	575489	5964
170422_B	April 22, 2017	Galaxy_1	SN5060382	590683	607636	16954
170508_A	May 8, 2017	Galaxy_2	12SEN314	164616	171163	6548
170512_A	May 12, 2017	Galaxy_2	12SEN314	489573	497909	8337
170512_B	May 12, 2017	Galaxy_2	12SEN314	507804	516148	8345

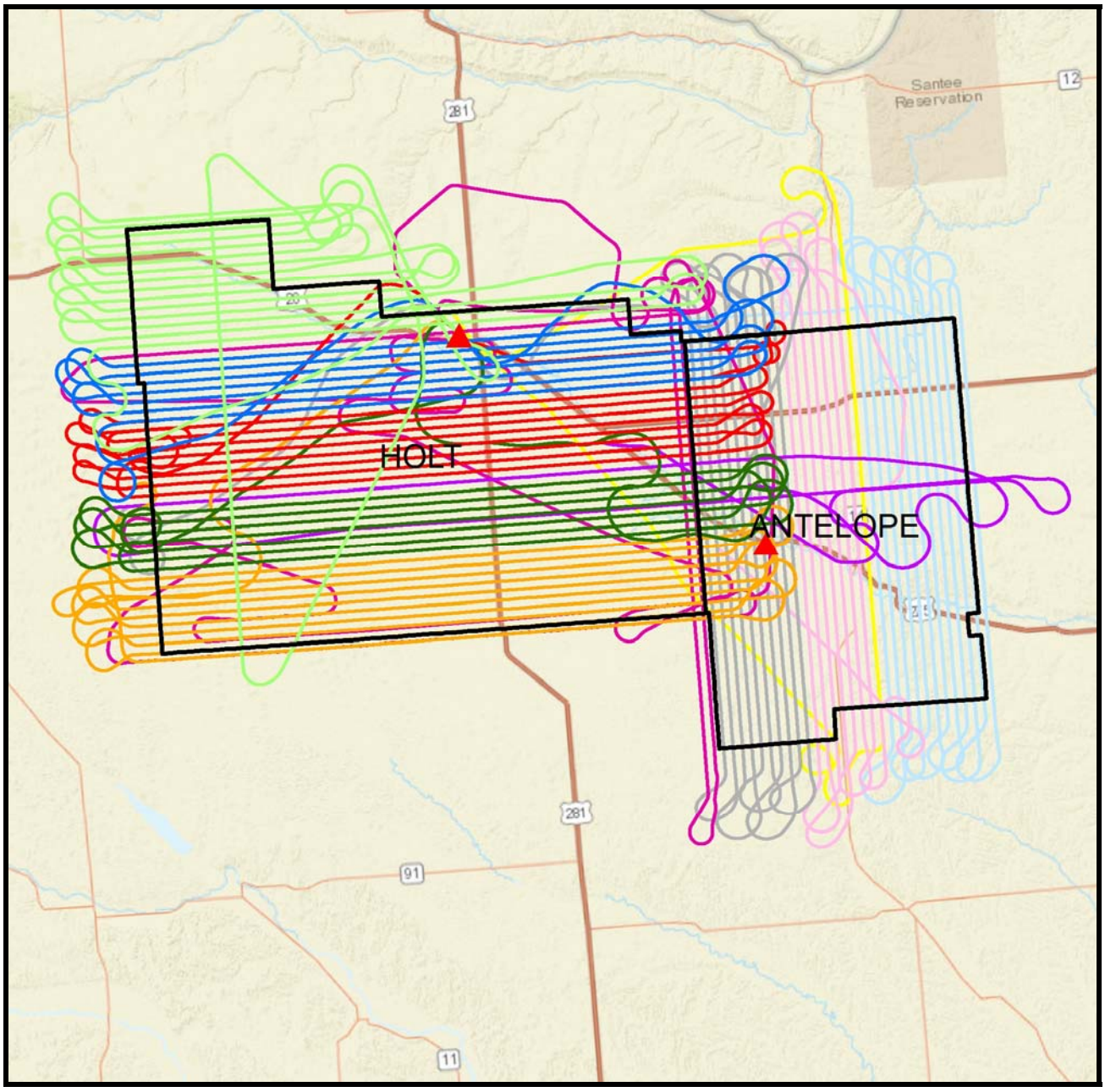
FIELD WORK / PROCEDURES

Many ground GNSS Base Stations were set up to control the lidar data collection. CORS (Continually Operating Reference Stations) were also used to control the airborne flight lines.

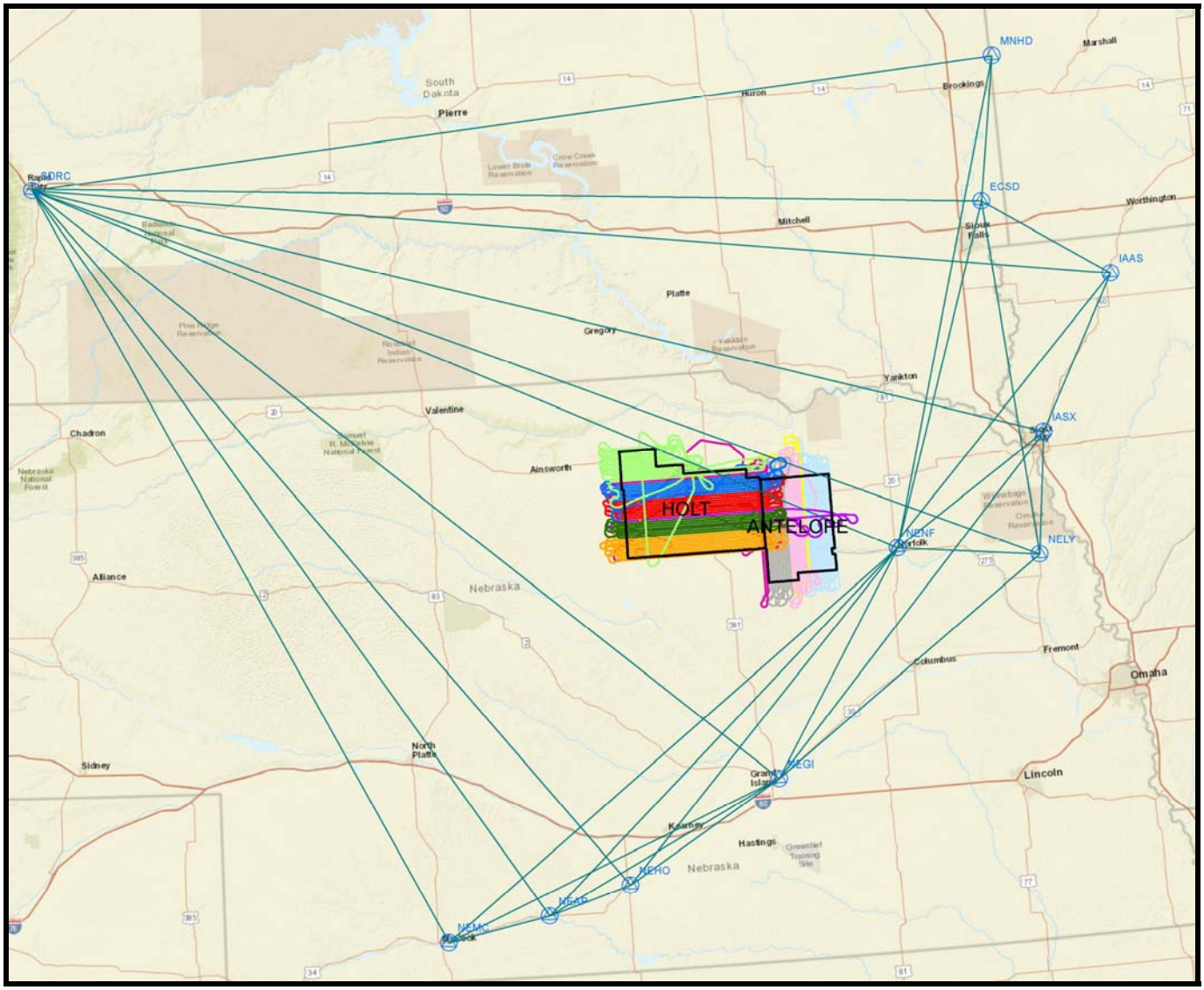
Pre-flight checks such as cleaning the sensor head glass are performed. A five-minute INS initialization is conducted on the ground, with the aircraft engines running, prior to flight, to establish fine-alignment of the INS. GPS ambiguities are resolved by flying within ten kilometers of the base stations. During the data collection, the operator recorded information on log sheets which includes weather conditions, lidar operation parameters, and flight line statistics. Near the end of the mission, GPS ambiguities were again resolved by flying within ten kilometers of the base stations to aid in post-processing. Data was sent back to the main office and preliminary data processing was performed for quality control of GPS data and to ensure sufficient overlap between flight lines. Any problematic data could then be reflown immediately as required.

Actual Flight Lines Colored by Mission for Holt and Antelope Counties Showing Ground Base Locations (red triangles) used to Control the Flight Lines

Mission	Date	County	Color	Mission	Date	County	Color
161109_A	November 9, 2016	Holt	light green	161111_B	November 11, 2016	Holt_Antelope	dark pink
161109_B	November 9, 2016	Holt	blue	161112_A	November 12, 2016	Holt_Antelope	grey
161110_B	November 10, 2016	Holt	red	161112_B	November 12, 2016	Antelope	light pink
161110_C	November 10, 2016	Holt	dark green	161112_C	November 12, 2016	Antelope	yellow
161110_D	November 10, 2016	Holt	orange	161113_A	November 13, 2016	Antelope	light blue
161111_A	November 11, 2016	Holt_Antelope	purple				

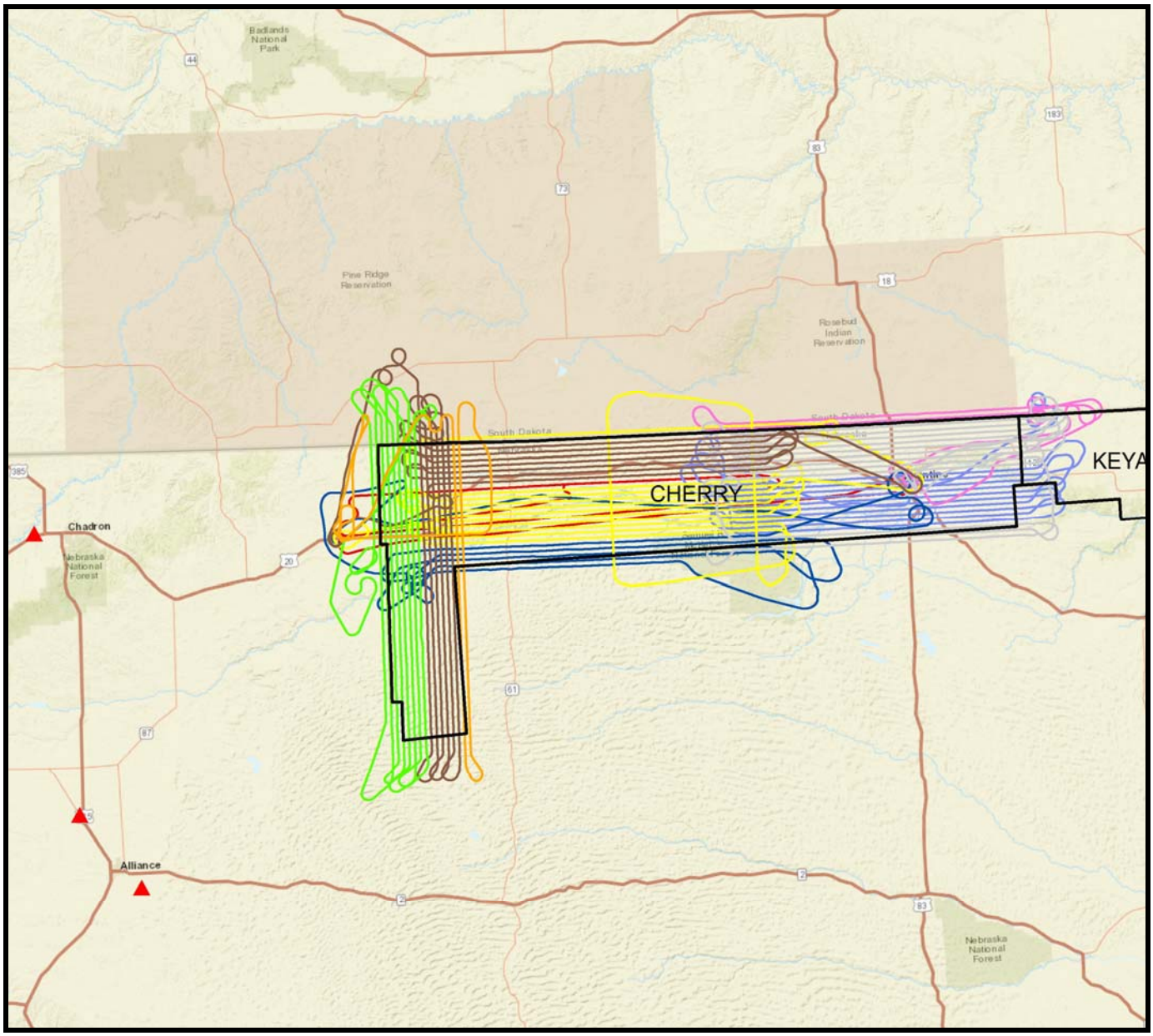


Actual Flight Lines Colored by Mission for Holt and Antelope Counties Showing a Representation of Smart Base Solution (CORS Stations) as a Check on Flight Line Quality



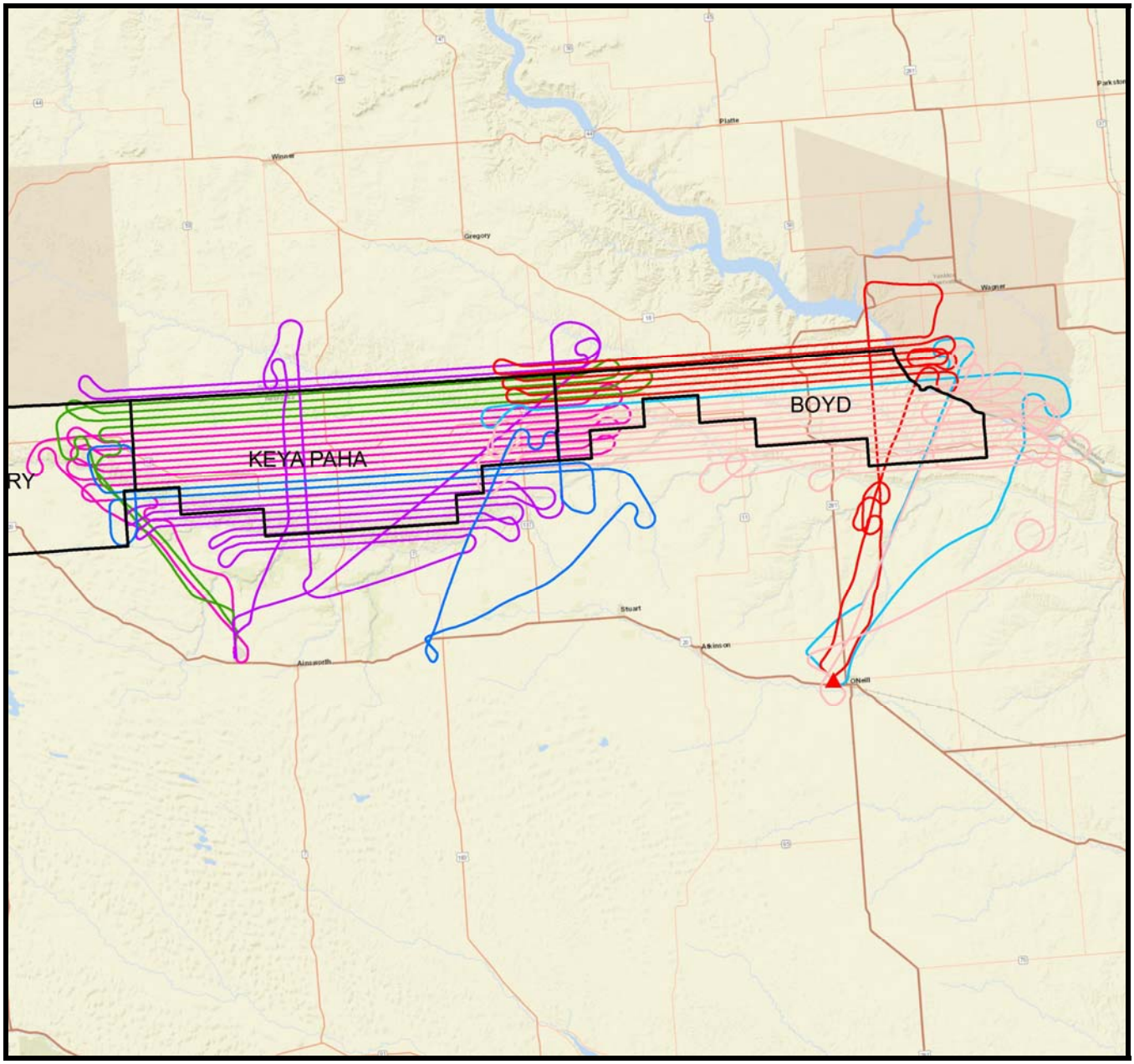
Actual Flight Lines Colored by Mission for Cherry County Showing Ground Base Locations (red triangles) used to Control the Flight Lines

Mission	Date	County	Color	Mission	Date	County	Color
170406_C	April 6, 2017	Cherry	orange	170420_A	April 20, 2017	Cherry	dark blue
170413_A	April 13, 2017	Cherry	light green	170422_A	April 22, 2017	Cherry	pink
170414_A	April 14, 2017	Cherry	brown	170422_B	April 22, 2017	Cherry	light purple
170417_A	April 17, 2017	Cherry	grey	170512_B	May 12, 2017	Cherry	dark red
170418_A	April 18, 2017	Cherry	yellow				

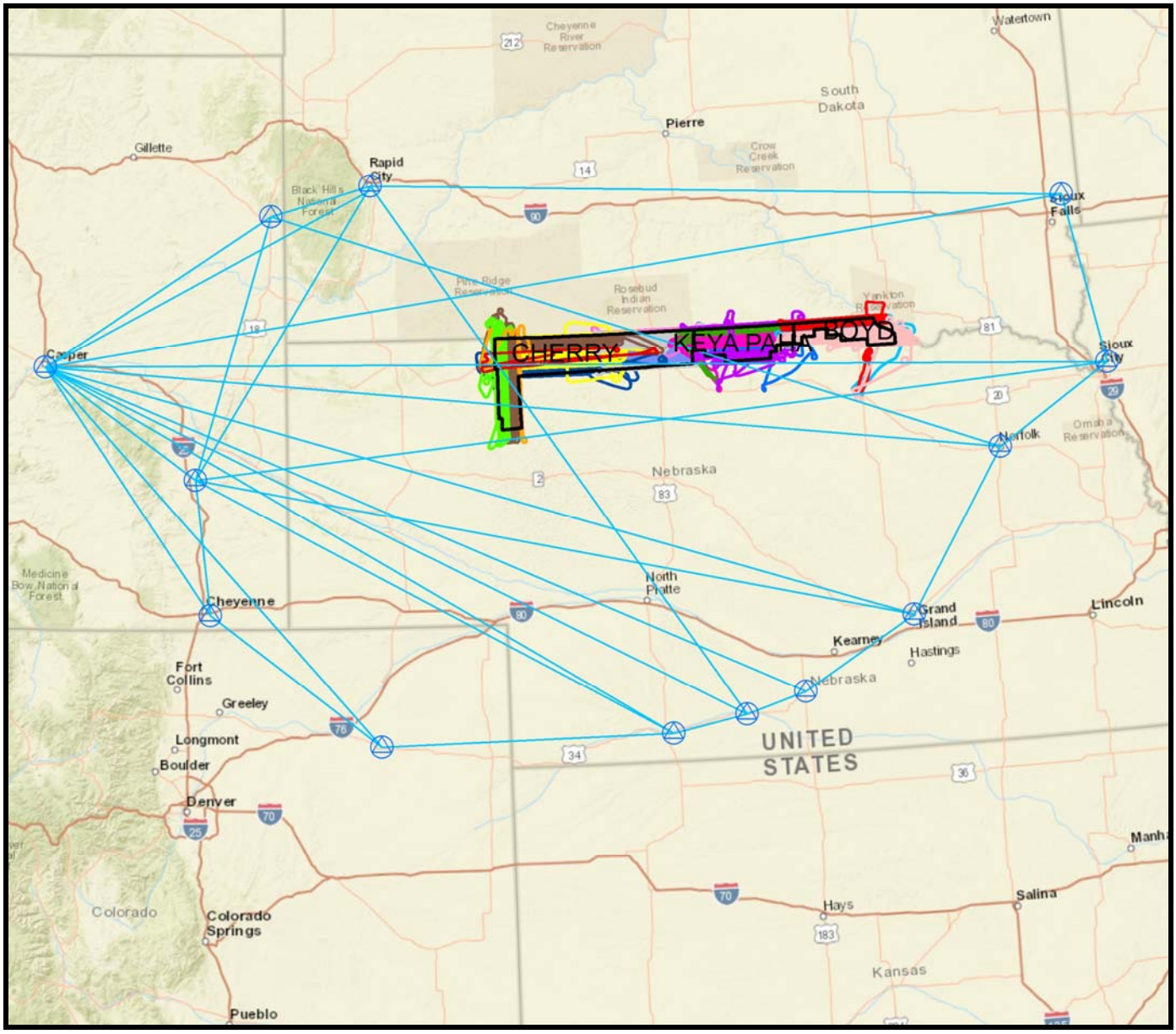


Actual Flight Lines Colored by Mission for Keya Paha and Boyd Counties Showing Ground Base Locations (red triangles) used to Control the Flight Lines

Mission	Date	County	Color	Mission	Date	County	Color
170408_A	April 8, 2017	Keya Paha	purple	161116_B	November 16, 2016	Boyd	light pink
170408_B	April 8, 2017	Keya Paha	dark green	170401_A	April 1, 2017	Boyd	red
170411_A	April 11, 2017	Keya Paha	dark pink	170407_A	April 7, 2017	Boyd	light blue
170508_A	May 8, 2017	Keya Paha	blue				

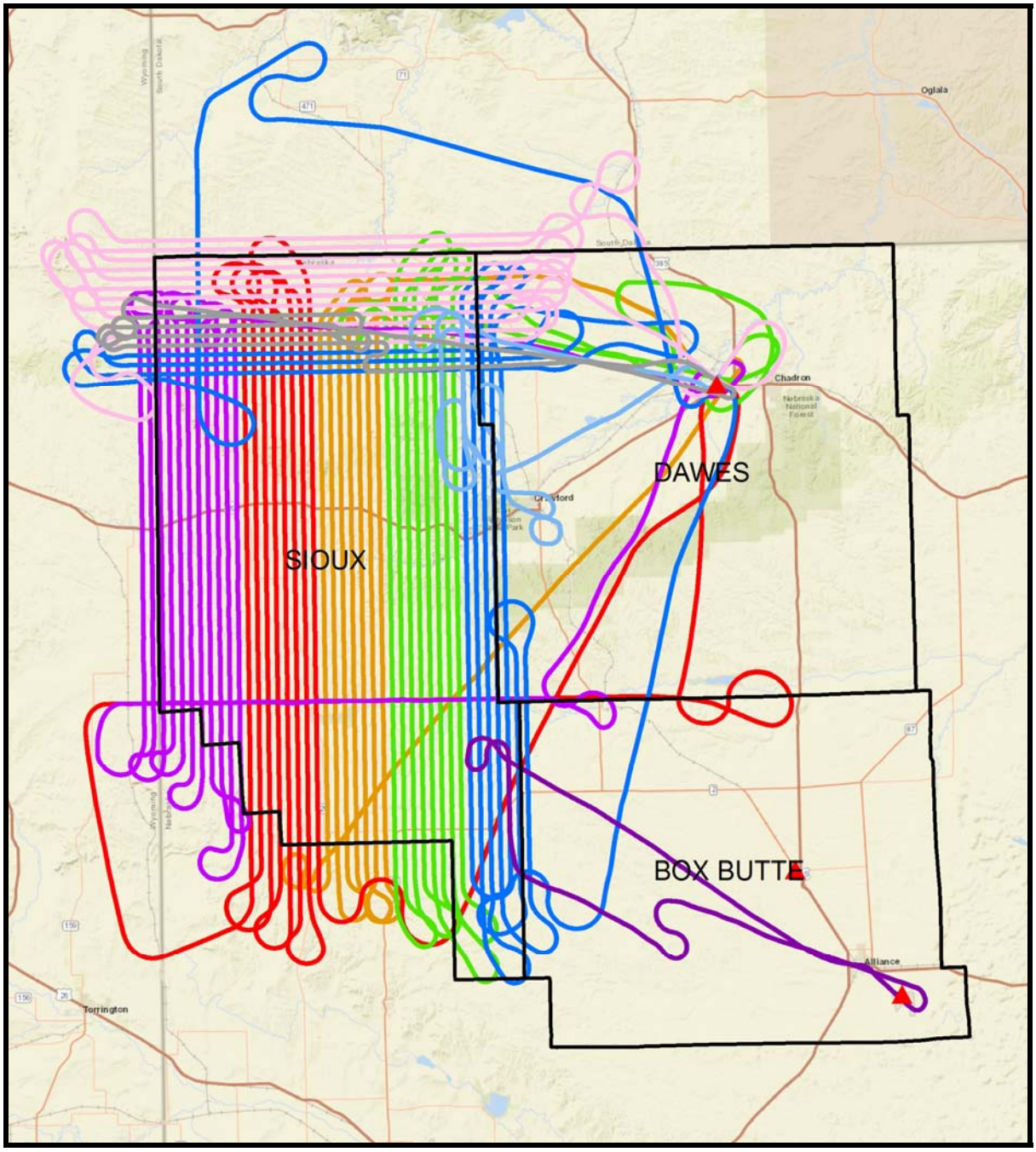


Actual Flight Lines Colored by Mission for Cherry, Keya Paha and Boyd Counties Showing a Representation of Smart Base Solution (CORS Stations) as a Check on Flight Line Quality



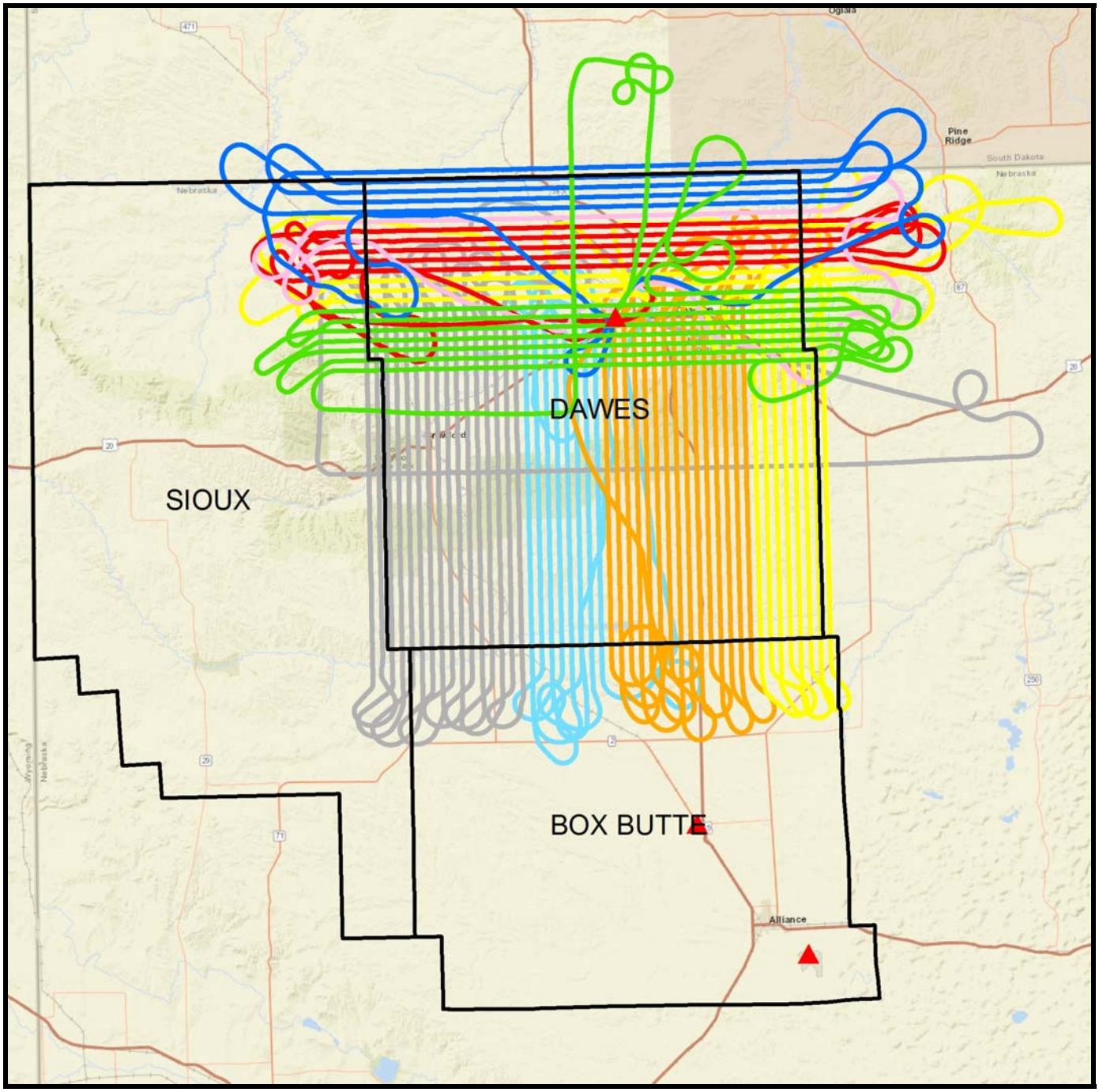
Actual Flight Lines Colored by Mission for Sioux County Showing Ground Base Locations (red triangles) used to Control the Flight Lines

Mission	Date	County	Color	Mission	Date	County	Color
161202_A	December 2, 2016	Sioux	pink	161206_B	December 6, 2016	Sioux	orange
161203_A	December 3, 2016	Sioux	blue	170330_A	March 30, 2017	Sioux	grey
161204_A	December 4, 2016	Sioux	purple	170405_A	April 5, 2017	Sioux	light blue
161204_B	December 4, 2016	Sioux	green	170406_B	April 6, 2017	Sioux	dark purple
161206_A	December 6, 2016	Sioux	red	170512_A	May 12, 2017	Sioux	dark green



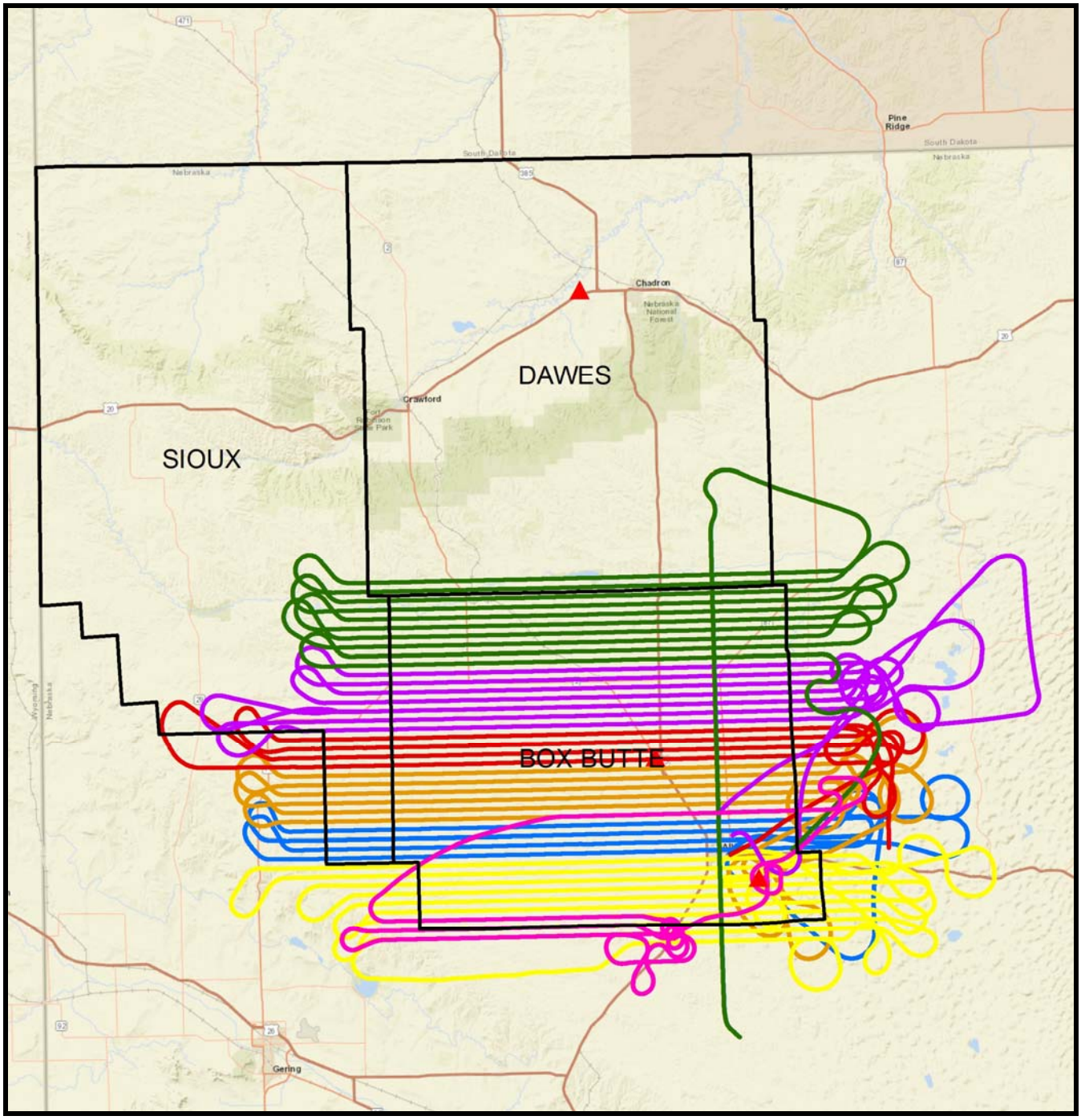
Actual Flight Lines Colored by Mission for Dawes County Showing Ground Base Locations (red triangles) used to Control the Flight Lines

Mission	Date	County	Color	Mission	Date	County	Color
161113_B	November 13, 2016	Dawes	green	161115_A	November 15, 2016	Dawes	yellow
161114_A	November 14, 2016	Dawes	blue	161115_B	November 15, 2016	Dawes	orange
161114_B	November 14, 2016	Dawes	pink	161115_C	November 15, 2016	Dawes	grey
161114_C	November 14, 2016	Dawes	red	161116_A	November 16, 2016	Dawes	light blue

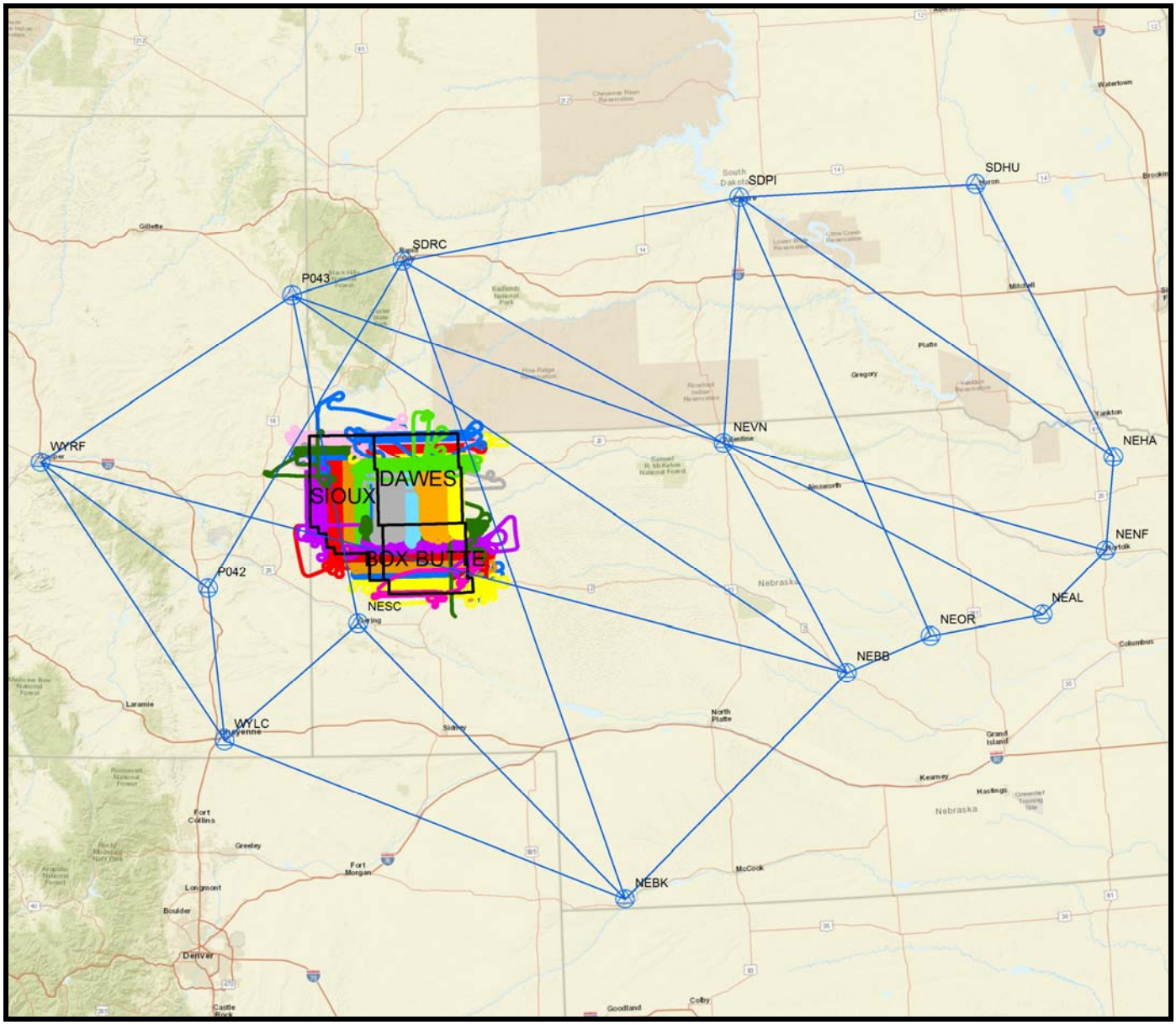


Actual Flight Lines Colored by Mission for Box Butte County Showing Ground Base Locations (red triangles) used to Control the Flight Lines

Mission	Date	County	Color	Mission	Date	County	Color
161126_A	November 26, 2016	Box Butte	dark green	161130_B	November 30, 2016	Box Butte	orange
161126_B	November 26, 2016	Box Butte	purple	161201_A	December 1, 2016	Box Butte	blue
161128_A	November 28, 2016	Box Butte	red	170406_A	April 6, 2017	Box Butte	pink
161130_A	November 30, 2016	Box Butte	yellow				



Actual Flight Lines Colored by Mission for Sioux, Dawes and Box Butte Counties Showing a Representation of Smart Base Solution (CORS Stations) as a Check on Flight Line Quality



LIDAR DATA PROCESSING

The airborne GPS data was post-processed using Applanix POSPac Mobile Mapping Suite version 8.0. A fixed-bias carrier phase solution was computed in both the forward and reverse chronological directions. Whenever practical, lidar acquisition was limited to periods when the PDOP (**P**ositional **D**ilution **O**f **P**recision) was less than 4.0. PDOP indicates satellite geometry relating to position. Generally, PDOP's of 4.0 or less result in a good quality solution, however PDOP's between 4.0 and 5.0 can still yield good results most of the time. PDOP's over 6.0 are of questionable results and PDOP's of over 7.0 usually result in a poor solution. Usually as the number of satellites increase the PDOP decreases. Other quality control checks used for the GPS include analyzing the combined separation of the forward and reverse GPS processing from one base station and the results of the combined separation when processed from two different base stations. Basically, this is the difference between the two trajectories. An analysis of the number of satellites, present during the flight and data collection times, is also performed.

The GPS trajectory was combined with the raw IMU data and post-processed using POSPac Mobile Mapping Suite version 8.0. The Smoothed Best Estimated Trajectory (SBET) and refined attitude data are then utilized in the LMS Post Processor to compute the laser point-positions – the trajectory is combined with the attitude data and laser range measurements to produce the 3-dimensional coordinates of the mass points. Up to four return values are produced within the Optech Lidar Mapping Suite (LMS) processor software for each pulse which ensures the greatest chance of ground returns in a heavily forested area.

Laser point classification was completed using lidar processing and modeling software. Several algorithms are used when comparing points to determine the best automatic ground solution. Each filter is built based on the projects terrain and land cover to provide a surface that is 90% free of anomalies and artifacts. After the auto filter has been completed the data sets are then reviewed by an operator to remove any other anomalies or artifacts not resolved by the automated filter process. During these final steps, the operator also verifies that the data sets are consistent and complete with no data voids.

GPS CONTROLS

Many ground GNSS Base Stations were set up to control the lidar data collection. CORS (Continually Operating Reference Stations) were also used to control the airborne flight lines. The ground GNSS Base Stations coordinates were obtained from NGS (National Geodetic Survey) Online Positioing User Service (OPUS) solutions. CORS coordinates were obtained from NGS datasheets. See the following spreadsheet for ground GNSS Base Station information:

Project: NE_Hat Creek - White River Lidar
Job #: 65219206
Date: June 2017

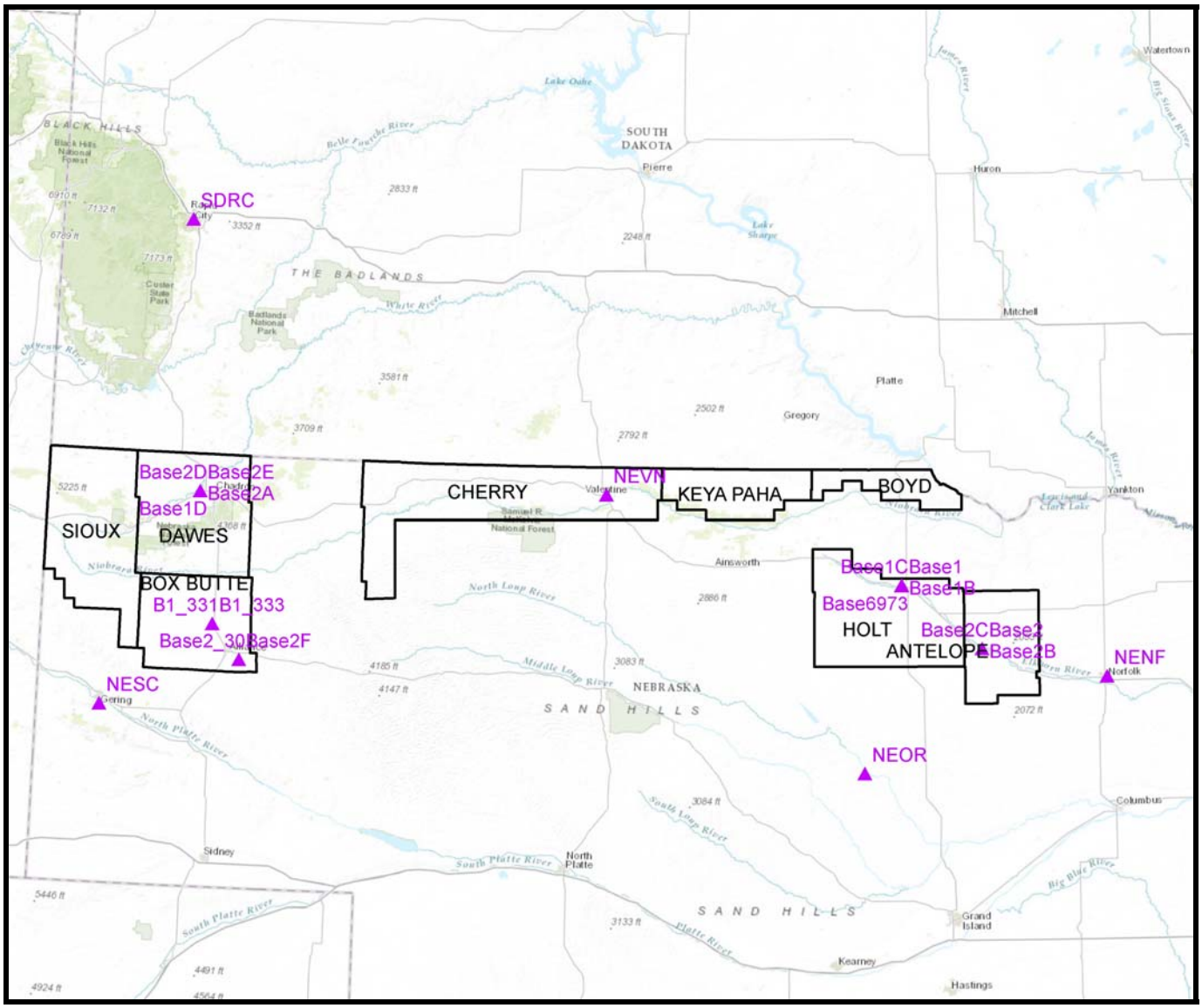
Coordinate System: UTM
Zone: 14N
Horizontal Datum: NAD83 (2011)
Vertical Datum (Geoid): NAVD88 (12B)
Units: Meters

Pt#	NAD83 (2011) epoch 2010		Ellipsoid	Description
Name	Latitude	Longitude	Height	Code
	North	West	Geoid12B	
	Deg Min Sec	Deg Min Sec	**Meters**	
B1_331	42°13'11.86769"	-102°59'00.94214"	1244.360	Base Station
B1_333	42°13'11.86776"	-102°59'00.94242"	1244.367	Base Station
Base1	42°28'01.29100"	-098°41'06.05477"	595.997	Base Station
Base1B	42°28'01.29116"	-098°41'06.05466"	596.015	Base Station
Base1C	42°28'01.29044"	-098°41'06.05509"	596.016	Base Station
Base1D	42°49'46.90131"	-103°05'50.79750"	989.984	Base Station
Base2	42°10'17.45100"	-098°11'12.57067"	522.365	Base Station
Base2_02	42°49'46.90174"	-103°05'50.79862"	989.998	Base Station
Base2_03	42°49'46.90162"	-103°05'50.79864"	990.006	Base Station
Base2_04	42°49'46.90149"	-103°05'50.79863"	990.049	Base Station
Base2_06	42°49'46.90178"	-103°05'50.79900"	990.031	Base Station
Base2_30	42°03'38.12603"	-102°48'32.32169"	1179.897	Base Station
Base2A	42°49'46.90158"	-103°05'50.79883"	989.968	Base Station
Base2B	42°10'17.45100"	-098°11'12.57075"	522.365	Base Station
Base2C	42°10'17.45087"	-098°11'12.57027"	522.399	Base Station
Base2D	42°49'46.90151"	-103°05'50.79898"	989.968	Base Station
Base2E	42°49'46.90158"	-103°05'50.79910"	989.980	Base Station
Base2F	42°03'38.12583"	-102°48'32.32141"	1180.019	Base Station
Base6960	42°28'01.29061"	-098°41'06.05544"	596.112	Base Station
Base6973	42°27'55.99140"	-098°41'11.93855"	596.337	Base Station

NENF (CORS)	42°02'13.00543"	-097°24'39.17554"	444.836	Base Station
NEOR (CORS)	41°35'42.80596"	-098°55'00.88864"	605.915	Base Station
NESC (CORS)	41°49'37.75248"	-103°39'39.72019"	1183.397	Base Station
NEVN (CORS)	42°52'20.90880"	-100°32'37.14424"	769.856	Base Station
SDRC (CORS)	44°04'57.97323"	-103°13'32.33746"	983.110	Base Station

Pt#	UTM14	UTM14	NAVD88	Description
Name	Northing	Easting	Elevation	Code
	Y	X	Geoid 12B	
	Meters	**Meters**	**Meters**	
B1_331	4681886.347	171200.757	1262.797	Base Station
B1_333	4681886.349	171200.751	1262.804	Base Station
Base1	4701679.687	525894.704	620.331	Base Station
Base1B	4701679.692	525894.707	620.349	Base Station
Base1C	4701679.670	525894.697	620.350	Base Station
Base1D	4750051.555	165081.278	1007.925	Base Station
Base2	4669139.526	567164.298	546.980	Base Station
Base2_02	4750051.569	165081.253	1007.939	Base Station
Base2_03	4750051.566	165081.252	1007.947	Base Station
Base2_04	4750051.562	165081.252	1007.990	Base Station
Base2_06	4750051.571	165081.244	1007.972	Base Station
Base2_30	4663527.283	184824.819	1198.661	Base Station
Base2A	4750051.565	165081.248	1007.909	Base Station
Base2B	4669139.526	567164.296	546.980	Base Station
Base2C	4669139.522	567164.307	547.014	Base Station
Base2D	4750051.563	165081.244	1007.909	Base Station
Base2E	4750051.565	165081.242	1007.921	Base Station
Base2F	4663527.277	184824.826	1198.783	Base Station
Base6960	4701679.675	525894.689	620.446	Base Station
Base6973	4701515.729	525760.946	620.666	Base Station
NENF (CORS)	4655099.878	631532.600	469.635	Base Station
NEOR (CORS)	4604839.324	506924.477	629.836	Base Station
NESC (CORS)	4641098.416	112893.761	1202.380	Base Station
NEVN (CORS)	4747809.195	373918.501	791.740	Base Station
SDRC (CORS)	4889753.624	161673.563	998.952	Base Station

Base Station Locations for Lidar Data Collection



Ground Control Parameters

Coordinate System: Universal Transverse Mercator Zone 14N. Countywide deliverables for Sioux, Dawes and Box Butte Counties will all be referenced to UTM Zone 13 North. Countywide deliverables for Cherry, Keya Paha, Boyd, Holt and Antelope Counties will all be referenced to UTM Zone 14 North. Project-wide control and lidar checkpoints are referenced to UTM 14 North.
Horizontal Datum: The horizontal datum for the project is North American Datum of 1983, adjusted to the National Spatial Reference System of 2011 (NAD83 /2011)
Vertical Datum: The Vertical datum for the project is North American Vertical Datum of 1988 (NAVD88)
Geiod Model: Geoid12B (Geoid12B will be used to convert ellipsoid heights to orthometric heights)
Units: Horizontal units are in Meters; Vertical units are in Meters.

GROUND SURVEY

The following listing shows the ground survey points that were established as lidar control and lidar checkpoints for the USGS Hat Creek-White River Project. Non-vegetated Vertical Accurcay (NVA) checkpoints, Vegetated Vertical Accuracy (VVA) checkpoints, and the ground Control Points (CP) were established and surveyed by CompassData Surveyors using Trimble GNSS receivers. Points are shown in grid values (UTM, NAVD88) and latitude, longitude and ellipsoid height.

Ground Points (Control and Lidar Checkpoints)

NE Hat Creek – White River Lidar						
PT#	**UTM ZONE 14**		**NAVD 88**			
	NAD83 (2011) epoch 2010		**ELEVATION**	**CODE**		
	EASTING	**NORTHING**	**GEOID 12B**	**LIPT=Lidar Point**		
	METERS	**METERS**	**METERS**	**Desc.**	**H. Accuracy**	**V. Accuracy**
CTL901	573500.095	4695406.052	536.044	LIPT_CP	0.013	0.016
CTL902	494951.926	4698081.335	670.712	LIPT_CP	0.009	0.010
CTL903	490075.246	4664802.724	715.690	LIPT_CP	0.010	0.012
CTL904	544757.794	4693633.229	597.551	LIPT_CP	0.013	0.018
CTL905	594313.438	4694155.142	516.694	LIPT_CP	0.009	0.012
CTL906	594639.035	4668416.481	537.627	LIPT_CP	0.008	0.013
CTL907	559322.718	4667936.522	586.234	LIPT_CP	0.010	0.011
CTL908	566254.009	4648680.619	596.910	LIPT_CP	0.011	0.012
CTL909	522406.603	4666103.398	648.976	LIPT_CP	0.010	0.019
CTL910	504716.342	4666008.913	695.490	LIPT_CP	0.013	0.015
CTL911	488890.866	4716340.455	658.470	LIPT_CP	0.011	0.011
CTL912	525482.997	4685436.199	628.848	LIPT_CP	0.012	0.013
CTL913	573749.745	4674515.978	616.782	LIPT_CP	0.008	0.008
CTL914	503003.454	4689323.486	673.881	LIPT_CP	0.011	0.011
CTL916	554414.213	4684023.100	583.397	LIPT_CP	0.011	0.015
CTL917	590183.586	4649069.806	555.000	LIPT_CP	0.009	0.015
CTL917_A	543295.879	4667205.899	620.844	LIPT_CP	0.012	0.013
CTL918	483094.309	4702893.385	684.773	LIPT_CP	0.011	0.013
CTL919	527016.844	4698226.028	604.202	LIPT_CP	0.010	0.012
CTL920	502972.030	4696887.870	654.232	LIPT_CP	0.008	0.010
CTL921	326430.880	4739186.381	890.600	LIPT_CP	0.012	0.011
CTL922	255065.071	4730268.519	1066.566	LIPT_CP	0.010	0.010
CTL923	279071.702	4741422.921	985.086	LIPT_CP	0.011	0.018
CTL924	433982.000	4741599.521	750.785	LIPT_CP	0.007	0.006
CTL925	249512.149	4707153.017	1155.225	LIPT_CP	0.010	0.009
CTL926	512029.864	4756439.703	550.956	LIPT_CP	0.012	0.011
CTL927	355401.945	4736068.411	861.453	LIPT_CP	0.010	0.009
CTL928	398544.006	4758152.284	789.028	LIPT_CP	0.011	0.010
CTL929	554985.271	4741966.615	406.469	LIPT_CP	0.017	0.017
CTL930	535502.352	4754723.840	537.730	LIPT_CP	0.011	0.010

CTL931	429423.570	4759282.217	737.750	LIPT_CP	0.013	0.015
CTL932	306299.197	4756465.358	963.848	LIPT_CP	0.011	0.010
CTL933	357323.797	4759111.178	868.190	LIPT_CP	0.010	0.009
CTL935	251412.807	4756756.984	1059.598	LIPT_CP	0.011	0.010
CTL936	491855.669	4750209.382	573.537	LIPT_CP	0.013	0.013
CTL937	256507.509	4699170.361	1150.542	LIPT_CP	0.010	0.009
CTL938	464542.897	4746195.833	649.553	LIPT_CP	0.008	0.009
CTL939	535945.335	4742460.050	448.515	LIPT_CP	0.011	0.011
CTL940	475815.736	4760648.904	678.418	LIPT_CP	0.009	0.011
CTL941	145313.348	4700297.403	1363.476	LIPT_CP	0.005	0.009
CTL942	174290.936	4721382.465	1258.687	LIPT_CP	0.006	0.011
CTL943	139236.473	4723554.820	1374.585	LIPT_CP	0.006	0.009
CTL944	188292.557	4720005.359	1234.493	LIPT_CP	0.007	0.008
CTL945	116084.932	4709272.389	1325.829	LIPT_CP	0.013	0.013
CTL946	179635.486	4741022.146	1114.813	LIPT_CP	0.008	0.011
CTL947	172784.845	4699626.876	1253.413	LIPT_CP	0.005	0.007
CTL948	130551.442	4767137.706	1196.186	LIPT_CP	0.011	0.011
CTL949	156552.225	4769081.520	1117.234	LIPT_CP	0.006	0.010
CTL950	154553.746	4682710.102	1305.157	LIPT_CP	0.005	0.007
CTL951	175591.650	4661696.979	1209.672	LIPT_CP	0.004	0.005
CTL952	100661.078	4738071.305	1475.553	LIPT_CP	0.010	0.009
CTL953	182750.297	4765566.078	954.687	LIPT_CP	0.010	0.010
CTL954	127475.306	4673712.147	1344.477	LIPT_CP	0.010	0.012
CTL955	131369.154	4751476.082	1131.353	LIPT_CP	0.021	0.023
CTL956	158132.852	4740525.106	1084.491	LIPT_CP	0.009	0.017
CTL957	124905.002	4733348.536	1406.597	LIPT_CP	0.010	0.009
CTL958	86252.229	4710100.358	1452.866	LIPT_CP	0.010	0.009
CTL959	88960.365	4764860.692	1274.922	LIPT_CP	0.010	0.010
CTL960	187726.691	4681763.365	1199.971	LIPT_CP	0.003	0.006
NVA100	279578.331	4755337.106	992.366	LIPT_NVA	0.011	0.010
NVA501	545641.876	4686244.641	580.209	LIPT_NVA	0.010	0.012
NVA502	545653.749	4686234.548	580.060	LIPT_NVA	0.011	0.014
NVA502_A	546998.789	4675903.951	587.999	LIPT_NVA	0.011	0.012
NVA503	536746.949	4687126.601	608.871	LIPT_NVA	0.012	0.014
NVA504	512092.389	4702961.938	623.302	LIPT_NVA	0.009	0.011
NVA505	490205.553	4687135.134	690.100	LIPT_NVA	0.010	0.013
NVA506	573497.273	4695396.958	536.099	LIPT_NVA	0.013	0.015
NVA507	497392.293	4698078.691	667.092	LIPT_NVA	0.012	0.013
NVA508	486937.104	4665875.604	728.486	LIPT_NVA	0.012	0.014
NVA508_alt	490083.628	4664803.161	715.664	LIPT_NVA	0.014	0.018
NVA509	544745.425	4693633.252	597.547	LIPT_NVA	0.010	0.015
NVA510	594471.329	4681286.160	547.820	LIPT_NVA	0.010	0.011
NVA511	536717.220	4697885.164	595.859	LIPT_NVA	0.010	0.013

NVA513	594326.371	4694157.971	516.701	LIPT_NVA	0.009	0.013
NVA514	497552.199	4706127.191	646.156	LIPT_NVA	0.009	0.009
NVA515	515873.580	4678965.848	647.007	LIPT_NVA	0.017	0.024
NVA516	575869.017	4645571.531	594.719	LIPT_NVA	0.010	0.012
NVA517	594647.534	4668250.212	537.714	LIPT_NVA	0.008	0.014
NVA518	490197.087	4693358.064	682.894	LIPT_NVA	0.010	0.017
NVA519	511107.253	4669270.554	662.753	LIPT_NVA	0.013	0.015
NVA520	499859.031	4685304.158	675.692	LIPT_NVA	0.011	0.013
NVA521	498255.678	4673663.531	698.058	LIPT_NVA	0.011	0.016
NVA521_alt	499871.153	4675663.765	686.372	LIPT_NVA	0.017	0.024
NVA522	514205.876	4696702.747	631.473	LIPT_NVA	0.009	0.010
NVA523	559329.620	4667947.275	586.125	LIPT_NVA	0.009	0.010
NVA524	522319.458	4675747.410	632.335	LIPT_NVA	0.012	0.014
NVA524_alt	522337.511	4674142.211	640.200	LIPT_NVA	0.010	0.012
NVA525	586073.684	4658026.647	520.757	LIPT_NVA	0.009	0.009
NVA526	566256.605	4648706.331	597.904	LIPT_NVA	0.010	0.012
NVA527	528778.098	4672573.818	624.253	LIPT_NVA	0.012	0.016
NVA528	528792.080	4667731.410	629.574	LIPT_NVA	0.014	0.020
NVA529	522409.643	4666115.893	648.740	LIPT_NVA	0.012	0.021
NVA530	580102.434	4677816.597	567.481	LIPT_NVA	0.011	0.014
NVA531	504724.463	4667611.250	685.865	LIPT_NVA	0.012	0.015
NVA532	489207.543	4715811.430	656.811	LIPT_NVA	0.011	0.011
NVA533	525483.483	4685560.403	629.290	LIPT_NVA	0.010	0.012
NVA533	484075.066	4757857.039	653.900	LIPT_NVA	0.011	0.010
NVA534	573267.337	4674506.768	613.003	LIPT_NVA	0.008	0.009
NVA535	506201.261	4687810.837	660.856	LIPT_NVA	0.010	0.011
NVA536	562495.651	4674411.447	558.664	LIPT_NVA	0.009	0.012
NVA537	543286.343	4667830.736	612.294	LIPT_NVA	0.012	0.013
NVA538	563947.047	4692114.970	556.146	LIPT_NVA	0.014	0.021
NVA538_alt	563954.407	4692109.091	555.902	LIPT_NVA	0.014	0.021
NVA539	554434.934	4684022.932	583.827	LIPT_NVA	0.011	0.014
NVA540	495969.005	4714177.270	652.681	LIPT_NVA	0.009	0.010
NVA541	590183.649	4649075.014	555.075	LIPT_NVA	0.009	0.012
NVA542	483093.445	4703779.047	681.806	LIPT_NVA	0.011	0.012
NVA543	572418.203	4687365.835	573.448	LIPT_NVA	0.011	0.013
NVA544	525428.574	4698214.857	606.845	LIPT_NVA	0.012	0.015
NVA545	572250.923	4663283.039	555.955	LIPT_NVA	0.007	0.009
NVA546	502959.979	4696889.238	654.158	LIPT_NVA	0.009	0.010
NVA547	529050.242	4754685.862	548.485	LIPT_NVA	0.011	0.010
NVA548	356933.763	4754145.431	815.444	LIPT_NVA	0.010	0.010
NVA549	522991.288	4750245.744	475.718	LIPT_NVA	0.012	0.011
NVA550	347541.665	4746606.641	902.208	LIPT_NVA	0.011	0.010
NVA551	451664.073	4741506.353	709.118	LIPT_NVA	0.007	0.007
NVA552	427669.486	4749665.944	745.737	LIPT_NVA	0.007	0.007

NVA554	498541.748	4757839.838	579.345	LIPT_NVA	0.011	0.010
NVA555	397422.332	4755014.773	791.732	LIPT_NVA	0.011	0.010
NVA556	443791.495	4759205.513	648.788	LIPT_NVA	0.007	0.008
NVA557	326442.539	4739167.478	890.567	LIPT_NVA	0.011	0.010
NVA558	255029.621	4729061.061	1071.945	LIPT_NVA	0.011	0.014
NVA559	389285.631	4755062.638	790.318	LIPT_NVA	0.011	0.010
NVA561	261165.247	4743824.837	1050.464	LIPT_NVA	0.012	0.010
NVA562	279090.760	4741423.591	984.818	LIPT_NVA	0.010	0.009
NVA563	436406.780	4741612.786	748.689	LIPT_NVA	0.007	0.007
NVA564	379883.075	4751635.846	811.386	LIPT_NVA	0.010	0.009
NVA565	252118.942	4735597.819	1044.799	LIPT_NVA	0.011	0.010
NVA566	371686.130	4758567.758	845.709	LIPT_NVA	0.010	0.009
NVA567	249436.744	4707124.601	1154.913	LIPT_NVA	0.010	0.009
NVA568	512931.080	4754832.285	511.733	LIPT_NVA	0.012	0.010
NVA569	279642.136	4755452.037	992.511	LIPT_NVA	0.010	0.009
NVA570	355400.658	4736081.251	861.329	LIPT_NVA	0.010	0.009
NVA571	399874.809	4758131.855	777.573	LIPT_NVA	0.010	0.009
NVA572	373744.017	4747323.035	786.812	LIPT_NVA	0.014	0.012
NVA573	554773.809	4742047.672	405.777	LIPT_NVA	0.012	0.011
NVA574	442055.997	4746402.292	707.479	LIPT_NVA	0.009	0.008
NVA575	418054.973	4746627.487	774.001	LIPT_NVA	0.010	0.011
NVA576	535500.732	4754711.554	537.884	LIPT_NVA	0.012	0.011
NVA577	291608.488	4742262.844	997.974	LIPT_NVA	0.010	0.009
NVA578	429416.056	4759317.729	737.312	LIPT_NVA	0.012	0.015
NVA579	298684.434	4749610.547	946.015	LIPT_NVA	0.012	0.010
NVA580	308918.543	4744490.290	921.919	LIPT_NVA	0.011	0.009
NVA581	376961.458	4740896.567	804.470	LIPT_NVA	0.013	0.013
NVA582	306048.733	4756393.531	966.742	LIPT_NVA	0.011	0.010
NVA583	323757.600	4755371.642	964.929	LIPT_NVA	0.011	0.010
NVA584	461594.788	4757563.300	625.212	LIPT_NVA	0.008	0.008
NVA585	312946.437	4743515.264	917.883	LIPT_NVA	0.011	0.010
NVA586	357309.658	4759112.631	868.013	LIPT_NVA	0.010	0.009
NVA587	363447.157	4740611.604	754.323	LIPT_NVA	0.011	0.010
NVA588	285053.708	4759372.691	986.852	LIPT_NVA	0.011	0.009
NVA589	340563.819	4757135.778	889.929	LIPT_NVA	0.010	0.009
NVA590	333324.388	4754226.228	937.265	LIPT_NVA	0.010	0.009
NVA591	451464.560	4751183.821	653.881	LIPT_NVA	0.007	0.007
NVA593	437241.483	4752880.577	733.944	LIPT_NVA	0.014	0.011
NVA594	250488.644	4756043.614	1063.181	LIPT_NVA	0.012	0.010
NVA595	506187.529	4683556.500	663.193	LIPT_NVA	0.010	0.012
NVA595	265231.036	4748366.889	1034.103	LIPT_NVA	0.010	0.010
NVA596	260972.752	4709171.188	1125.480	LIPT_NVA	0.010	0.009
NVA597	491856.215	4750399.469	568.276	LIPT_NVA	0.012	0.011
NVA598	257341.111	4699247.161	1148.599	LIPT_NVA	0.010	0.009

NVA599	341409.304	4739532.522	801.465	LIPT_NVA	0.011	0.010
NVA600	411705.569	4749941.984	766.265	LIPT_NVA	0.007	0.007
NVA601	462493.098	4747886.950	654.159	LIPT_NVA	0.007	0.007
NVA602	331507.785	4748650.423	943.970	LIPT_NVA	0.010	0.009
NVA603	472592.180	4745527.267	626.856	LIPT_NVA	0.009	0.012
NVA604	538767.725	4742110.078	441.048	LIPT_NVA	0.012	0.010
NVA605	475781.595	4760647.831	678.763	LIPT_NVA	0.009	0.009
NVA606	116297.665	4735339.661	1457.775	LIPT_NVA	0.010	0.009
NVA607	144289.032	4680078.187	1319.404	LIPT_NVA	0.010	0.013
NVA608	119436.551	4699911.971	1362.506	LIPT_NVA	0.008	0.007
NVA609	145635.744	4700302.700	1356.362	LIPT_NVA	0.005	0.009
NVA610	116976.977	4765303.985	1106.340	LIPT_NVA	0.022	0.027
NVA611	174312.963	4720532.067	1260.898	LIPT_NVA	0.007	0.009
NVA612	139639.781	4721314.326	1399.051	LIPT_NVA	0.012	0.019
NVA613	155050.093	4710106.955	1242.247	LIPT_NVA	0.031	0.052
NVA614	157097.348	4734119.998	1150.101	LIPT_NVA	0.006	0.013
NVA615	188691.317	4719987.873	1233.825	LIPT_NVA	0.007	0.019
NVA616	129510.134	4706794.739	1291.200	LIPT_NVA	0.009	0.007
NVA617	156603.957	4699571.851	1329.857	LIPT_NVA	0.008	0.011
NVA618	115531.666	4709367.302	1326.176	LIPT_NVA	0.011	0.010
NVA619	164563.532	4693504.855	1298.166	LIPT_NVA	0.009	0.010
NVA620	158341.928	4724499.768	1369.273	LIPT_NVA	0.006	0.009
NVA621	136375.046	4743263.822	1125.119	LIPT_NVA	0.006	0.008
NVA622	168668.860	4681983.224	1272.170	LIPT_NVA	0.004	0.006
NVA623	104150.740	4722434.525	1481.042	LIPT_NVA	0.012	0.012
NVA624	165605.971	4709634.474	1237.362	LIPT_NVA	0.018	0.021
NVA625	161234.971	4663024.174	1241.100	LIPT_NVA	0.011	0.013
NVA626	179947.658	4741532.016	1114.015	LIPT_NVA	0.006	0.011
NVA627	88738.087	4724899.190	1430.486	LIPT_NVA	0.010	0.010
NVA628	172827.724	4699625.769	1253.303	LIPT_NVA	0.006	0.008
NVA629	177146.368	4749320.497	1036.109	LIPT_NVA	0.006	0.013
NVA630	127478.807	4698695.836	1399.646	LIPT_NVA	0.008	0.007
NVA631	171369.161	4749526.815	1027.304	LIPT_NVA	0.020	0.029
NVA632	167434.470	4688522.518	1278.144	LIPT_NVA	0.005	0.007
NVA633	166212.769	4722157.906	1305.905	LIPT_NVA	0.006	0.008
NVA634	91531.415	4761556.868	1255.431	LIPT_NVA	0.012	0.013
NVA635	149860.538	4719075.262	1342.354	LIPT_NVA	0.007	0.014
NVA636	117241.242	4743790.590	1458.860	LIPT_NVA	0.010	0.009
NVA637	137542.526	4734584.736	1128.858	LIPT_NVA	0.006	0.011
NVA638	130555.690	4767102.535	1196.275	LIPT_NVA	0.010	0.013
NVA639	107980.763	4756731.628	1158.828	LIPT_NVA	0.012	0.011
NVA640	149887.791	4733977.119	1129.461	LIPT_NVA	0.015	0.011
NVA641	173663.035	4732985.346	1261.846	LIPT_NVA	0.009	0.009
NVA642	168169.556	4760598.770	1017.655	LIPT_NVA	0.005	0.010

NVA643	182514.047	4728174.797	1240.474	LIPT_NVA	0.009	0.012
NVA644	155592.731	4769565.399	1125.822	LIPT_NVA	0.008	0.011
NVA645	106621.717	4701527.162	1385.707	LIPT_NVA	0.011	0.010
NVA646	98615.447	4729214.582	1431.092	LIPT_NVA	0.010	0.008
NVA647	115688.492	4690394.181	1434.069	LIPT_NVA	0.008	0.009
NVA648	181111.916	4693318.491	1212.038	LIPT_NVA	0.006	0.010
NVA649	105838.969	4715877.085	1437.476	LIPT_NVA	0.012	0.010
NVA650	181107.981	4683390.556	1222.858	LIPT_NVA	0.004	0.005
NVA651	187997.655	4741732.245	1132.903	LIPT_NVA	0.006	0.016
NVA652	154151.064	4682731.729	1308.765	LIPT_NVA	0.005	0.007
NVA653	175645.723	4661688.777	1209.939	LIPT_NVA	0.006	0.012
NVA654	100572.597	4738076.524	1475.555	LIPT_NVA	0.013	0.017
NVA655	189183.388	4731173.099	1197.301	LIPT_NVA	0.007	0.009
NVA656	105770.748	4707826.859	1345.912	LIPT_NVA	0.012	0.011
NVA657	100084.542	4760315.907	1192.539	LIPT_NVA	0.012	0.012
NVA658	183044.838	4766054.654	969.024	LIPT_NVA	0.007	0.009
NVA659	161722.607	4672635.766	1265.223	LIPT_NVA	0.002	0.003
NVA660	177925.962	4668639.363	1215.417	LIPT_NVA	0.002	0.003
NVA661	188190.409	4666852.891	1206.384	LIPT_NVA	0.003	0.005
NVA662	97824.657	4753343.660	1236.916	LIPT_NVA	0.010	0.009
NVA663	119227.544	4721593.178	1434.588	LIPT_NVA	0.010	0.009
NVA664	103712.254	4772189.113	1130.994	LIPT_NVA	0.017	0.019
NVA665	126911.508	4673449.410	1350.138	LIPT_NVA	0.008	0.008
NVA666	127024.952	4690642.132	1400.108	LIPT_NVA	0.008	0.008
NVA667	136520.524	4761043.629	1193.418	LIPT_NVA	0.009	0.009
NVA668	126352.942	4757193.872	1151.756	LIPT_NVA	0.019	0.021
NVA669	150521.792	4673233.409	1301.279	LIPT_NVA	0.007	0.008
NVA670	185393.272	4755027.366	1002.548	LIPT_NVA	0.007	0.009
NVA671	131869.235	4750906.832	1132.268	LIPT_NVA	0.018	0.022
NVA672	158178.351	4741318.386	1074.922	LIPT_NVA	0.006	0.009
NVA673	143801.347	4666740.183	1281.688	LIPT_NVA	0.008	0.009
NVA674	125512.304	4733381.151	1382.537	LIPT_NVA	0.010	0.010
NVA675	163500.087	4764755.912	1048.767	LIPT_NVA	0.011	0.014
NVA676	151244.991	4749804.703	1042.967	LIPT_NVA	0.007	0.008
NVA677	143010.578	4711238.404	1306.008	LIPT_NVA	0.026	0.034
NVA678	86286.848	4710466.355	1450.993	LIPT_NVA	0.010	0.009
NVA679	88687.426	4765277.926	1253.930	LIPT_NVA	0.010	0.010
NVA680	191075.365	4702687.725	1171.361	LIPT_NVA	0.004	0.007
NVA681	189389.254	4681776.605	1199.198	LIPT_NVA	0.004	0.005
NVA682	138222.400	4687928.941	1362.402	LIPT_NVA	0.005	0.007
NVA683	90947.415	4746071.878	1553.972	LIPT_NVA	0.011	0.011
NVA684	176896.159	4709227.475	1183.705	LIPT_NVA	0.023	0.022
NVA685	139215.771	4735791.013	1140.226	LIPT_NVA	0.009	0.014

VVA701	551206.392	4687262.539	590.573	LIPT_VVA	0.012	0.013
VVA702	573494.634	4695797.274	529.947	LIPT_VVA	0.012	0.016
VVA703	594623.749	4668386.339	536.567	LIPT_VVA	0.010	0.018
VVA704	490218.199	4693335.094	682.205	LIPT_VVA	0.010	0.013
VVA705	522439.724	4666868.894	644.949	LIPT_VVA	0.010	0.014
VVA706	497537.713	4706183.246	645.461	LIPT_VVA	0.009	0.009
VVA707	543261.180	4667848.144	611.924	LIPT_VVA	0.012	0.013
VVA708	566250.518	4648651.376	596.522	LIPT_VVA	0.010	0.012
VVA709	572465.973	4687316.257	571.849	LIPT_VVA	0.010	0.012
VVA710	573094.592	4674483.846	605.948	LIPT_VVA	0.010	0.012
VVA711	498269.619	4673626.168	697.697	LIPT_VVA	0.015	0.022
VVA712	594324.034	4694146.951	516.477	LIPT_VVA	0.010	0.013
VVA713	511058.674	4670292.507	663.763	LIPT_VVA	0.013	0.015
VVA714	506204.088	4683523.072	661.901	LIPT_VVA	0.011	0.014
VVA715	563990.957	4692075.816	554.703	LIPT_VVA	0.010	0.014
VVA716	560819.159	4667977.817	575.584	LIPT_VVA	0.009	0.011
VVA717	536781.369	4697926.532	594.810	LIPT_VVA	0.009	0.013
VVA718	575878.929	4645531.387	593.705	LIPT_VVA	0.010	0.011
VVA719	487814.985	4715727.992	654.333	LIPT_VVA	0.012	0.012
VVA720	512090.102	4702947.865	622.661	LIPT_VVA	0.009	0.011
VVA721	514169.806	4696659.619	631.401	LIPT_VVA	0.010	0.011
VVA722	591201.047	4649073.103	561.219	LIPT_VVA	0.009	0.014
VVA723	489305.920	4664814.334	716.099	LIPT_VVA	0.011	0.012
VVA724	497401.901	4698067.131	666.370	LIPT_VVA	0.011	0.012
VVA725	483124.227	4701919.079	684.744	LIPT_VVA	0.010	0.011
VVA726	515894.308	4679000.092	646.227	LIPT_VVA	0.019	0.023
VVA727	572247.431	4663224.100	555.083	LIPT_VVA	0.008	0.010
VVA727_A	572274.953	4663334.901	555.177	LIPT_VVA	0.010	0.013
VVA728	586108.990	4658031.042	520.893	LIPT_VVA	0.009	0.010
VVA729	594452.878	4681312.897	547.433	LIPT_VVA	0.010	0.011
VVA730	496059.333	4714150.221	652.107	LIPT_VVA	0.013	0.016
VVA731	536765.662	4687105.319	608.156	LIPT_VVA	0.012	0.014
VVA732	504748.755	4666043.223	693.805	LIPT_VVA	0.012	0.013
VVA733	528838.688	4672538.279	623.034	LIPT_VVA	0.011	0.014
VVA734	251438.764	4756747.206	1059.389	LIPT_VVA	0.011	0.010
VVA735	377004.211	4740893.540	801.927	LIPT_VVA	0.010	0.009
VVA736	298772.547	4749658.986	945.844	LIPT_VVA	0.014	0.013
VVA737	472637.028	4745569.995	625.060	LIPT_VVA	0.007	0.007
VVA738	529091.326	4754665.497	546.705	LIPT_VVA	0.012	0.010
VVA739	256540.491	4699184.325	1150.732	LIPT_VVA	0.012	0.010
VVA740	342514.929	4739475.707	828.144	LIPT_VVA	0.011	0.009
VVA741	306319.149	4756492.546	963.477	LIPT_VVA	0.010	0.009
VVA742	363395.291	4740612.735	753.882	LIPT_VVA	0.010	0.009

VVA743	279054.901	4741453.669	984.113	LIPT_VVA	0.010	0.009
VVA744	357293.533	4759152.969	867.581	LIPT_VVA	0.011	0.009
VVA745	429441.382	4759267.554	736.885	LIPT_VVA	0.011	0.014
VVA746	389311.963	4755096.414	789.114	LIPT_VVA	0.011	0.010
VVA747	356898.742	4754130.737	815.001	LIPT_VVA	0.010	0.009
VVA748	326455.551	4739187.523	890.188	LIPT_VVA	0.011	0.010
VVA749	331491.100	4748677.364	943.762	LIPT_VVA	0.010	0.009
VVA750	442073.563	4746433.375	706.154	LIPT_VVA	0.010	0.010
VVA751	255012.952	4729037.751	1071.947	LIPT_VVA	0.010	0.009
VVA752	462526.140	4747865.914	654.330	LIPT_VVA	0.007	0.007
VVA753	265201.964	4748345.342	1034.755	LIPT_VVA	0.011	0.010
VVA754	444587.118	4759174.664	643.114	LIPT_VVA	0.010	0.010
VVA755	524393.161	4748536.496	473.070	LIPT_VVA	0.011	0.012
VVA756	535893.049	4742461.167	446.975	LIPT_VVA	0.011	0.011
VVA757	397396.089	4755027.498	790.135	LIPT_VVA	0.010	0.010
VVA758	461113.905	4757484.849	612.715	LIPT_VVA	0.007	0.009
VVA759	279409.654	4754268.322	991.219	LIPT_VVA	0.010	0.009
VVA760	555191.593	4741957.998	404.116	LIPT_VVA	0.011	0.010
VVA761	340645.986	4757164.718	889.230	LIPT_VVA	0.010	0.009
VVA762	260893.031	4709192.735	1125.973	LIPT_VVA	0.010	0.009
VVA763	426481.941	4749712.084	748.867	LIPT_VVA	0.007	0.007
VVA764	308891.844	4744473.861	921.818	LIPT_VVA	0.010	0.010
VVA765	371702.569	4758614.241	844.332	LIPT_VVA	0.010	0.009
VVA766	432378.200	4741615.591	751.008	LIPT_VVA	0.007	0.007
VVA767	252094.331	4735616.182	1045.089	LIPT_VVA	0.010	0.009
VVA769	451712.769	4741537.718	707.338	LIPT_VVA	0.007	0.007
VVA770	285133.671	4759378.375	986.537	LIPT_VVA	0.011	0.010
VVA771	512116.820	4756401.514	553.290	LIPT_VVA	0.011	0.011
VVA772	484052.373	4757834.663	653.658	LIPT_VVA	0.011	0.010
VVA773	249611.919	4707213.128	1155.392	LIPT_VVA	0.011	0.011
VVA774	411685.764	4749962.210	764.430	LIPT_VVA	0.007	0.006
VVA775	249281.237	4748039.528	1087.053	LIPT_VVA	0.011	0.012
VVA776	137720.014	4734561.215	1127.707	LIPT_VVA	0.011	0.009
VVA777	108014.291	4756744.520	1157.970	LIPT_VVA	0.012	0.010
VVA778	157970.849	4693892.099	1320.519	LIPT_VVA	0.005	0.007
VVA779	90976.654	4746068.570	1553.383	LIPT_VVA	0.011	0.009
VVA780	181071.896	4683367.985	1221.845	LIPT_VVA	0.003	0.005
VVA781	177193.408	4749331.336	1034.350	LIPT_VVA	0.010	0.009
VVA782	117380.984	4765255.958	1107.377	LIPT_VVA	0.025	0.030
VVA783	115858.024	4709351.616	1328.382	LIPT_VVA	0.011	0.011
VVA784	143858.773	4666836.098	1283.634	LIPT_VVA	0.006	0.008
VVA785	136616.307	4761008.070	1192.793	LIPT_VVA	0.014	0.014
VVA786	127837.170	4690551.849	1407.312	LIPT_VVA	0.009	0.007
VVA787	143075.410	4711243.785	1310.444	LIPT_VVA	0.021	0.024

VVA788	139655.151	4721295.669	1398.054	LIPT_VVA	0.017	0.020
VVA789	88712.200	4724912.526	1430.077	LIPT_VVA	0.010	0.009
VVA790	136370.794	4743315.572	1124.286	LIPT_VVA	0.010	0.010
VVA791	188221.638	4666830.043	1205.280	LIPT_VVA	0.003	0.005
VVA792	171532.753	4737757.680	1149.306	LIPT_VVA	0.013	0.012
VVA793	145686.285	4700261.101	1355.219	LIPT_VVA	0.005	0.009
VVA794	105826.336	4715905.621	1437.439	LIPT_VVA	0.010	0.010
VVA795	166248.845	4722114.147	1304.797	LIPT_VVA	0.010	0.009
VVA796	188037.768	4741759.007	1132.548	LIPT_VVA	0.011	0.010
VVA797	116321.795	4735412.266	1459.673	LIPT_VVA	0.010	0.009
VVA798	100899.160	4738116.400	1476.823	LIPT_VVA	0.010	0.009
VVA799	181110.997	4693285.792	1211.486	LIPT_VVA	0.005	0.009
VVA800	149885.801	4734013.296	1128.669	LIPT_VVA	0.011	0.010
VVA801	174363.750	4720593.567	1267.529	LIPT_VVA	0.012	0.010
VVA802	129412.453	4706764.060	1291.448	LIPT_VVA	0.010	0.010
VVA803	88672.822	4765262.765	1254.297	LIPT_VVA	0.010	0.009
VVA804	166564.499	4749812.434	1005.705	LIPT_VVA	0.010	0.009
VVA805	168273.608	4761130.095	998.944	LIPT_VVA	0.010	0.009
VVA806	154170.520	4682708.062	1308.849	LIPT_VVA	0.005	0.007
VVA807	191058.283	4702667.340	1170.691	LIPT_VVA	0.004	0.007
VVA808	103668.465	4772163.119	1130.881	LIPT_VVA	0.020	0.023
VVA809	158133.605	4740471.460	1082.529	LIPT_VVA	0.010	0.009
VVA810	185427.314	4755034.160	1001.858	LIPT_VVA	0.010	0.010
VVA811	182508.903	4728142.685	1239.876	LIPT_VVA	0.010	0.009
VVA812	106619.640	4701468.746	1384.805	LIPT_VVA	0.011	0.010
VVA813	150524.356	4673208.123	1301.203	LIPT_VVA	0.009	0.011
VVA814	176927.769	4709181.417	1182.831	LIPT_VVA	0.011	0.012
VVA815	179729.917	4741443.803	1107.899	LIPT_VVA	0.011	0.009
VVA816	97854.311	4753317.929	1235.582	LIPT_VVA	0.011	0.010
VVA817	188635.576	4719952.972	1233.977	LIPT_VVA	0.010	0.009
VVA818	155052.811	4710137.036	1242.012	LIPT_VVA	0.011	0.013
VVA819	149823.010	4719075.363	1341.782	LIPT_VVA	0.010	0.010
VVA820	119462.560	4699903.361	1362.682	LIPT_VVA	0.009	0.008
VVA821	117273.017	4743745.489	1456.336	LIPT_VVA	0.011	0.009
VVA822	125568.259	4733432.277	1391.929	LIPT_VVA	0.010	0.009
VVA823	151292.262	4750256.509	1049.962	LIPT_VVA	0.010	0.009
VVA824	138236.953	4687912.143	1361.855	LIPT_VVA	0.005	0.008
VVA825	130522.301	4767127.192	1195.023	LIPT_VVA	0.016	0.019
VVA826	183030.977	4766085.329	969.372	LIPT_VVA	0.011	0.010
VVA827	172825.553	4699595.919	1253.963	LIPT_VVA	0.007	0.009
VVA828	86260.885	4710447.976	1451.214	LIPT_VVA	0.010	0.009
VVA829	161812.663	4672650.141	1263.574	LIPT_VVA	0.005	0.009
VVA830	115663.181	4690408.809	1433.762	LIPT_VVA	0.008	0.009

VVA831	155553.437	4769497.102	1123.930	LIPT_VVA	0.011	0.009

NE Hat Creek - White River Lidar

PT#	NAD83 (2011) epoch 2010					
	LATITUDE	LONGITUDE	ELLIPSOID	CODE		
	North	West	HEIGHT	LIPT=Lidar Point		
	Decimal Degrees		METERS	Desc.	H. Accuracy	V. Accuracy
CTL901	42.40747810	-98.10678874	510.847	LIPT_CP	0.013	0.016
CTL902	42.43503510	-99.06137392	646.993	LIPT_CP	0.009	0.010
CTL903	42.13527424	-99.12009336	692.387	LIPT_CP	0.010	0.012
CTL904	42.39370209	-98.45619777	572.954	LIPT_CP	0.013	0.018
CTL905	42.39396508	-97.85410291	491.592	LIPT_CP	0.009	0.012
CTL906	42.16216378	-97.85435401	512.920	LIPT_CP	0.008	0.013
CTL907	42.16131395	-98.28187980	561.723	LIPT_CP	0.010	0.011
CTL908	41.98734582	-98.20016229	572.409	LIPT_CP	0.011	0.012
CTL909	42.14673107	-98.72882266	625.082	LIPT_CP	0.010	0.019
CTL910	42.14618637	-98.94292063	671.888	LIPT_CP	0.013	0.015
CTL911	42.59941044	-99.13541802	634.491	LIPT_CP	0.011	0.011
CTL912	42.32075150	-98.69074203	604.762	LIPT_CP	0.012	0.013
CTL913	42.21933777	-98.10642045	592.087	LIPT_CP	0.008	0.008
CTL914	42.35617214	-98.96353004	650.069	LIPT_CP	0.011	0.011
CTL916	42.30654139	-98.33978660	558.713	LIPT_CP	0.011	0.015
CTL917	41.98847448	-97.91126145	530.482	LIPT_CP	0.009	0.015
CTL917_A	42.15578423	-98.47593472	596.652	LIPT_CP	0.012	0.013
CTL918	42.47820405	-99.20567865	661.246	LIPT_CP	0.011	0.013
CTL919	42.43588401	-98.67152801	579.918	LIPT_CP	0.010	0.012
CTL920	42.42429750	-98.96387257	630.350	LIPT_CP	0.008	0.010
CTL921	42.78556470	-101.12206130	870.175	LIPT_CP	0.012	0.011
CTL922	42.68588555	-101.98973203	1047.760	LIPT_CP	0.010	0.010
CTL923	42.79349633	-101.70139107	965.757	LIPT_CP	0.011	0.018
CTL924	42.82411369	-99.80765185	727.360	LIPT_CP	0.007	0.006
CTL925	42.47622066	-102.04727038	1136.641	LIPT_CP	0.010	0.009
CTL926	42.96050673	-98.85250388	525.172	LIPT_CP	0.012	0.011
CTL927	42.76351465	-100.76724266	840.187	LIPT_CP	0.010	0.009
CTL928	42.96926232	-100.24410419	766.092	LIPT_CP	0.011	0.010
CTL929	42.82829172	-98.32727466	380.580	LIPT_CP	0.017	0.017
CTL930	42.94432295	-98.56482597	511.749	LIPT_CP	0.011	0.010
CTL931	42.98292560	-99.86563770	713.858	LIPT_CP	0.013	0.015
CTL932	42.93621006	-101.37394903	943.821	LIPT_CP	0.011	0.010
CTL933	42.97128506	-100.74961463	846.577	LIPT_CP	0.010	0.009
CTL935	42.92291673	-102.04592601	1040.880	LIPT_CP	0.011	0.010

CTL936	42.90445301	-99.09976576	548.330	LIPT_CP	0.013	0.013
CTL937	42.40665535	-101.95889837	1131.890	LIPT_CP	0.010	0.009
CTL938	42.86753053	-99.43408023	625.203	LIPT_CP	0.008	0.009
CTL939	42.83386676	-98.56018156	422.719	LIPT_CP	0.011	0.011
CTL940	42.99812157	-99.29669990	653.216	LIPT_CP	0.009	0.011
CTL941	42.37399936	-103.30768580	1345.371	LIPT_CP	0.005	0.009
CTL942	42.57611026	-102.96857521	1240.561	LIPT_CP	0.006	0.011
CTL943	42.58004430	-103.39590255	1356.905	LIPT_CP	0.006	0.009
CTL944	42.56951397	-102.79759457	1216.422	LIPT_CP	0.007	0.008
CTL945	42.44068983	-103.66754948	1308.459	LIPT_CP	0.013	0.013
CTL946	42.75480080	-102.91467661	1096.851	LIPT_CP	0.008	0.011
CTL947	42.38001832	-102.97447466	1235.155	LIPT_CP	0.005	0.007
CTL948	42.96720237	-103.52989841	1179.772	LIPT_CP	0.011	0.011
CTL949	42.99682325	-103.21316464	1100.014	LIPT_CP	0.006	0.010
CTL950	42.22018740	-103.18526379	1286.740	LIPT_CP	0.005	0.007
CTL951	42.04038975	-102.91930175	1190.871	LIPT_CP	0.004	0.005
CTL952	42.69133087	-103.87455153	1459.405	LIPT_CP	0.010	0.009
CTL953	42.97661155	-102.89054537	936.774	LIPT_CP	0.010	0.010
CTL954	42.12697409	-103.50663375	1326.088	LIPT_CP	0.010	0.012
CTL955	42.82699991	-103.50962438	1114.422	LIPT_CP	0.021	0.023
CTL956	42.74106282	-103.17646731	1066.587	LIPT_CP	0.009	0.017
CTL957	42.66113675	-103.57644830	1389.514	LIPT_CP	0.010	0.009
CTL958	42.43279627	-104.02953551	1436.259	LIPT_CP	0.010	0.009
CTL959	42.92549108	-104.03635796	1259.666	LIPT_CP	0.010	0.010
CTL960	42.22563280	-102.78374164	1181.434	LIPT_CP	0.003	0.006
NVA100	42.91880474	-101.70065559	973.037	LIPT_NVA	0.011	0.010
NVA501	42.32711139	-98.44604156	555.695	LIPT_NVA	0.010	0.012
NVA502	42.32701980	-98.44589826	555.546	LIPT_NVA	0.011	0.014
NVA502_A	42.23390468	-98.43041276	563.621	LIPT_NVA	0.011	0.012
NVA503	42.33552492	-98.55394019	584.577	LIPT_NVA	0.012	0.014
NVA504	42.47891156	-98.85287945	599.117	LIPT_NVA	0.009	0.011
NVA505	42.33640774	-99.11889352	666.594	LIPT_NVA	0.010	0.013
NVA506	42.40739647	-98.10682419	510.903	LIPT_NVA	0.013	0.015
NVA507	42.43502333	-99.03170421	643.317	LIPT_NVA	0.012	0.013
NVA508	42.14489101	-99.15809000	705.245	LIPT_NVA	0.012	0.014
NVA508_alt	42.13527828	-99.11999194	692.361	LIPT_NVA	0.014	0.018
NVA509	42.39370300	-98.45634805	572.950	LIPT_NVA	0.010	0.015
NVA510	42.27806932	-97.85429047	522.981	LIPT_NVA	0.010	0.011
NVA511	42.43241568	-98.55361520	571.392	LIPT_NVA	0.010	0.013
NVA513	42.39398898	-97.85394535	491.599	LIPT_NVA	0.009	0.013
NVA514	42.50750803	-99.02979444	622.223	LIPT_NVA	0.009	0.009
NVA515	42.26273371	-98.80753718	623.067	LIPT_NVA	0.017	0.024
NVA516	41.95847938	-98.08450160	570.218	LIPT_NVA	0.010	0.012
NVA517	42.16066557	-97.85427816	513.008	LIPT_NVA	0.008	0.014

NVA518	42.39245180	-99.11910210	659.350	LIPT_NVA	0.010	0.017
NVA519	42.17549742	-98.86551282	638.997	LIPT_NVA	0.013	0.015
NVA520	42.31997932	-99.00171075	651.956	LIPT_NVA	0.011	0.013
NVA521	42.21513903	-99.02113354	674.450	LIPT_NVA	0.011	0.016
NVA521_alt	42.23315571	-99.00156151	662.706	LIPT_NVA	0.017	0.024
NVA522	42.42250592	-98.82732098	607.374	LIPT_NVA	0.009	0.010
NVA523	42.16141027	-98.28179517	561.614	LIPT_NVA	0.009	0.010
NVA524	42.23359012	-98.72950727	608.348	LIPT_NVA	0.012	0.014
NVA524_alt	42.21913284	-98.72935024	616.227	LIPT_NVA	0.010	0.012
NVA525	42.06959186	-97.95955546	496.147	LIPT_NVA	0.009	0.009
NVA526	41.98757716	-98.20012805	573.403	LIPT_NVA	0.010	0.012
NVA527	42.20479696	-98.65139256	600.230	LIPT_NVA	0.012	0.016
NVA528	42.16118470	-98.65146281	605.589	LIPT_NVA	0.014	0.020
NVA529	42.14684352	-98.72878539	624.847	LIPT_NVA	0.012	0.021
NVA530	42.24843446	-98.02900364	542.701	LIPT_NVA	0.011	0.014
NVA531	42.16061764	-98.94280936	662.246	LIPT_NVA	0.012	0.015
NVA532	42.59465070	-99.13154778	632.840	LIPT_NVA	0.011	0.011
NVA533	42.32187007	-98.69073065	605.203	LIPT_NVA	0.010	0.012
NVA533	42.97319847	-99.19529305	628.600	LIPT_NVA	0.011	0.010
NVA534	42.21930022	-98.11226597	588.311	LIPT_NVA	0.008	0.009
NVA535	42.34253014	-98.92471639	636.987	LIPT_NVA	0.010	0.011
NVA536	42.21937758	-98.24277795	534.046	LIPT_NVA	0.009	0.012
NVA537	42.16141206	-98.47600373	588.095	LIPT_NVA	0.012	0.013
NVA538	42.37868691	-98.22323674	531.130	LIPT_NVA	0.014	0.021
NVA538_alt	42.37863337	-98.22314801	530.886	LIPT_NVA	0.014	0.021
NVA539	42.30653843	-98.33953522	559.143	LIPT_NVA	0.011	0.014
NVA540	42.57999886	-99.04912175	628.590	LIPT_NVA	0.009	0.010
NVA541	41.98852138	-97.91125989	530.556	LIPT_NVA	0.009	0.012
NVA542	42.48618017	-99.20571530	658.260	LIPT_NVA	0.011	0.012
NVA543	42.33517746	-98.12094519	548.482	LIPT_NVA	0.011	0.013
NVA544	42.43583712	-98.69083848	582.583	LIPT_NVA	0.012	0.015
NVA545	42.11832125	-98.12597241	531.338	LIPT_NVA	0.007	0.009
NVA546	42.42430986	-98.96401904	630.276	LIPT_NVA	0.009	0.010
NVA547	42.94425429	-98.64391375	522.563	LIPT_NVA	0.011	0.010
NVA548	42.92651544	-100.75312604	793.964	LIPT_NVA	0.010	0.010
NVA549	42.90447752	-98.71836318	449.942	LIPT_NVA	0.012	0.011
NVA550	42.85684277	-100.86611097	881.109	LIPT_NVA	0.011	0.010
NVA551	42.82459615	-99.59133799	685.259	LIPT_NVA	0.007	0.007
NVA552	42.89617495	-99.88590721	722.244	LIPT_NVA	0.007	0.007
NVA554	42.97320877	-99.01788306	553.714	LIPT_NVA	0.011	0.010
NVA555	42.94086503	-100.25728024	768.921	LIPT_NVA	0.011	0.010
NVA556	42.98343199	-99.68941783	624.447	LIPT_NVA	0.007	0.008
NVA557	42.78539723	-101.12191304	870.142	LIPT_NVA	0.011	0.010
NVA558	42.67501521	-101.98964303	1053.145	LIPT_NVA	0.011	0.014

NVA559	42.94015727	-100.35699379	767.747	LIPT_NVA	0.011	0.010
NVA561	42.80972667	-101.92109127	1031.507	LIPT_NVA	0.012	0.010
NVA562	42.79350785	-101.70115854	965.489	LIPT_NVA	0.010	0.009
NVA563	42.82443852	-99.77799177	725.193	LIPT_NVA	0.007	0.007
NVA564	42.90788454	-100.47146795	789.212	LIPT_NVA	0.010	0.009
NVA565	42.73286793	-102.02797533	1026.036	LIPT_NVA	0.011	0.010
NVA566	42.96894965	-100.57343556	823.626	LIPT_NVA	0.010	0.009
NVA567	42.47594073	-102.04817404	1136.330	LIPT_NVA	0.010	0.009
NVA568	42.94601695	-98.84149140	485.976	LIPT_NVA	0.012	0.010
NVA569	42.91985700	-101.69991986	973.181	LIPT_NVA	0.010	0.009
NVA570	42.76362997	-100.76726168	840.064	LIPT_NVA	0.010	0.009
NVA571	42.96925458	-100.22778525	754.601	LIPT_NVA	0.010	0.009
NVA572	42.86806949	-100.54567724	764.934	LIPT_NVA	0.014	0.012
NVA573	42.82903679	-98.32985376	379.889	LIPT_NVA	0.012	0.011
NVA574	42.86801500	-99.70937867	683.671	LIPT_NVA	0.009	0.008
NVA575	42.86784527	-100.00320617	750.875	LIPT_NVA	0.010	0.011
NVA576	42.94421239	-98.56484662	511.904	LIPT_NVA	0.012	0.011
NVA577	42.80456528	-101.54856074	978.414	LIPT_NVA	0.010	0.009
NVA578	42.98324466	-99.86573434	713.418	LIPT_NVA	0.012	0.015
NVA579	42.87256535	-101.46473126	926.295	LIPT_NVA	0.012	0.010
NVA580	42.82912241	-101.33779932	901.984	LIPT_NVA	0.011	0.009
NVA581	42.81074188	-100.50489654	782.643	LIPT_NVA	0.013	0.013
NVA582	42.93550013	-101.37699121	946.723	LIPT_NVA	0.011	0.010
NVA583	42.93060442	-101.15979501	944.384	LIPT_NVA	0.011	0.010
NVA584	42.96975109	-99.47094997	600.448	LIPT_NVA	0.008	0.008
NVA585	42.82134424	-101.28823477	897.837	LIPT_NVA	0.011	0.010
NVA586	42.97129548	-100.74978830	846.401	LIPT_NVA	0.010	0.009
NVA587	42.80588555	-100.67005714	732.846	LIPT_NVA	0.011	0.010
NVA588	42.95666991	-101.63518888	967.366	LIPT_NVA	0.011	0.009
NVA589	42.95018144	-100.95446564	868.920	LIPT_NVA	0.010	0.009
NVA590	42.92244778	-101.04229122	916.511	LIPT_NVA	0.010	0.009
NVA591	42.91172731	-99.59461456	629.649	LIPT_NVA	0.007	0.007
NVA593	42.92596799	-99.76903989	710.050	LIPT_NVA	0.014	0.011
NVA594	42.91620012	-102.05691657	1044.486	LIPT_NVA	0.012	0.010
NVA595	42.30421505	-98.92492866	639.349	LIPT_NVA	0.010	0.012
NVA595	42.85183522	-101.87331897	1015.038	LIPT_NVA	0.010	0.010
NVA596	42.49799335	-101.90886860	1106.702	LIPT_NVA	0.010	0.009
NVA597	42.90616480	-99.09976182	543.061	LIPT_NVA	0.012	0.011
NVA598	42.40760699	-101.94881395	1129.935	LIPT_NVA	0.010	0.009
NVA599	42.79192659	-100.93913905	780.530	LIPT_NVA	0.011	0.010
NVA600	42.89698048	-100.08144643	743.212	LIPT_NVA	0.007	0.007
NVA601	42.88266115	-99.45928686	629.794	LIPT_NVA	0.007	0.007
NVA602	42.87186970	-101.06286218	923.314	LIPT_NVA	0.010	0.009
NVA603	42.86184119	-99.33550694	602.314	LIPT_NVA	0.009	0.012

NVA604	42.83057740	-98.52567269	415.228	LIPT_NVA	0.012	0.010
NVA605	42.99811082	-99.29711870	653.562	LIPT_NVA	0.009	0.009
NVA606	42.67476921	-103.68247096	1441.069	LIPT_NVA	0.010	0.009
NVA607	42.19194987	-103.30768133	1300.932	LIPT_NVA	0.010	0.013
NVA608	42.35831485	-103.62074816	1344.817	LIPT_NVA	0.008	0.007
NVA609	42.37419385	-103.30378427	1338.254	LIPT_NVA	0.005	0.009
NVA610	42.94404479	-103.69454766	1090.294	LIPT_NVA	0.022	0.027
NVA611	42.56847946	-102.96782236	1242.758	LIPT_NVA	0.007	0.009
NVA612	42.56011451	-103.38958862	1381.340	LIPT_NVA	0.012	0.019
NVA613	42.46648601	-103.19562473	1224.076	LIPT_NVA	0.031	0.052
NVA614	42.68307397	-103.18521090	1132.180	LIPT_NVA	0.006	0.013
NVA615	42.56951764	-102.79273723	1215.756	LIPT_NVA	0.007	0.019
NVA616	42.42496959	-103.50323176	1273.489	LIPT_NVA	0.009	0.007
NVA617	42.37254862	-103.17048732	1311.671	LIPT_NVA	0.008	0.011
NVA618	42.44126795	-103.67431770	1308.818	LIPT_NVA	0.011	0.010
NVA619	42.32151980	-103.07053578	1279.903	LIPT_NVA	0.009	0.010
NVA620	42.59722051	-103.16428350	1351.268	LIPT_NVA	0.006	0.009
NVA621	42.75566132	-103.44327834	1107.786	LIPT_NVA	0.006	0.008
NVA622	42.21976507	-103.01425279	1253.737	LIPT_NVA	0.004	0.006
NVA623	42.55281417	-103.82123827	1464.338	LIPT_NVA	0.012	0.012
NVA624	42.46686616	-103.06727773	1219.157	LIPT_NVA	0.018	0.021
NVA625	42.04626409	-103.09309799	1222.313	LIPT_NVA	0.011	0.013
NVA626	42.75951194	-102.91115924	1096.048	LIPT_NVA	0.006	0.011
NVA627	42.56688399	-104.01004477	1414.273	LIPT_NVA	0.010	0.010
NVA628	42.38002642	-102.97395443	1235.044	LIPT_NVA	0.006	0.008
NVA629	42.82831041	-102.94976736	1018.100	LIPT_NVA	0.006	0.013
NVA630	42.35128658	-103.52261412	1381.804	LIPT_NVA	0.008	0.007
NVA631	42.82770596	-103.02039727	1009.309	LIPT_NVA	0.020	0.029
NVA632	42.27798982	-103.03291894	1259.800	LIPT_NVA	0.005	0.007
NVA633	42.57962759	-103.06721803	1287.801	LIPT_NVA	0.006	0.008
NVA634	42.89723297	-104.00256961	1240.064	LIPT_NVA	0.012	0.013
NVA635	42.54470386	-103.26405724	1324.391	LIPT_NVA	0.007	0.014
NVA636	42.75109048	-103.67669778	1442.354	LIPT_NVA	0.010	0.009
NVA637	42.67828714	-103.42350461	1111.315	LIPT_NVA	0.006	0.011
NVA638	42.96688870	-103.52982327	1179.860	LIPT_NVA	0.010	0.013
NVA639	42.86255028	-103.79845284	1142.915	LIPT_NVA	0.012	0.011
NVA640	42.67854496	-103.27288128	1111.611	LIPT_NVA	0.015	0.011
NVA641	42.68008460	-102.98285853	1243.911	LIPT_NVA	0.009	0.009
NVA642	42.92578110	-103.06598028	999.851	LIPT_NVA	0.005	0.010
NVA643	42.64056437	-102.87239090	1222.459	LIPT_NVA	0.009	0.012
NVA644	43.00073526	-103.22520204	1108.643	LIPT_NVA	0.008	0.011
NVA645	42.36644189	-103.77692843	1368.280	LIPT_NVA	0.011	0.010
NVA646	42.61079790	-103.89318448	1414.716	LIPT_NVA	0.010	0.008
NVA647	42.27103912	-103.65979022	1416.199	LIPT_NVA	0.008	0.009

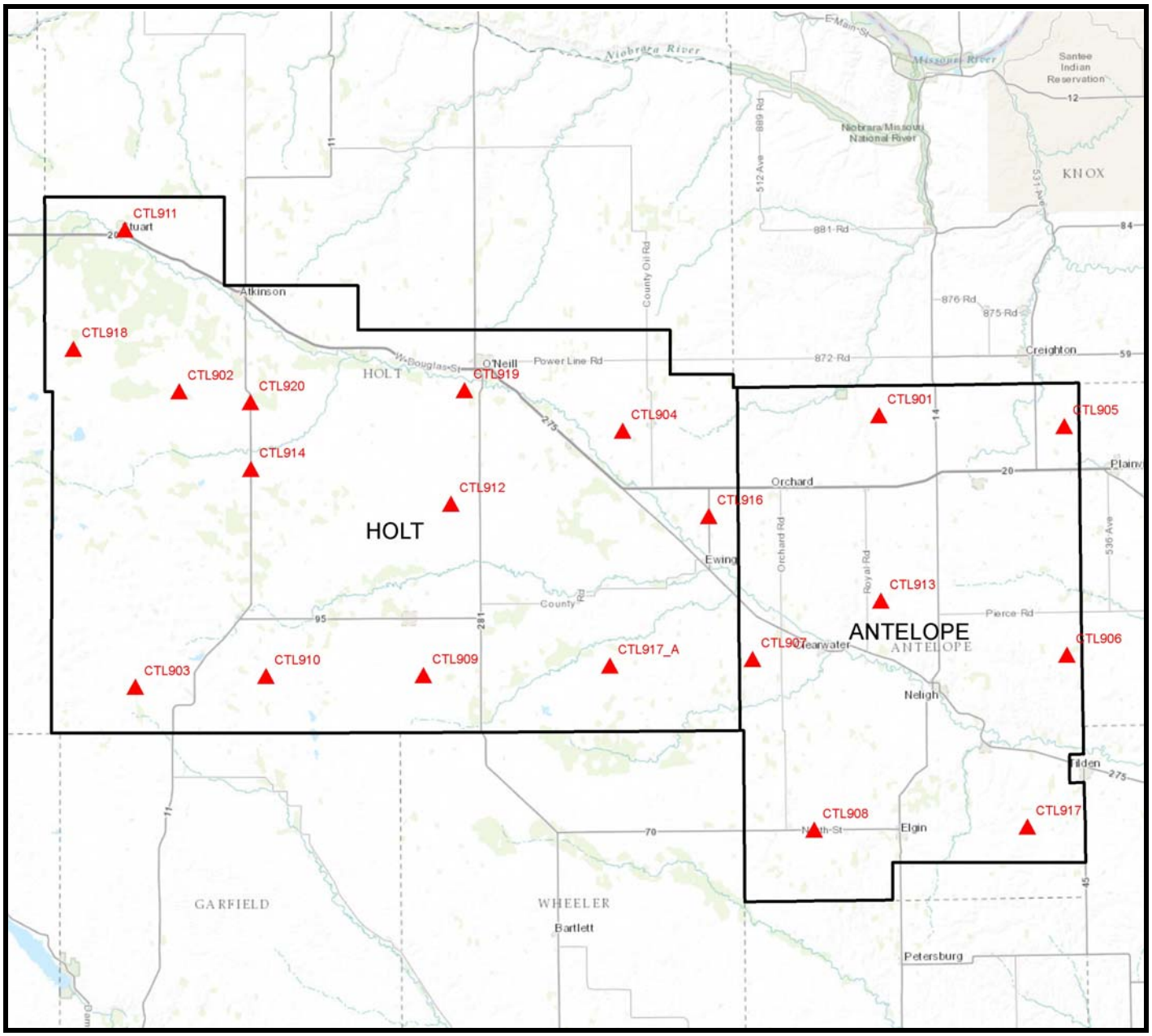
NVA648	42.32679366	-102.87007359	1193.597	LIPT_NVA	0.006	0.010
NVA649	42.49482864	-103.79623278	1420.512	LIPT_NVA	0.012	0.010
NVA650	42.23758287	-102.86465729	1204.361	LIPT_NVA	0.004	0.005
NVA651	42.76462628	-102.81311094	1114.934	LIPT_NVA	0.006	0.016
NVA652	42.22020369	-103.19014273	1290.348	LIPT_NVA	0.005	0.007
NVA653	42.04033834	-102.91864541	1191.138	LIPT_NVA	0.006	0.012
NVA654	42.69133178	-103.87563144	1459.409	LIPT_NVA	0.013	0.017
NVA655	42.67022576	-102.79285930	1179.288	LIPT_NVA	0.007	0.009
NVA656	42.42254821	-103.79153589	1328.673	LIPT_NVA	0.012	0.011
NVA657	42.89062312	-103.89731286	1176.923	LIPT_NVA	0.012	0.012
NVA658	42.98112372	-102.88721836	951.116	LIPT_NVA	0.007	0.009
NVA659	42.13282003	-103.09277692	1246.640	LIPT_NVA	0.002	0.003
NVA660	42.10373101	-102.89498116	1196.748	LIPT_NVA	0.002	0.003
NVA661	42.09181976	-102.77016065	1187.682	LIPT_NVA	0.003	0.005
NVA662	42.82688210	-103.91990647	1221.221	LIPT_NVA	0.010	0.009
NVA663	42.55283394	-103.63764700	1417.445	LIPT_NVA	0.010	0.009
NVA664	42.99904834	-103.86144079	1115.437	LIPT_NVA	0.017	0.019
NVA665	42.12434728	-103.51326608	1331.754	LIPT_NVA	0.008	0.008
NVA666	42.27876287	-103.52291626	1382.087	LIPT_NVA	0.008	0.008
NVA667	42.91536059	-103.45297548	1176.636	LIPT_NVA	0.009	0.009
NVA668	42.87589551	-103.57459491	1135.184	LIPT_NVA	0.019	0.021
NVA669	42.13327849	-103.22830044	1282.657	LIPT_NVA	0.007	0.008
NVA670	42.88301981	-102.85229130	984.576	LIPT_NVA	0.007	0.009
NVA671	42.82213001	-103.50315342	1115.302	LIPT_NVA	0.018	0.022
NVA672	42.74820795	-103.17639199	1057.019	LIPT_NVA	0.006	0.009
NVA673	42.07194027	-103.30543555	1262.897	LIPT_NVA	0.008	0.009
NVA674	42.66172501	-103.56908320	1365.433	LIPT_NVA	0.010	0.010
NVA675	42.96107502	-103.12554906	1031.202	LIPT_NVA	0.011	0.014
NVA676	42.82130137	-103.26611705	1025.286	LIPT_NVA	0.007	0.008
NVA677	42.47119781	-103.34236316	1288.054	LIPT_NVA	0.026	0.034
NVA678	42.43609816	-104.02937946	1434.397	LIPT_NVA	0.010	0.009
NVA679	42.92908680	-104.03999548	1238.685	LIPT_NVA	0.010	0.010
NVA680	42.41500735	-102.75442956	1153.027	LIPT_NVA	0.004	0.007
NVA681	42.22641410	-102.76364607	1180.652	LIPT_NVA	0.004	0.005
NVA682	42.25966933	-103.38582862	1344.181	LIPT_NVA	0.005	0.007
NVA683	42.75800517	-103.99846146	1538.377	LIPT_NVA	0.011	0.011
NVA684	42.46799694	-102.93004404	1165.490	LIPT_NVA	0.023	0.022
NVA685	42.68990429	-103.40390933	1122.643	LIPT_NVA	0.009	0.014
VVA701	42.33593204	-98.37841805	565.900	LIPT_VVA	0.012	0.013
VVA702	42.41100154	-98.10680511	504.740	LIPT_VVA	0.012	0.016
VVA703	42.16189421	-97.85454391	511.860	LIPT_VVA	0.010	0.018
VVA704	42.39224520	-99.11884520	658.660	LIPT_VVA	0.010	0.013
VVA705	42.15362444	-98.72839234	621.046	LIPT_VVA	0.010	0.014
VVA706	42.50801281	-99.02997100	621.528	LIPT_VVA	0.009	0.009

VVA707	42.16157023	-98.47630703	587.726	LIPT_VVA	0.012	0.013
VVA708	41.98708275	-98.20020773	572.021	LIPT_VVA	0.010	0.012
VVA709	42.33472656	-98.12037161	546.884	LIPT_VVA	0.010	0.012
VVA710	42.21910998	-98.11436166	581.257	LIPT_VVA	0.010	0.012
VVA711	42.21480256	-99.02096453	674.089	LIPT_VVA	0.015	0.022
VVA712	42.39389004	-97.85397554	491.376	LIPT_VVA	0.010	0.013
VVA713	42.18470219	-98.86608160	639.995	LIPT_VVA	0.013	0.015
VVA714	42.30391385	-98.92472811	638.058	LIPT_VVA	0.011	0.014
VVA715	42.37833071	-98.22270777	529.687	LIPT_VVA	0.010	0.014
VVA716	42.16157103	-98.26376204	551.046	LIPT_VVA	0.009	0.011
VVA717	42.43278518	-98.55283269	570.340	LIPT_VVA	0.009	0.013
VVA718	41.95811692	-98.08438718	569.205	LIPT_VVA	0.010	0.011
VVA719	42.59387853	-99.14851965	630.396	LIPT_VVA	0.012	0.012
VVA720	42.47878485	-98.85290757	598.478	LIPT_VVA	0.009	0.011
VVA721	42.42211817	-98.82776049	607.304	LIPT_VVA	0.010	0.011
VVA722	41.98838703	-97.89897985	536.694	LIPT_VVA	0.009	0.014
VVA723	42.13536868	-99.12940269	692.813	LIPT_VVA	0.011	0.012
VVA724	42.43491925	-99.03158734	642.596	LIPT_VVA	0.011	0.012
VVA725	42.46943024	-99.20528598	661.238	LIPT_VVA	0.010	0.011
VVA726	42.26304170	-98.80728493	622.287	LIPT_VVA	0.019	0.023
VVA727	42.11779080	-98.12602194	530.466	LIPT_VVA	0.008	0.010
VVA727_A	42.11878608	-98.12567533	530.560	LIPT_VVA	0.010	0.013
VVA728	42.06962757	-97.95912811	496.283	LIPT_VVA	0.009	0.010
VVA729	42.27831230	-97.85450983	522.594	LIPT_VVA	0.010	0.011
VVA730	42.57975573	-99.04802082	628.015	LIPT_VVA	0.013	0.016
VVA731	42.33533238	-98.55371441	583.862	LIPT_VVA	0.012	0.014
VVA732	42.14649518	-98.94252808	670.202	LIPT_VVA	0.012	0.013
VVA733	42.20447466	-98.65066038	599.011	LIPT_VVA	0.011	0.014
VVA734	42.92283725	-102.04560406	1040.671	LIPT_VVA	0.011	0.010
VVA735	42.81072150	-100.50437315	780.098	LIPT_VVA	0.010	0.009
VVA736	42.87302436	-101.46367080	926.122	LIPT_VVA	0.014	0.013
VVA737	42.86222756	-99.33496003	600.514	LIPT_VVA	0.007	0.007
VVA738	42.94406934	-98.64341122	520.783	LIPT_VVA	0.012	0.010
VVA739	42.40679128	-101.95850399	1132.080	LIPT_VVA	0.012	0.010
VVA740	42.79164331	-100.92561184	807.175	LIPT_VVA	0.011	0.009
VVA741	42.93645975	-101.37371412	943.449	LIPT_VVA	0.010	0.009
VVA742	42.80588648	-100.67069148	732.406	LIPT_VVA	0.010	0.009
VVA743	42.79376807	-101.70160831	964.785	LIPT_VVA	0.010	0.009
VVA744	42.97165554	-100.74999625	845.969	LIPT_VVA	0.011	0.009
VVA745	42.98279523	-99.86541741	712.992	LIPT_VVA	0.011	0.014
VVA746	42.94046518	-100.35667782	766.540	LIPT_VVA	0.011	0.010
VVA747	42.92637661	-100.75355124	793.523	LIPT_VVA	0.010	0.009
VVA748	42.78558057	-101.12176022	869.762	LIPT_VVA	0.011	0.010
VVA749	42.87210847	-101.06307440	923.107	LIPT_VVA	0.010	0.009

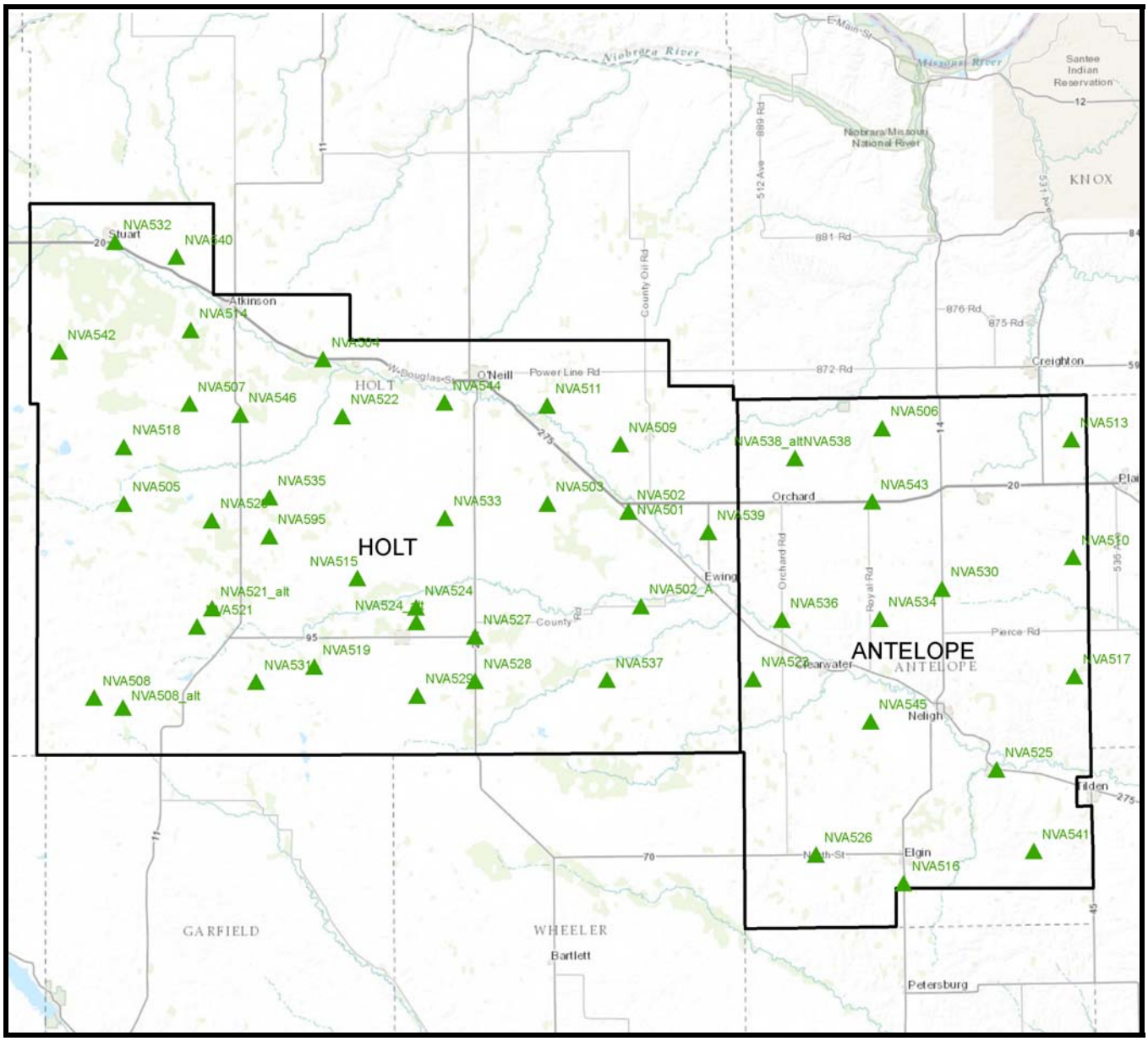
VVA750	42.86829623	-99.70916684	682.344	LIPT_VVA	0.010	0.010
VVA751	42.67480027	-101.98983613	1053.147	LIPT_VVA	0.010	0.009
VVA752	42.88247334	-99.45888086	629.964	LIPT_VVA	0.007	0.007
VVA753	42.85163250	-101.87366535	1015.691	LIPT_VVA	0.011	0.010
VVA754	42.98321256	-99.67965685	618.749	LIPT_VVA	0.010	0.010
VVA755	42.88904198	-98.70126516	447.317	LIPT_VVA	0.011	0.012
VVA756	42.83387928	-98.56082123	421.179	LIPT_VVA	0.011	0.011
VVA757	42.94097607	-100.25760416	767.324	LIPT_VVA	0.010	0.010
VVA758	42.96902024	-99.47684122	587.965	LIPT_VVA	0.007	0.009
VVA759	42.90914207	-101.70229964	971.896	LIPT_VVA	0.010	0.009
VVA760	42.82819926	-98.32475140	378.226	LIPT_VVA	0.011	0.010
VVA761	42.95045908	-100.95346720	868.218	LIPT_VVA	0.010	0.009
VVA762	42.49816253	-101.90984655	1107.195	LIPT_VVA	0.010	0.009
VVA763	42.89647692	-99.90045661	725.408	LIPT_VVA	0.007	0.007
VVA764	42.82896792	-101.33812012	901.883	LIPT_VVA	0.010	0.010
VVA765	42.96937086	-100.57324472	822.247	LIPT_VVA	0.010	0.009
VVA766	42.82411833	-99.82727240	727.628	LIPT_VVA	0.007	0.007
VVA767	42.73302512	-102.02828360	1026.325	LIPT_VVA	0.010	0.009
VVA769	42.82488166	-99.59074496	683.476	LIPT_VVA	0.007	0.007
VVA770	42.95674359	-101.63421174	967.049	LIPT_VVA	0.011	0.010
VVA771	42.96016146	-98.85143855	527.506	LIPT_VVA	0.011	0.011
VVA772	42.97299650	-99.19557071	628.359	LIPT_VVA	0.011	0.010
VVA773	42.47679350	-102.04608456	1136.806	LIPT_VVA	0.011	0.011
VVA774	42.89716030	-100.08169214	741.378	LIPT_VVA	0.007	0.006
VVA775	42.84382894	-102.06811693	1068.378	LIPT_VVA	0.011	0.012
VVA776	42.67815950	-103.42132979	1110.157	LIPT_VVA	0.011	0.009
VVA777	42.86268315	-103.79805283	1142.056	LIPT_VVA	0.012	0.010
VVA778	42.32213280	-103.15056561	1302.275	LIPT_VVA	0.005	0.007
VVA779	42.75799107	-103.99810311	1537.787	LIPT_VVA	0.011	0.009
VVA780	42.23736533	-102.86508125	1203.348	LIPT_VVA	0.003	0.005
VVA781	42.82842762	-102.94919941	1016.341	LIPT_VVA	0.010	0.009
VVA782	42.94381651	-103.68957935	1091.316	LIPT_VVA	0.025	0.030
VVA783	42.44128872	-103.67035220	1311.018	LIPT_VVA	0.011	0.011
VVA784	42.07282771	-103.30480165	1264.845	LIPT_VVA	0.006	0.008
VVA785	42.91508694	-103.45178247	1176.006	LIPT_VVA	0.014	0.014
VVA786	42.27833994	-103.51303853	1389.280	LIPT_VVA	0.009	0.007
VVA787	42.47127598	-103.34158010	1292.490	LIPT_VVA	0.021	0.024
VVA788	42.55995415	-103.38939016	1380.342	LIPT_VVA	0.017	0.020
VVA789	42.56698986	-104.01036855	1413.865	LIPT_VVA	0.010	0.009
VVA790	42.75612394	-103.44336341	1106.954	LIPT_VVA	0.010	0.010
VVA791	42.09162682	-102.76977167	1186.577	LIPT_VVA	0.003	0.005
VVA792	42.72205047	-103.01155976	1131.374	LIPT_VVA	0.013	0.012
VVA793	42.37384329	-103.30314657	1337.110	LIPT_VVA	0.005	0.009
VVA794	42.49507831	-103.79640559	1420.476	LIPT_VVA	0.010	0.010

VVA795	42.57925009	-103.06675393	1286.692	LIPT_VVA	0.010	0.009
VVA796	42.76488306	-102.81263652	1114.579	LIPT_VVA	0.011	0.010
VVA797	42.67543290	-103.68222648	1442.967	LIPT_VVA	0.010	0.009
VVA798	42.69185900	-103.87168731	1460.670	LIPT_VVA	0.010	0.009
VVA799	42.32649947	-102.87006669	1193.045	LIPT_VVA	0.005	0.009
VVA800	42.67886894	-103.27292780	1110.820	LIPT_VVA	0.011	0.010
VVA801	42.56905339	-102.96724014	1249.390	LIPT_VVA	0.012	0.010
VVA802	42.42464754	-103.50439573	1273.738	LIPT_VVA	0.010	0.010
VVA803	42.92894293	-104.04016264	1239.052	LIPT_VVA	0.010	0.009
VVA804	42.82819435	-103.07920109	987.739	LIPT_VVA	0.010	0.009
VVA805	42.93059897	-103.06502279	981.150	LIPT_VVA	0.010	0.009
VVA806	42.21999971	-103.18989354	1290.431	LIPT_VVA	0.005	0.007
VVA807	42.41481736	-102.75462578	1152.357	LIPT_VVA	0.004	0.007
VVA808	42.99879232	-103.86195765	1115.325	LIPT_VVA	0.020	0.023
VVA809	42.74058133	-103.17642574	1064.625	LIPT_VVA	0.010	0.009
VVA810	42.88309487	-102.85187919	983.886	LIPT_VVA	0.010	0.010
VVA811	42.64027372	-102.87243558	1221.861	LIPT_VVA	0.010	0.009
VVA812	42.36591657	-103.77691375	1367.376	LIPT_VVA	0.011	0.010
VVA813	42.13305251	-103.22825437	1282.580	LIPT_VVA	0.009	0.011
VVA814	42.46759629	-102.92963451	1164.616	LIPT_VVA	0.011	0.012
VVA815	42.75862856	-102.91376411	1089.933	LIPT_VVA	0.011	0.009
VVA816	42.82666681	-103.91952666	1219.885	LIPT_VVA	0.011	0.010
VVA817	42.56918156	-102.79339585	1215.908	LIPT_VVA	0.010	0.009
VVA818	42.46675740	-103.19560984	1223.841	LIPT_VVA	0.011	0.013
VVA819	42.54468778	-103.26451309	1323.820	LIPT_VVA	0.010	0.010
VVA820	42.35825027	-103.62042768	1344.992	LIPT_VVA	0.009	0.008
VVA821	42.75070152	-103.67628030	1439.828	LIPT_VVA	0.011	0.009
VVA822	42.66221117	-103.56843629	1374.824	LIPT_VVA	0.010	0.009
VVA823	42.82538028	-103.26581983	1032.289	LIPT_VVA	0.010	0.009
VVA824	42.25952522	-103.38564222	1343.634	LIPT_VVA	0.005	0.008
VVA825	42.96709386	-103.53024769	1178.609	LIPT_VVA	0.016	0.019
VVA826	42.98139355	-102.88740536	951.464	LIPT_VVA	0.011	0.010
VVA827	42.37975732	-102.97396379	1235.704	LIPT_VVA	0.007	0.009
VVA828	42.43591945	-104.02968069	1434.619	LIPT_VVA	0.010	0.009
VVA829	42.13298800	-103.09169836	1244.991	LIPT_VVA	0.005	0.009
VVA830	42.27115797	-103.66010583	1415.892	LIPT_VVA	0.008	0.009
VVA831	43.00010413	-103.22564071	1106.751	LIPT_VVA	0.011	0.009

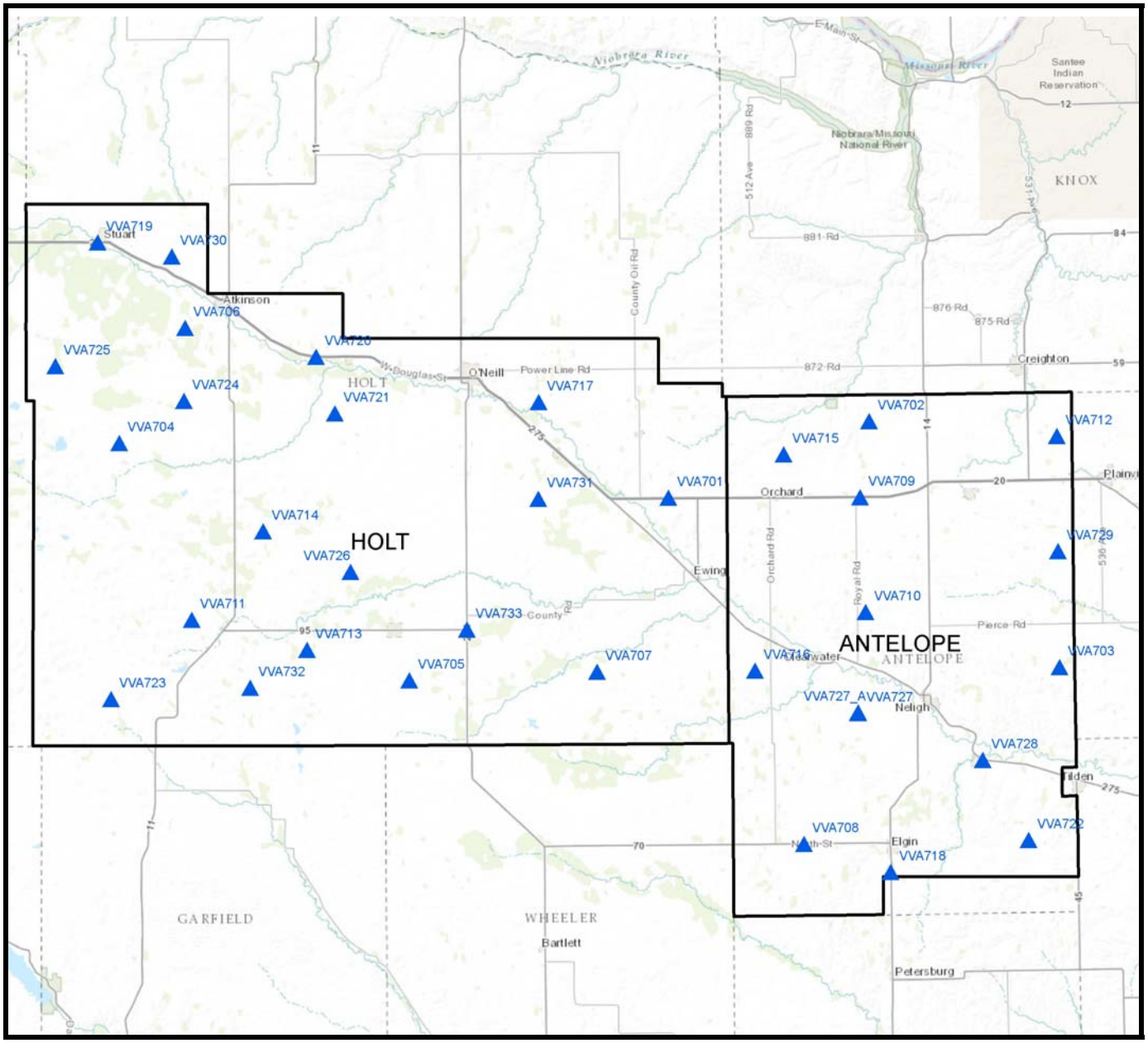
Holt and Antelope Counties Ground Points (Lidar Checkpoints) Control



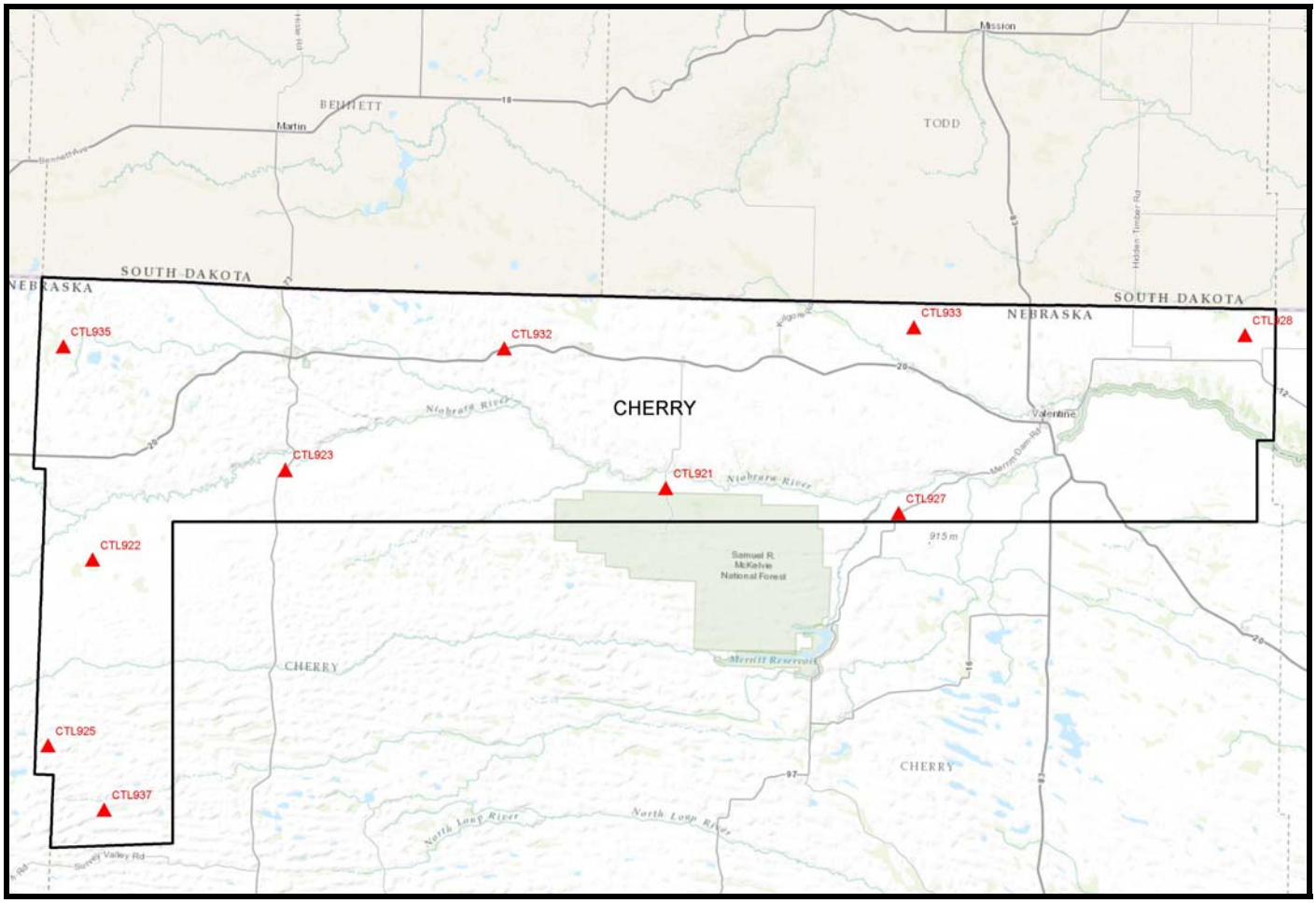
Holt and Antelope Counties Ground Points (Lidar Checkpoints) NVA



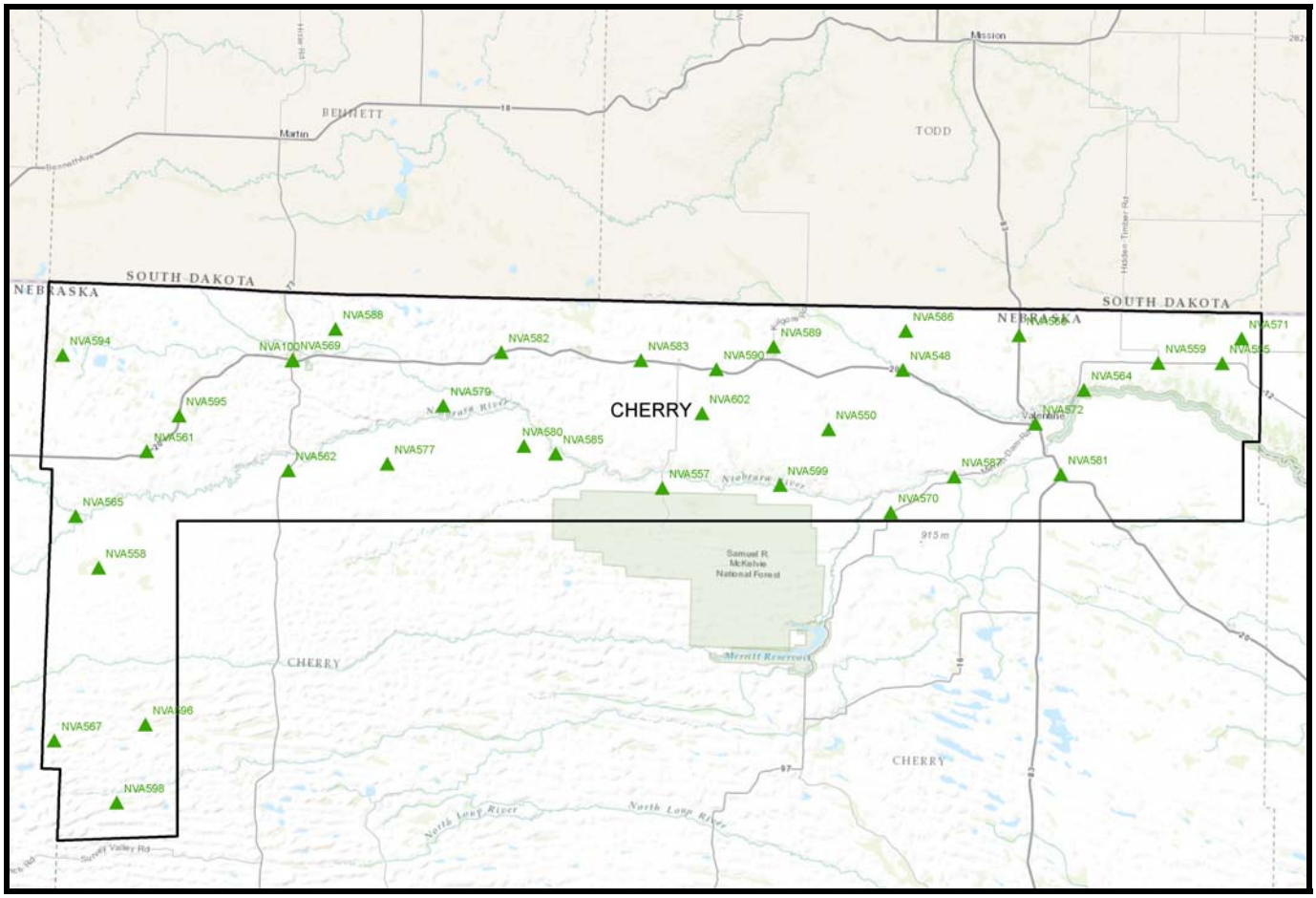
Holt and Antelope Counties Ground Points (Lidar Checkpoints) VVA



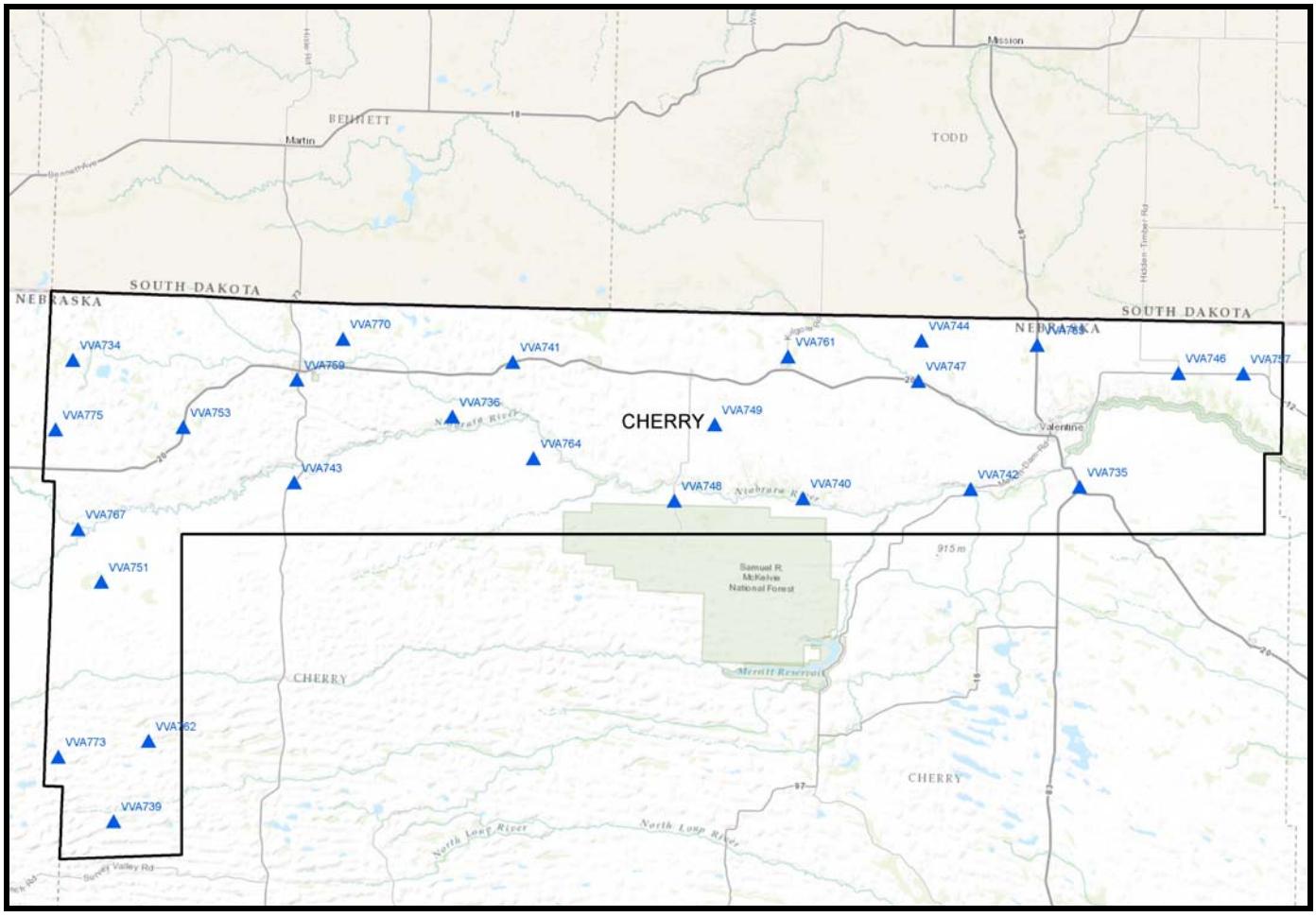
Cherry County Ground Points (Lidar Checkpoints) Control



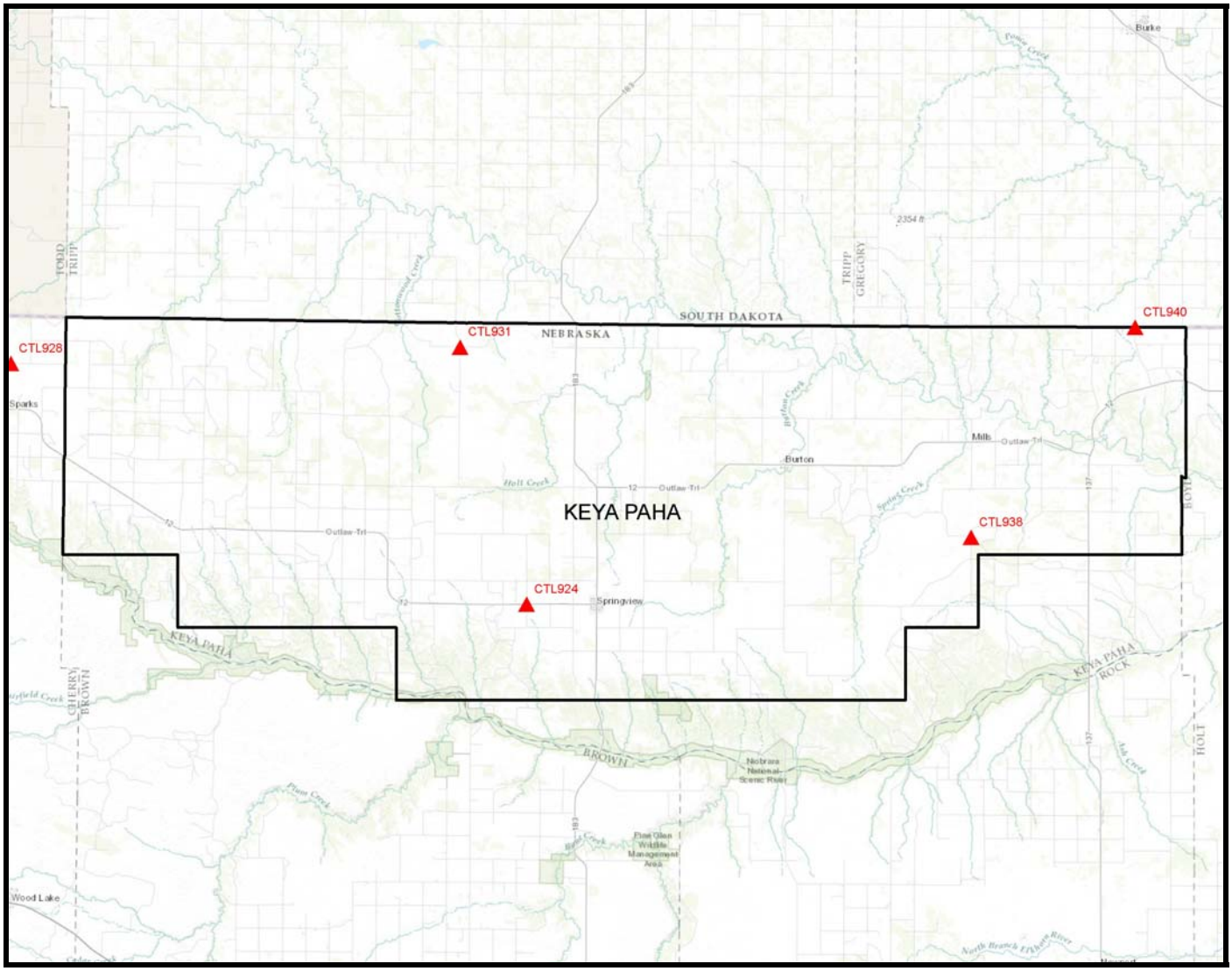
Cherry County Ground Points (Lidar Checkpoints) NVA



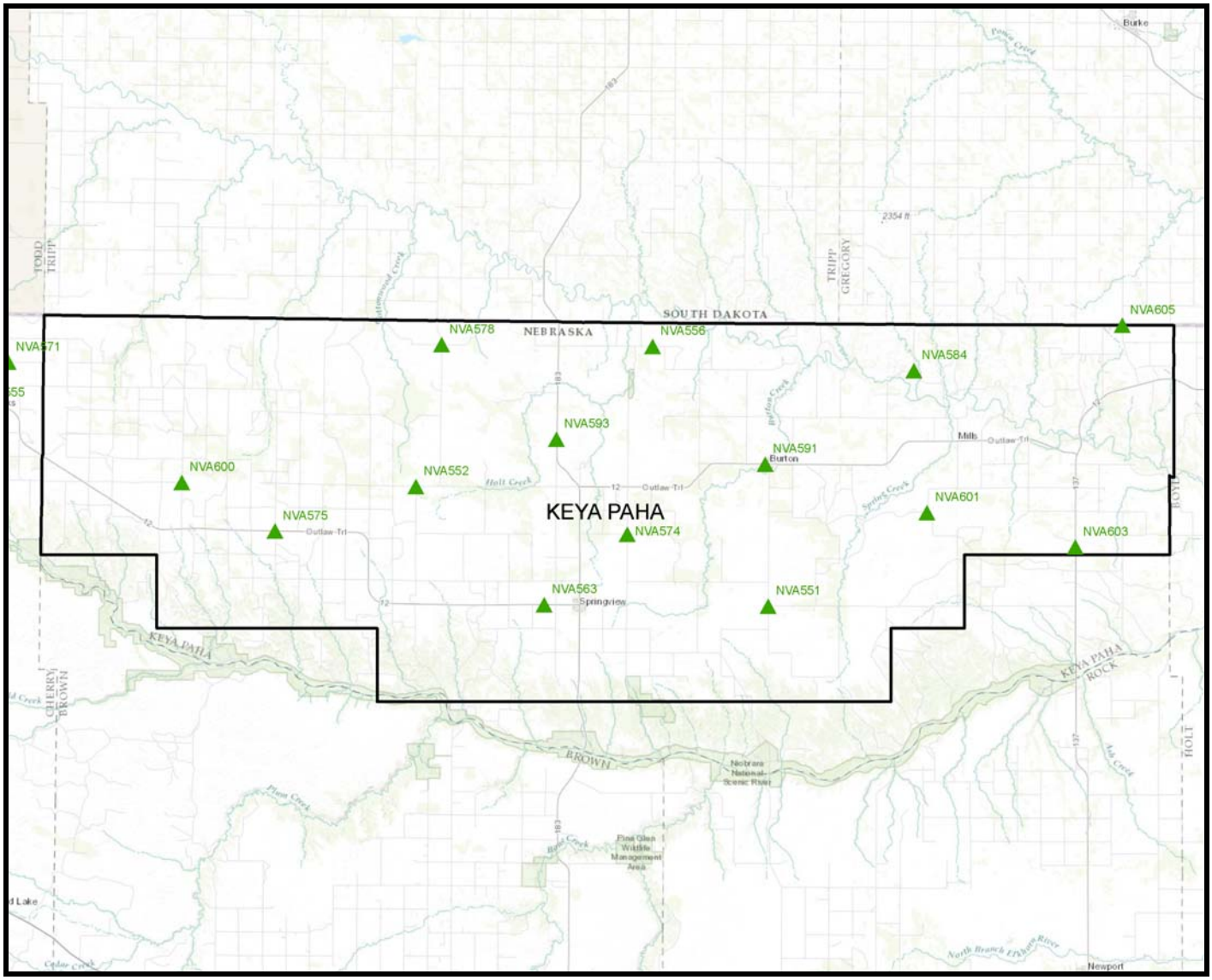
Cherry County Ground Points (Lidar Checkpoints) VVA



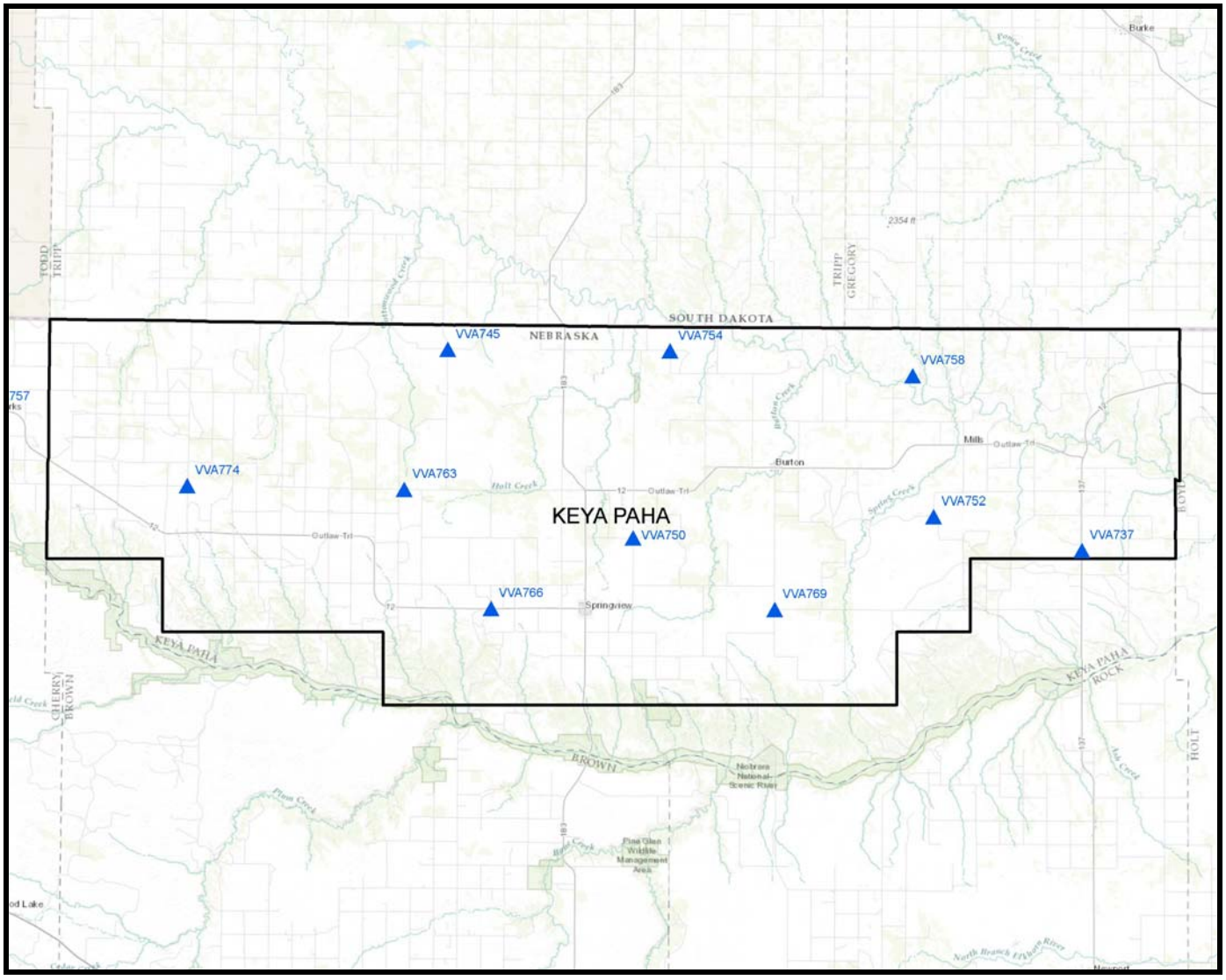
Keya Paha County Ground Points (Lidar Checkpoints) Control



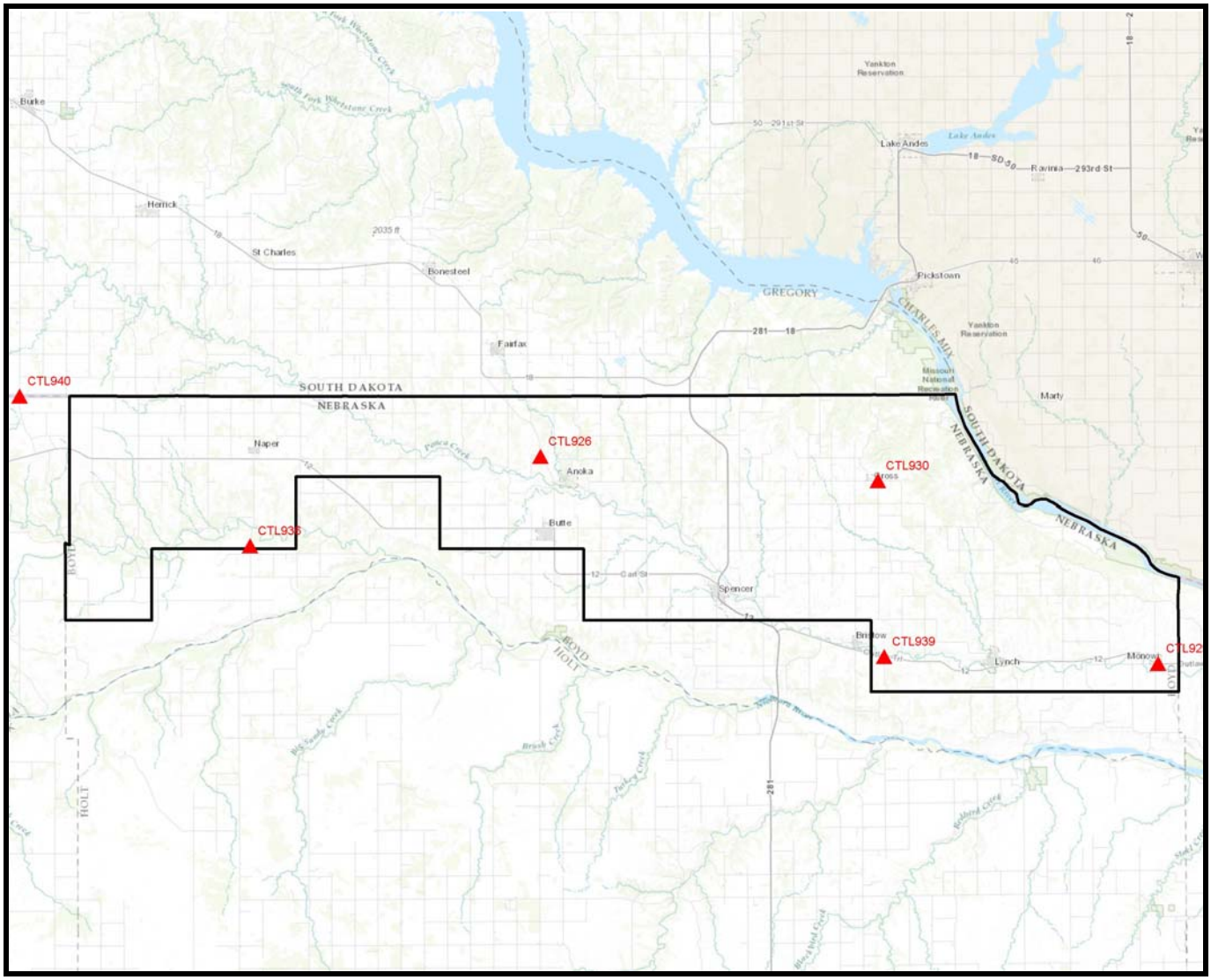
Keya Paha Ground Points (Lidar Checkpoints) NVA



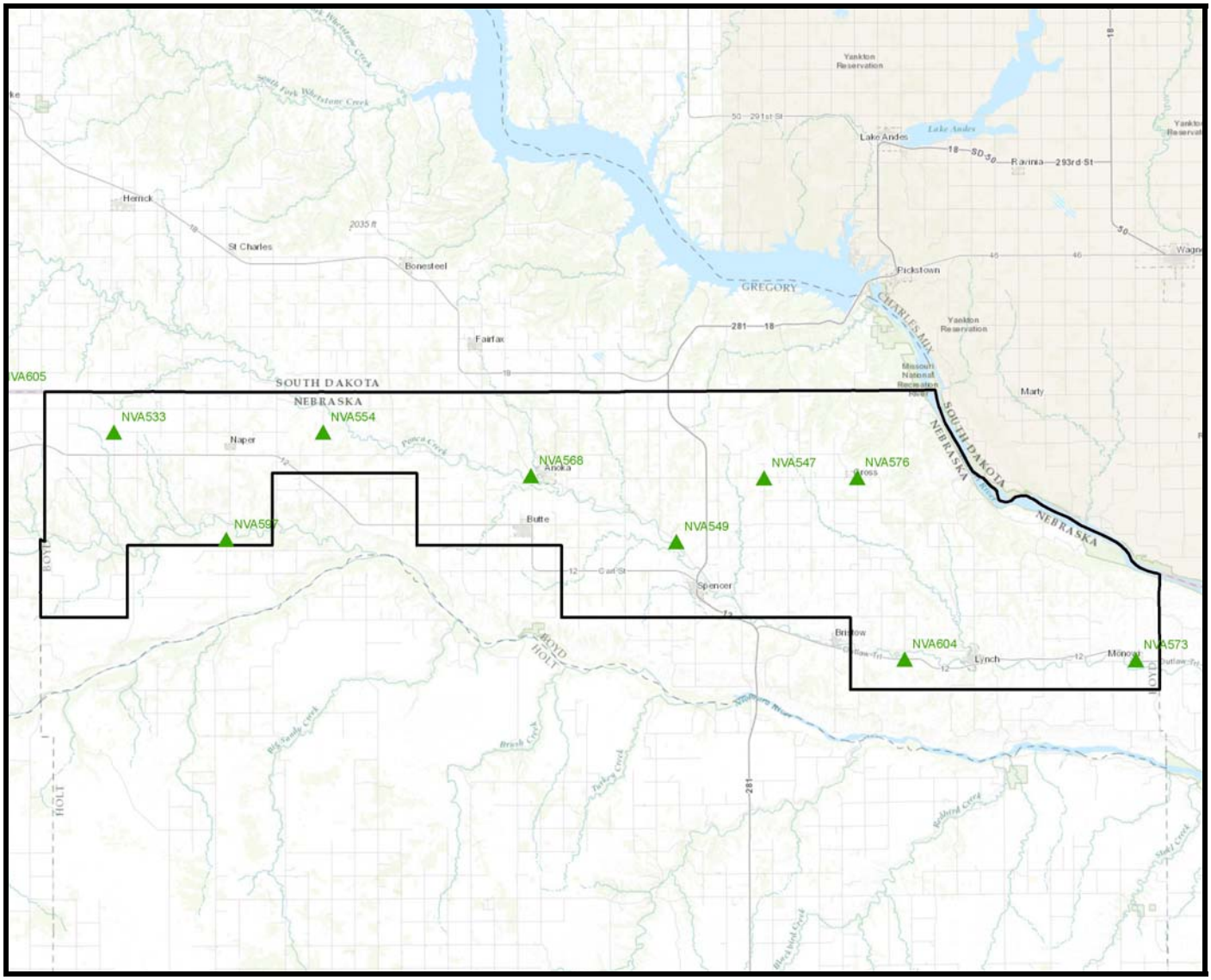
Keya Paha Ground Points (Lidar Checkpoints) VVA



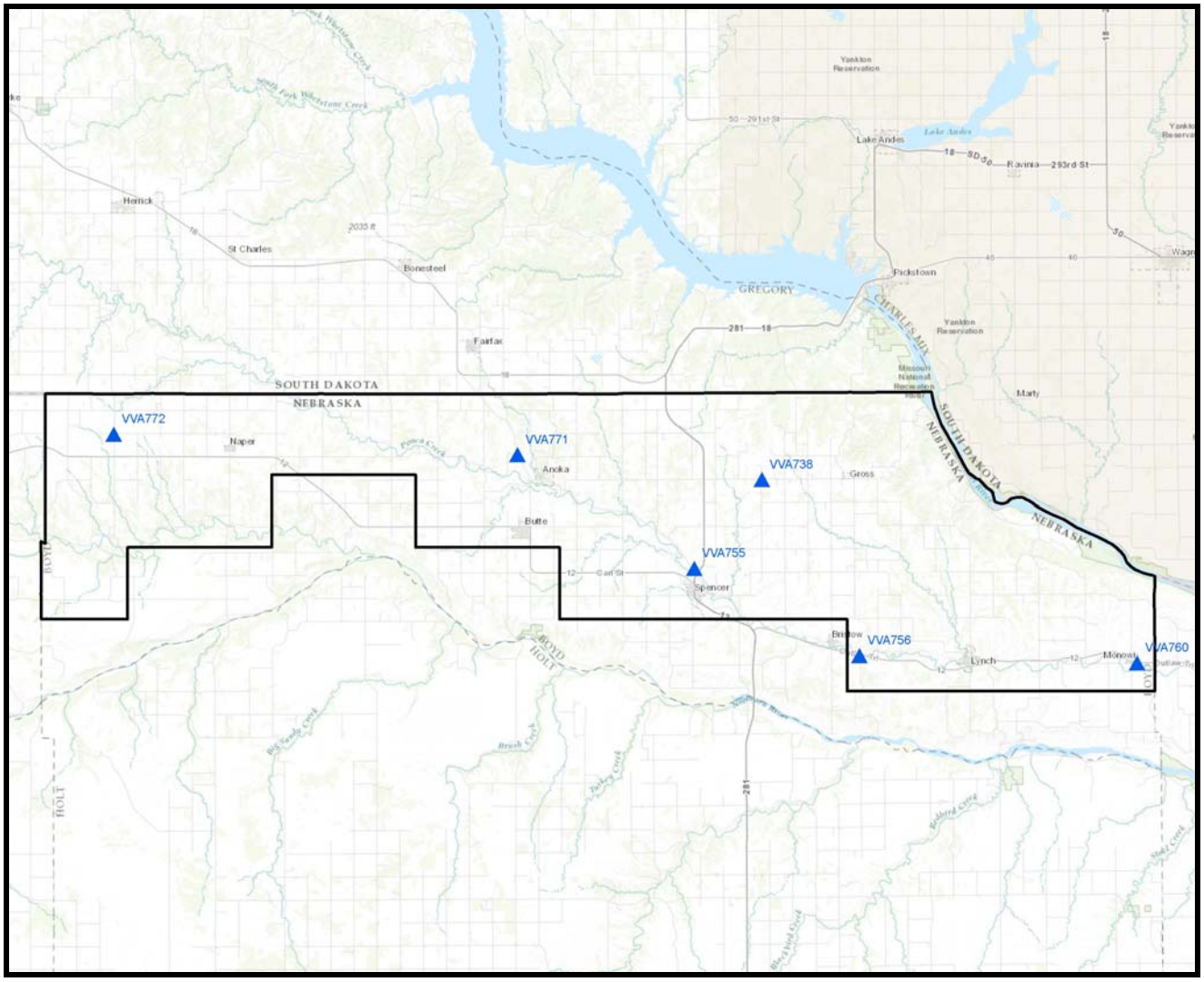
Boyd County Ground Points (Lidar Checkpoints) Control



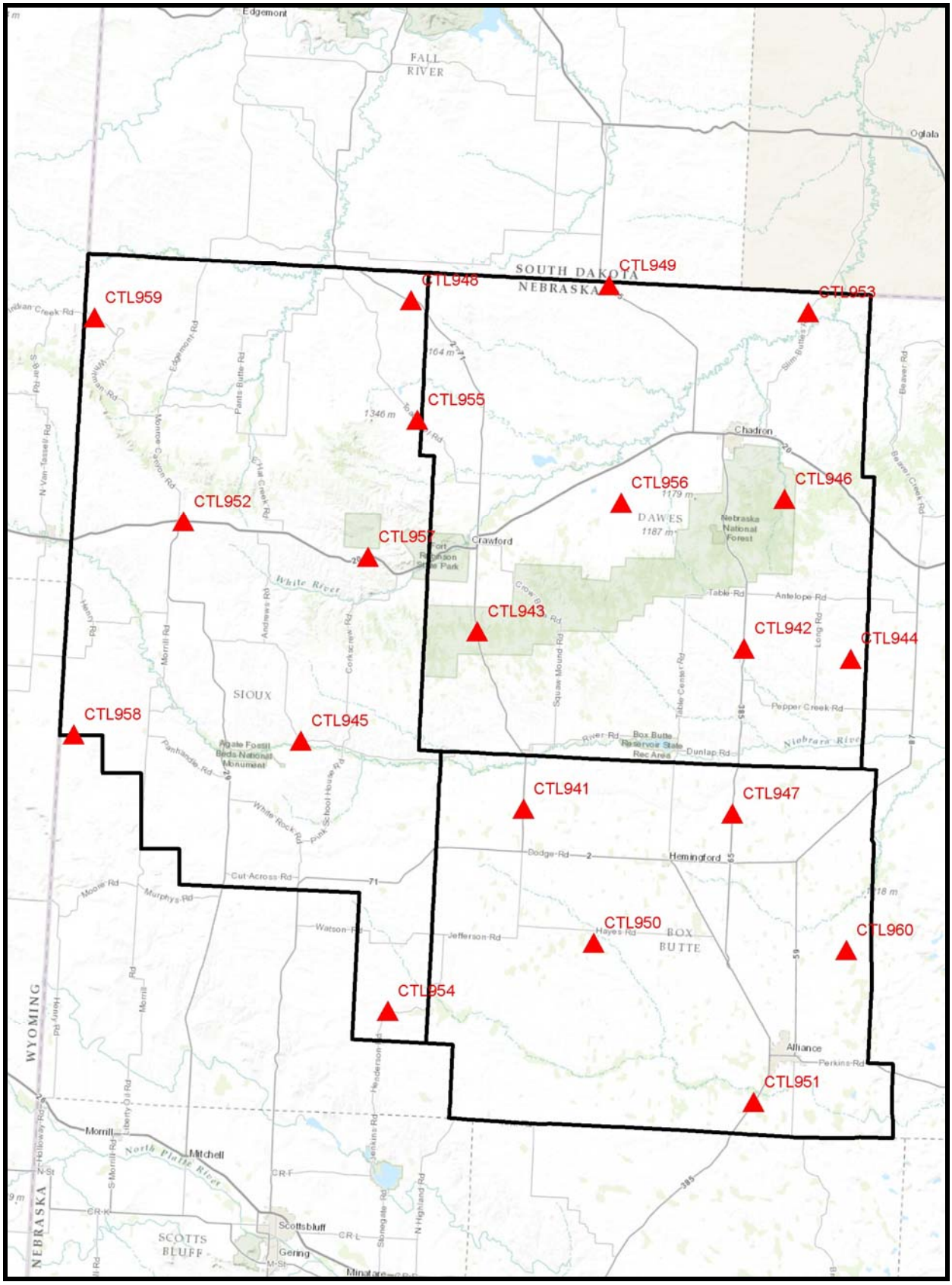
Boyd Ground Points (Lidar Checkpoints) NVA



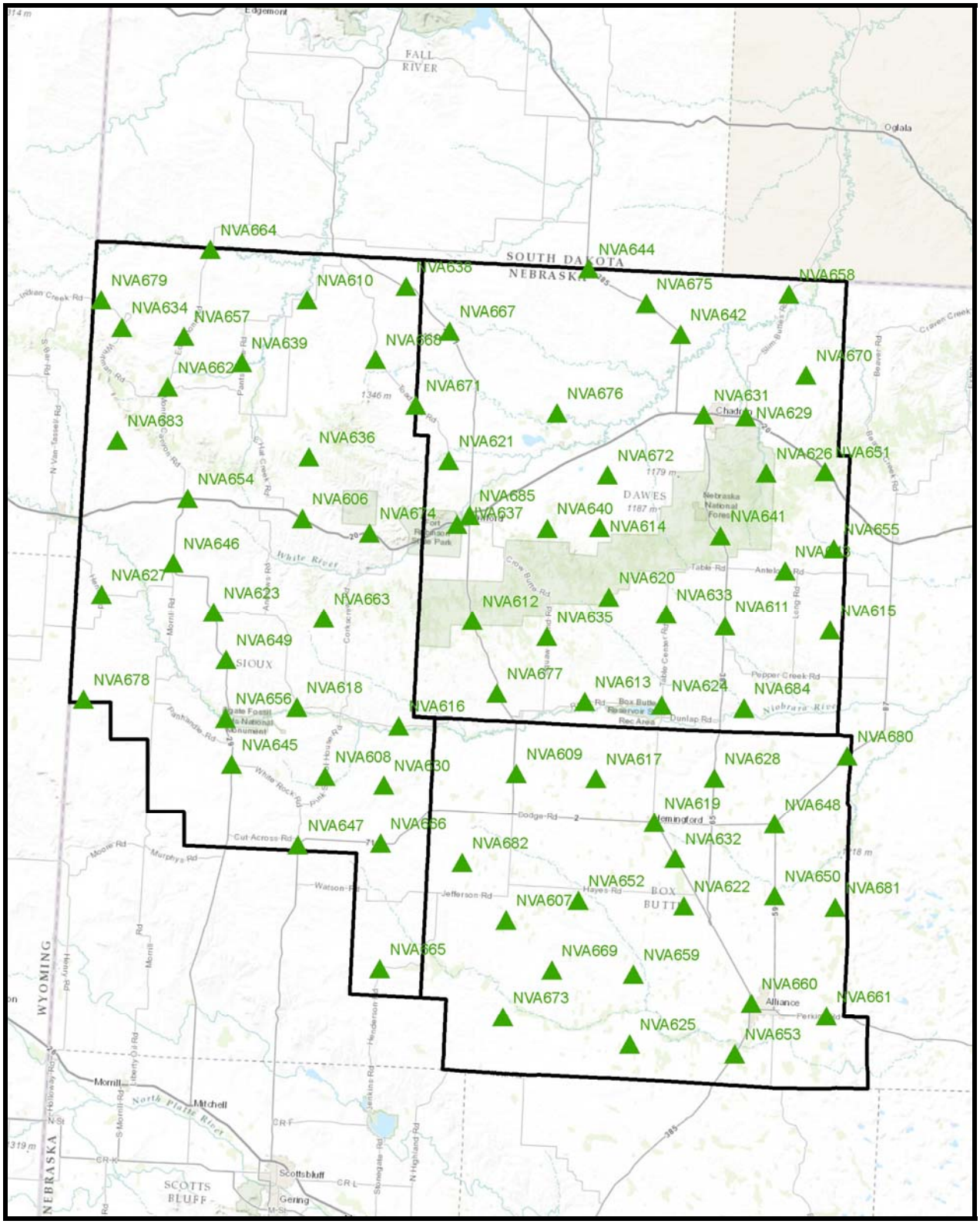
Boyd Ground Points (Lidar Checkpoints) VVA



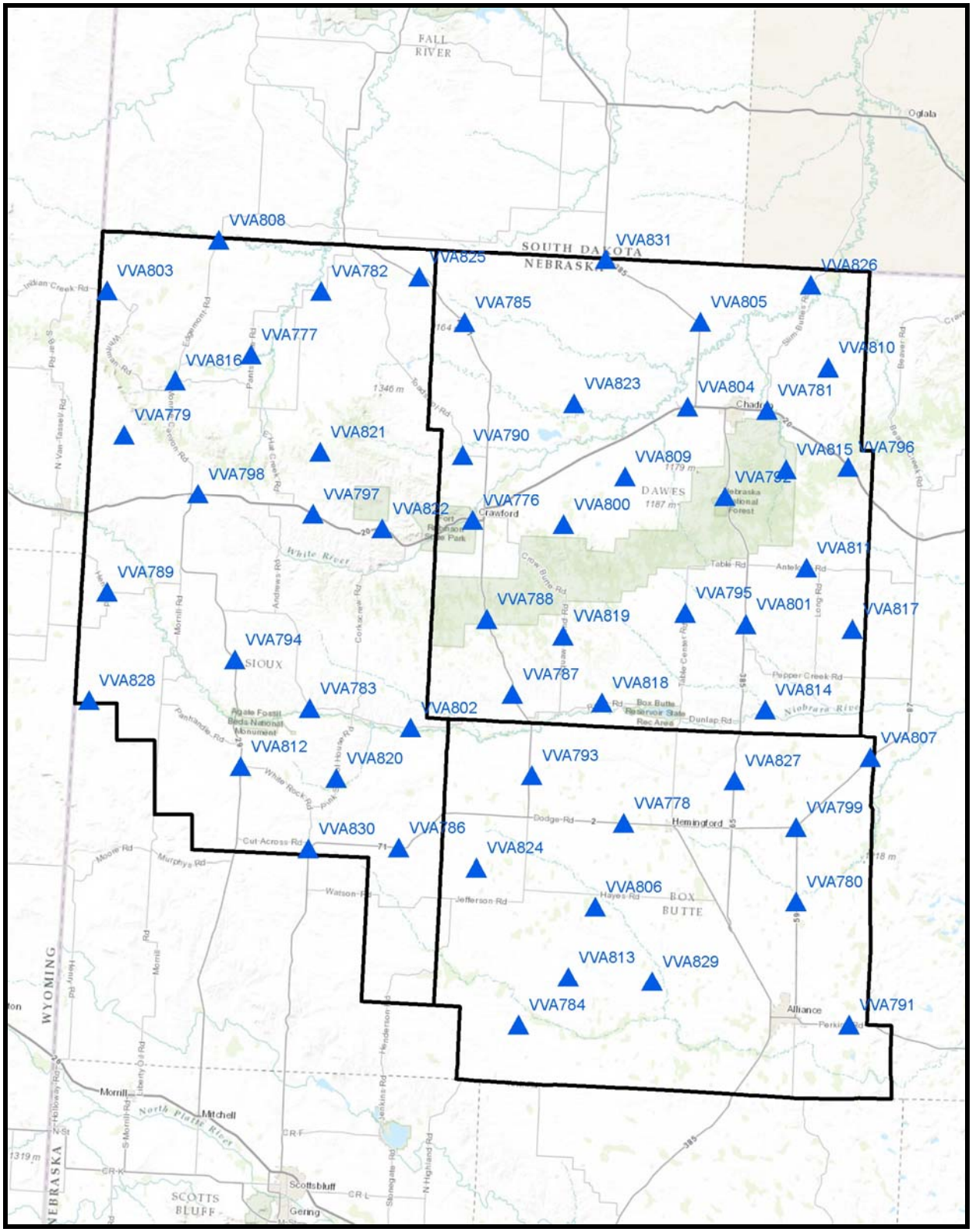
Sioux, Dawes and Box Butte Counties Ground Points (Lidar Checkpoints) Control



Sioux, Dawes and Box Butte Ground Points (Lidar Checkpoints) NVA



Sioux, Dawes and Box Butte Counties Ground Points (Lidar Checkpoints) VVA

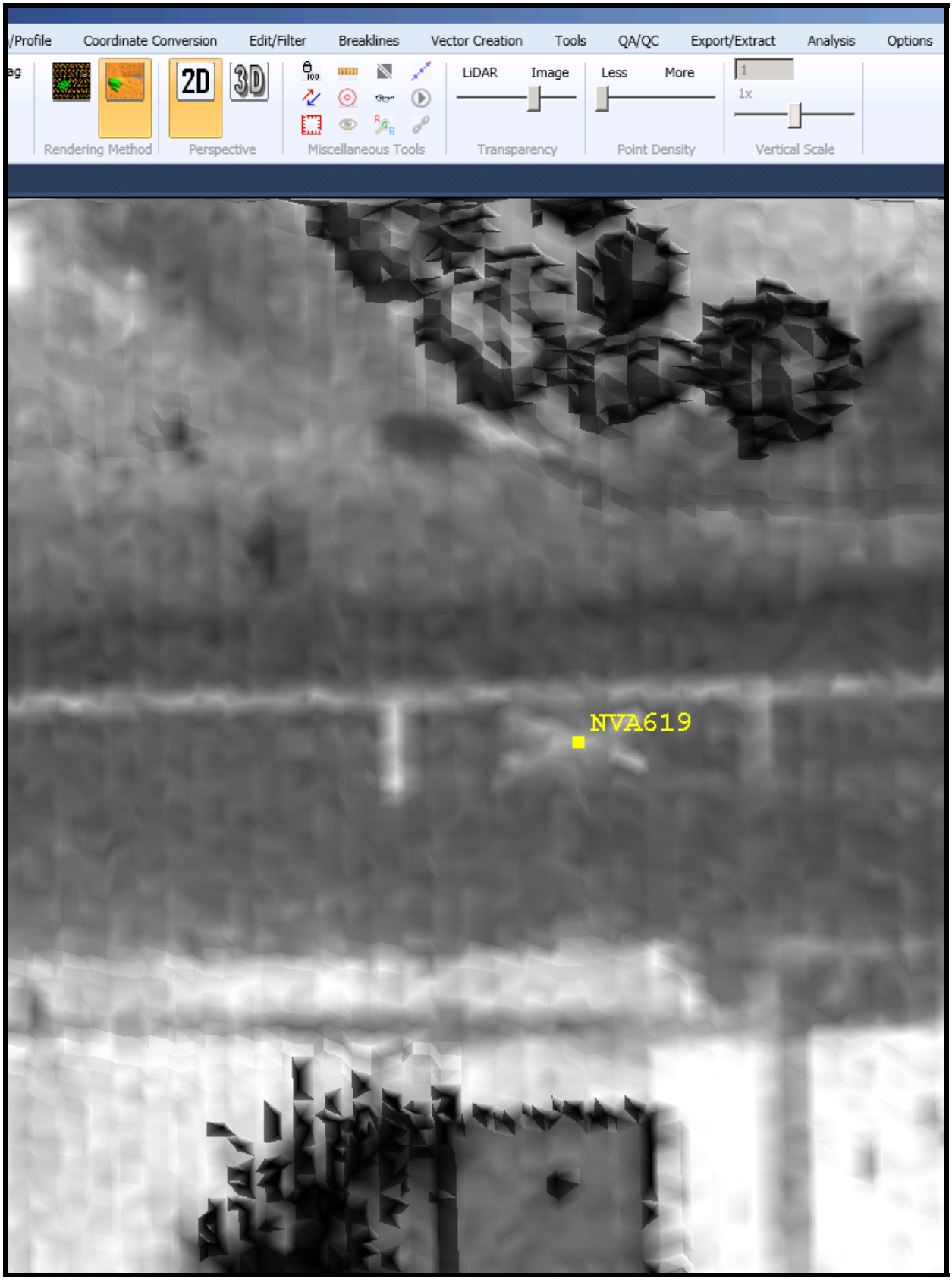


Horizontal Check for Ground Point matching Lidar points

To perform a horizontal check on the lidar data, several Non-vegetated Vertical Accuracy (NVA) points are collected by the surveyors on photo identifiable features. At these loactions the lidar data is viewed by intensity with the lidar checkpoint and a horizontal quality check can be done.

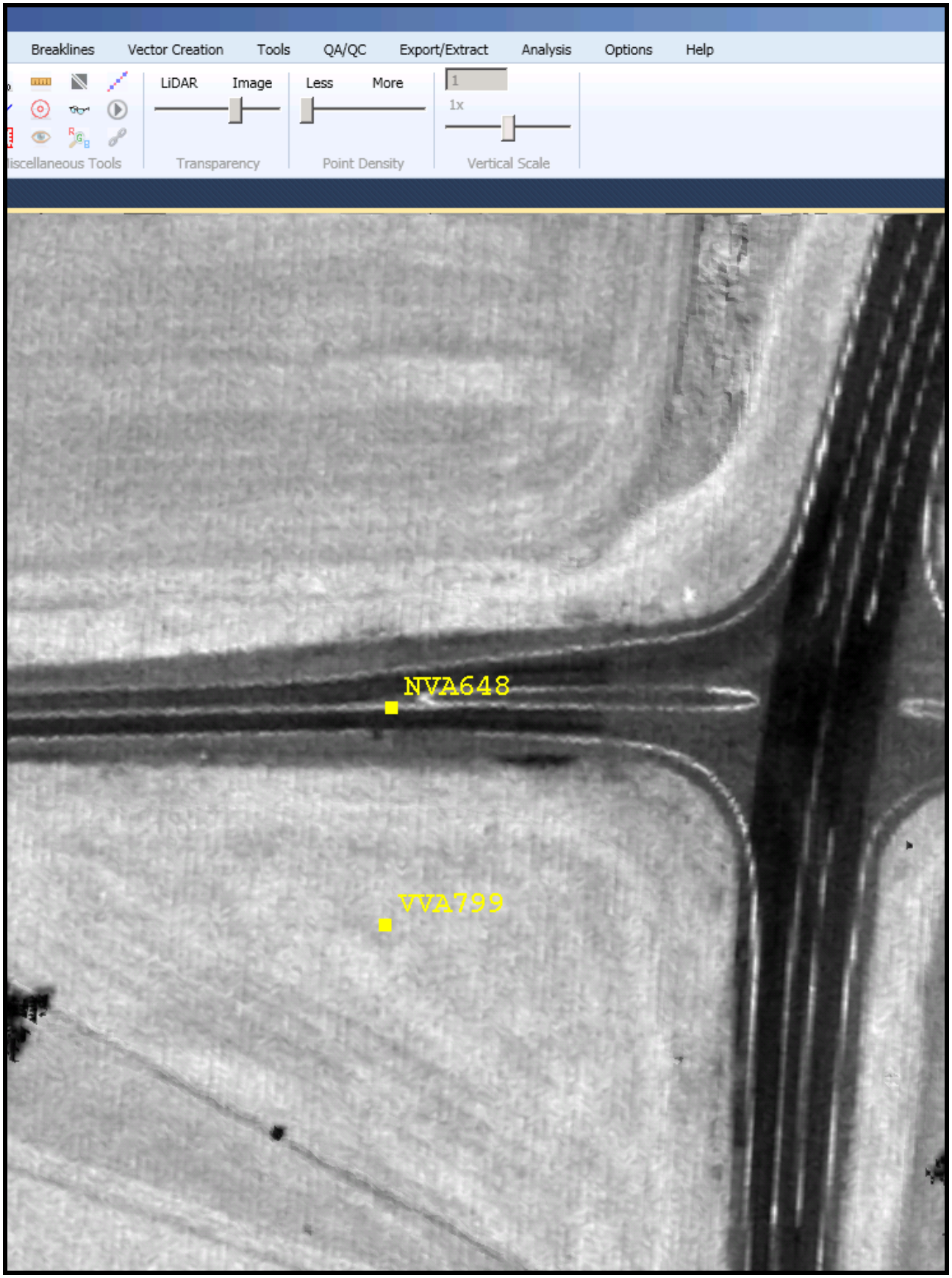
Surveyor Field Picture of point NVA619

Horizontal Check for Ground Point NVA619 matching Lidar Intensity (TIN)



Surveyor Field Picture of point NVA648

Horizontal Check for Ground Point NVA648 matching Lidar Intensity (TIN)



Control Points Vertical Accuracy Results for NE_Hat Creek - White River Lidar

Project Data Unit: Meter
Vertical Accuracy Class tested: 10.0-cm
Elevation Calculation Method: Interpolated from TIN
LiDAR Classifications Included: 0/0W
Check Points in Report: 59
Check Points with LiDAR Coverage: 59
Check Points (NVA): 59
Check Points (VVA): 0
Average Vertical Error Reported: -0.001 Meter
Maximum (highest) Vertical Error Reported: 0.065 Meter
Median Vertical Error Reported: 0.004 Meter
Minimum (lowest) Vertical Error Reported: -0.143 Meter
Standard deviation of Vertical Error: 0.035 Meter
Skewness of Vertical Error: -1.111
Kurtosis of Vertical Error: 2.916
Non-vegetated Vertical Accuracy (NVA) RMSE(z): 3.510cm PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/-: 6.880cm PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-: 6.880cm
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM): 3.530cm PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/- (DEM): 6.918cm PASS

This data set was tested to meet ASPRS Positional Accuracy Standard for Digital Geospatial Data (2014) for a 10.0-cm RMSEz Vertical Accuracy Class. Actual NVA accuracy was found to be RMSEz = 3.510cm, equating to +/- 6.880cm at the 95% confidence level.

Control Pt	Control Pt	Control Pt	Cover	Control Pt	Z from	**Z Error**	Min.	Median	Max.
Point Id	X (East)	Y (North)		Z (Elev)	LiDAR		Z	Z	Z
	Meters	Meters		Meters	Meters	**Meters**	Meters	Meters	Meters
CTL901	573500.095	4695406.052	Yes	536.044	536.082	**0.038**	536.051	536.063	536.123
CTL902	494951.926	4698081.335	Yes	670.712	670.690	**-0.022**	670.689	670.704	670.706
CTL903	490075.246	4664802.724	Yes	715.690	715.679	**-0.011**	715.654	715.683	715.684
CTL904	544757.794	4693633.229	Yes	597.551	597.586	**0.035**	597.553	597.580	597.593
CTL905	594313.438	4694155.142	Yes	516.694	516.722	**0.028**	516.710	516.719	516.726
CTL906	594639.035	4668416.481	Yes	537.627	537.613	**-0.014**	537.587	537.605	537.629
CTL907	559322.718	4667936.522	Yes	586.234	586.219	**-0.015**	586.216	586.217	586.221
CTL908	566254.009	4648680.619	Yes	596.910	596.898	**-0.012**	596.889	596.891	596.905
CTL909	522406.603	4666103.398	Yes	648.976	648.962	**-0.014**	648.954	648.955	648.979
CTL910	504716.342	4666008.913	Yes	695.490	695.496	**0.006**	695.489	695.498	695.513
CTL911	488890.866	4716340.455	Yes	658.470	658.468	**-0.002**	658.460	658.462	658.484
CTL912	525482.997	4685436.199	Yes	628.848	628.863	**0.015**	628.861	628.869	628.872
CTL913	573749.745	4674515.978	Yes	616.782	616.793	**0.011**	616.769	616.798	616.813
CTL914	503003.454	4689323.486	Yes	673.881	673.916	**0.035**	673.892	673.893	673.932
CTL916	554414.213	4684023.100	Yes	583.397	583.443	**0.046**	583.422	583.432	583.477
CTL917	590183.586	4649069.806	Yes	555.000	554.941	**-0.059**	554.921	554.935	554.967
CTL917_A	543295.879	4667205.899	Yes	620.844	620.856	**0.012**	620.844	620.852	620.864
CTL918	483094.309	4702893.385	Yes	684.773	684.747	**-0.026**	684.745	684.749	684.753
CTL919	527016.844	4698226.028	Yes	604.202	604.179	**-0.023**	604.165	604.188	604.191
CTL920	502972.030	4696887.870	Yes	654.232	654.196	**-0.036**	654.194	654.200	654.201
CTL921	326430.880	4739186.381	Yes	890.600	890.575	**-0.025**	890.565	890.577	890.587
CTL922	255065.071	4730268.519	Yes	1066.566	1066.558	**-0.008**	1066.534	1066.558	1066.560

CTL923	279071.702	4741422.921	Yes	985.086	985.105	**0.019**	985.100	985.108	985.124
CTL924	433982.000	4741599.521	Yes	750.785	750.801	**0.016**	750.794	750.802	750.807
CTL925	249512.149	4707153.017	Yes	1155.225	1155.219	**-0.006**	1155.189	1155.257	1155.269
CTL926	512029.864	4756439.703	Yes	550.956	550.984	**0.028**	550.977	550.988	550.996
CTL927	355401.945	4736068.411	Yes	861.453	861.458	**0.005**	861.453	861.457	861.460
CTL928	398544.006	4758152.284	Yes	789.028	789.036	**0.008**	789.024	789.031	789.040
CTL929	554985.271	4741966.615	Yes	406.469	406.391	**-0.078**	406.369	406.400	406.401
CTL930	535502.352	4754723.840	Yes	537.730	537.748	**0.018**	537.739	537.750	537.766
CTL931	429423.570	4759282.217	Yes	737.750	737.763	**0.013**	737.749	737.779	737.784
CTL932	306299.197	4756465.358	Yes	963.848	963.852	**0.004**	963.845	963.854	963.894
CTL933	357323.797	4759111.178	Yes	868.190	868.204	**0.014**	868.189	868.200	868.216
CTL935	251412.807	4756756.984	Yes	1059.598	1059.624	**0.026**	1059.612	1059.613	1059.629
CTL936	491855.669	4750209.382	Yes	573.537	573.394	**-0.143**	573.368	573.383	573.418
CTL937	256507.509	4699170.361	Yes	1150.542	1150.529	**-0.013**	1150.478	1150.509	1150.538
CTL938	464542.897	4746195.833	Yes	649.553	649.618	**0.065**	649.607	649.615	649.622
CTL939	535945.335	4742460.050	Yes	448.515	448.546	**0.031**	448.534	448.545	448.551
CTL940	475815.736	4760648.904	Yes	678.418	678.388	**-0.030**	678.381	678.389	678.458
CTL941	145313.348	4700297.403	Yes	1363.476	1363.505	**0.029**	1363.499	1363.504	1363.511
CTL942	174290.936	4721382.465	Yes	1258.687	1258.659	**-0.028**	1258.640	1258.660	1258.664
CTL943	139236.473	4723554.820	Yes	1374.585	1374.576	**-0.009**	1374.566	1374.571	1374.590
CTL944	188292.557	4720005.359	Yes	1234.493	1234.513	**0.020**	1234.481	1234.485	1234.532
CTL945	116084.932	4709272.389	Yes	1325.829	1325.885	**0.056**	1325.824	1325.884	1325.889
CTL946	179635.486	4741022.146	Yes	1114.813	1114.813	**0.000**	1114.791	1114.809	1114.821
CTL947	172784.845	4699626.876	Yes	1253.413	1253.409	**-0.004**	1253.408	1253.409	1253.419
CTL948	130551.442	4767137.706	Yes	1196.186	1196.168	**-0.018**	1196.158	1196.176	1196.196
CTL949	156552.225	4769081.520	Yes	1117.234	1117.276	**0.042**	1117.266	1117.276	1117.281
CTL950	154553.746	4682710.102	Yes	1305.157	1305.107	**-0.050**	1305.098	1305.110	1305.122
CTL951	175591.650	4661696.979	Yes	1209.672	1209.720	**0.048**	1209.706	1209.711	1209.723
CTL952	100661.078	4738071.305	Yes	1475.553	1475.510	**-0.043**	1475.490	1475.507	1475.535
CTL953	182750.297	4765566.078	Yes	954.687	954.648	**-0.039**	954.644	954.647	954.653
CTL954	127475.306	4673712.147	Yes	1344.477	1344.517	**0.040**	1344.491	1344.494	1344.532
CTL955	131369.154	4751476.082	Yes	1131.353	1131.319	**-0.034**	1131.309	1131.337	1131.360
CTL956	158132.852	4740525.106	Yes	1084.491	1084.459	**-0.032**	1084.450	1084.462	1084.473
CTL957	124905.002	4733348.536	Yes	1406.597	1406.626	**0.029**	1406.619	1406.630	1406.633
CTL958	86252.229	4710100.358	Yes	1452.866	1452.876	**0.010**	1452.869	1452.871	1452.882
CTL959	88960.365	4764860.692	Yes	1274.922	1274.891	**-0.031**	1274.888	1274.891	1274.910
CTL960	187726.691	4681763.365	Yes	1199.971	1199.992	**0.021**	1199.986	1199.998	1200.014

NVA / VVA Lidar Checkpoint Vertical Accuracy Results for NE_Hat Creek - White River Lidar

Project Data Unit: Meter
Vertical Accuracy Class tested: 10.0-cm
Elevation Calculation Method: Interpolated from TIN
LiDAR Classifications Included: 2/0 Ground (All)/0W
Check Points in Report: 319
Check Points with LiDAR Coverage: 319
Check Points (NVA): 188
Check Points (VVA): 131
Average Vertical Error Reported: 0.004 Meter
Maximum (highest) Vertical Error Reported: 0.1 Meter
Median Vertical Error Reported: 0.007 Meter
Minimum (lowest) Vertical Error Reported: -0.088 Meter
Standard deviation of Vertical Error: 0.035 Meter
Skewness of Vertical Error: -0.338
Kurtosis of Vertical Error: 0.121
Non-vegetated Vertical Accuracy (NVA) RMSE(z): 3.496cm PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/-: 6.852cm PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile +/-: 14.450cm PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-: 6.852cm
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM): 3.384cm PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/- (DEM): 6.633cm PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile +/- (DEM): 14.578cm PASS
This data set was tested to meet ASPRS Positional Accuracy Standard for Digital Geospatial Data (2014) for a 10.0-cm RMSEz Vertical Accuracy Class. Actual NVA accuracy was found to be RMSEz = 3.496cm, equating to +/- 6.852cm at the 95% confidence level. Actual VVA accuracy was found to be +/- 14.450cm at the 95th percentile.

Control Pt	Control Pt	Control Pt	Cover	Control Pt	Z from	NVA	**Z Error**	Min.	Median	Max.
Point Id	X (East)	Y (North)		Z (Elev)	LiDAR	or		Z	Z	Z
	Meters	Meters		Meters	Meters	VVA	**Meters**	Meters	Meters	Meters
VVA708	566250.518	4648651.376	Yes	596.522	596.809	VVA	**0.287**	596.774	596.779	596.843
VVA730	496059.333	4714150.221	Yes	652.107	652.389	VVA	**0.282**	652.319	652.391	652.409
VVA756	535893.049	4742461.167	Yes	446.975	447.234	VVA	**0.259**	447.183	447.230	447.259
VVA731	536765.662	4687105.319	Yes	608.156	608.371	VVA	**0.215**	608.360	608.369	608.397
VVA718	575878.929	4645531.387	Yes	593.705	593.872	VVA	**0.167**	593.848	593.870	593.885
VVA705	522439.724	4666868.894	Yes	644.949	645.095	VVA	**0.146**	645.087	645.118	645.149
VVA703	594623.749	4668386.339	Yes	536.567	536.710	VVA	**0.143**	536.682	536.712	536.720
VVA793	145686.285	4700261.101	Yes	1355.219	1355.343	VVA	**0.124**	1355.323	1355.342	1355.397
VVA760	555191.593	4741957.998	Yes	404.116	404.239	VVA	**0.123**	404.226	404.237	404.252
VVA733	528838.688	4672538.279	Yes	623.034	623.150	VVA	**0.116**	623.146	623.151	623.182
VVA702	573494.634	4695797.274	Yes	529.947	530.051	VVA	**0.104**	529.996	530.068	530.070
VVA719	487814.985	4715727.992	Yes	654.333	654.436	VVA	**0.103**	654.407	654.430	654.453
VVA758	461113.905	4757484.849	Yes	612.715	612.818	VVA	**0.103**	612.808	612.818	612.867
VVA725	483124.227	4701919.079	Yes	684.744	684.844	VVA	**0.100**	684.831	684.849	684.857
NVA580	308918.543	4744490.290	Yes	921.919	922.019	NVA	**0.100**	921.990	922.016	922.023
VVA706	497537.713	4706183.246	Yes	645.461	645.560	VVA	**0.099**	645.542	645.552	645.583
VVA764	308891.844	4744473.861	Yes	921.818	921.916	VVA	**0.098**	921.907	921.909	921.928
VVA813	150524.356	4673208.123	Yes	1301.203	1301.300	VVA	**0.097**	1301.271	1301.321	1301.326
VVA722	591201.047	4649073.103	Yes	561.219	561.314	VVA	**0.095**	561.223	561.304	561.415
VVA747	356898.742	4754130.737	Yes	815.001	815.095	VVA	**0.094**	815.071	815.096	815.120
VVA737	472637.028	4745569.995	Yes	625.060	625.151	VVA	**0.091**	625.148	625.149	625.155
VVA716	560819.159	4667977.817	Yes	575.584	575.670	VVA	**0.086**	575.667	575.671	575.672
VVA728	586108.990	4658031.042	Yes	520.893	520.978	VVA	**0.085**	520.965	520.985	521.004
VVA769	451712.769	4741537.718	Yes	707.338	707.421	VVA	**0.083**	707.418	707.425	707.427
VVA701	551206.392	4687262.539	Yes	590.573	590.655	VVA	**0.082**	590.612	590.627	590.734

VVA825	130522.301	4767127.192	Yes	1195.023	1195.104	VVA	**0.081**	1195.091	1195.099	1195.114
NVA624	165605.971	4709634.474	Yes	1237.362	1237.441	NVA	**0.079**	1237.436	1237.444	1237.449
VVA743	279054.901	4741453.669	Yes	984.113	984.191	VVA	**0.078**	984.177	984.180	984.201
VVA829	161812.663	4672650.141	Yes	1263.574	1263.652	VVA	**0.078**	1263.645	1263.659	1263.673
NVA665	126911.508	4673449.410	Yes	1350.138	1350.215	NVA	**0.077**	1350.203	1350.212	1350.217
NVA659	161722.607	4672635.766	Yes	1265.223	1265.296	NVA	**0.073**	1265.293	1265.293	1265.302
VVA814	176927.769	4709181.417	Yes	1182.831	1182.904	VVA	**0.073**	1182.898	1182.920	1182.927
VVA745	429441.382	4759267.554	Yes	736.885	736.957	VVA	**0.072**	736.946	736.953	736.975
VVA746	389311.963	4755096.414	Yes	789.114	789.185	VVA	**0.071**	789.177	789.179	789.205
VVA740	342514.929	4739475.707	Yes	828.144	828.215	VVA	**0.071**	828.186	828.207	828.217
NVA650	181107.981	4683390.556	Yes	1222.858	1222.928	NVA	**0.070**	1222.916	1222.929	1222.935
VVA790	136370.794	4743315.572	Yes	1124.286	1124.356	VVA	**0.070**	1124.347	1124.365	1124.390
NVA574	442055.997	4746402.292	Yes	707.479	707.549	NVA	**0.070**	707.502	707.549	707.562
VVA744	357293.533	4759152.969	Yes	867.581	867.650	VVA	**0.069**	867.622	867.649	867.661
VVA726	515894.308	4679000.092	Yes	646.227	646.294	VVA	**0.067**	646.286	646.290	646.303
VVA734	251438.764	4756747.206	Yes	1059.389	1059.456	VVA	**0.067**	1059.455	1059.456	1059.460
VVA823	151292.262	4750256.509	Yes	1049.962	1050.029	VVA	**0.067**	1050.023	1050.029	1050.033
VVA741	306319.149	4756492.546	Yes	963.477	963.544	VVA	**0.067**	963.531	963.535	963.569
VVA757	397396.089	4755027.498	Yes	790.135	790.196	VVA	**0.061**	790.183	790.193	790.200
VVA765	371702.569	4758614.241	Yes	844.332	844.392	VVA	**0.060**	844.385	844.392	844.399
VVA714	506204.088	4683523.072	Yes	661.901	661.960	VVA	**0.059**	661.945	661.960	661.970
NVA586	357309.658	4759112.631	Yes	868.013	868.072	NVA	**0.059**	868.061	868.074	868.077
NVA667	136520.524	4761043.629	Yes	1193.418	1193.477	NVA	**0.059**	1193.474	1193.476	1193.495
NVA674	125512.304	4733381.151	Yes	1382.537	1382.596	NVA	**0.059**	1382.590	1382.598	1382.602
VVA748	326455.551	4739187.523	Yes	890.188	890.247	VVA	**0.059**	890.203	890.238	890.262
NVA548	356933.763	4754145.431	Yes	815.444	815.502	NVA	**0.058**	815.467	815.499	815.507
VVA709	572465.973	4687316.257	Yes	571.849	571.906	VVA	**0.057**	571.896	571.919	571.932
VVA761	340645.986	4757164.718	Yes	889.230	889.287	VVA	**0.057**	889.284	889.287	889.287
NVA682	138222.400	4687928.941	Yes	1362.402	1362.459	NVA	**0.057**	1362.446	1362.456	1362.465
NVA502	545653.749	4686234.548	Yes	580.060	580.115	NVA	**0.055**	580.095	580.113	580.129
VVA772	484052.373	4757834.663	Yes	653.658	653.710	VVA	**0.052**	653.701	653.709	653.755
NVA619	164563.532	4693504.855	Yes	1298.166	1298.217	NVA	**0.051**	1298.190	1298.193	1298.223
NVA583	323757.600	4755371.642	Yes	964.929	964.978	NVA	**0.049**	964.976	964.977	964.999
VVA712	594324.034	4694146.951	Yes	516.477	516.526	VVA	**0.049**	516.522	516.541	516.570
VVA780	181071.896	4683367.985	Yes	1221.845	1221.893	VVA	**0.048**	1221.877	1221.887	1221.912
NVA556	443791.495	4759205.513	Yes	648.788	648.834	NVA	**0.046**	648.829	648.834	648.843
VVA771	512116.820	4756401.514	Yes	553.290	553.336	VVA	**0.046**	553.324	553.334	553.357
NVA573	554773.809	4742047.672	Yes	405.777	405.823	NVA	**0.046**	405.816	405.818	405.841
VVA778	157970.849	4693892.099	Yes	1320.519	1320.565	VVA	**0.046**	1320.561	1320.562	1320.573
VVA821	117273.017	4743745.489	Yes	1456.336	1456.382	VVA	**0.046**	1456.368	1456.399	1456.416
NVA655	189183.388	4731173.099	Yes	1197.301	1197.346	NVA	**0.045**	1197.343	1197.346	1197.350
VVA766	432378.200	4741615.591	Yes	751.008	751.053	VVA	**0.045**	751.028	751.053	751.059
NVA535	506201.261	4687810.837	Yes	660.856	660.901	NVA	**0.045**	660.886	660.897	660.905
NVA579	298684.434	4749610.547	Yes	946.015	946.060	NVA	**0.045**	946.041	946.043	946.080
NVA647	115688.492	4690394.181	Yes	1434.069	1434.112	NVA	**0.043**	1434.106	1434.134	1434.136
NVA501	545641.876	4686244.641	Yes	580.209	580.252	NVA	**0.043**	580.236	580.242	580.258
VVA817	188635.576	4719952.972	Yes	1233.977	1234.020	VVA	**0.043**	1234.001	1234.025	1234.070
NVA666	127024.952	4690642.132	Yes	1400.108	1400.150	NVA	**0.042**	1400.148	1400.150	1400.151
NVA669	150521.792	4673233.409	Yes	1301.279	1301.321	NVA	**0.042**	1301.304	1301.316	1301.342

NVA684	176896.159	4709227.475	Yes	1183.705	1183.747	NVA	**0.042**	1183.736	1183.750	1183.759
NVA671	131869.235	4750906.832	Yes	1132.268	1132.309	NVA	**0.041**	1132.236	1132.275	1132.337
VVA720	512090.102	4702947.865	Yes	622.661	622.702	VVA	**0.041**	622.692	622.709	622.714
VVA791	188221.638	4666830.043	Yes	1205.280	1205.321	VVA	**0.041**	1205.296	1205.309	1205.335
VVA777	108014.291	4756744.520	Yes	1157.970	1158.011	VVA	**0.041**	1157.963	1158.000	1158.025
VVA729	594452.878	4681312.897	Yes	547.433	547.474	VVA	**0.041**	547.464	547.472	547.478
VVA727	572247.431	4663224.100	Yes	555.083	555.123	VVA	**0.040**	555.121	555.126	555.126
VVA818	155052.811	4710137.036	Yes	1242.012	1242.051	VVA	**0.039**	1242.045	1242.049	1242.071
VVA762	260893.031	4709192.735	Yes	1125.973	1126.012	VVA	**0.039**	1125.992	1126.007	1126.039
NVA653	175645.723	4661688.777	Yes	1209.939	1209.978	NVA	**0.039**	1209.974	1209.977	1209.981
VVA763	426481.941	4749712.084	Yes	748.867	748.906	VVA	**0.039**	748.895	748.918	748.929
NVA657	100084.542	4760315.907	Yes	1192.539	1192.578	NVA	**0.039**	1192.575	1192.596	1192.598
NVA506	573497.273	4695396.958	Yes	536.099	536.137	NVA	**0.038**	536.126	536.134	536.144
NVA599	341409.304	4739532.522	Yes	801.465	801.503	NVA	**0.038**	801.498	801.516	801.533
VVA759	279409.654	4754268.322	Yes	991.219	991.257	VVA	**0.038**	991.231	991.260	991.275
NVA680	191075.365	4702687.725	Yes	1171.361	1171.398	NVA	**0.037**	1171.380	1171.389	1171.434
VVA799	181110.997	4693285.792	Yes	1211.486	1211.523	VVA	**0.037**	1211.507	1211.513	1211.532
VVA831	155553.437	4769497.102	Yes	1123.930	1123.966	VVA	**0.036**	1123.960	1123.968	1123.971
NVA578	429416.056	4759317.729	Yes	737.312	737.348	NVA	**0.036**	737.317	737.345	737.352
VVA751	255012.952	4729037.751	Yes	1071.947	1071.983	VVA	**0.036**	1071.952	1071.976	1071.990
NVA661	188190.409	4666852.891	Yes	1206.384	1206.420	NVA	**0.036**	1206.375	1206.418	1206.433
VVA753	265201.964	4748345.342	Yes	1034.755	1034.791	VVA	**0.036**	1034.782	1034.798	1034.810
NVA539	554434.934	4684022.932	Yes	583.827	583.863	NVA	**0.036**	583.852	583.864	583.868
NVA595	265231.036	4748366.889	Yes	1034.103	1034.138	NVA	**0.035**	1034.133	1034.138	1034.140
NVA555	397422.332	4755014.773	Yes	791.732	791.767	NVA	**0.035**	791.758	791.761	791.779
NVA533_A	525483.483	4685560.403	Yes	629.290	629.325	NVA	**0.035**	629.256	629.332	629.333
NVA571	399874.809	4758131.855	Yes	777.573	777.607	NVA	**0.034**	777.578	777.626	777.645
VVA767	252094.331	4735616.182	Yes	1045.089	1045.123	VVA	**0.034**	1045.121	1045.123	1045.134
VVA710	573094.592	4674483.846	Yes	605.948	605.982	VVA	**0.034**	605.954	605.998	606.001
VVA752	462526.140	4747865.914	Yes	654.330	654.362	VVA	**0.032**	654.353	654.365	654.388
NVA636	117241.242	4743790.590	Yes	1458.860	1458.892	NVA	**0.032**	1458.878	1458.881	1458.899
VVA738	529091.326	4754665.497	Yes	546.705	546.737	VVA	**0.032**	546.724	546.745	546.758
NVA594	250488.644	4756043.614	Yes	1063.181	1063.213	NVA	**0.032**	1063.207	1063.213	1063.219
NVA551	451664.073	4741506.353	Yes	709.118	709.148	NVA	**0.030**	709.137	709.147	709.160
NVA668	126352.942	4757193.872	Yes	1151.756	1151.786	NVA	**0.030**	1151.750	1151.791	1151.801
NVA577	291608.488	4742262.844	Yes	997.974	998.004	NVA	**0.030**	997.992	998.033	998.037
NVA625	161234.971	4663024.174	Yes	1241.100	1241.130	NVA	**0.030**	1241.107	1241.122	1241.168
VVA830	115663.181	4690408.809	Yes	1433.762	1433.791	VVA	**0.029**	1433.783	1433.786	1433.836
VVA724	497401.901	4698067.131	Yes	666.370	666.399	VVA	**0.029**	666.390	666.405	666.410
NVA584	461594.788	4757563.300	Yes	625.212	625.241	NVA	**0.029**	625.237	625.238	625.243
VVA749	331491.100	4748677.364	Yes	943.762	943.791	VVA	**0.029**	943.782	943.786	943.846
NVA572	373744.017	4747323.035	Yes	786.812	786.841	NVA	**0.029**	786.789	786.829	786.872
NVA590	333324.388	4754226.228	Yes	937.265	937.294	NVA	**0.029**	937.277	937.292	937.305
NVA521_alt	499871.153	4675663.765	Yes	686.372	686.400	NVA	**0.028**	686.377	686.383	686.405
NVA648	181111.916	4693318.491	Yes	1212.038	1212.066	NVA	**0.028**	1212.054	1212.066	1212.093
VVA755	524393.161	4748536.496	Yes	473.070	473.098	VVA	**0.028**	473.093	473.095	473.105
NVA598	257341.111	4699247.161	Yes	1148.599	1148.627	NVA	**0.028**	1148.627	1148.627	1148.629
NVA638	130555.690	4767102.535	Yes	1196.275	1196.303	NVA	**0.028**	1196.228	1196.316	1196.319
NVA609	145635.744	4700302.700	Yes	1356.362	1356.390	NVA	**0.028**	1356.384	1356.395	1356.397

NVA513	594326.371	4694157.971	Yes	516.701	516.728	NVA	**0.027**	516.700	516.701	516.739
VVA807	191058.283	4702667.340	Yes	1170.691	1170.718	VVA	**0.027**	1170.716	1170.720	1170.721
VVA804	166564.499	4749812.434	Yes	1005.705	1005.731	VVA	**0.026**	1005.711	1005.732	1005.760
VVA811	182508.903	4728142.685	Yes	1239.876	1239.902	VVA	**0.026**	1239.889	1239.903	1239.904
NVA563	436406.780	4741612.786	Yes	748.689	748.714	NVA	**0.025**	748.698	748.718	748.724
VVA736	298772.547	4749658.986	Yes	945.844	945.869	VVA	**0.025**	945.866	945.880	945.924
VVA750	442073.563	4746433.375	Yes	706.154	706.178	VVA	**0.024**	706.156	706.166	706.187
NVA569	279642.136	4755452.037	Yes	992.511	992.535	NVA	**0.024**	992.520	992.558	992.563
NVA602	331507.785	4748650.423	Yes	943.970	943.993	NVA	**0.023**	943.972	943.993	944.002
NVA550	347541.665	4746606.641	Yes	902.208	902.231	NVA	**0.023**	902.225	902.232	902.235
VVA822	125568.259	4733432.277	Yes	1391.929	1391.951	VVA	**0.022**	1391.939	1391.968	1391.970
NVA618	115531.666	4709367.302	Yes	1326.176	1326.198	NVA	**0.022**	1326.184	1326.191	1326.202
VVA797	116321.795	4735412.266	Yes	1459.673	1459.695	VVA	**0.022**	1459.654	1459.689	1459.703
NVA549	522991.288	4750245.744	Yes	475.718	475.740	NVA	**0.022**	475.708	475.740	475.769
NVA640	149887.791	4733977.119	Yes	1129.461	1129.483	NVA	**0.022**	1129.462	1129.484	1129.489
NVA595_A	506187.529	4683556.500	Yes	663.193	663.215	NVA	**0.022**	663.197	663.200	663.248
NVA526	566256.605	4648706.331	Yes	597.904	597.925	NVA	**0.021**	597.919	597.921	597.955
NVA514	497552.199	4706127.191	Yes	646.156	646.177	NVA	**0.021**	646.161	646.177	646.188
VVA776	137720.014	4734561.215	Yes	1127.707	1127.728	VVA	**0.021**	1127.724	1127.725	1127.740
NVA643	182514.047	4728174.797	Yes	1240.474	1240.495	NVA	**0.021**	1240.472	1240.484	1240.501
VVA824	138236.953	4687912.143	Yes	1361.855	1361.876	VVA	**0.021**	1361.855	1361.858	1361.904
NVA642	168169.556	4760598.770	Yes	1017.655	1017.675	NVA	**0.020**	1017.668	1017.677	1017.691
NVA564	379883.075	4751635.846	Yes	811.386	811.406	NVA	**0.020**	811.404	811.407	811.423
NVA559	389285.631	4755062.638	Yes	790.318	790.338	NVA	**0.020**	790.329	790.339	790.355
NVA660	177925.962	4668639.363	Yes	1215.417	1215.436	NVA	**0.019**	1215.433	1215.438	1215.444
NVA547	529050.242	4754685.862	Yes	548.485	548.504	NVA	**0.019**	548.483	548.501	548.506
NVA544	525428.574	4698214.857	Yes	606.845	606.864	NVA	**0.019**	606.849	606.859	606.907
NVA589	340563.819	4757135.778	Yes	889.929	889.948	NVA	**0.019**	889.942	889.946	889.977
VVA788	139655.151	4721295.669	Yes	1398.054	1398.073	VVA	**0.019**	1398.031	1398.066	1398.081
VVA784	143858.773	4666836.098	Yes	1283.634	1283.653	VVA	**0.019**	1283.647	1283.650	1283.672
VVA786	127837.170	4690551.849	Yes	1407.312	1407.331	VVA	**0.019**	1407.331	1407.335	1407.336
NVA612	139639.781	4721314.326	Yes	1399.051	1399.070	NVA	**0.019**	1399.070	1399.070	1399.074
NVA620	158341.928	4724499.768	Yes	1369.273	1369.292	NVA	**0.019**	1369.287	1369.290	1369.296
NVA565	252118.942	4735597.819	Yes	1044.799	1044.818	NVA	**0.019**	1044.803	1044.823	1044.825
NVA100	279578.331	4755337.106	Yes	992.366	992.384	NVA	**0.018**	992.350	992.402	992.407
VVA827	172825.553	4699595.919	Yes	1253.963	1253.980	VVA	**0.017**	1253.972	1253.980	1253.983
NVA521	498255.678	4673663.531	Yes	698.058	698.075	NVA	**0.017**	698.057	698.072	698.084
VVA713	511058.674	4670292.507	Yes	663.763	663.780	VVA	**0.017**	663.770	663.780	663.786
NVA610	116976.977	4765303.985	Yes	1106.340	1106.357	NVA	**0.017**	1106.331	1106.356	1106.389
NVA621	136375.046	4743263.822	Yes	1125.119	1125.135	NVA	**0.016**	1125.134	1125.137	1125.138
VVA812	106619.640	4701468.746	Yes	1384.805	1384.820	VVA	**0.015**	1384.820	1384.820	1384.824
VVA773	249611.919	4707213.128	Yes	1155.392	1155.407	VVA	**0.015**	1155.403	1155.405	1155.421
NVA593	437241.483	4752880.577	Yes	733.944	733.959	NVA	**0.015**	733.919	733.922	733.977
VVA803	88672.822	4765262.765	Yes	1254.297	1254.312	VVA	**0.015**	1254.294	1254.327	1254.334
NVA585	312946.437	4743515.264	Yes	917.883	917.897	NVA	**0.014**	917.880	917.884	917.906
NVA524	522319.458	4675747.410	Yes	632.335	632.349	NVA	**0.014**	632.346	632.354	632.367
VVA717	536781.369	4697926.532	Yes	594.810	594.824	VVA	**0.014**	594.812	594.824	594.837
VVA800	149885.801	4734013.296	Yes	1128.669	1128.682	VVA	**0.013**	1128.681	1128.683	1128.713
VVA808	103668.465	4772163.119	Yes	1130.881	1130.894	VVA	**0.013**	1130.885	1130.898	1130.902

NVA520	499859.031	4685304.158	Yes	675.692	675.705	NVA	**0.013**	675.682	675.690	675.709
NVA532	489207.543	4715811.430	Yes	656.811	656.824	NVA	**0.013**	656.800	656.824	656.879
NVA613	155050.093	4710106.955	Yes	1242.247	1242.260	NVA	**0.013**	1242.246	1242.270	1242.271
NVA562	279090.760	4741423.591	Yes	984.818	984.830	NVA	**0.012**	984.819	984.828	984.834
VVA787	143075.410	4711243.785	Yes	1310.444	1310.456	VVA	**0.012**	1310.452	1310.462	1310.474
VVA770	285133.671	4759378.375	Yes	986.537	986.549	VVA	**0.012**	986.544	986.546	986.549
NVA649	105838.969	4715877.085	Yes	1437.476	1437.487	NVA	**0.011**	1437.460	1437.489	1437.502
VVA795	166248.845	4722114.147	Yes	1304.797	1304.808	VVA	**0.011**	1304.782	1304.809	1304.836
VVA704	490218.199	4693335.094	Yes	682.205	682.216	VVA	**0.011**	682.206	682.214	682.217
NVA677	143010.578	4711238.404	Yes	1306.008	1306.019	NVA	**0.011**	1306.002	1306.016	1306.023
VVA826	183030.977	4766085.329	Yes	969.372	969.382	VVA	**0.010**	969.364	969.393	969.406
VVA735	377004.211	4740893.540	Yes	801.927	801.937	VVA	**0.010**	801.920	801.952	801.981
NVA628	172827.724	4699625.769	Yes	1253.303	1253.313	NVA	**0.010**	1253.297	1253.310	1253.322
NVA658	183044.838	4766054.654	Yes	969.024	969.033	NVA	**0.009**	969.009	969.039	969.041
NVA651	187997.655	4741732.245	Yes	1132.903	1132.912	NVA	**0.009**	1132.867	1132.903	1132.914
VVA781	177193.408	4749331.336	Yes	1034.350	1034.359	VVA	**0.009**	1034.326	1034.357	1034.362
VVA805	168273.608	4761130.095	Yes	998.944	998.952	VVA	**0.008**	998.945	998.960	998.966
NVA626	179947.658	4741532.016	Yes	1114.015	1114.023	NVA	**0.008**	1114.011	1114.025	1114.029
NVA566	371686.130	4758567.758	Yes	845.709	845.716	NVA	**0.007**	845.701	845.726	845.732
NVA604	538767.725	4742110.078	Yes	441.048	441.055	NVA	**0.007**	441.041	441.061	441.063
NVA507	497392.293	4698078.691	Yes	667.092	667.099	NVA	**0.007**	667.078	667.101	667.109
VVA711	498269.619	4673626.168	Yes	697.697	697.704	VVA	**0.007**	697.692	697.701	697.712
NVA543	572418.203	4687365.835	Yes	573.448	573.455	NVA	**0.007**	573.385	573.459	573.484
NVA614	157097.348	4734119.998	Yes	1150.101	1150.107	NVA	**0.006**	1150.095	1150.112	1150.118
NVA528	528792.080	4667731.410	Yes	629.574	629.580	NVA	**0.006**	629.565	629.582	629.582
NVA527	528778.098	4672573.818	Yes	624.253	624.258	NVA	**0.005**	624.245	624.247	624.266
NVA509	544745.425	4693633.252	Yes	597.547	597.552	NVA	**0.005**	597.543	597.553	597.553
NVA596	260972.752	4709171.188	Yes	1125.480	1125.485	NVA	**0.005**	1125.478	1125.487	1125.487
NVA557	326442.539	4739167.478	Yes	890.567	890.572	NVA	**0.005**	890.554	890.558	890.593
NVA627	88738.087	4724899.190	Yes	1430.486	1430.490	NVA	**0.004**	1430.486	1430.494	1430.501
NVA515	515873.580	4678965.848	Yes	647.007	647.011	NVA	**0.004**	647.006	647.011	647.013
NVA676	151244.991	4749804.703	Yes	1042.967	1042.970	NVA	**0.003**	1042.965	1042.977	1042.978
VVA727_A	572274.953	4663334.901	Yes	555.177	555.179	VVA	**0.002**	555.171	555.187	555.197
NVA502_A	546998.789	4675903.951	Yes	587.999	588.001	NVA	**0.002**	587.995	587.999	588.003
NVA540	495969.005	4714177.270	Yes	652.681	652.683	NVA	**0.002**	652.680	652.689	652.700
NVA591	451464.560	4751183.821	Yes	653.881	653.883	NVA	**0.002**	653.860	653.877	653.887
NVA531	504724.463	4667611.250	Yes	685.865	685.867	NVA	**0.002**	685.853	685.874	685.877
VVA732	504748.755	4666043.223	Yes	693.805	693.807	VVA	**0.002**	693.800	693.801	693.816
VVA739	256540.491	4699184.325	Yes	1150.732	1150.734	VVA	**0.002**	1150.726	1150.726	1150.741
NVA630	127478.807	4698695.836	Yes	1399.646	1399.648	NVA	**0.002**	1399.612	1399.625	1399.663
NVA681	189389.254	4681776.605	Yes	1199.198	1199.199	NVA	**0.001**	1199.194	1199.200	1199.203
VVA774	411685.764	4749962.210	Yes	764.430	764.431	VVA	**0.001**	764.424	764.436	764.437
NVA637	137542.526	4734584.736	Yes	1128.858	1128.859	NVA	**0.001**	1128.845	1128.861	1128.870
NVA505	490205.553	4687135.134	Yes	690.100	690.100	NVA	**0.000**	690.090	690.107	690.115
NVA639	107980.763	4756731.628	Yes	1158.828	1158.828	NVA	**0.000**	1158.795	1158.835	1158.863
NVA616	129510.134	4706794.739	Yes	1291.200	1291.200	NVA	**0.000**	1291.178	1291.195	1291.204
NVA503	536746.949	4687126.601	Yes	608.871	608.870	NVA	**-0.001**	608.869	608.871	608.879
NVA600	411705.569	4749941.984	Yes	766.265	766.263	NVA	**-0.002**	766.232	766.264	766.279
NVA617	156603.957	4699571.851	Yes	1329.857	1329.855	NVA	**-0.002**	1329.839	1329.855	1329.862

VVA796	188037.768	4741759.007	Yes	1132.548	1132.546	VVA	**-0.002**	1132.537	1132.543	1132.565
NVA534	573267.337	4674506.768	Yes	613.003	613.000	NVA	**-0.003**	612.986	613.000	613.005
NVA606	116297.665	4735339.661	Yes	1457.775	1457.772	NVA	**-0.003**	1457.765	1457.779	1457.783
NVA568	512931.080	4754832.285	Yes	511.733	511.730	NVA	**-0.003**	511.724	511.734	511.751
NVA529	522409.643	4666115.893	Yes	648.740	648.736	NVA	**-0.004**	648.690	648.740	648.749
NVA576	535500.732	4754711.554	Yes	537.884	537.879	NVA	**-0.005**	537.876	537.888	537.891
NVA561	261165.247	4743824.837	Yes	1050.464	1050.459	NVA	**-0.005**	1050.457	1050.459	1050.467
VVA789	88712.200	4724912.526	Yes	1430.077	1430.071	VVA	**-0.006**	1430.027	1430.045	1430.078
NVA670	185393.272	4755027.366	Yes	1002.548	1002.542	NVA	**-0.006**	1002.542	1002.548	1002.555
NVA675	163500.087	4764755.912	Yes	1048.767	1048.761	NVA	**-0.006**	1048.748	1048.756	1048.765
VVA707	543261.180	4667848.144	Yes	611.924	611.918	VVA	**-0.006**	611.909	611.931	611.936
VVA828	86260.885	4710447.976	Yes	1451.214	1451.207	VVA	**-0.007**	1451.192	1451.217	1451.241
NVA678	86286.848	4710466.355	Yes	1450.993	1450.986	NVA	**-0.007**	1450.966	1450.996	1451.000
NVA545	572250.923	4663283.039	Yes	555.955	555.948	NVA	**-0.007**	555.939	555.946	555.963
NVA519	511107.253	4669270.554	Yes	662.753	662.745	NVA	**-0.008**	662.739	662.746	662.747
NVA607	144289.032	4680078.187	Yes	1319.404	1319.396	NVA	**-0.008**	1319.391	1319.396	1319.397
VVA810	185427.314	4755034.160	Yes	1001.858	1001.850	VVA	**-0.008**	1001.849	1001.850	1001.853
NVA504	512092.389	4702961.938	Yes	623.302	623.294	NVA	**-0.008**	623.288	623.292	623.297
VVA794	105826.336	4715905.621	Yes	1437.439	1437.430	VVA	**-0.009**	1437.417	1437.436	1437.464
NVA601	462493.098	4747886.950	Yes	654.159	654.150	NVA	**-0.009**	654.117	654.147	654.167
NVA542	483093.445	4703779.047	Yes	681.806	681.796	NVA	**-0.010**	681.751	681.785	681.802
NVA656	105770.748	4707826.859	Yes	1345.912	1345.902	NVA	**-0.010**	1345.895	1345.903	1345.918
NVA570	355400.658	4736081.251	Yes	861.329	861.318	NVA	**-0.011**	861.315	861.328	861.334
NVA518	490197.087	4693358.064	Yes	682.894	682.882	NVA	**-0.012**	682.877	682.884	682.911
VVA721	514169.806	4696659.619	Yes	631.401	631.389	VVA	**-0.012**	631.381	631.390	631.391
NVA510	594471.329	4681286.160	Yes	547.820	547.808	NVA	**-0.012**	547.791	547.810	547.810
VVA806	154170.520	4682708.062	Yes	1308.849	1308.837	VVA	**-0.012**	1308.822	1308.838	1308.842
NVA552	427669.486	4749665.944	Yes	745.737	745.725	NVA	**-0.012**	745.714	745.714	745.742
NVA517	594647.534	4668250.212	Yes	537.714	537.702	NVA	**-0.012**	537.697	537.708	537.708
NVA582	306048.733	4756393.531	Yes	966.742	966.730	NVA	**-0.012**	966.700	966.734	966.735
NVA523	559329.620	4667947.275	Yes	586.125	586.112	NVA	**-0.013**	586.102	586.111	586.119
NVA554	498541.748	4757839.838	Yes	579.345	579.330	NVA	**-0.015**	579.309	579.316	579.376
NVA672	158178.351	4741318.386	Yes	1074.922	1074.907	NVA	**-0.015**	1074.905	1074.907	1074.912
NVA679	88687.426	4765277.926	Yes	1253.930	1253.914	NVA	**-0.016**	1253.883	1253.917	1253.918
NVA629	177146.368	4749320.497	Yes	1036.109	1036.092	NVA	**-0.017**	1036.080	1036.090	1036.105
VVA815	179729.917	4741443.803	Yes	1107.899	1107.882	VVA	**-0.017**	1107.878	1107.895	1107.904
NVA611	174312.963	4720532.067	Yes	1260.898	1260.881	NVA	**-0.017**	1260.877	1260.880	1260.886
VVA782	117380.984	4765255.958	Yes	1107.377	1107.359	VVA	**-0.018**	1107.340	1107.368	1107.378
VVA775	249281.237	4748039.528	Yes	1087.053	1087.035	VVA	**-0.018**	1087.031	1087.036	1087.037
VVA792	171532.753	4737757.680	Yes	1149.306	1149.288	VVA	**-0.018**	1149.282	1149.289	1149.291
NVA588	285053.708	4759372.691	Yes	986.852	986.833	NVA	**-0.019**	986.806	986.824	986.857
NVA508_alt	490083.628	4664803.161	Yes	715.664	715.645	NVA	**-0.019**	715.636	715.645	715.654
VVA723	489305.920	4664814.334	Yes	716.099	716.080	VVA	**-0.019**	716.060	716.090	716.100
NVA575	418054.973	4746627.487	Yes	774.001	773.981	NVA	**-0.020**	773.975	773.982	773.986
VVA742	363395.291	4740612.735	Yes	753.882	753.862	VVA	**-0.020**	753.859	753.863	753.864
NVA524_alt	522337.511	4674142.211	Yes	640.200	640.178	NVA	**-0.022**	640.170	640.180	640.188
NVA633	166212.769	4722157.906	Yes	1305.905	1305.883	NVA	**-0.022**	1305.876	1305.879	1305.885
NVA546	502959.979	4696889.238	Yes	654.158	654.135	NVA	**-0.023**	654.130	654.130	654.143
VVA801	174363.750	4720593.567	Yes	1267.529	1267.505	VVA	**-0.024**	1267.482	1267.504	1267.508

NVA558	255029.621	4729061.061	Yes	1071.945	1071.921	NVA	**-0.024**	1071.919	1071.923	1071.929
VVA816	97854.311	4753317.929	Yes	1235.582	1235.556	VVA	**-0.026**	1235.550	1235.553	1235.570
NVA587	363447.157	4740611.604	Yes	754.323	754.297	NVA	**-0.026**	754.274	754.275	754.302
NVA645	106621.717	4701527.162	Yes	1385.707	1385.680	NVA	**-0.027**	1385.675	1385.681	1385.682
VVA779	90976.654	4746068.570	Yes	1553.383	1553.355	VVA	**-0.028**	1553.345	1553.352	1553.361
NVA662	97824.657	4753343.660	Yes	1236.916	1236.887	NVA	**-0.029**	1236.877	1236.889	1236.891
NVA538	563947.047	4692114.970	Yes	556.146	556.117	NVA	**-0.029**	556.088	556.095	556.122
VVA820	119462.560	4699903.361	Yes	1362.682	1362.653	VVA	**-0.029**	1362.644	1362.651	1362.673
NVA631	171369.161	4749526.815	Yes	1027.304	1027.274	NVA	**-0.030**	1027.262	1027.276	1027.294
NVA537	543286.343	4667830.736	Yes	612.294	612.264	NVA	**-0.030**	612.258	612.280	612.299
NVA634	91531.415	4761556.868	Yes	1255.431	1255.400	NVA	**-0.031**	1255.392	1255.395	1255.406
NVA511	536717.220	4697885.164	Yes	595.859	595.828	NVA	**-0.031**	595.815	595.833	595.839
NVA516	575869.017	4645571.531	Yes	594.719	594.687	NVA	**-0.032**	594.681	594.681	594.718
NVA623	104150.740	4722434.525	Yes	1481.042	1481.010	NVA	**-0.032**	1481.007	1481.012	1481.032
NVA541	590183.649	4649075.014	Yes	555.075	555.041	NVA	**-0.034**	555.003	555.011	555.052
NVA605	475781.595	4760647.831	Yes	678.763	678.729	NVA	**-0.034**	678.723	678.732	678.753
VVA715	563990.957	4692075.816	Yes	554.703	554.668	VVA	**-0.035**	554.655	554.672	554.674
VVA809	158133.605	4740471.460	Yes	1082.529	1082.494	VVA	**-0.035**	1082.485	1082.498	1082.508
NVA652	154151.064	4682731.729	Yes	1308.765	1308.730	NVA	**-0.035**	1308.725	1308.736	1308.743
NVA673	143801.347	4666740.183	Yes	1281.688	1281.653	NVA	**-0.035**	1281.648	1281.651	1281.672
NVA615	188691.317	4719987.873	Yes	1233.825	1233.789	NVA	**-0.036**	1233.771	1233.780	1233.799
NVA508	486937.104	4665875.604	Yes	728.486	728.449	NVA	**-0.037**	728.427	728.442	728.468
NVA641	173663.035	4732985.346	Yes	1261.846	1261.809	NVA	**-0.037**	1261.801	1261.815	1261.824
VVA798	100899.160	4738116.400	Yes	1476.823	1476.786	VVA	**-0.037**	1476.781	1476.787	1476.791
VVA754	444587.118	4759174.664	Yes	643.114	643.074	VVA	**-0.040**	643.048	643.069	643.081
NVA664	103712.254	4772189.113	Yes	1130.994	1130.954	NVA	**-0.040**	1130.942	1130.952	1130.961
NVA663	119227.544	4721593.178	Yes	1434.588	1434.547	NVA	**-0.041**	1434.542	1434.561	1434.570
NVA632	167434.470	4688522.518	Yes	1278.144	1278.102	NVA	**-0.042**	1278.073	1278.099	1278.110
NVA567	249436.744	4707124.601	Yes	1154.913	1154.868	NVA	**-0.045**	1154.859	1154.871	1154.872
NVA581	376961.458	4740896.567	Yes	804.470	804.423	NVA	**-0.047**	804.407	804.453	804.489
NVA622	168668.860	4681983.224	Yes	1272.170	1272.119	NVA	**-0.051**	1272.098	1272.123	1272.130
NVA533	484075.066	4757857.039	Yes	653.900	653.846	NVA	**-0.054**	653.839	653.850	653.879
NVA597	491856.215	4750399.469	Yes	568.276	568.222	NVA	**-0.054**	568.221	568.222	568.234
VVA819	149823.010	4719075.363	Yes	1341.782	1341.725	VVA	**-0.057**	1341.709	1341.735	1341.744
NVA525	586073.684	4658026.647	Yes	520.757	520.700	NVA	**-0.057**	520.688	520.701	520.704
NVA646	98615.447	4729214.582	Yes	1431.092	1431.032	NVA	**-0.060**	1430.988	1431.032	1431.040
NVA522	514205.876	4696702.747	Yes	631.473	631.411	NVA	**-0.062**	631.394	631.401	631.414
NVA538_alt	563954.407	4692109.091	Yes	555.902	555.838	NVA	**-0.064**	555.831	555.855	555.858
NVA536	562495.651	4674411.447	Yes	558.664	558.600	NVA	**-0.064**	558.585	558.625	558.662
NVA608	119436.551	4699911.971	Yes	1362.506	1362.434	NVA	**-0.072**	1362.414	1362.432	1362.466
NVA644	155592.731	4769565.399	Yes	1125.822	1125.750	NVA	**-0.072**	1125.727	1125.735	1125.763
NVA530	580102.434	4677816.597	Yes	567.481	567.403	NVA	**-0.078**	567.391	567.403	567.406
NVA654	100572.597	4738076.524	Yes	1475.555	1475.476	NVA	**-0.079**	1475.425	1475.489	1475.493
NVA683	90947.415	4746071.878	Yes	1553.972	1553.889	NVA	**-0.083**	1553.885	1553.899	1553.910
NVA603	472592.180	4745527.267	Yes	626.856	626.772	NVA	**-0.084**	626.747	626.768	626.792
NVA635	149860.538	4719075.262	Yes	1342.354	1342.266	NVA	**-0.088**	1342.255	1342.258	1342.269
VVA785	136616.307	4761008.070	Yes	1192.793	1192.705	VVA	**-0.088**	1192.695	1192.709	1192.714
VVA802	129412.453	4706764.060	Yes	1291.448	1291.322	VVA	**-0.126**	1291.299	1291.312	1291.351
VVA783	115858.024	4709351.616	Yes	1328.382	1328.232	VVA	**-0.150**	1328.206	1328.240	1328.243

LIDAR CALIBRATION AND BLOCK LAS OUTPUT

Note: All figures represented on the following pages are for general illustration purposes, and are not examples derived from actual Hat Creek – White River data.

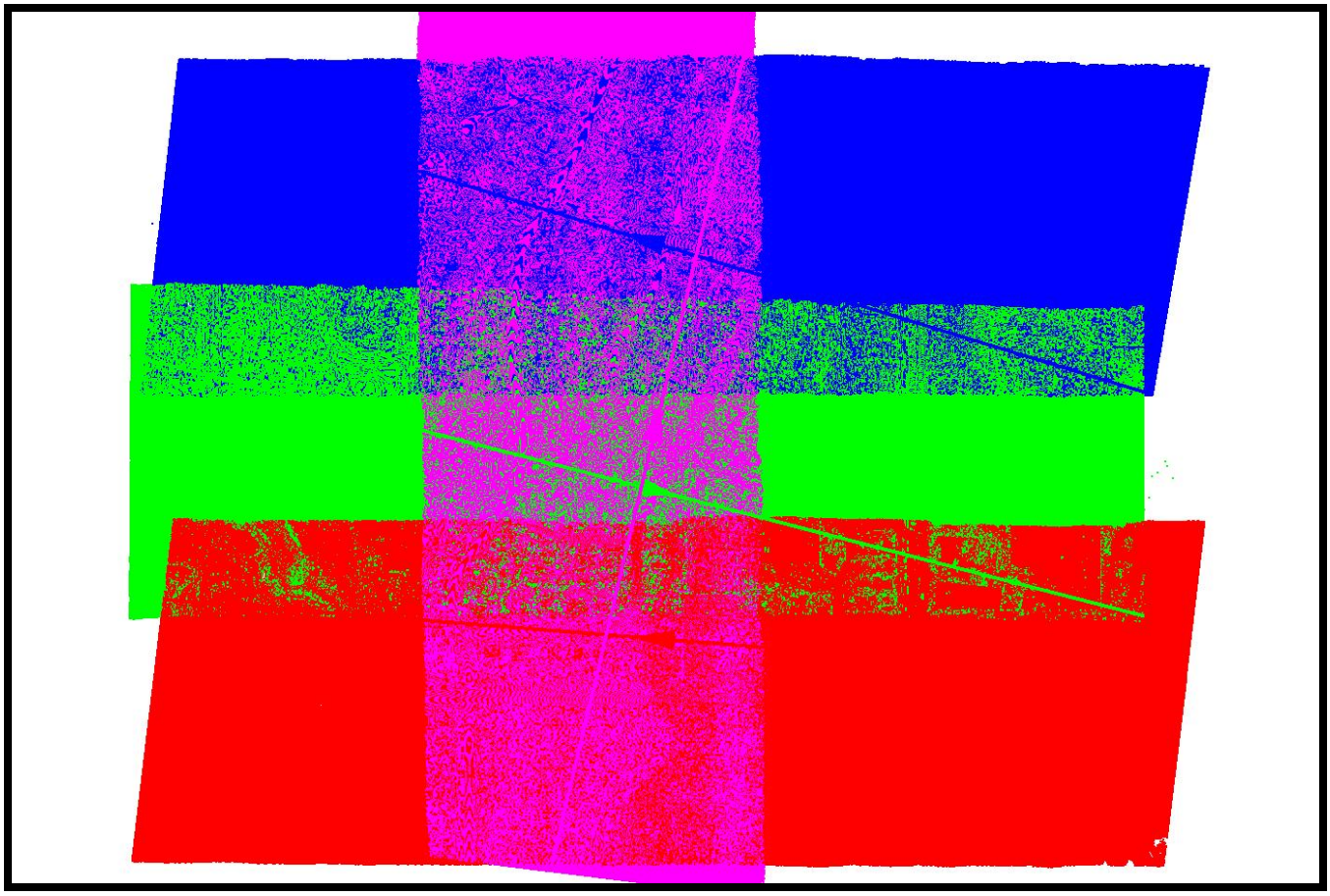
Initial Processing

Lidar data is output as LAS point data using Optech's Lidar Mapping Suite (LMS). LMS matches ground and roof planes plus roof lines to self-calibrate and correct system biases. These biases occur within the hardware of the laser scanning systems, within the Inertial Measurement Unit (IMU) and because of environmental conditions which affect the refraction of light. The systemic biases that are corrected for include scale, roll, pitch, and heading.

In addition to the self-calibration mode LMS runs a "production" mode which applies the self-calibration parameters and then analyzes each individual flight line and applies small adjustments to each line to tie overlapping lidar points even more tightly together.

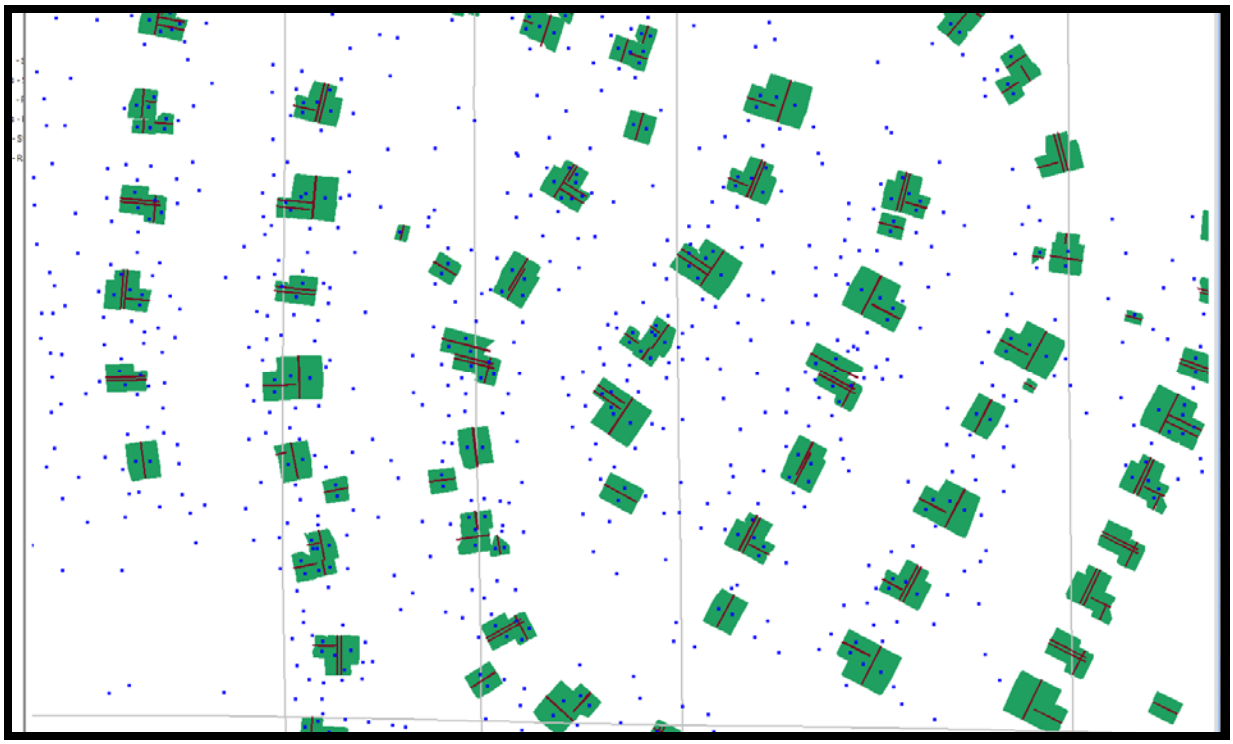
Boresight Self-Calibration Processing Procedures

An LMS boresight calibration is performed on an as-needed basis to correct scale, roll, pitch and heading biases. A minimum of three overlapping flights are flown in opposing directions with one cross flight.



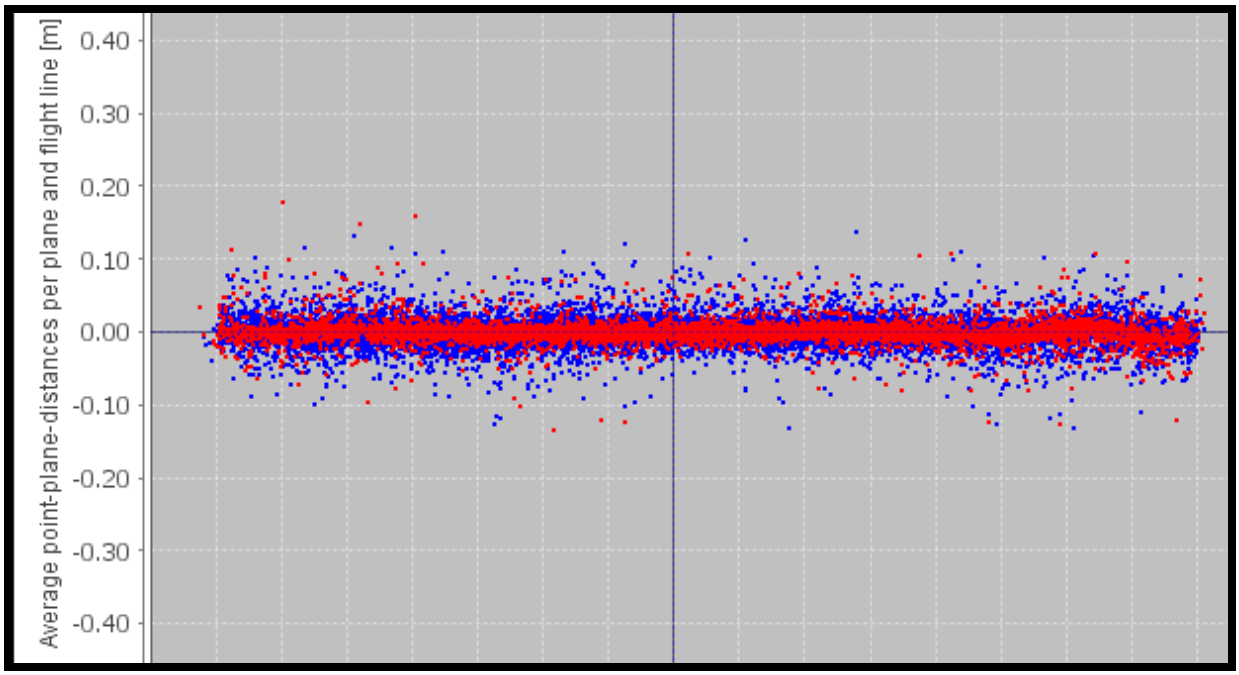
The Boresighting module frees scan angle scale, scan angle lag, XYZ boresight corrections and elevation position corrections while locking scan angle offset and XY position corrections.

The picked calibration site will have a good distribution of buildings for the self-calibration software to match ground planes, roof planes and roof lines.

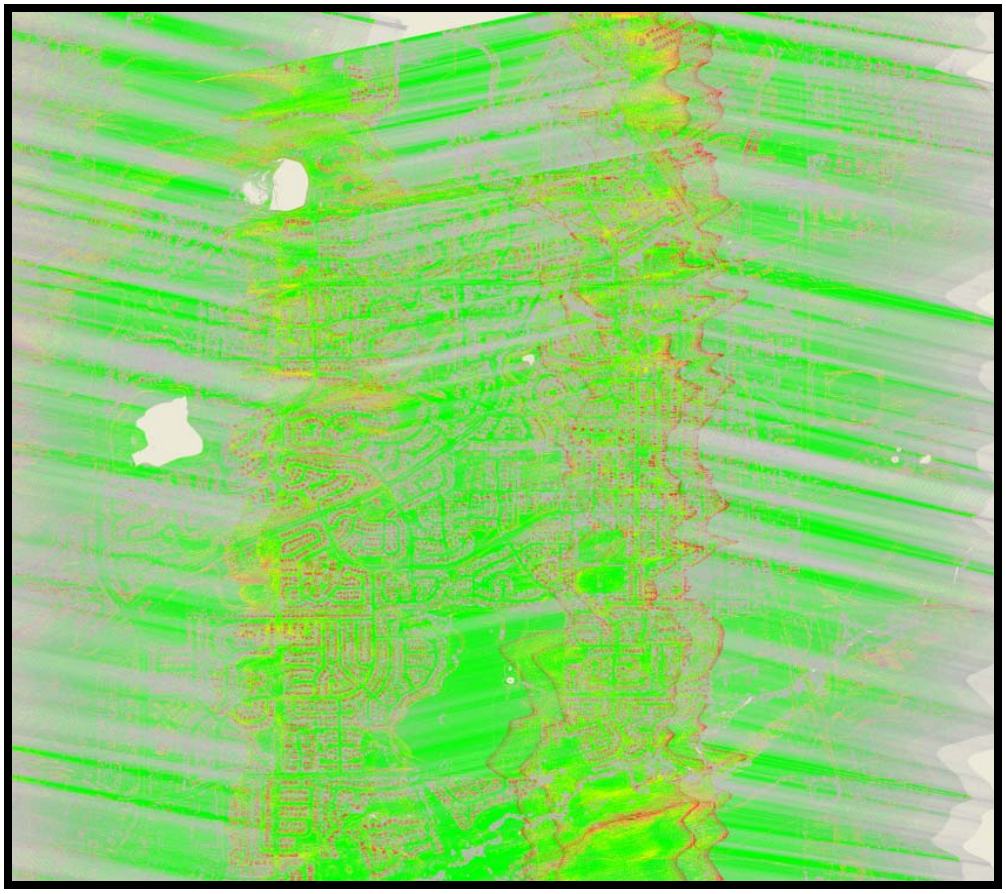


At the conclusion of the self-calibration run the data is quality checked with LMS plots

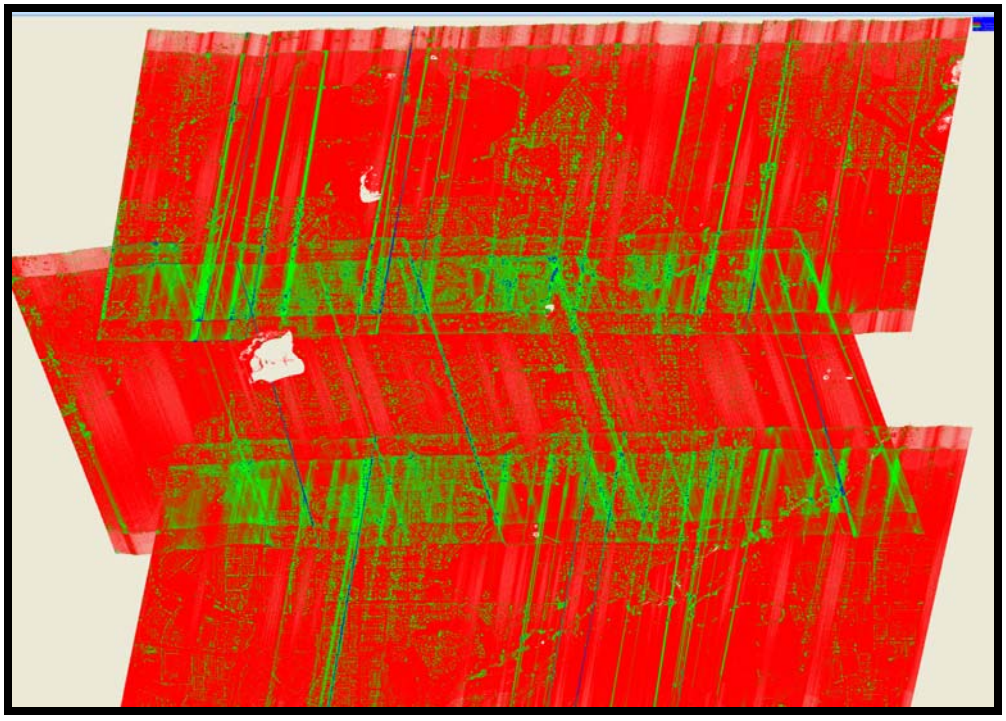
Plot of plane vertical distances from datum plane.



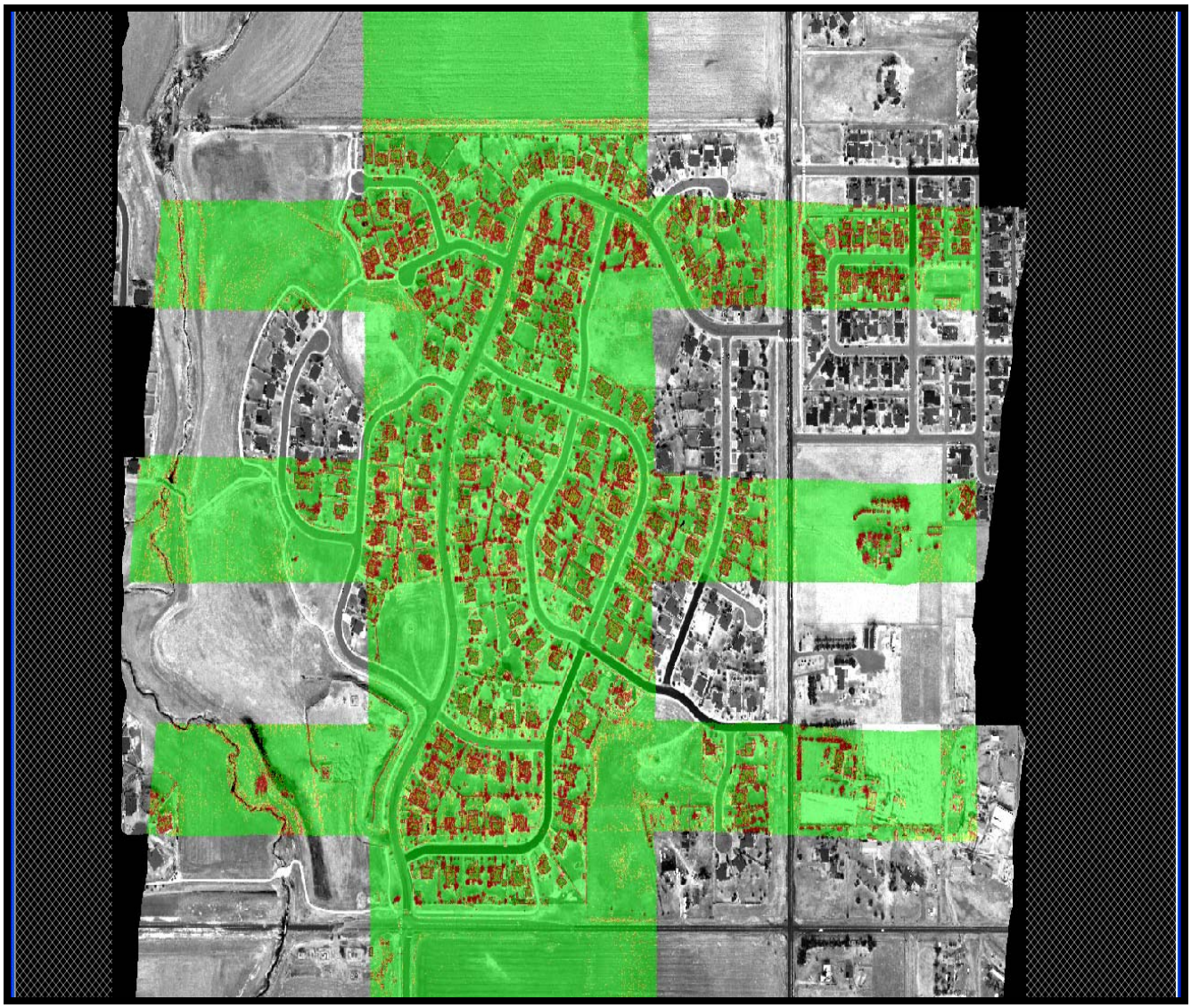
Plot of height differenced between flight lines. (Green=less than 5cm).



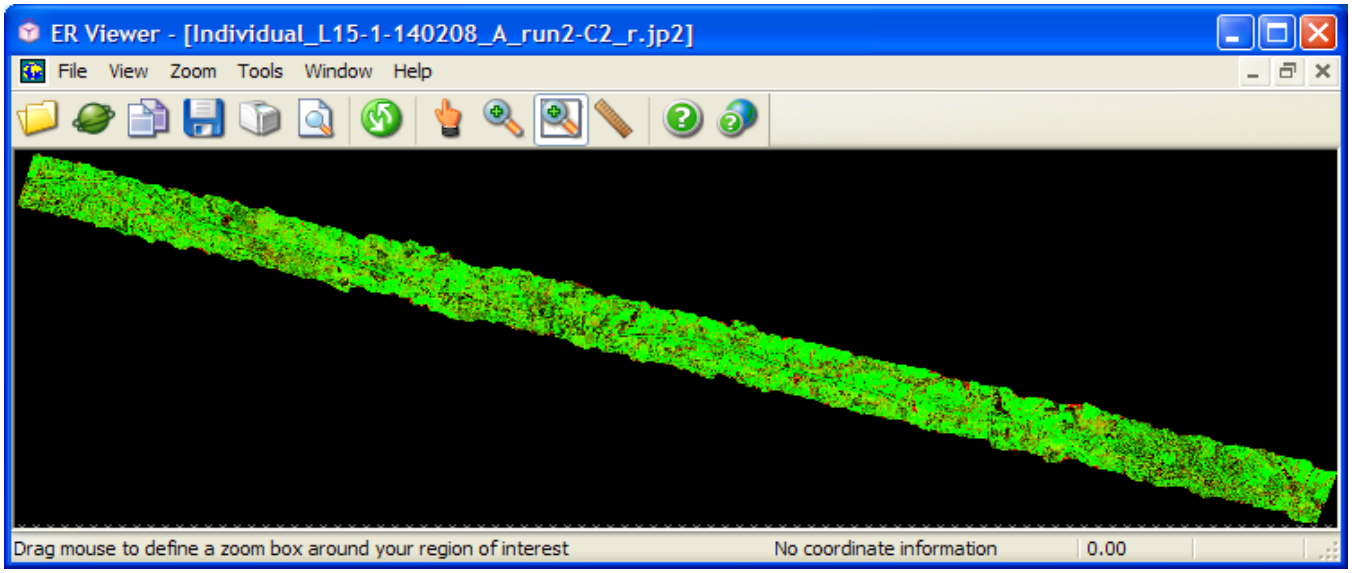
Plot of point densities. (Red=5-9 points per cell, green 10+ points per cell).



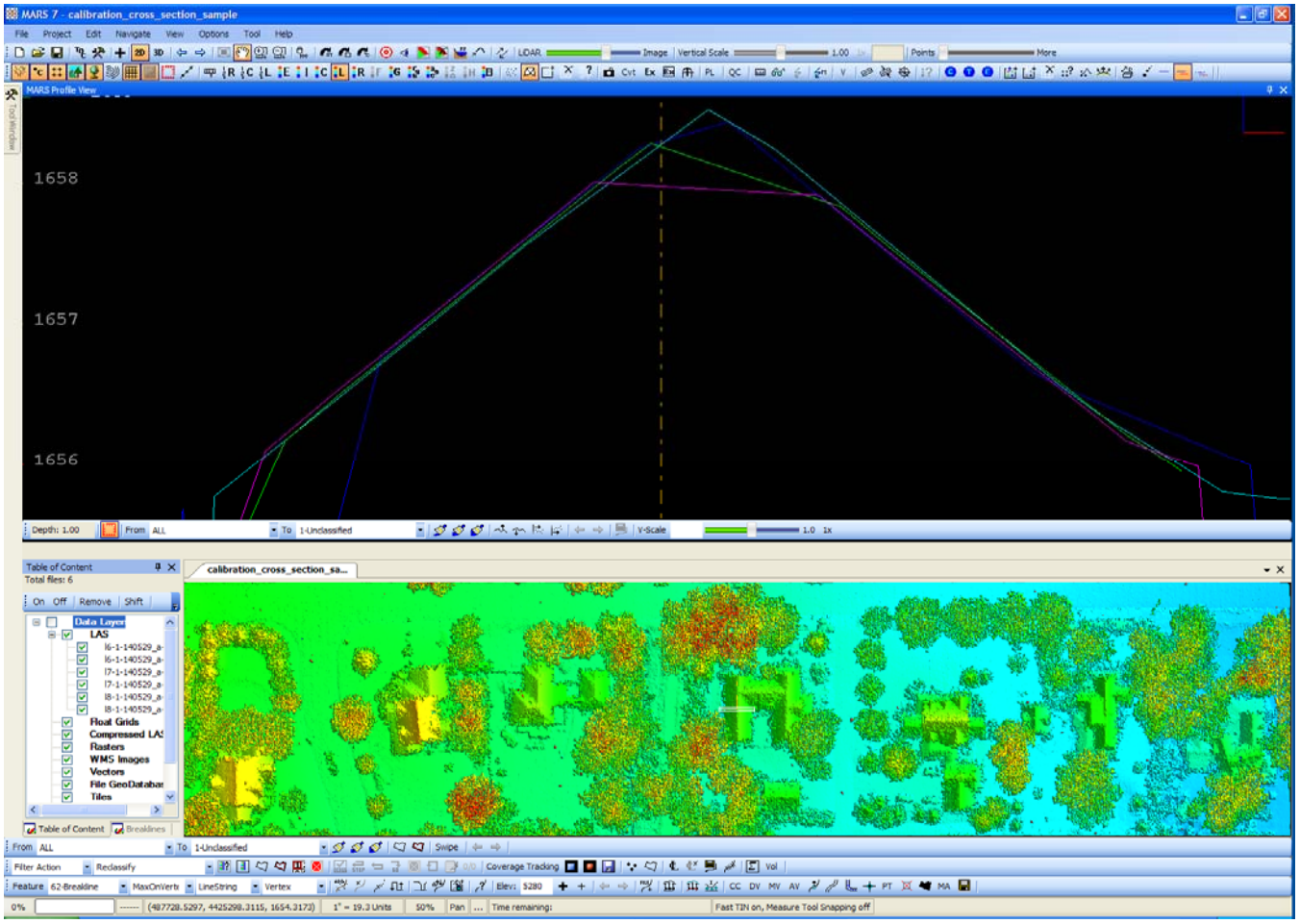
A Flight Line Separation Raster image is generated in Merrick Advanced Remote Sensing Software (MARS®), in this example ground returns from multiple flight lines that are fitting within 3 centimeters are colored green.



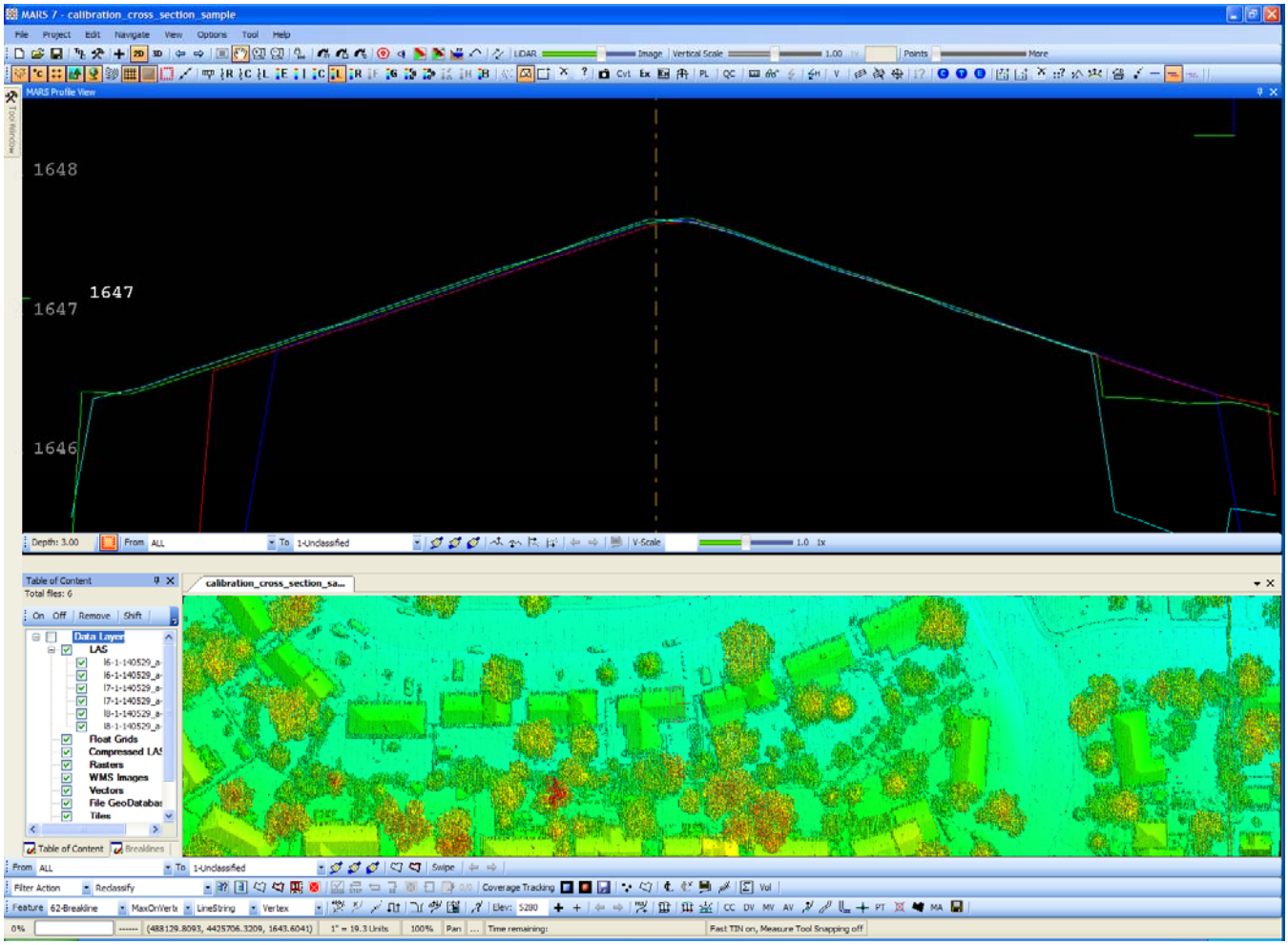
MARS® tests for internal relative vertical accuracy using inbound and outbound scan values. Again, Green is showing inbound and outbound scan data fitting to 3 centimeters.



Building cross sections are checked for good alignment. Pitch and heading are checked on roof planes parallel to the flight direction.



Roll and scale are checked on roof planes perpendicular to the flight direction.

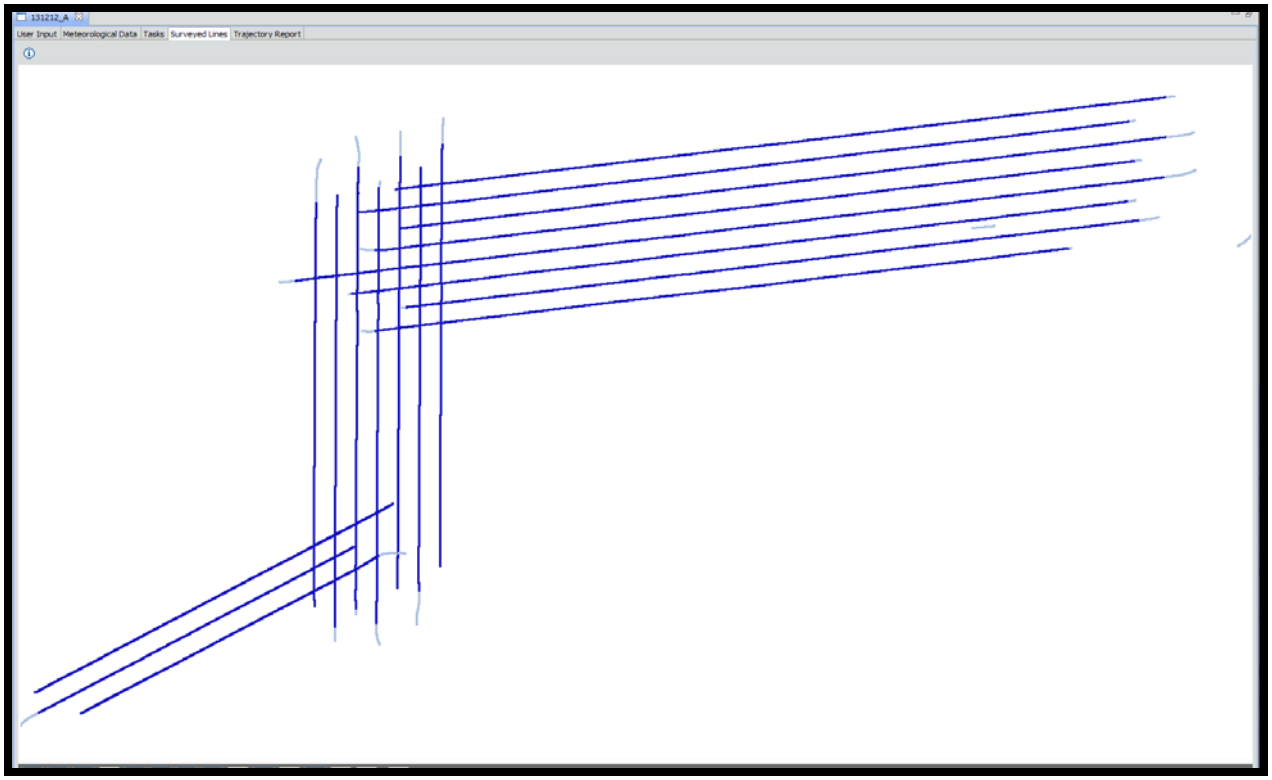


The LMS program outputs a "LCP" file with all the correction parameters. The calibration process may be run several times until the boresight adjustments are acceptable. When the boresight solution is acceptable the LCP file adjustments are saved and also applied to subsequent projects. Each new project is again analyzed and when the adjustment biases show too much drift a new boresight calibration is run. The LCP file may hold calibration tolerances for several projects.

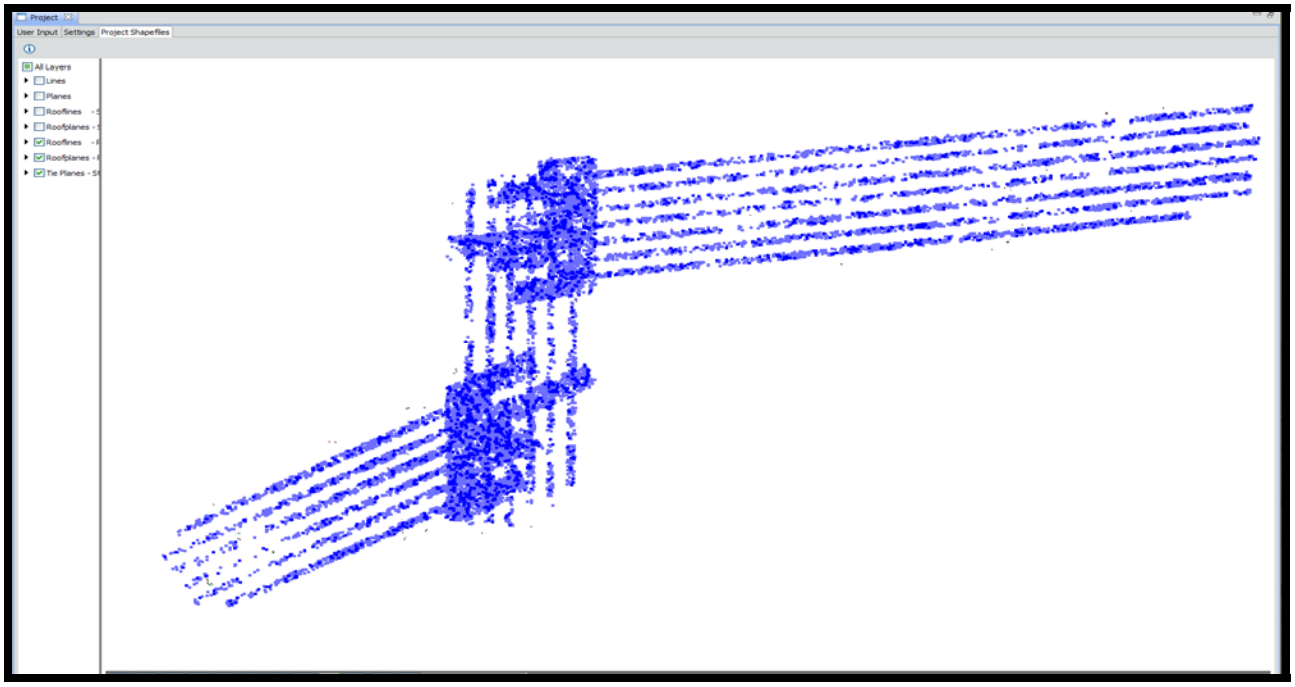
Block LAS Production Processing Procedures

The LMS production mode is run on each flight line to further tie the final lidar LAS flight line files tightly together. Production settings allow scan angle scale, scan angle lag to float and allows elevation to move slightly during flight line to flight line comparison thus further tying flight lines together. A cross flight with locked elevation data is used for controlling flight line elevations.

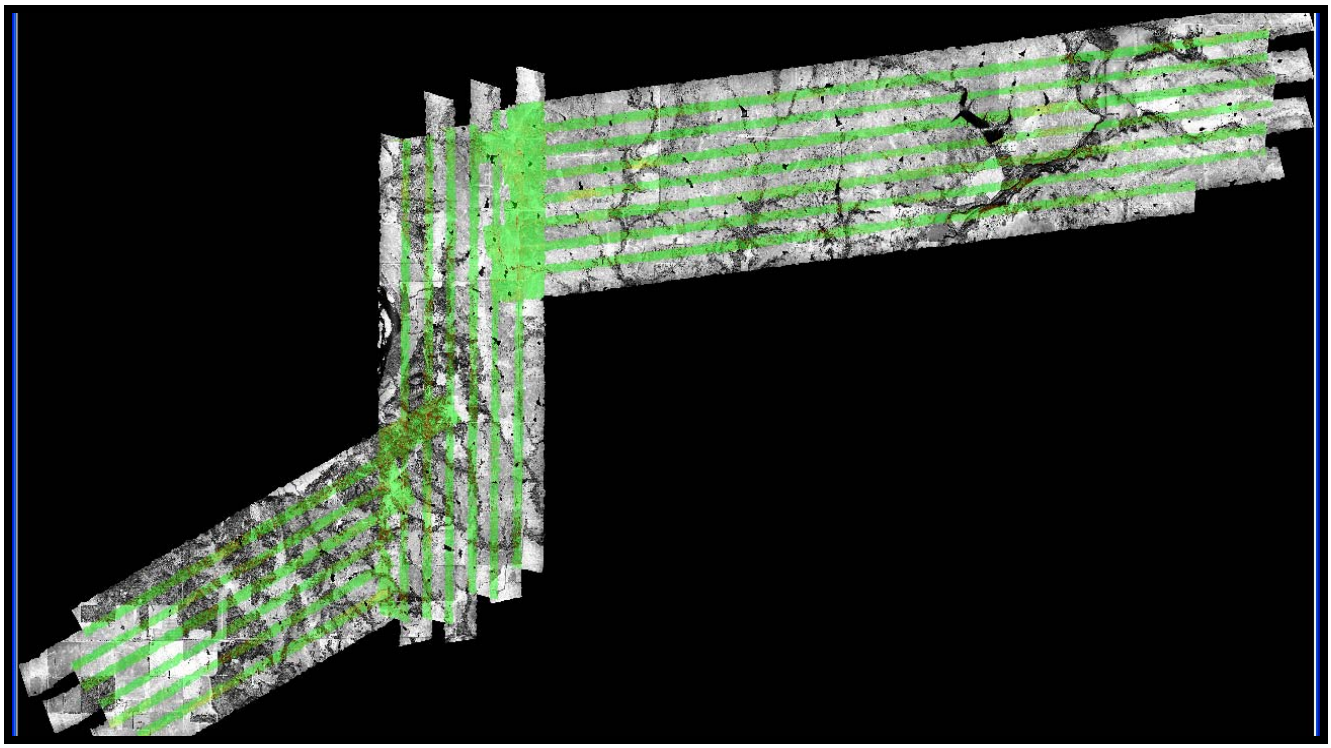
A block of data is selected to process with LMS production settings. Data collected during turns at the ends of flight lines is deselected (light blue lines).



As in self-calibration the LMS production program analyses ground, roof planes and rooflines. One cross flight is locked in elevation and all other lines are adjusted to it. Unlike the calibration site the distribution of roof planes is usually much less dense. Here matched ground tie planes are blue.

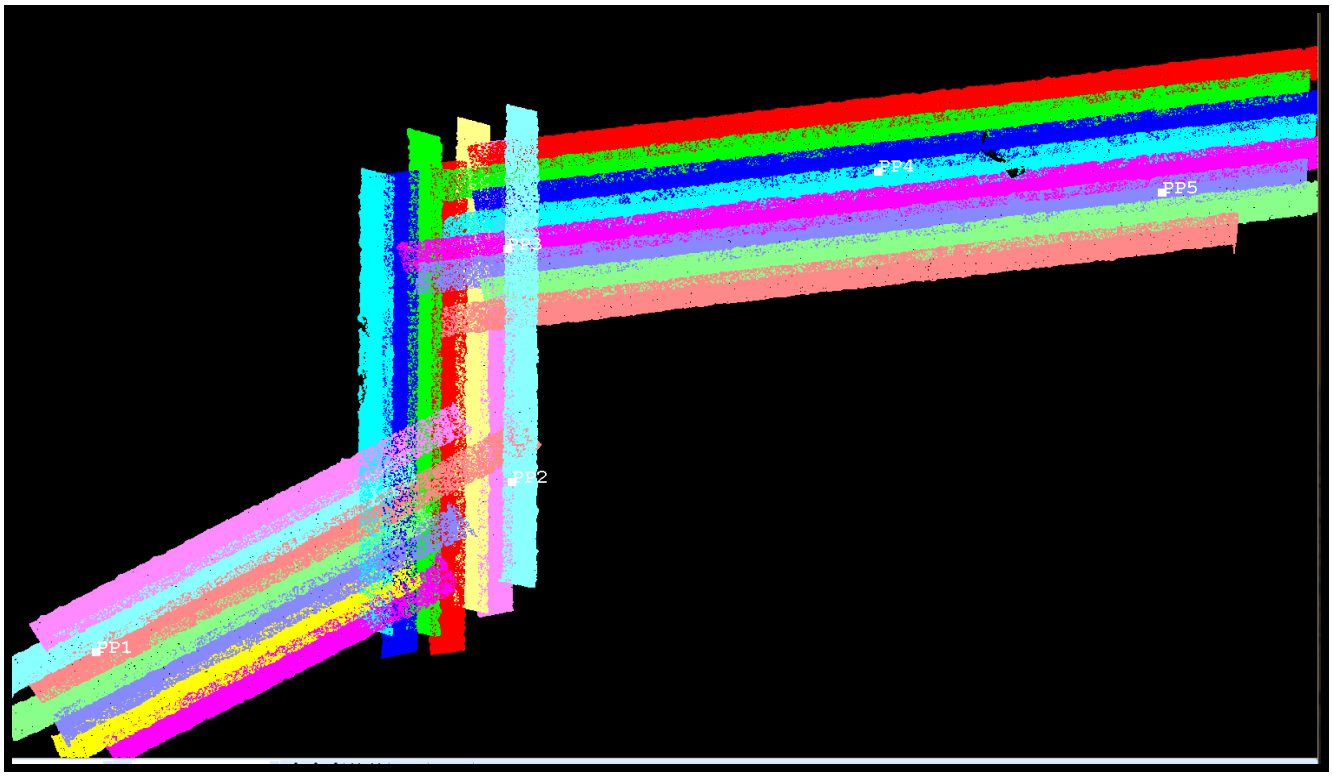


The same quality control outputs used to check self-calibrations are available to analyze the production run. Output plots are again available in LMS and cross sections plus a Flight Line Separation Raster are generated in MARS® to check coverage and quality.

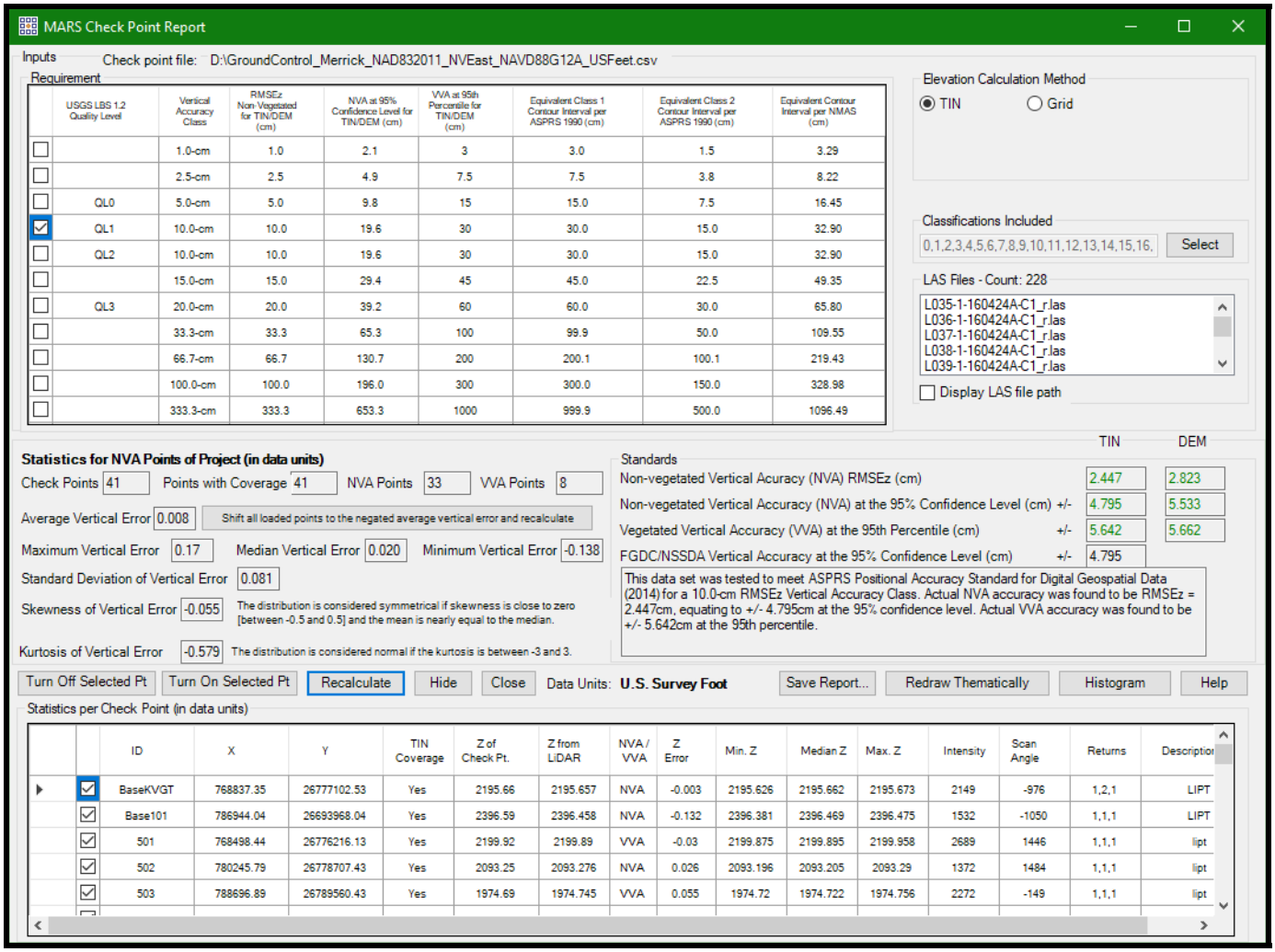


Correcting the Final Elevation

After all the lines are tied together a ground control network is imported into MARS®. The ground control network may be pre-existing or collected by a licensed surveyor.



The next step is to match the ground control elevations to the lidar data set. A control report is run and the data set is shifted slightly to zero out the average elevation error and points checked for quality.



The final step before boresighted, leveled LAS files are ready for filtering is to run the MARS® QC Module on the block data. The Boresighted lidar QC Report outputs individual reports on Point Density, Nominal Pulse Spacing, Data Voids, Spatial Distribution, Scan Angles, Control Report, Flight Line Separation, Flight Line Overlap, Buffered Boundary, LAS Formats, Datums and Coordinates. These reports are checked with the required specifications in the Project Management Plan.

LIDAR CLASSIFICATION

Auto-Filter (automated)

Merrick-Surdex JV uses customizable software to classify an automated bare-earth (i.e., ground / Class 2) solution from the lidar point cloud. The software uses several different algorithms combined in a macro to determine the classification for each point. Filter parameters are adjusted based on the terrain and land cover for each project to produce the best ground result and to minimize hand-filter. Automated filters typically classify 85- to 90-percent of the ground.

Hand-Filter (manual editing)

The remaining 10- to 15-percent of the points resulting from the automated filtering techniques are possibly misclassified and require final editing. Merrick-Surdex JV has several manual edit tools which allow us to re-classify these features to the appropriate class. All the data within the project extent is viewed by an operator to ensure all artifacts are removed, and that we are meeting project specifications. Bridges are classified to Class 17. Once it is deemed the best ground solution is met, a final auto-filter is run to classify all points to meet the ASPRS LAS 1.4 specification. During this process, all non-ground and non-bridge points are classified to Class 1 (Unclassified), and following this is a height-from-surface auto-filter is run to re-class noise to Classes 7 and 18.

The following table represents the ASPRS LAS 1.4 classifications used:

- Class 0 = Never classified (Noise Withheld Flags set)
- Class 1 = Unclassified (Noise Withheld Flags set)
- Class 2 = Bare-earth Ground (Note: Model keypoints bitflagged)
- Class 2 MKP bit-flag = Model Keypoint bitflag
- Class 7 = Low point (noise)
- Class 9 = Water
- Class 10 = Ignored ground (near a breakline)
- Class 17 = Bridge decks
- Class 18 = High noise

HYDRO-FLATTENING BREAKLINES

Hydro- flattening breaklines are captured per the USGS National Geospatial Program Lidar Base Specification Version 1.2. Final hydro-flattened breaklines features are appropriately turned into polygons (flat elevations) and polylines (decreasing by elevation) and are used to reclassify ground points in water to Water (Class 9). The lidar points around the breaklines are reclassified to Ignored Ground (Class 10) based on predetermined buffer.

Linear hydrographic features

To collect hydrographic features, Merrick-Surdex JV uses a methodology that directly interacts with the lidar bare-earth data to collect drainage breaklines. To determine the alignment of a drainageway, the technician first views the area as a TIN of bare-earth points using a color ramp to depict varying elevations. In areas of extremely flat terrain, the technician may need to determine the direction of flow based on measuring lidar bare-earth points at each end of the drain. The operator will then use the color ramped TIN to digitize the drainage in 2D with the elevation being attributed directly from the bare-earth LAS data. MARS® software has the capability of “flipping” views between the elevationTIN, Intensity and imagery, as necessary, to further assist in the determination of the drainage. All drainage breaklines are collected in a downhill direction. For each point collected, the software uses a five-foot

(5') search radius to identify the lowest point within that proximity. Within each radius, if a bare-earth point is not found that is lower than the previous point, the elevation for subsequent point remains the same as the previous point. This forces the drain to always flow in a downhill direction. Waterbodies that are embedded along a drainageway are validated to ensure consistency with the downhill direction of flow.

This methodology may differ from those of other vendors in that Merrick-Surdex JV relies on the bare-earth data to attribute breakline elevations. As a result of our methodology, there is no mismatch between lidar bare-earth data and breaklines that might otherwise be collected in stereo 3D as a separate process. This is particularly important in densely vegetated areas where breaklines collected in 3D from imagery will most likely not match (either horizontally or vertically), the more reliable lidar bare-earth data.

Merrick-Surdex JV has the capability of "draping" 2D breaklines to a bare-earth elevation model to attribute the "z" as opposed to the forced downhill attribution methodology described above. However, the problem with this process is the "pooling "effect or depressions along the drainageway caused by a lack of consistent penetration in densely vegetated areas.

Criteria of linear hydrographic breaklines are as follows:

- Linear hydrographic features (e.g., visible streams, rivers, shorelines, canals, etc.) greater than one hundred feet (100') wide will be captured as a double-lined polygon
  - linear hydrographic features must be flat and level bank-to-bank (perpendicular to the apparent flow centerline) with gradient following the immediately surrounding terrain
  - water surface edge must be at or just below the immediately surrounding terrain
  - streams should break at road crossings (e.g., culverts), and streams and rivers should not break at bridges

Waterbodies

Waterbodies are digitized from the color ramped TIN, similar to the process described above. The elevation attribute is determined as the technitian collects the hydro feature by using the lowest bare-earth point within the polygon.

Criteria of waterbody breaklines are as follows:

- Waterbodies (e.g., lakes, ponds, reservoirs) greater than two (2) acres in size are surrounded by a water breakline (i.e., closed polygon)
  - waterbodies must be flat and level with a single elevation for every bank vertex
  - water surface edge must be at or just below the immediately surrounding terrain
  - long impoundments, such as reservoirs or inlets, whose water surface elevations drop when moving downstream should be treated as rivers

DIGITAL ELEVATION MODEL (DEM) TILED AND COUNTYWIDE

Merrick-Surdex JV exports the hydro-flattening breakline enforced Class 2 (ground) lidar points to a one-meter (1m) cell size, 32-bit ERDAS Imagine (IMG) format using MARS®, the DEMs are exported to the project tiling scheme. Projection information is applied that reflects the project requirements.

FIRST RETURN DIGITAL SURFACE MODEL (DSM) TILED AND COUNTYWIDE

Merrick-Surdex JV exports all return lidar points, except noise, to a one meter (1m) cell size, 32-bit ERDAS Imagine (IMG) format using MARS®, the DSMs are exported to the project tiling scheme. Projection information is applied that reflects the project requirements.

INTENSITY IMAGES TILED AND COUNTYWIDE

Merrick-Surdex JV exports all lidar points to a one-meter (1m) cell size 16-bit ERDAS Imagine (IMG) format using MARS®, the intensity images are exported to the project tiling scheme. Projection information is applied that reflects the project requirements.

HILLSHADES (Countywide)

Merrick-Surdex JV converts the DEM and DSM countywide images to a hillshade format using Esri default parameters.

CONTOURS (Countywide)

Merrick-Surdex JV exports the hydro-flattening breakline enforced Class 2 (ground) lidar points to a one meter two pass filter gridded surface using MARS®. This is used to generate two-foot interval contour tile based Esri shapefiles which are merged into a countywide final geodatabase feature class.

METADATA

FGDC-compliant metadata was created at the project level, in addition to countywide level for deliverables.

Project wide:

USGS_HatCreek_WhiteRiver_Classified_LAS_tile.xml
USGS_HatCreek_WhiteRiver_DEM_tile.xml
USGS_HatCreek_WhiteRiver_DSM_tile.xml
USGS_HatCreek_WhiteRiver_Hydro_Line.xml
USGS_HatCreek_WhiteRiver_Hydro_Poly.xml
USGS_HatCreek_WhiteRiver_Intensity_tile.xml
USGS_HatCreek_WhiteRiver_Project.xml

Raw Swaths by mission:

RawSwath_YYYMMSS_mision.xml

County wide (embedded within features):

DEM
DEM Hillshade
DSM
DSM Hillshade
Intensity
Contours_2ft
Breaklines

CONTROL

Esri shapefile are generated for calibration control and for lidar checkpoints project wide and by area. The areas are Antelope_Holt, BoxButte_Dawes_Sioux and Cherry_KeyaPaha_Boyd.

SHAPEFILES

Esri shapefile are provided for 100-meter Buffered Project Area (BPA), Defined Project Area (DPA), project tiles (1,000 x 1,000 meters).

DELIVERABLES

Deliverable products are formatted to the USGS desired folder structure.
All countywide deliverables include any previous NRCS Nebraska Lidar projects (or those that were partial counties). Countywide deliverables for Sioux, Dawes and Box Butte Counties will all be referenced to UTM Zone 13 North. Countywide deliverables for Cherry, Keya Paha, Boyd, Holt and Antelope Counties will all be referenced to UTM Zone 14 North.

Below is a list of the project deliverables:

Raw LiDAR point cloud

- Fully compliant ASPRS LAS 1.4, point record format 6, 7, 8, 9 or 10
- Calibrated
- By swath
- Intensity values normalized to 16-bit
- FGDC-compliant metadata by mission

Classified LiDAR point cloud

- Fully compliant ASPRS LAS 1.4, point record format 6, 7, 8, 9 or 10
- By tile
- Intensity values normalized to 16-bit
- FGDC-compliant metadata

Bare-earth DEM

- 1m cell size 32-bit DEM development in ERDAS IMG format
- Bare-earth (hydro-flattened)
- Culverts will not be removed from the DEMs
- Bridges will be removed from the DEMs
- By tile and by county
- FGDC-compliant metadata

First Return Digital Surface Model (DSM)

- 1m cell size 32-bit DEM development in ERDAS IMG format
- By tile and by county
- FGDC-compliant metadata

Hillshades

- 1m cell size in ERDAS IMG format
- By county
- FGDC-compliant metadata

Hydro-flattened breaklines

- Project-wide Esri feature class(es) for insertion into file geodatabase
- FGDC-compliant metadata

Intensity Images

- 1m cell size in ERDAS IMG format
- By tile and by county
- FGDC-compliant metadata

Two-foot (2') contours

- Esri feature class(es) for insertion into file geodatabase
- By county
- FGDC-compliant metadata

Control

- Survey report
- Esri shapefile format
- FGDC-compliant metadata

FGDC-compliant metadata (project level)

Detailed LiDAR Mapping / Project Report