Ground Control Report

Wisconsin WROC – 3DEP | Washburn County LiDAR 2016-17

1.1 Ground Control Design and Methodology

The ground control network and design used for the Washburn 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 20 locations in and around the Washburn 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 WISCRS Washburn County, NAD83 (2011), US survey feet; NAVD88 (Geoid 12A), 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 GEOID12A
Rectangular Coordinate System:	Wisconsin Coordinate Reference System (WISCRS)-Washburn County
Used NGS Control?	☒ Yes ☐ No

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 GNSS Base and 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. ***(Survey Methods continued below)***
Equipment Used:	GPS Trimble R8-3 GNSS S/N 5220487835 – (Ayres #75.37), Base-GPS Trimble R8-3 GNSS S/N 5126468515 – (Ayres #75.23), Robotic Total Station Trimble S6 S/N 93410505 - (Ayres #75.53), Data Collector Trimble TSC3 S/N RS17C22013

Survey Methods

All work was performed in and referenced to NAD83 (2011), NAVD 88(2012), Geoid 12A, Wisconsin Coordinate Reference System (WISCRS) Washburn County in US Survey Feet.

Established horizontal and vertical coordinate values on the points by a minimum of two – 180 epoch observations with separate initializations using RTK GNSS BASE or RTK GPS and the WISCORS network. The resultant coordinates and elevations provided in the deliverables are an average of the two observations.

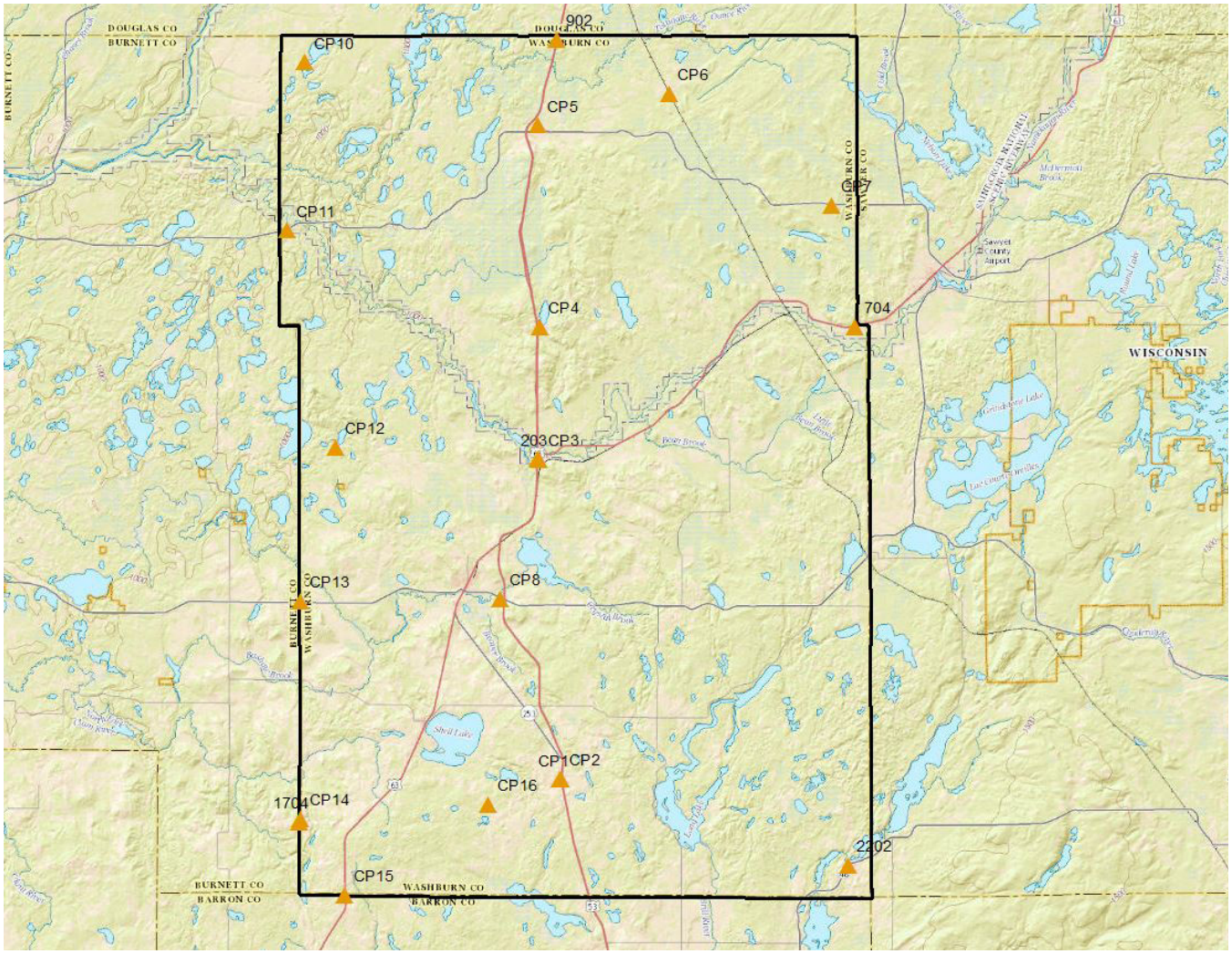
Check shots were taken on numerous NGS control points (see field notes) to verify that the values obtained are consistent with the datum/adjustment as described herein and meet the ±3 centimeter vertical accuracy requirement at the 95% confidence level.

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 Washburn County Calibration Points



1.1.3 Washburn County LiDAR, Calibration Point Statistics

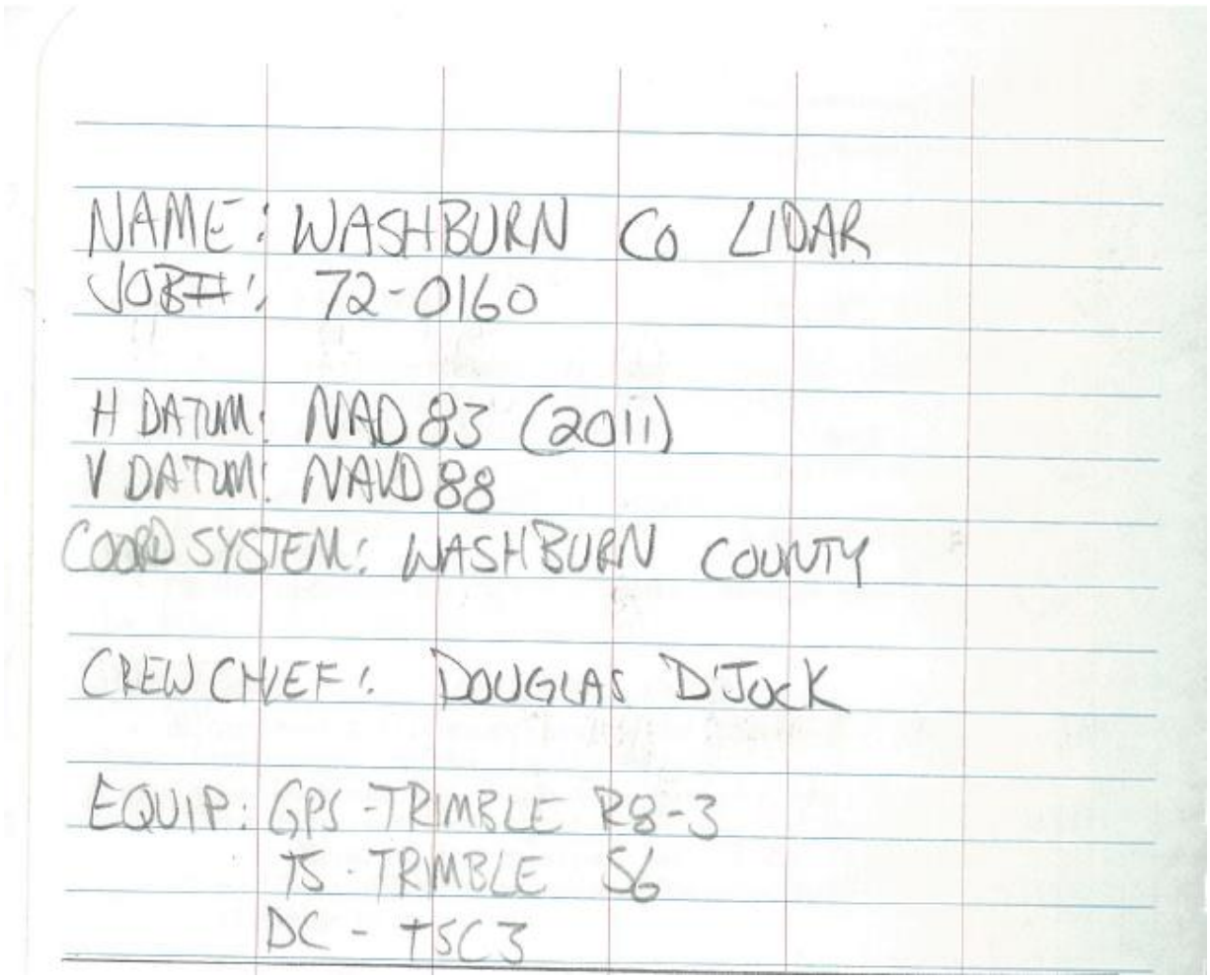
The final step in using the calibration points is to run a statistical comparison against the bare earth ground surface to confirm that the vertical accuracy is within specification. The follow results indicate that the overall RMSEz of the calibration points is 0.210'. This is a separate check as compared 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
203	756961.910	596702.810	1092.270	1092.64	+0.370
704	826986.320	625849.240	1182.240	1182.47	+0.230
902	761099.240	689129.600	1071.520	1071.64	+0.120
1704	704521.090	516713.080	1363.420	1363.46	+0.040
2202	825312.800	507167.820	1264.630	1264.88	+0.250
CP1	761809.140	526155.800	1288.430	1288.3	-0.130
CP2	762041.010	526165.550	1290.030	1290.07	+0.040
CP3	757261.450	596624.360	1088.540	1088.88	+0.340
CP4	757374.720	625844.320	1112.300	1112.26	-0.040
CP5	756984.930	670227.130	1050.720	1050.62	-0.100
CP6	785879.810	677212.310	1091.410	1091.55	+0.140
CP7	821718.840	652548.090	1214.420	1214.71	+0.290
CP8	748814.110	565926.240	1098.320	1098.08	-0.240
CP10	705716.110	684061.660	1025.720	1025.68	-0.040
CP11	701819.280	647112.110	949.820	949.67	-0.150
CP12	712436.730	599195.180	1020.810	1020.77	-0.040
CP13	704596.660	565446.070	1122.710	1122.52	-0.190
CP14	704585.930	517399.240	1342.750	1342.44	-0.310
CP15	714421.190	500622.700	1364.740	1364.51	-0.230
CP16	746126.040	520677.230	1281.580	1281.27	-0.310

Average Dz	+0.002 ft
Minimum Dz	-0.310 ft
Maximum Dz	+0.370 ft
Average Magnitude	0.180 ft
Root Mean Square	0.210 ft
Std Deviation	0.265 ft

1.1.4 Field Notes

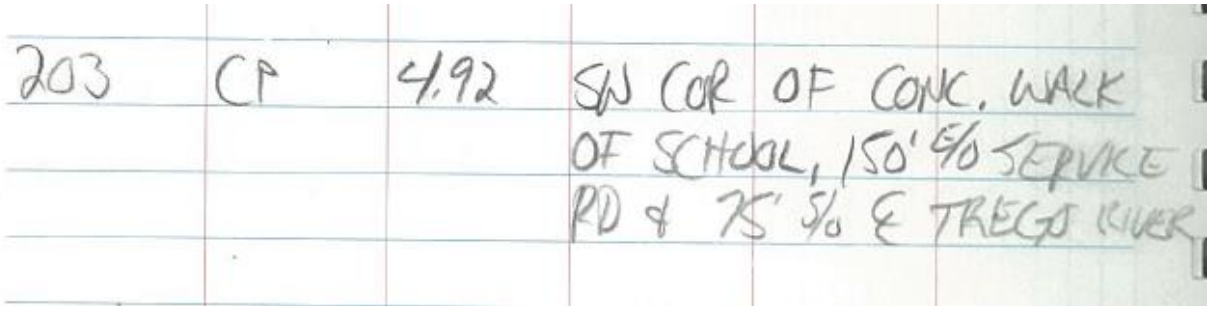


NAME: WASHBURN Co LIDAR
JOB#: 72-0160

H DATUM: NAD 83 (2011)
V DATUM: NAVD 88
COORD SYSTEM: WASHBURN COUNTY

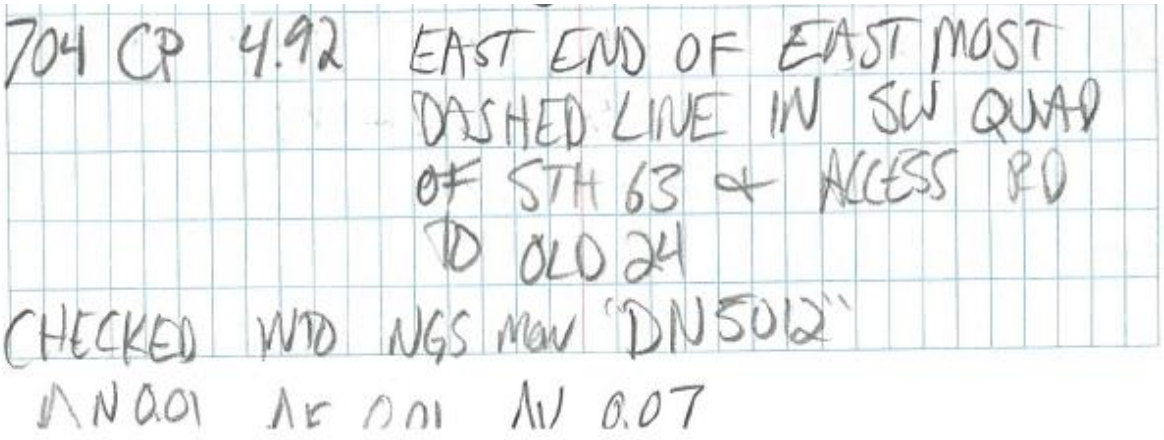
CREW CHIEF: DOUGLAS D'JOCK

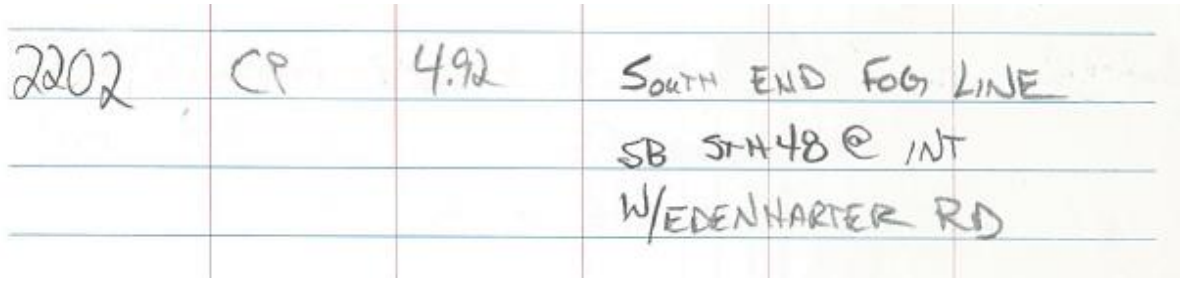
EQUIP: GPS - TRIMBLE R8-3
TS - TRIMBLE S6
DC - TSC3



203	CP	4.92	SW COR OF CONC. WALK OF SCHOOL, 150' S/O SERVICE RD & 75' S/O E TREGO RIVER

Field Notes (Continued)





(Field notes for the remaining calibration control points are not available.)