

# Ground Control Report

## Wisconsin WROC - 3DEP | Buffalo County LiDAR 2016-17

### 1.1 Ground Control Design and Methodology

The ground control network and design used for the Buffalo 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 11 locations in and around the Buffalo 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 Buffalo 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)-Buffalo County
Used NGS Control?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> 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. <b>(Survey Methods continued below)</b>
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) Buffalo 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.

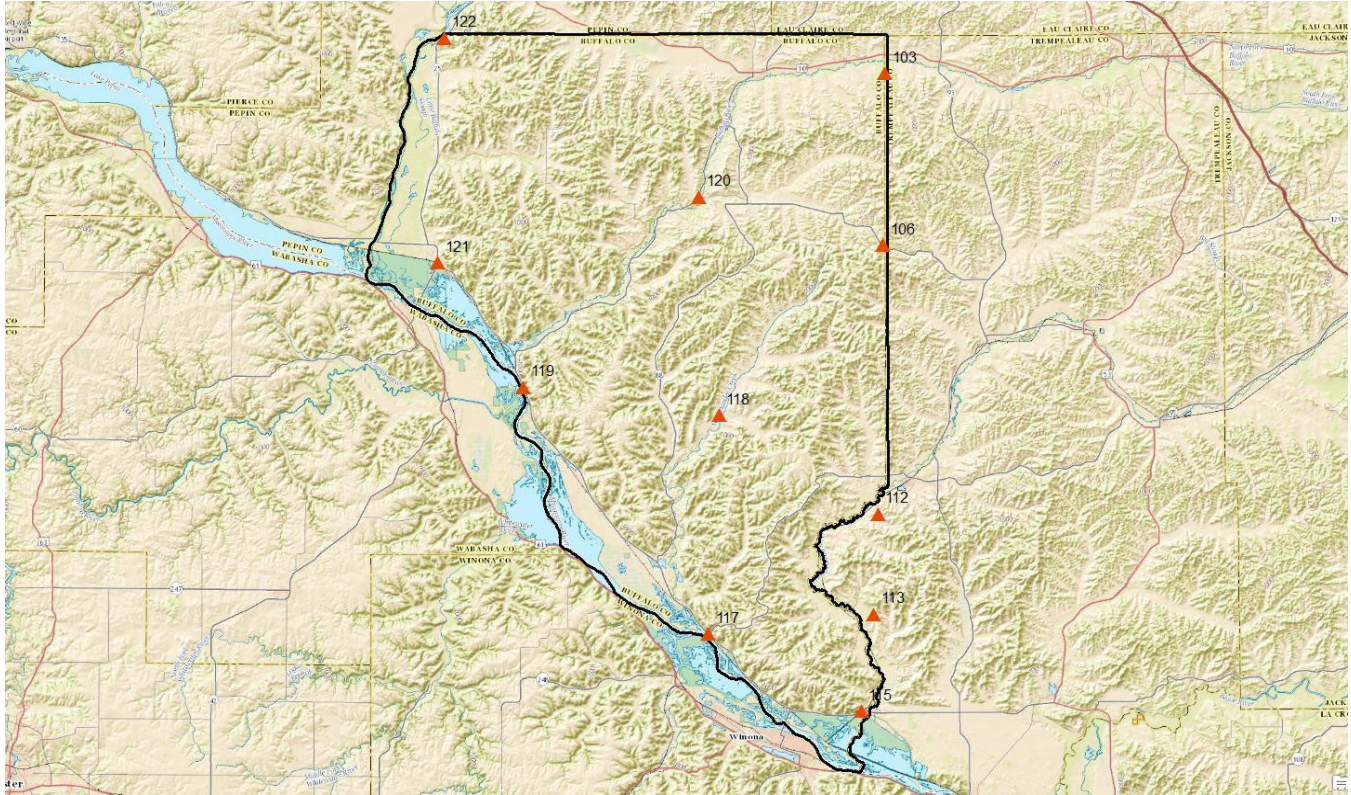
Check shots were taken on numerous NGS control points (see field notes) to verify that the values obtained are consistent with the datum/adjustment as described herein and meet the  $\pm 3$  centimeter vertical accuracy requirement at the 95% confidence level.

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 Buffalo County Calibration Points



### 1.1.3 Buffalo 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 0.159'. 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
118	598657.126	299032.378	771.022	771.23	0.208
117	595622.58	237069.619	662.492	662.69	0.198
122	521479.143	405977.284	736.957	737.11	0.153
121	519755.536	342287.74	690.012	690.1	0.088
106	644547.533	347225.665	957.482	957.56	0.078
112	643216.769	271082.179	881.391	881.4	0.009
119	543778.075	307007.367	680.954	680.94	-0.014
113	641955.615	242691.643	745.785	745.72	-0.065
120	592970.706	360860.413	743.187	743.04	-0.147
103	644916.874	395879.665	893.594	893.41	-0.184
115	638490.729	215210.058	667.754	667.44	-0.314

**Average Dz**                    +0.001 ft  
**Minimum Dz**                   -0.314 ft  
**Maximum Dz**                  +0.208 ft  
**Average Magnitude**        0.133 ft  
**Root Mean Square**         0.159 ft



1.1.4 Field Notes

PID Point # 119

checked into NGS monument "Z 125"

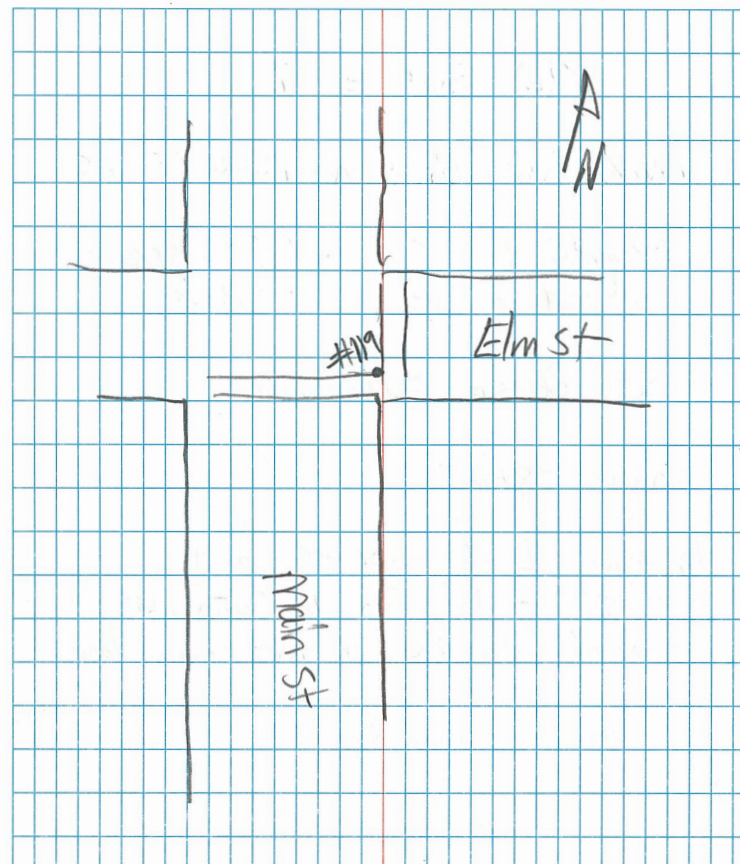
occupation: 3 min - (2) 90 second  
occupations with Re-Initialization

Set - Berasten Survey Nail

Surface: Asphalt

location: South East Quad of Main St  
and Elm St in intersection of  
North and East Crosswalk Lines.

Performed One Point vertical  
and horizontal calibration to  
NGS Mon "Z 125"



Field Notes (Continued)

PID Point # 117

checked into NGS Mon "Milton S GPS"

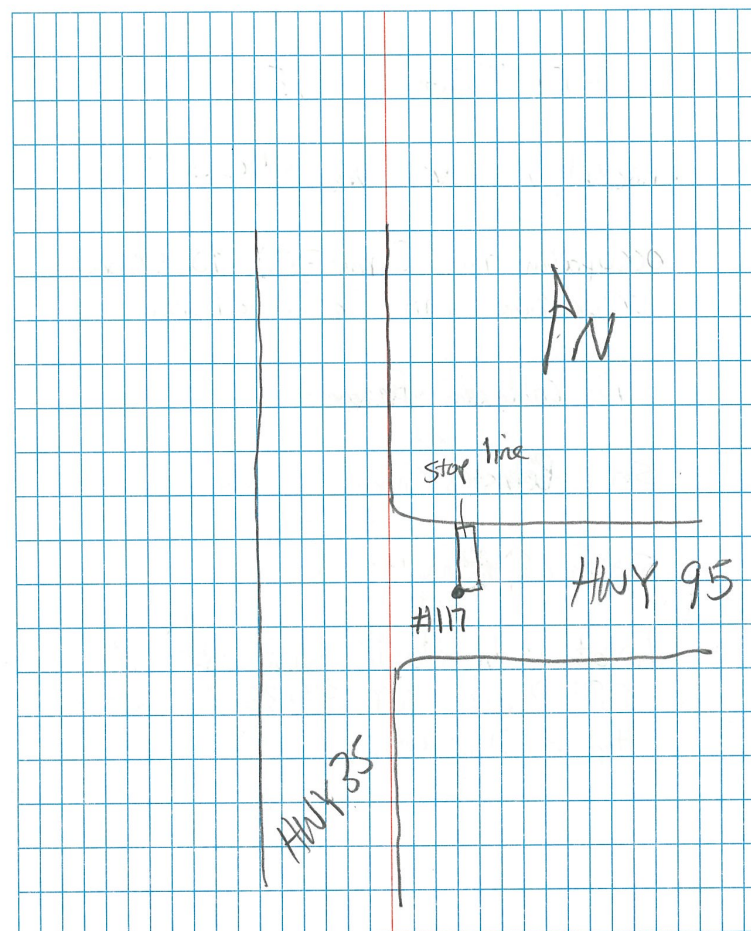
occupation time: 3 min - (2) 90 second  
occupations with Re-Initialization

Set: Bernstein Survey Nail

Surface: Asphalt

Location: E of HWY 95 on the  
East side of HWY 35, in South West  
corner of stop line in west bound lane

No Calibration Required



Field Notes (Continued)

PID Point # 115

checked into NGS Mon "4C51"

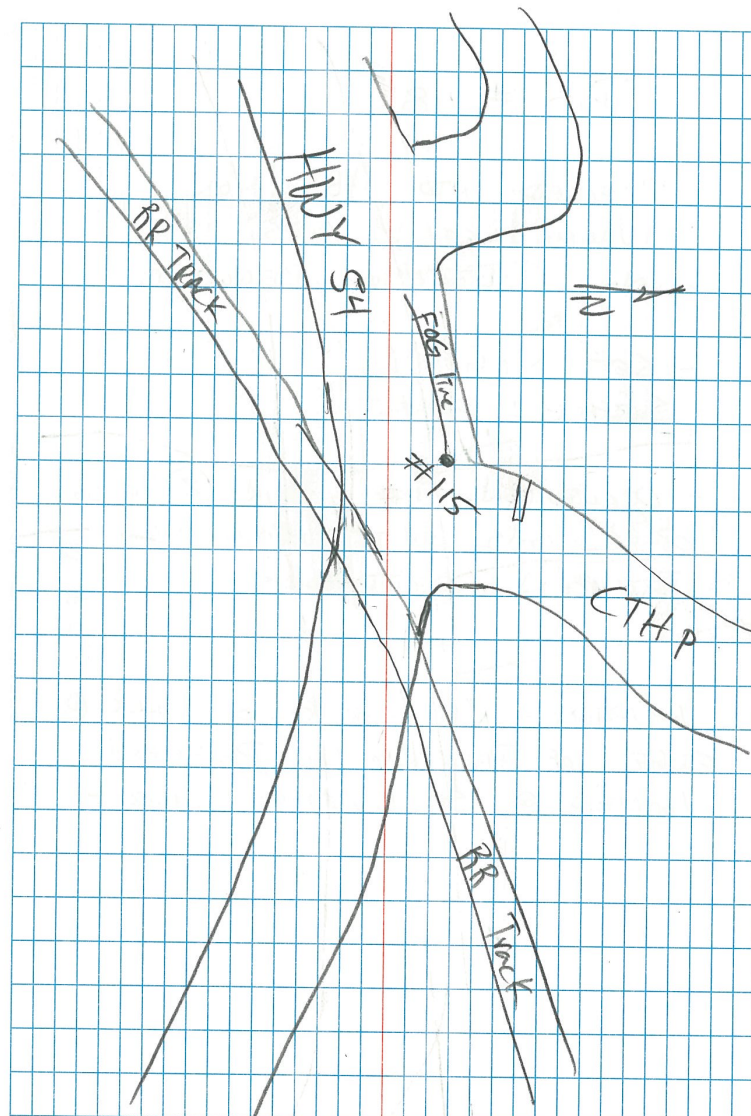
occupation time: 3 min - (2) 90 second  
occupations with Re-Initialization

No Calibration Required

Set: Bernstein Surveying Nail

Surface: Asphalt

Location: In North West Quad of  
CTH P and HWY 54/35. in East  
tip of fog line.





Field Notes (Continued)

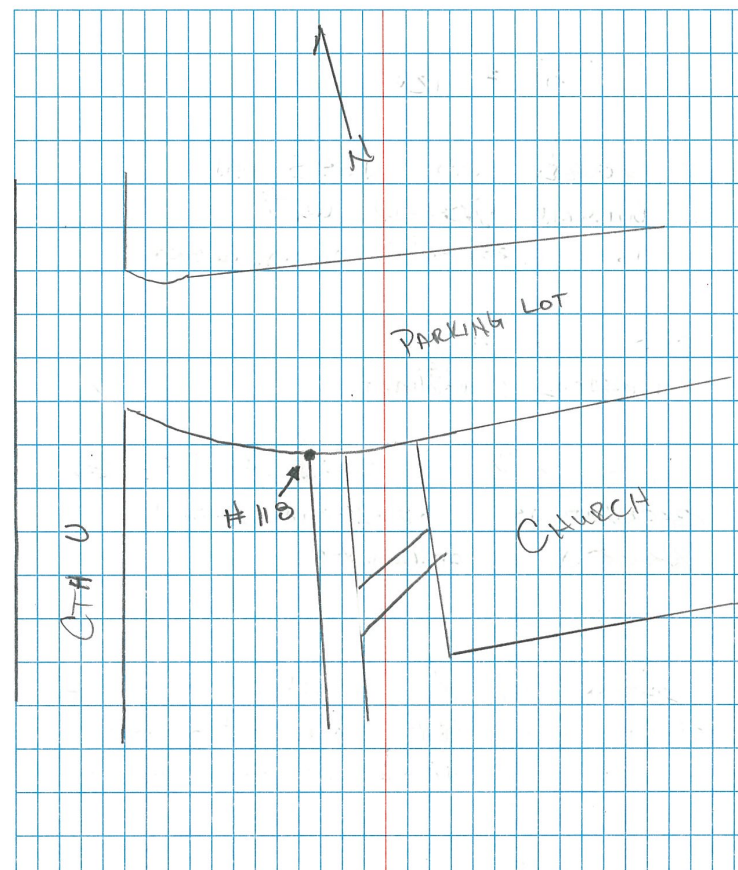
PID # 118

- CHECKED INTO NGS MON  
" WAMMADEE W GPS "
- NO CALIBRATION REQUIRED

- SET MAG NAIL
- SURFACE: ASPHALT

- OCCUPATION TIME - 3MIN - (2) 90 SEC  
OBSERVATIONS W/ RE-INITIALIZATION  
BETWEEN OCCUPATIONS

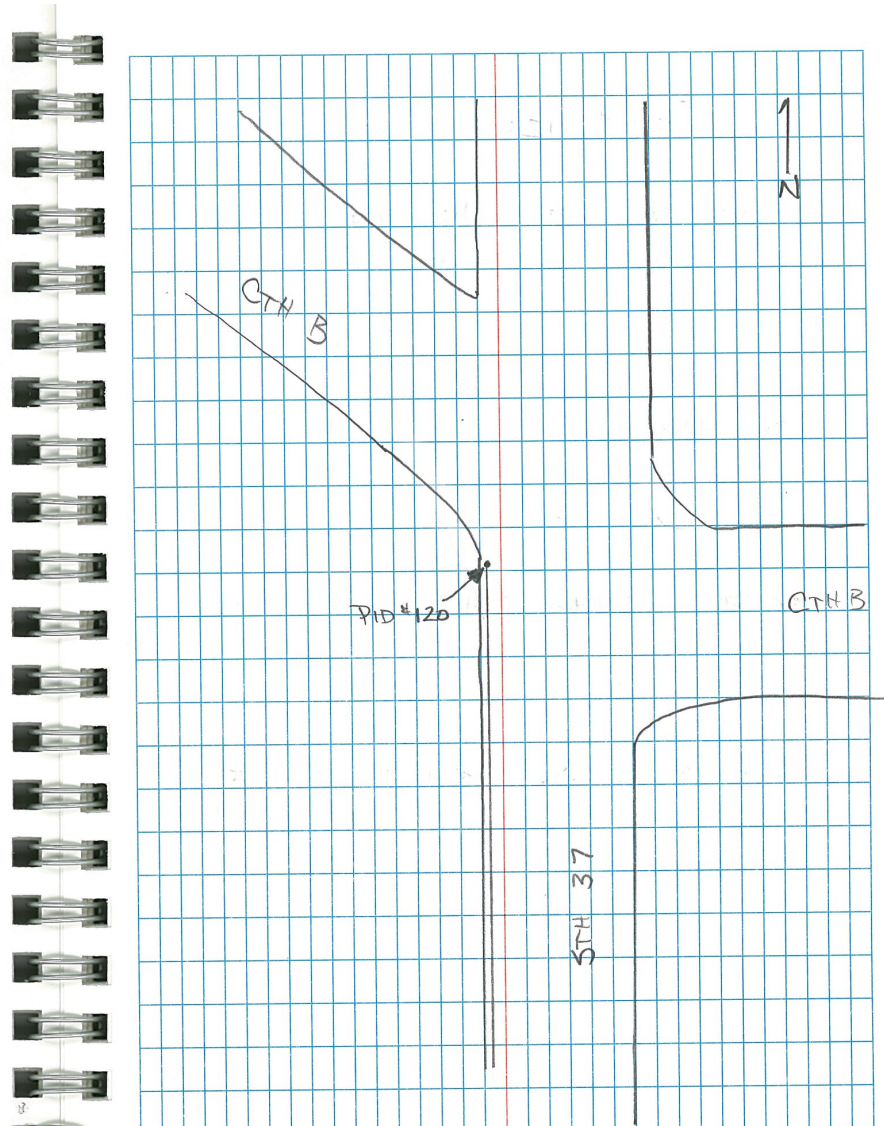
LOCATION - NW CORNER OF WALK @  
EDGE OF PARKING LOT PAVEMENT.  
LOCATED @ ST BONIFACE CHURCH



Field Notes (Continued)

PID # 120

- CHECKED INTO NGS MON "GILMAN VALLEY GPS"
- NO CALIBRATION REQUIRED
- SET MAG NAIL
- SURFACE: ASPHALT
- OCCUPATION TIME: 3 MIN - (Z) 90 SEC OBSERVATIONS W/RE-INITIALIZATION BETWEEN OBSERVATIONS
- LOCATION: MAG NAIL @ NORTH END OF FOG LINE @ SW QUAD 5TH 37<sup>E</sup> CTH B





Field Notes (Continued)

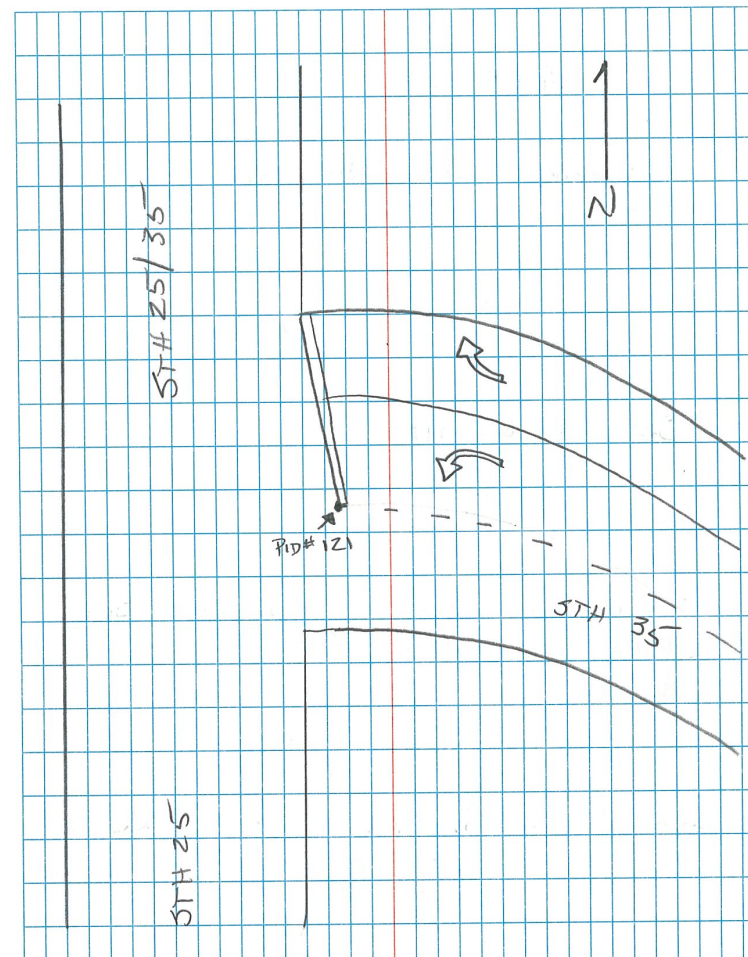
PID# 121

- CHECKED INTO NGS MON "NELSON W GPS"

- SET MAG NAIL  
- SURFACE: ASPHALT

- OCCUPATION TIME: 3 MIN - (2) 90 SEC.  
OBSERVATIONS W/RE-INITIALIZATION BETWEEN OCCUPATIONS

LOCATION: @ SW CORNER OF "STOP" STRIDE @ INTERSECTION OF 5TH 35<sup>E</sup> & 5TH 25<sup>W</sup> IN THE VILLAGE OF NELSON



Field Notes (Continued)

PID # 122

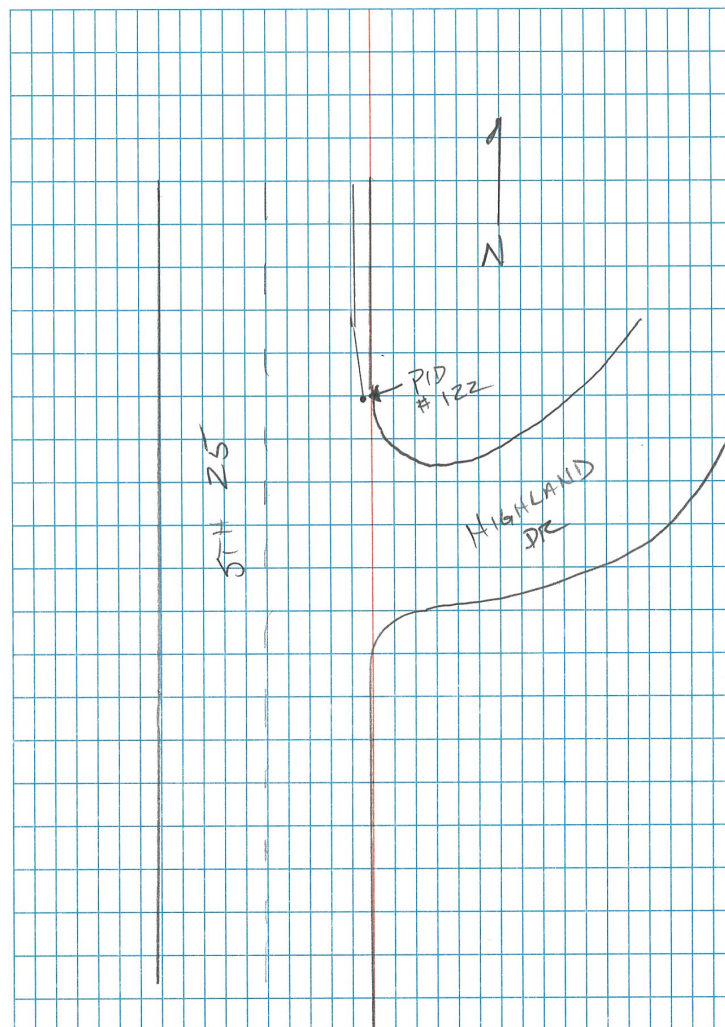
- CHECKED INTO NGS MON  
"MAXVILLE N GPS"

- SET MAG NAIL

- SURFACE: ASPHALT

- OCCUPATION TIME: 3 MIN - (2) 90 SEC  
OBSERVATIONS W/RE-INITIALIZATION  
BETWEEN OBSERVATIONS

LOCATION: @ S. END OF FOG LINE 5TH  
25 @ NE QUAD 5TH 25 & HIGHLAND DR



Field Notes (Continued)

PHOTO ID POINT #103

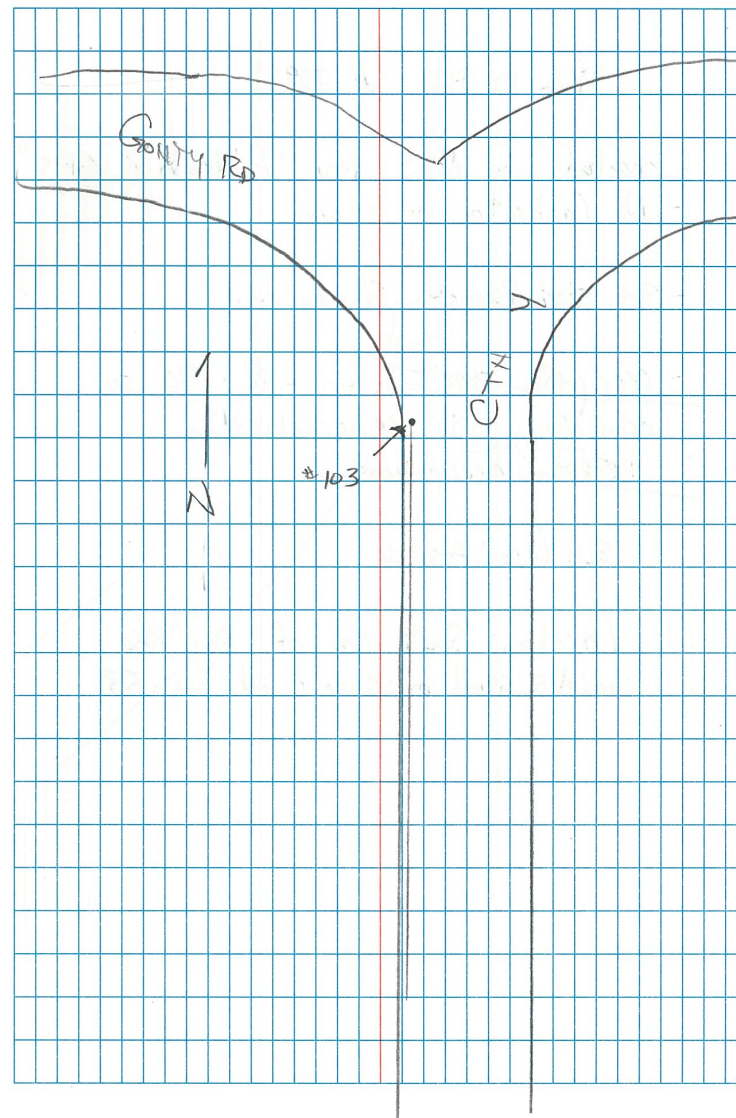
- CHECKED INTO NGS MON "ALBION NE GPS"
- NO CALIBRATION NECESSARY

- SET STEEL BERTSEN SURVEY NAIL

- OCCUPATION TIME 3 MIN - (2) 90 SEC.  
OCCUPATIONS WITH RE-INITIALIZATION  
BETWEEN OCCUPATIONS

SURFACE: ASPHALT

LOCATION: N END OF FOG LINE  
CTH 4 @ SW QUAD OF CTH 4 & GONTY RD.

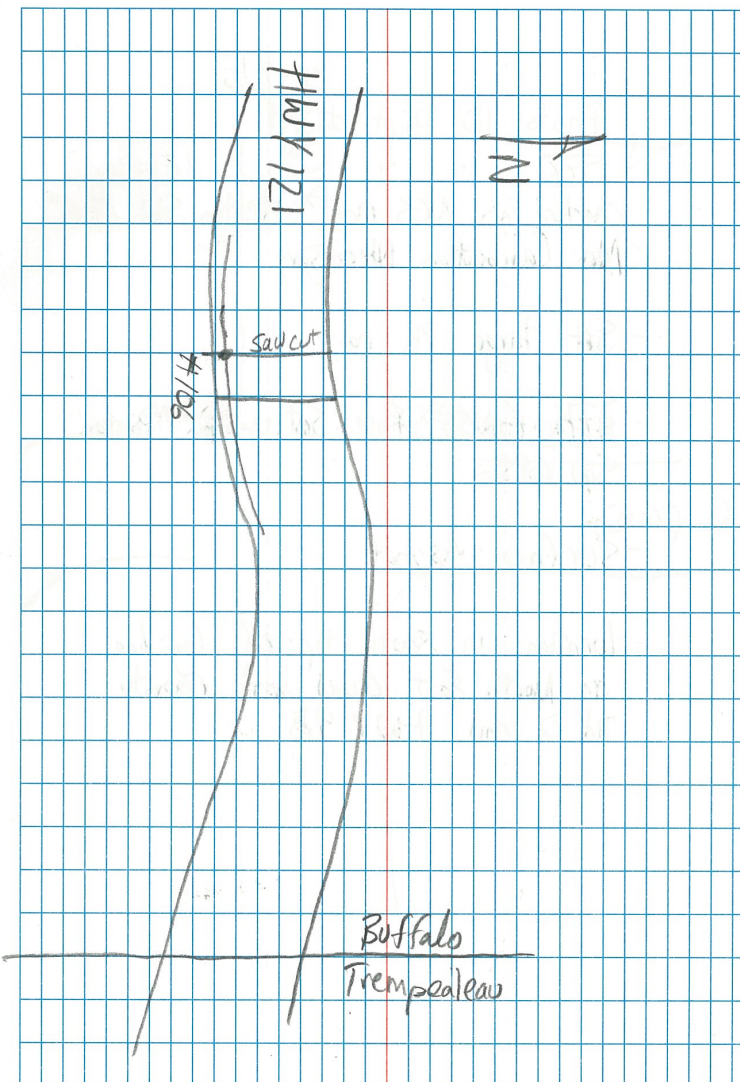




Field Notes (Continued)

Photo ID Point #106

- checked into NGS Mon "Chimney Rock South East GPS"
- No Calibration Necessary
- Set Bernstein Survey Nail
- Occupation time 3 min. (2) 90 sec occupations with Re-Initialization
- Surface: Asphalt
- location: In Curve on Hwy 121, Approximately 300 West of Buffalo/Trempealeau County line on West saw cut line of Culvert on South side of Hwy 121 on South side of fog line.
- RTK GNSS Base Setup, base station set over NGS Mon "Chimney Rock South West GPS"



Field Notes (Continued)

Photo ID Point #112

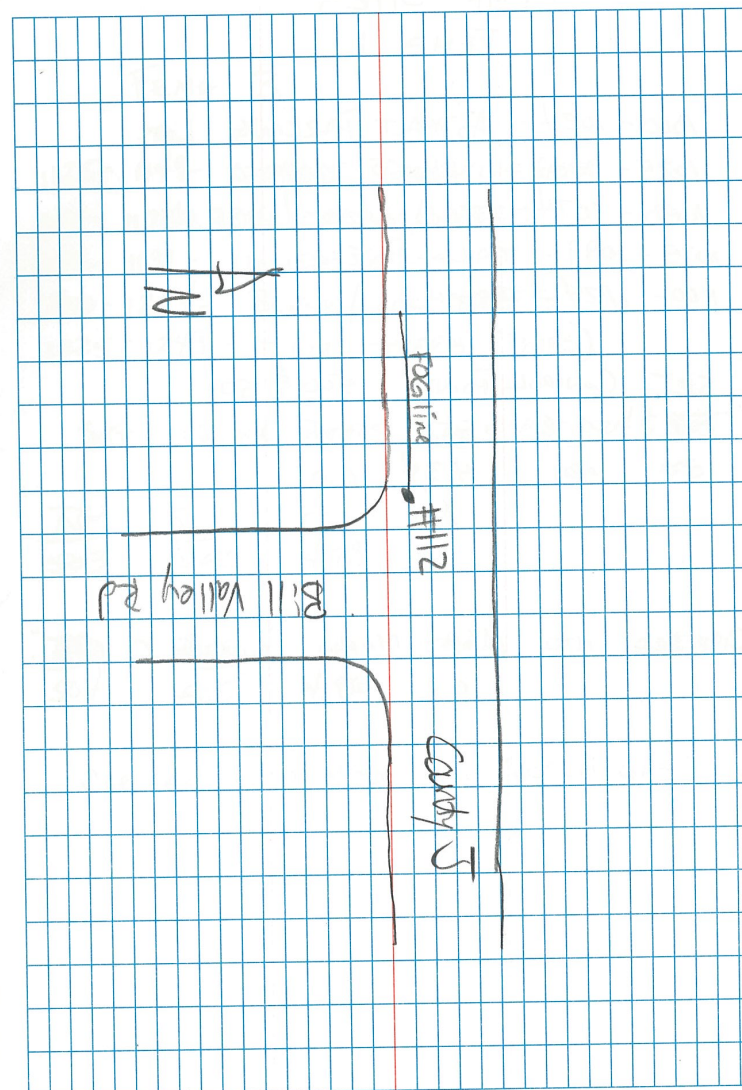
- checked into NGS man "Arcadia W GPS"

- Set Bernsten Survey Nail

- occupation time 3 min - (2) 90 sec  
occupations with re-initialization

- Surface: Asphalt

- location: South West Quad of county J  
and Bill Valley Rd in the East end  
of fog line





Field Notes (Continued)

Photo ID Point # 113

- checked into NGS Mon "Dodge West GPS"
- No Calibration Necessary

- Set large PK Nail

- RTK GNSS Base Set up on "Dodge West GPS"
- Surface - Asphalt

- location: South East Quad of Leo Kulas Rd and County Rd J at N end of fog line.

