

Ground Control Report

Wisconsin WROC – 3DEP | Sawyer County LiDAR 2017

1.1 Ground Control Design and Methodology

The ground control network and design used for the Sawyer County LiDAR acquisition was made up of calibration points, GPS base stations, NGS base stations, and independent check points from the vertical accuracy ground control survey. This report will focus on the LiDAR calibration points that were collected at 15 locations in and around the Sawyer County project area. The control points are used for QC checks and calibration of the raw point cloud and for additional vertical checks against the processed bare earth surface.

The ground control calibration survey was done in Wisconsin County Coordinate System-Sawyer County, NAD83 (2011), US survey feet; NAVD88 (Geoid 12B), US survey feet. The field work was conducted by Ayres Associates surveyors.

Control Summary and Methodology

Control Summary

Horizontal Datum:	NAD83 (2011)
Vertical Datum:	NAVD88 (2012), Wisconsin GEOID12B
Rectangular Coordinate System:	WISCORS – Sawyer Zone
Used NGS Control?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
List any NGS control points used:	AF9989, AG9547, AG9565, AG9575, AG9590, DN5053, DN5119, DN5221, DN7186
Summary of control checks and calibration (if applicable):	(See Field Notes for control checks on NGS monuments – No calibration was needed)
Survey Methods Used:	RTK-GPS using WISCORS Network through VRS connection were used for direct observations and to set control pairs for Robotic Total Station shots under canopy, etc
Equipment Used:	GPS Trimble R8-3 GNSS S/N 5220487835– (Ayres #72.36) Total station Trimble S 6 S/N 93410505 – (Ayres #75.53) Data Collector Trimble TSC 3 S/N RS17C22013 (Ayres #75.37)

Crew Chief Notes

<p>Set PK nails or spikes at control points used for total station measurements and for calibration points.</p> <p>Recorded appropriate: NVA (Bare Earth & Urban) and VVA (Forested, Swamp/Wetland, Tall Weed/Crop). Took (4) pictures of each point – one from each cardinal direction.</p>
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Survey Methods (continued)

All work was performed in and referenced to NAD83 (2011), NAVD 88(2012), Geoid 12B, Wisconsin State Plane Coordinate System - Wisconsin North Zone in US Survey Feet. THIS DATA WAS THEN TRANSFORMED TO WISCRS COUNTY COORDINATE SYSTEM, SAWYER ZONE

Established horizontal and vertical coordinate values on the points by a minimum of two – 90 epoch observations with separate initializations using RTK GPS and the WISCORS network. The resultant coordinates and elevations provided in the deliverables are an average of the two observations.

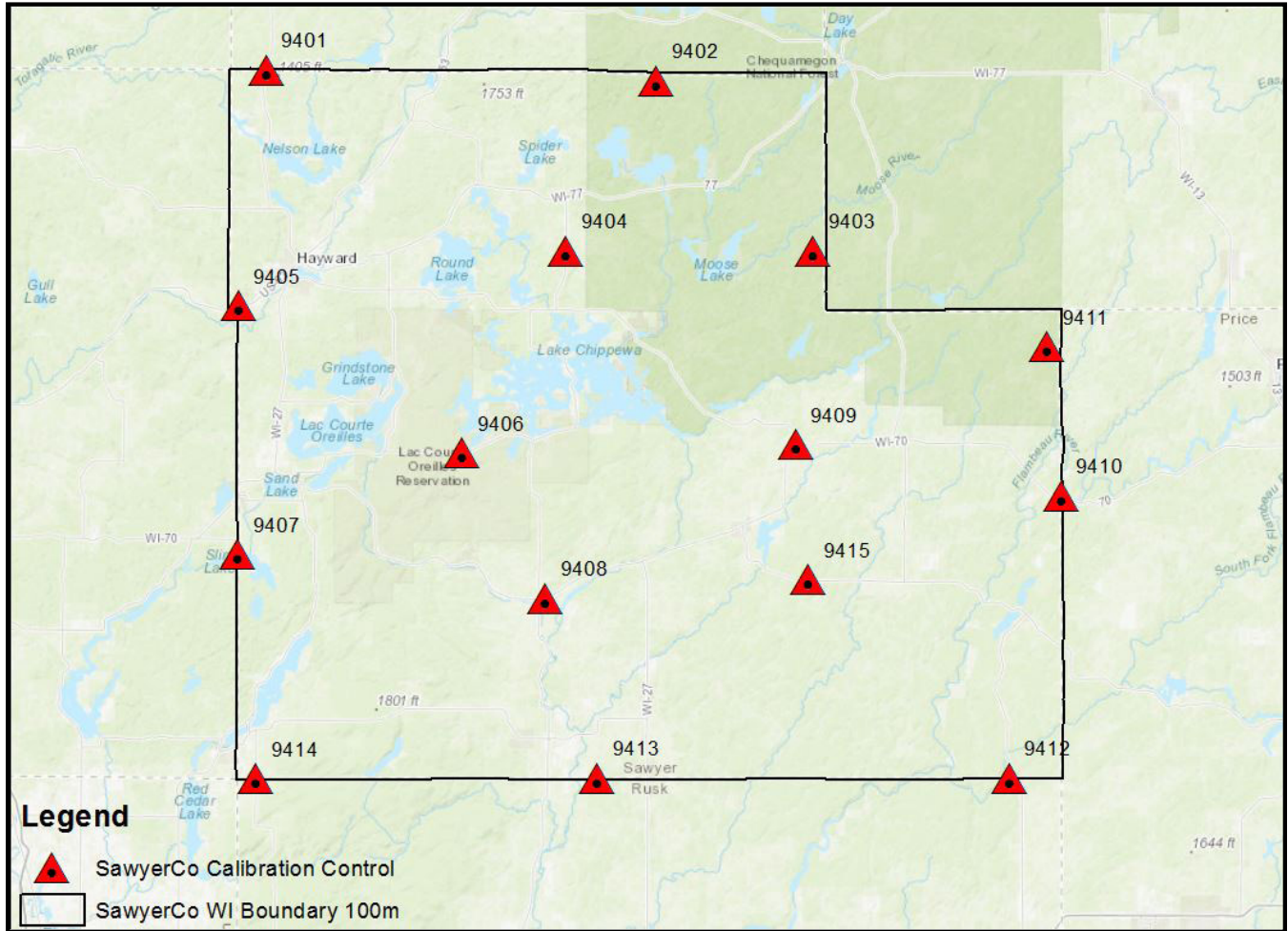
Check shots were taken on numerous NGS control points (see field notes) to verify that the values obtained are consistent with the datum/adjustment as described herein and meet the ± 3 centimeter vertical accuracy requirement at the 95% confidence level.

Points not able to be directly occupied by GPS means were measured using Total Station methods from control point pairs set utilizing GPS methods outlined above.

1.1.2 Control Layout

The locations were selected around the outer geometry of the project boundary and on major roads within the project area. This layout design is preferred when the calibration points will be used to check different areas across a large flight block. The control survey was conducted with a Trimble R-8 GPS receiver and a VRS connection with a TSC3 data collector.

1.1.2.1 Map of Sawyer County Calibration Points



1.1.3 Sawyer County LiDAR, Calibration Point Statistics

The final step in using the calibration points is to run a statistical comparison against the bare earth ground surface to confirm that the vertical accuracy is within specification. The follow results indicate that the overall RMSEz of the calibration points is 0.147'. This is a separate check as compared to the Vertical Accuracy Survey QA/QC report. These points are used in the calibration of the raw point cloud, and therefore are not an independent set of checkpoints like those used in the vertical accuracy testing.

1.1.3.1 Statistical Report for Calibration Points

NUMBER	EASTING	NORTHING	KNOWN Z	LASER Z	Dz
9401	610329.233	490024.297	1322.856	1322.769	-0.087
9402	714596.197	487226.117	1451.260	1451.054	-0.206
9403	756537.436	441759.764	1438.910	1438.900	-0.010
9404	690612.801	441760.752	1386.465	1386.166	-0.299
9405	602916.486	426980.645	1174.902	1175.013	+0.111
9406	662723.578	387672.368	1343.673	1343.787	+0.114
9407	602860.483	360693.866	1322.502	1322.486	-0.016
9408	685042.165	348785.845	1245.214	1245.242	+0.028
9409	751886.962	389911.003	1363.416	1363.473	+0.057
9410	822869.191	376275.987	1395.070	1395.217	+0.147
9411	819063.486	416149.346	1548.961	1549.262	+0.301
9412	809003.954	300861.044	1388.852	1388.705	-0.147
9413	698959.464	300826.998	1190.901	1190.963	+0.062
9414	607555.307	300710.777	1271.539	1271.535	-0.004
9415	755266.657	353773.380	1490.192	1490.057	-0.135

Average Dz -0.006
Minimum Dz -0.299
Maximum Dz +0.301
Average Magnitude 0.115
Root Mean Square 0.147
Std Deviation 0.152

1.1.4 Field Notes

CALIBRATION POINTS			
PNT	CODE	TH	LOCATION
9401	CP	2M	SOUTH END OF 1 st DASHED LINE 5/8 NO. PASSING LANE, 1035' 8/8 RABBIT HATCH RD ON STH. 27.
9402	CP	5.00	200' 5/4 E FR 203, 1800' 5/8 INTERSECTION FR 203 + FR 401
9403	CP	5.00	E OF FR 164, E OF N/8 TRAIL, 6140' N/8 FR 164 + FR 173 INTERSECTION
9404	CP	5.00	NORTH END OF FOG LINE, SEQUAD OF CTH A + MOOSE LAKE RD.

Field Notes (Continued)

PNT	CODE	TH	LOCATION	
9405	CP	500	SOUTH PI. OF ANGLED STOP BAR, SOUTH EAST QUAD OF STH 63 & KRUGER RD	60
9406	CP	5.00	WEST END OF SOUTH SOLID YELLOW LINE E OF CTH N + 25' 1/2 E EXTENDED N CTH CC	
9407	CP	500	NORTH END OF DASHED YELLOW LINE, E RANCH RD, 120' 9/16 E SISSABAGAMA	
9408	CP	2M	EAST END OF FOG LINE, NW QUAD OF STH 70 & WOODMAN AVE	

Field Notes (Continued)

PNT	CODE	TH	LOCATION
9409	CP	500	SOUTH END OF EAST SOLID YELLOW LINE ON CTH B, 40' W & STH 70
9410	CP		WEST END OF NORTH FOG LINE, NORTH EAST QUAD OF STH 70 + PRETTIE RD
9411	CP	0M	E OF FR 161, & FR 307
9412	CP	500	FOG LINE ON WEST SIDE OF CTH M @ CHANGE OF PAVEMENT

Field Notes (Continued)

PNT	CODE	TH	LOCATION
9413	CP	2M	WEST EDGE OF ASPHALT @ TAR STRIPE ON LUND RD, 2925' S/W BIRCH LAKE RD
9414	CP		NORTH END OF DASHED YELLOW LINE, E OF CTH F, 2 ND DASH S/W COUNTY LINE, 5200' S/W CEDAR AVE.
9415	CP	500 E	OF SOUTH SOLID YELLOW LINE ON CTH W, E OF TRAIL TO SOUTH, 4660' W/E TOWER RD.

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1.1.5 Field Photos



Point 9401



Point 9402



Point 9403



Point 9404



Point 9405

Field Photos (Continued)



Point 9406



Point 9407



Point 9408



Point 9409



Point 9410

Field Photos (Continued)



Point 9411



Point 9412



Point 9413



Point 9414



Point 9415