Ground Control Report

Wisconsin WROC – 3DEP | Jefferson County Lidar 2019

1.1 Ground Control Design and Methodology

The ground control network and design used for the Jefferson 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 17 locations in and around the Jefferson 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 State Plane Coordinate, South Zone, NAD83 (2011), US survey feet; NAVD88 (Geoid 12B), US survey feet. The field work was conducted by Ayres surveyors. All field work was completed between April 30, 2019, and May 2, 2019.

Control Summary and Methodology

Control Summary

Horizontal Datum:	State Plane Coordinate NAD83(2011), South Zone
Vertical Datum:	NAVD88 (2012), Wisconsin GEOID12A
Rectangular Coordinate System:	State Plane Coordinate NAD83(2011), South Zone
Used NGS Control?	☒ Yes ☐ No
List any NGS control points used:	DG3890, DG4981, DF9608, DF9620, DF9993, DF9997
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.
Equipment Used:	GPS Trimble R10 74.02 Data Collector Trimble TSC 3

Survey Methods (continued)

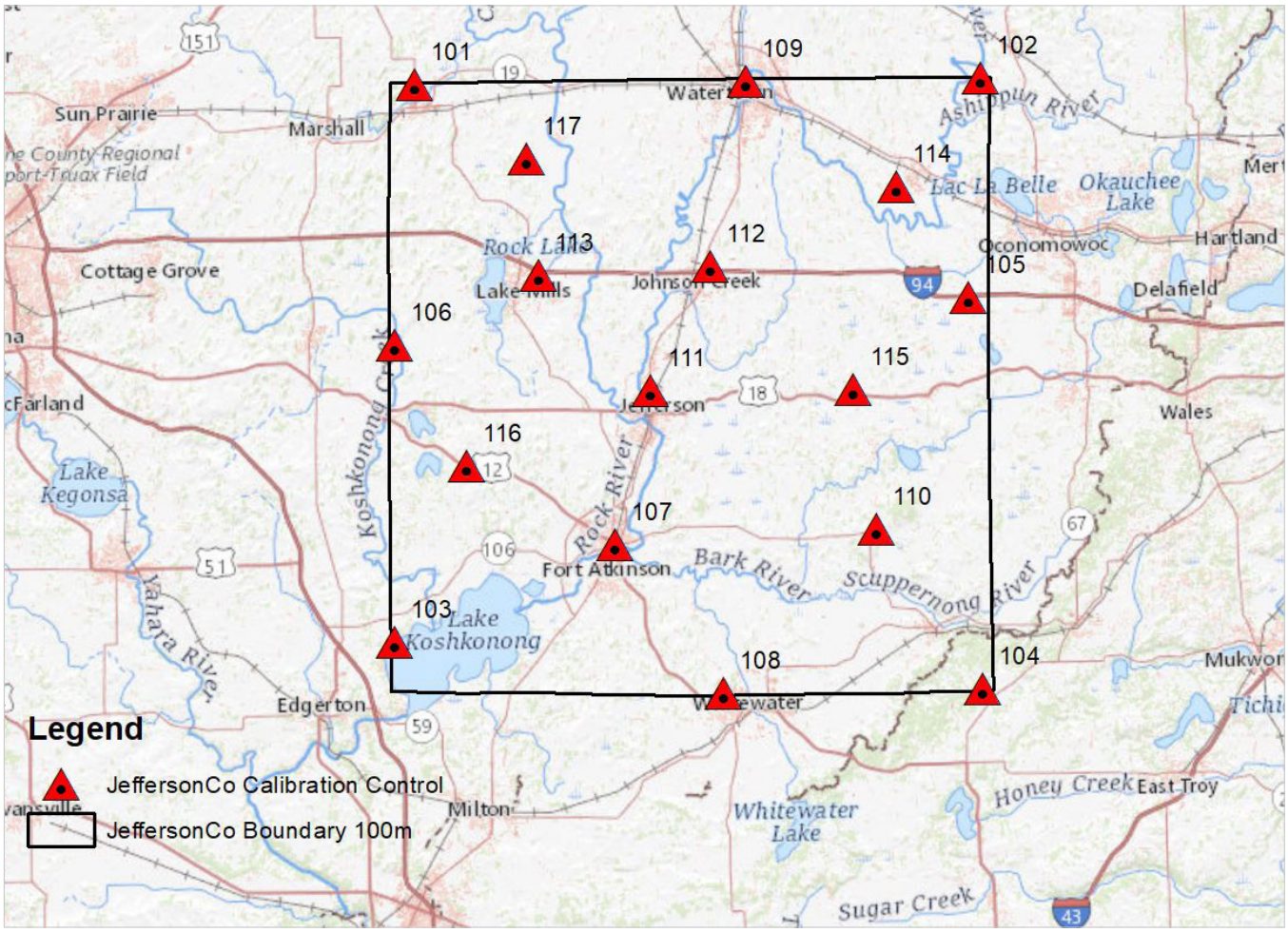
Established horizontal and vertical coordinate values on the points by a minimum of two – 180 epoch observations with separate initializations using RTK GPS and the WISCORS network. The resultant coordinates and elevations provided in the deliverables are an average of the two observations.

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.

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 Jefferson County Calibration Points



1.1.3 Jefferson 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 following results indicate that the overall RMSEz of the calibration points is 0.089'. 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
101	2237717.436	438155.400	899.958	900.000	0.042
102	2357104.231	439364.794	851.955	851.950	-0.005
103	2233397.683	320451.369	807.359	807.400	0.041
104	2357619.709	310580.683	963.669	963.700	0.031
105	2354505.404	393055.407	850.144	850.040	-0.104
106	2233367.854	383147.437	867.069	867.060	-0.009
107	2280009.712	341117.014	791.078	791.120	0.042
108	2302904.167	309764.431	864.001	864.180	0.179
109	2307631.296	438797.777	844.148	844.120	-0.028
110	2335126.666	344230.298	845.930	846.030	0.100
111	2287567.768	373502.378	819.865	819.820	-0.045
112	2300081.550	399708.529	861.781	861.750	-0.031
113	2263726.829	397955.650	829.208	829.200	-0.008
114	2339381.174	416639.975	853.326	853.510	0.184
115	2330330.547	373702.569	871.832	871.66	-0.172
116	2248571.689	357594.446	874.482	874.4	-0.082
117	2261302.467	422490.602	806.080	806.070	-0.010

Average Dz	+0.007 ft
Minimum Dz	-0.172 ft
Maximum Dz	+0.184 ft
Average Magnitude	0.065 ft
Root Mean Square	0.089 ft
Std Deviation	0.091 ft

1.1.4 Field Notes

PNT CODE RH PICS Location
101 CP 2M ✓ NE corner of invert in SW corner of intersection of STH 89 & Clarkson Rd. Inrent is in Southbound curbline

DG4981-1 Waterloo GPS (Check shot)
ΔN: -0.034' ΔE: -0.017' ΔV: -0.012'

102 CP 2M ✓ Very corner of tar NW corner of driveway, 12.4' S. of CL

103 CP 2M ✓ SW corner of concrete parking pad of W9667 Lake Dr.

DF9997 Busseyville GPS (Dual 180°)

104 CP 2M ✓ Eastern tip of driveway where it meets Young Rd. (W5001 Young Rd.)

DF9993-1 CK on Palmyra GPS (15 sec)
ΔN: 0.001' ΔE: -0.004' ΔV: 0.002'

PNT CODE RH PICS Location
105 CP 2M ✓ Junction of fogline & stopline at end of I-94E offramp Willow Glenn Rd. turning south.

DF9620 Sullivan N GPS (Dual 180°)
*NGS Data Sheet coordinates off by 6.5' East & 1.5' South
ΔN: 0.002' ΔE: 0.002' ΔV: 0.025'

106 CP 2M ✓ NE corner of concrete driveway of W9655 E. Main St.

107 CP 2M ✓ Manhole in sidewalk on NE corner of intersection of Sherman Ave & N. Main St. 1.66' from back of curb of W. Bound Sherman Ave. 10.05' E. of fire hydrant

108 CP 2M ✓ Manhole in center of Walton Dr at T-intersection @ Tratt St. (CTH N)

DF9608-2 CK on Ixonia N GPS
ΔN: -0.023' ΔE: 0.046 ΔV: 0.005'

109 CP 2M ✓ Center of manhole in sidewalk SE corner of intersection Cady & Church St. 36.1' south of CL of Cady St.

110 CP 2M ✓ Crosspoint of CTH F centerline & tar-line approx. 147' from Stop sign.

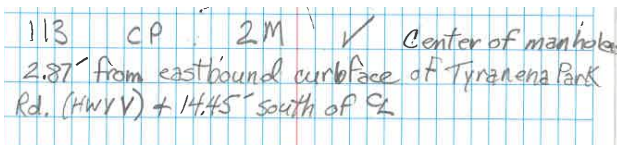
DF9993 - Palmyra GPS (Dual 180°)
ΔN: 0.044' ΔE: 0.031' ΔV: Cut 0.009'

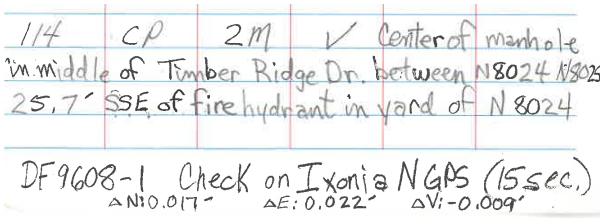
111 CP 2M ✓ Manhole; Center of Maple Grove Blvd @ intersection @ John Michael Dr just east of intersection,

DG3890 Oakland E GPS (Dual 180°)
ΔN: 0.005' ΔE: 0.007' ΔV: 0.008'

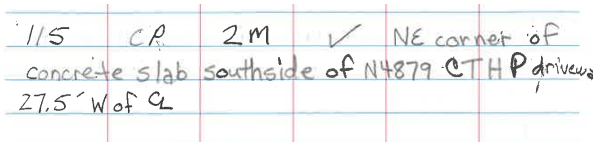
112 CP 2M ✓ Manhole at intersection of Linmar Ln & Glover Ln (Westbound lane of Linmar Ln.)

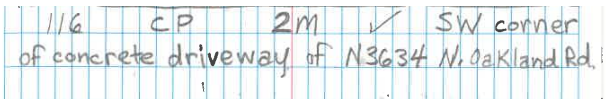
1.1.4 Field Notes

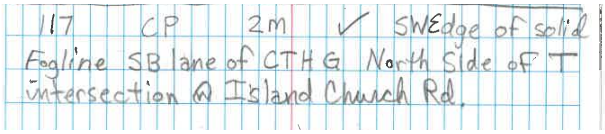

113 CP 2M ✓ Center of manhole 2.87' from eastbound curbface of Tyranena Park Rd. (HWY V) & 14.45' south of ℄


114 CP 2M ✓ Center of manhole in middle of Timber Ridge Dr. between N8024 & N8025 25.7' SSE of fire hydrant in yard of N8024

DF9608-1 Check on Ixonia NGPS (15sec.)
ΔN: 0.017' ΔE: 0.022' ΔV: -0.009'


115 CP 2M ✓ NE corner of concrete slab southside of N4879 CTH P driveway 27.5' W of ℄


116 CP 2M ✓ SW corner of concrete driveway of N3634 N. Oakland Rd.


117 CP 2M ✓ SW Edge of solid Eogline SB lane of CTH G North side of T intersection @ Island Church Rd.

1.1.5 Field Photos

Point 101

Point 102

Point 103

Point 104

1.1.5 Field Photos (Continued)

Point 105

Point 106

Point 107

Point 108

1.1.5 Field Photos (Continued)

Point 109

Point 110

Point 111

Point 112

1.1.5 Field Photos

Point 113

Point 114

Point 115

Point 116

1.1.5 Field Photos

Point 117