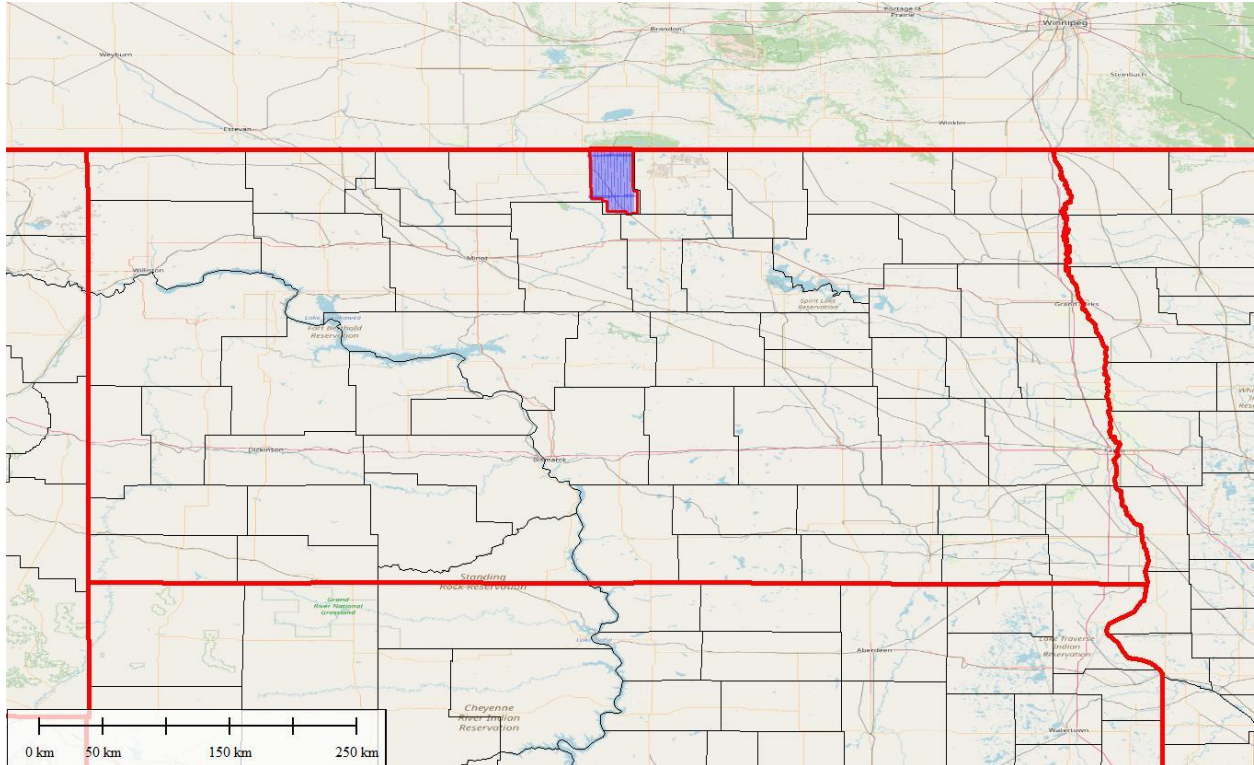


# REPORT OF LIDAR SURVEY

## Ground Control Report

### Central North Dakota

#### Phase 9 Add-On



Performed by:



For:

**Fugro Geospatial**

**Terrasurv Project Number: 21012**

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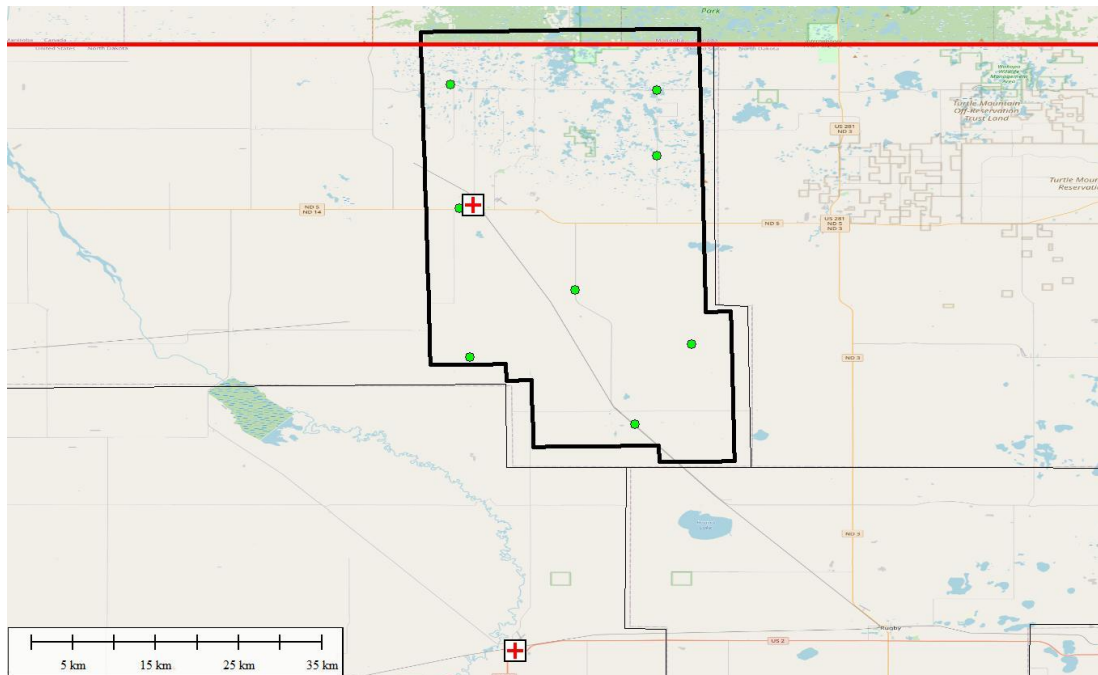
# REPORT OF SURVEY CENTRAL NORTH DAKOTA ADD-ON

## INTRODUCTION

Terrasurv, Inc of Pittsburgh, PA was tasked by Fugro Geospatial with performing a control survey in support of LiDAR data collection covering the eastern 15 miles of Bottineau County in north-central North Dakota. The project consisted of two parts: 8 ground control (calibration) points (GCP) and 50 quality control (QC: NVA/VVA/VVA-F), for a total of 58 new stations. The map in figure 1 shows the location of the Ground Control (GCP) and figure 2 shows the location of the QC points. The control symbology for figures 1 and 2 are listed in table 1. Also shown are the Continuously Operating Reference Stations used in the project via the Mid-States VRS/RTN Network.

**Table 1 - Map Symbology and Control Quantity**

Type	Symbol	VA Quantity
Ground Control (GCP)	Green Dot	8
Non-Vegetated (NVA)	Red Dot	30
Vegetated (VVA)	Red X	11
Woods (VVA-F)	Yellow X	9
CORS	White square with red "+"	2



**Figure 1 – GCP stations and CORS**

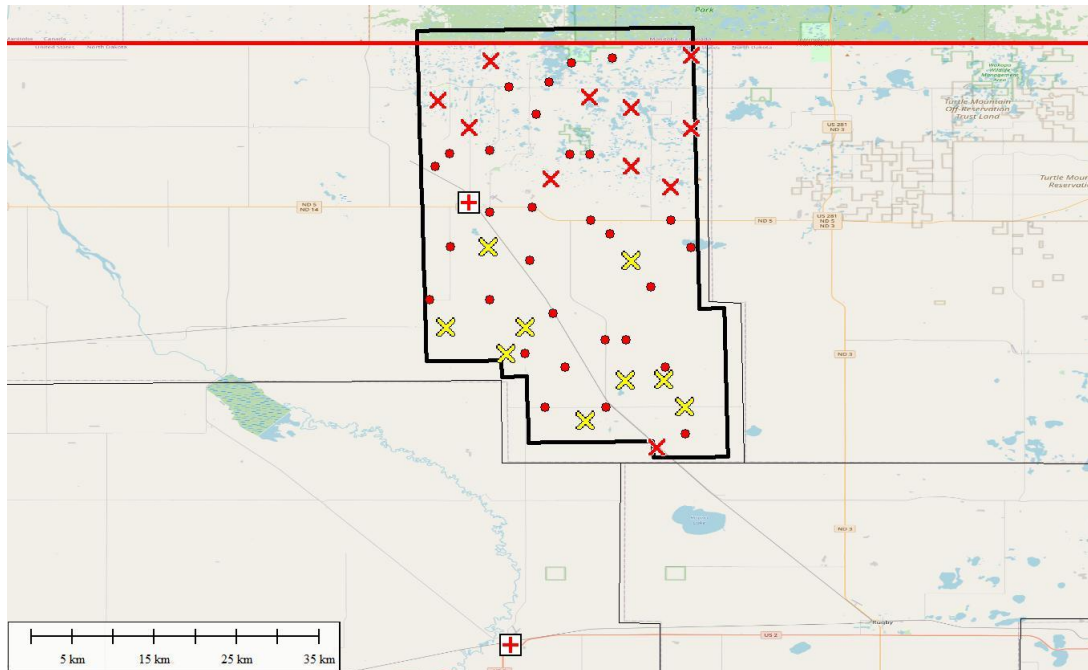


Figure 2 – Checkpoints

## CONTROL

The National Spatial Reference System (NSRS) was used to provide control for the network. The Trimble [VRSNow](#) real time network (RTN) was utilized. The horizontal datum was the North American Datum of 1983 – NAD83 (2011), epoch 2010.0. The vertical datum was the North American Vertical Datum of 1988 (NAVD88), realized with the GEOID18 geoid model from the National Geodetic Survey (NGS).

## STATIONS

Table 2 lists the GCP and CP stations established in this survey, including the GCP, NVA, VVA, and VVA-F.

Table 2 - Station List

Station Name	GPSID	USGS Quadrangle	Description
GCP01	21012UY	LAKE KLINGENBERG	paved apron to field entrance on north side of ND 43
GCP02	21012UZ	BOUNDARY LAKE	sparse grass at west edge of field and just east of field entrance on east side of CR 57
GCP03	21012VA	BOTTINEAU	pavement in center of cul-du-sac at west end of 10th Street W
GCP04	21012VB	GARDENA	bare road surface of 12th Avenue NE on north side of 86th Street NE
GCP05	21012VC	OVERLY	sparse grass in middle of field road (23rd Avenue NE) on south side of CR 22
GCP06	21012VD	OMEMEE	sparse grass in NW quadrant of intersection of ND 60 and 91st Street NE
GCP07	21012VE	BOUNDARY LAKE	bare road surface on turn radius from 21st Avenue NE NB to 101st Street NE
GCP08	21012VF	WILLOW CITY	bare road surface in EB travel lane of 81st Street NE just east of ND 60
NVA01	21012VG	WILLOW CITY	bare ground at south edge of Michigan Street and east edge of parking lot

Station Name	GPSID	USGS Quadrangle	Description
NVA02	21012VH	OMEMEE	sparse grass on field entrance on north side of 85th Street NE at 17th Avenue NE (field entrances)
NVA03	21012VI	WILLOW CITY	mowed grass on field entrance on south side of CR 28A opposite 16th Avenue NE to the north
NVA04	21012VJ	OVERLY	bare road surface on turn radius from 22nd Avenue NE NB to 85th Street NE EB
NVA05	21012VK	LORDS LAKE	bare road surface on turn radius from 23rd Avenue NB to 94th Street EB
NVA06	21012VL	BOTTINEAU	sparse grass on south side of ND 5
NVA07	21012VM	METIGOSHE LAKE	pavement in cul-de-sac at north end of short street off of Oak Shore Road on south side of lake
NVA08	21012VN	METIGOSHE LAKE	bare road surface on NE bound lane of 108th Street NE just north of CR 0547
NVA09	21012VO	BOTTINEAU	bare road surface on SB turn radius to WB 100th Street NE
NVA10	21012VP	METIGOSHE LAKE	center of grass drive on south side of 104th Street NE
NVA11	21012VQ	LAKE KLINGENBERG	bare road surface on EB travel lane of 101st Street NE at Svingen Road to the north
NVA12	21012VR	BOTTINEAU	bare dirt on field entrance on west side of 15th Avenue NE opposite 93rd Street NE
NVA13	21012VS	GARDENA	bare road surface of NB lane of 10th Avenue NE just north of CR 47
NVA14	21012VT	BARTON	bare dirt on field entrance on south side of 80th Street NE opposite 23rd Avenue
NVA15	21012VU	GARDENA	dirt road surface in NB travel lane of 15th Avenue NE just south of 86th Street NE
NVA16	21012VV	OVERLY	center of dirt/grass trail on south side of 91st Street NE opposite 21st Avenue NE
NVA17	21012VW	BOTTINEAU SE	bare road surface in SB lane of 19th Avenue NE just south of 95th Street NE
NVA18	21012VX	BOTTINEAU	bare ground on field entrance on west side of 13th Avenue NE opposite unnamed road east
NVA19	21012VY	BOTTINEAU	matted grass on field entrance on south side of 94th Street NE just east of CR 47
NVA20	21012VZ	METIGOSHE LAKE	center of 18th Avenue NE just south of 101st Street NE
NVA21	21012WA	LORDS LAKE	center of field entrance on south side of ND 5 opposite 22nd Avenue NE
NVA22	21012WB	LAKE KLINGENBERG	bare road surface on turn radius from 101st Street NE EB to 11th Avenue NE SB
NVA23	21012WC	GARDENA	bare road surface of NB lane of 13th Avenue NE north of Town Line Road
NVA24	21012WD	OMEMEE	dirt road surface of unnamed road north on north side of 89th Street NE
NVA25	21012WE	METIGOSHE LAKE	bare road surface of EB lane of 108th Street NE just east of drive south
NVA26	21012WF	OMEMEE	sparse grass on field entrance (20th Avenue NE) on north side of CR 22
NVA27	21012WG	BOTTINEAU SE	center of grass/dirt trail (18th Avenue NE) on south side of ND 5
NVA28	21012WH	METIGOSHE LAKE	bare road surface on turn radius from 17th Avenue NB to 101st Street NE EB
NVA29	21012WI	LAKE KLINGENBERG	old pavement on SB lane of apron to 14th Avenue NE on north side of ND 43
NVA30	21012WJ	OMEMEE	bare ground on field road (87th Street NE) on west side of ND 60 opposite CR 22
VVAF01	21012WK	LORDS LAKE	woods on west side of 22nd Avenue NE
VVAF02	21012WL	BOTTINEAU SE	woods on east side of 16th Avenue NE
VVAF03	21012WM	LAKE KLINGENBERG	woods on north side of 105th Street NE
VVAF04	21012WN	LAKE KLINGENBERG	woods on south side of 108th Street NE just west of drive north
VVAF05	21012WO	BOUNDARY LAKE	woods in island at Y intersection of 23rd Avenue and unknown road

Station Name	GPSID	USGS Quadrangle	Description
VVAF06	21012WP	BARTON	woods on south side of 79th Street NE west of ND60 and RR
VVAF07	21012WQ	METIGOSHE LAKE	woods in NE quadrant of intersection of 20th Avenue NE and Long Lake Landing
VVAF08	21012WR	LAKE KLINGENBERG	woods on west side of CR 49 opposite 103rd Street NE
VVAF09	21012WS	METIGOSHE LAKE	woods on south side of 18th Avenue NE and north of lake
VVAF10	21012WT	BOTTINEAU SE	woods on east side of 100th Street NE and north side of woods road to the east
VVAF11	21012WU	BOUNDARY LAKE	light woods in SW quadrant of intersection of 103rd Street NE and 23rd Avenue NE
VVANF01	21012WV	BOTTINEAU	high weeds on north side of 94th Street NE
VVANF02	21012WW	GARDENA	high weeds in SW quadrant of intersection of 88th Street NE and 15th Avenue NE
VVANF03	21012WX	GARDENA	high weeds in SE quadrant of intersection of 11th Avenue NE and Kramer Road
VVANF04	21012WY	WILLOW CITY	high weeds in NE quadrant of intersection of 18th Avenue NE and 81st Street NE
VVANF05	21012WZ	OVERLY	high weeds on SE side of 84th Street NE and SW side of 22nd Avenue NE (field road)
VVANF06	21012XA	BOTTINEAU SE	high weeds in SE quadrant of intersection of 20th Avenue NE and 93rd Street NE (road not open)
VVANF07	21012XB	GARDENA	high weeds in NE quadrant of the intersection of 86th Street NE and 14th Avenue NE (field road north)
VVANF08	21012XC	OMEMEE	high weeds on north side of 84th Street NE just west of 20th Avenue NE (field road)
VVANF09	21012XD	BARTON	high weeds on north side of 82nd Street NE west of field road (23rd Avenue NE)
WOODS BASE	21012Z	LAKE KLINGENBERG	Temporary base for woods QC point VVAF04

The stations were not permanently marked.

## METHODOLOGY

The field survey was done by using a Trimble R10 multi-frequency, multi-constellation GNSS receiver in a real time (RTK/VRS) mode. Corrections were obtained from the Trimble VRSNow VRS network with corrections delivered over the cellular network. These corrections are applied in real time and used by the rover receivers to converge to a cm level solution. Each station was occupied once for 2 to 3 minutes (120 to 180 epochs), then re-initialized and occupied a second time immediately after the first occupation. The solutions are stored as vectors from the nearest physical CORS. Eight of the nine woods checkpoints were occupied directly. One station, VVAF04 (GPSID 21012WN), was surveyed using RTK over radio using a temporary local base station (21012Z) nearby and was also surveyed directly using the RTN. Table 3 summarizes the VRS/RTK occupations (precisions in meters):

Table 3 – VRS/RTK Occupation Summary

GPSID	UTC Start	UTC End	Horz Prec	Vert Prec	# of SV's	PDOP
21012WY	04/29/2021 19:48:05	19:50:04	0.014	0.017	13	1.4
21012WY	04/29/2021 19:50:36	19:52:35	0.016	0.020	13	1.4
21012VI	04/29/2021 19:59:07	20:01:06	0.017	0.023	14	1.3
21012VI	04/29/2021 20:01:29	20:03:28	0.018	0.023	14	1.3
21012VH	04/29/2021 20:12:37	20:14:36	0.012	0.016	14	1.4
21012VH	04/29/2021 20:15:00	20:16:59	0.014	0.019	14	1.4
21012VU	04/29/2021 20:24:00	20:25:59	0.014	0.018	14	1.4
21012VU	04/29/2021 20:26:19	20:28:18	0.014	0.016	14	1.4
21012XB	04/29/2021 20:32:17	20:34:16	0.012	0.015	14	1.4

GPSID	UTC Start	UTC End	Horz Prec	Vert Prec	# of SV's	PDOP
21012XB	04/29/2021 20:34:46	20:36:45	0.012	0.014	14	1.4
21012VB	04/29/2021 20:42:15	20:44:14	0.010	0.014	14	1.4
21012VB	04/29/2021 20:44:49	20:46:48	0.010	0.014	14	1.3
21012WX	04/29/2021 20:54:32	20:56:31	0.013	0.015	11	1.7
21012WX	04/29/2021 20:56:54	20:58:53	0.010	0.014	11	1.7
21012WW	04/29/2021 21:07:31	21:09:30	0.014	0.014	12	1.5
21012WW	04/29/2021 21:09:50	21:11:49	0.009	0.012	12	1.5
21012WD	04/29/2021 21:18:22	21:20:21	0.011	0.013	14	1.3
21012WD	04/29/2021 21:21:39	21:23:38	0.010	0.012	14	1.3
21012WC	04/29/2021 21:31:29	21:33:28	0.013	0.016	12	1.6
21012WC	04/29/2021 21:33:51	21:35:50	0.015	0.015	12	1.6
21012VS	04/29/2021 21:41:43	21:43:42	0.013	0.014	12	1.6
21012VS	04/29/2021 21:44:42	21:46:41	0.015	0.015	12	1.6
21012VY	04/29/2021 21:54:35	21:56:34	0.014	0.014	12	1.6
21012VY	04/29/2021 21:57:06	21:59:05	0.014	0.014	12	1.6
21012WV	04/29/2021 22:04:06	22:06:08	0.015	0.016	12	1.8
21012WV	04/29/2021 22:06:35	22:08:38	0.016	0.017	11	2.2
21012VR	04/29/2021 22:16:24	22:18:27	0.013	0.013	11	2.3
21012VR	04/29/2021 22:18:49	22:20:48	0.013	0.013	11	2.3
21012VD	04/29/2021 22:27:34	22:29:33	0.013	0.016	11	2.1
21012VD	04/29/2021 22:30:03	22:32:02	0.014	0.016	11	2.1
21012VL	04/29/2021 22:41:36	22:43:35	0.010	0.012	11	1.7
21012VL	04/29/2021 22:43:57	22:45:56	0.009	0.011	11	1.7
21012VX	04/29/2021 22:50:50	22:52:49	0.009	0.013	12	1.6
21012VX	04/29/2021 22:53:13	22:55:12	0.011	0.013	12	1.6
21012VA	04/29/2021 23:02:36	23:04:35	0.006	0.008	12	1.6
21012VA	04/29/2021 23:05:03	23:07:02	0.006	0.008	12	1.7
21012VO	04/30/2021 11:56:08	11:58:07	0.009	0.009	14	1.3
21012VO	04/30/2021 11:58:31	12:00:30	0.008	0.008	14	1.3
21012WB	04/30/2021 12:06:10	12:08:09	0.010	0.010	13	1.4
21012WB	04/30/2021 12:08:32	12:10:31	0.010	0.009	12	1.5
21012VQ	04/30/2021 12:16:00	12:17:59	0.010	0.011	12	1.5
21012VQ	04/30/2021 12:18:25	12:20:24	0.011	0.012	13	1.4
21012WR	04/30/2021 12:30:11	12:32:10	0.010	0.013	10	1.8
21012WR	04/30/2021 12:32:32	12:34:31	0.010	0.014	12	1.5
21012WM	04/30/2021 12:45:17	12:47:16	0.017	0.033	8	3.1
21012WM	04/30/2021 12:47:41	12:49:40	0.013	0.022	11	1.6
21012WM	04/30/2021 12:50:07	12:52:06	0.011	0.016	10	1.8
21012UY	04/30/2021 13:03:32	13:05:51	0.009	0.017	12	1.7
21012UY	04/30/2021 13:08:12	13:10:11	0.009	0.017	12	1.5
21012UY	04/30/2021 13:10:44	13:12:43	0.009	0.017	12	1.6
21012WI	04/30/2021 13:24:57	13:26:56	0.010	0.020	14	1.5
21012WI	04/30/2021 13:27:21	13:29:20	0.011	0.020	14	1.5
21012VM	04/30/2021 13:34:50	13:36:49	0.011	0.018	15	1.4
21012VM	04/30/2021 13:37:25	13:39:24	0.009	0.015	15	1.4
21012WN	04/30/2021 14:04:15	14:05:13	0.026	0.046	12	1.9
21012Z	04/30/2021 14:13:56	14:15:55	0.012	0.019	11	2.0
21012Z	04/30/2021 14:16:20	14:18:19	0.012	0.019	13	1.7
21012WN	04/30/2021 14:20:55	14:22:56	0.007	0.011	22	1.3
21012VN	04/30/2021 14:35:56	14:37:55	0.012	0.017	15	1.3
21012VN	04/30/2021 14:38:23	14:40:22	0.011	0.016	15	1.3
21012WE	04/30/2021 14:50:12	14:52:44	0.011	0.015	16	1.2
21012WE	04/30/2021 14:53:12	14:55:11	0.013	0.016	15	1.3
21012WO	04/30/2021 15:06:23	15:08:33	0.018	0.024	11	2.0
21012WO	04/30/2021 15:09:02	15:11:01	0.019	0.025	11	1.9
21012UZ	04/30/2021 15:20:16	15:22:15	0.011	0.017	15	1.4
21012UZ	04/30/2021 15:22:49	15:24:48	0.011	0.016	15	1.4
21012WU	04/30/2021 15:39:21	15:41:20	0.012	0.017	13	1.6
21012WU	04/30/2021 15:42:41	15:44:40	0.014	0.018	13	2.0
21012WQ	04/30/2021 15:55:43	15:57:42	0.014	0.019	11	1.6
21012WQ	04/30/2021 15:58:12	16:00:11	0.014	0.017	12	1.6
21012WS	04/30/2021 16:09:25	16:11:45	0.020	0.028	11	2.5
21012WS	04/30/2021 16:12:36	16:14:35	0.019	0.025	10	2.7
21012VP	04/30/2021 16:24:26	16:26:25	0.012	0.016	16	1.4

GPSID	UTC Start	UTC End	Horz Prec	Vert Prec	# of SV's	PDOP
21012VP	04/30/2021 16:26:50	16:28:49	0.012	0.016	16	1.4
21012WH	04/30/2021 16:37:06	16:39:05	0.009	0.012	15	1.5
21012WH	04/30/2021 16:39:31	16:41:30	0.010	0.014	16	1.4
21012WL	04/30/2021 16:49:55	16:51:54	0.015	0.019	13	1.8
21012WL	04/30/2021 16:52:23	16:54:22	0.012	0.016	12	1.9
21012WL	04/30/2021 16:54:48	16:56:47	0.011	0.014	12	1.9
21012VZ	04/30/2021 17:09:31	17:12:15	0.008	0.013	16	1.3
21012VZ	04/30/2021 17:12:40	17:14:39	0.009	0.013	15	1.4
21012VE	04/30/2021 17:30:57	17:32:56	0.011	0.017	13	1.6
21012VE	04/30/2021 17:33:18	17:35:17	0.010	0.016	13	1.6
21012WT	04/30/2021 17:41:57	17:43:56	0.016	0.023	11	2.2
21012WT	04/30/2021 17:44:23	17:46:22	0.012	0.018	10	2.0
21012WT	04/30/2021 17:46:50	17:48:49	0.010	0.015	10	2.3
21012WK	04/30/2021 17:59:56	18:01:55	0.019	0.024	10	2.2
21012WK	04/30/2021 18:02:24	18:04:24	0.014	0.017	11	1.8
21012WA	04/30/2021 18:12:48	18:14:47	0.011	0.012	12	1.7
21012WA	04/30/2021 18:15:11	18:17:10	0.011	0.012	12	1.7
21012WG	04/30/2021 18:22:40	18:24:39	0.012	0.010	13	1.5
21012WG	04/30/2021 18:25:35	18:27:34	0.010	0.009	13	1.4
21012VW	04/30/2021 18:35:13	18:37:12	0.009	0.010	13	1.4
21012VW	04/30/2021 18:37:36	18:39:35	0.011	0.011	13	1.3
21012VK	04/30/2021 18:53:37	18:55:36	0.010	0.012	13	1.3
21012VK	04/30/2021 18:56:03	18:58:02	0.010	0.012	11	1.6
21012XA	04/30/2021 19:13:17	19:15:16	0.012	0.014	11	1.7
21012XA	04/30/2021 19:17:04	19:19:03	0.013	0.014	11	1.7
21012VV	04/30/2021 19:25:38	19:27:37	0.010	0.014	12	1.6
21012VV	04/30/2021 19:28:47	19:30:46	0.010	0.013	12	1.7
21012VC	04/30/2021 19:44:57	19:46:56	0.013	0.017	10	2.1
21012VC	04/30/2021 19:47:22	19:49:21	0.014	0.018	11	1.7
21012WF	04/30/2021 19:57:31	19:59:30	0.013	0.018	10	1.6
21012WF	04/30/2021 19:59:55	20:01:54	0.013	0.018	12	1.6
21012WJ	04/30/2021 20:05:17	20:07:16	0.013	0.016	13	1.5
21012WJ	04/30/2021 20:07:40	20:09:39	0.012	0.015	13	1.5
21012XC	04/30/2021 20:20:41	20:22:40	0.009	0.014	14	1.5
21012XC	04/30/2021 20:23:07	20:25:06	0.012	0.017	14	1.5
21012WZ	04/30/2021 20:30:56	20:32:55	0.013	0.018	15	1.4
21012WZ	04/30/2021 20:33:13	20:35:12	0.011	0.015	15	1.4
21012VJ	04/30/2021 20:39:41	20:41:40	0.010	0.015	14	1.4
21012VJ	04/30/2021 20:42:01	20:44:00	0.011	0.017	13	1.6
21012XD	04/30/2021 20:56:54	20:58:53	0.016	0.021	12	1.7
21012XD	04/30/2021 20:59:18	21:01:17	0.016	0.018	12	1.7
21012VT	04/30/2021 21:06:34	21:08:33	0.013	0.017	12	1.6
21012VT	04/30/2021 21:09:07	21:11:06	0.014	0.019	13	1.4
21012VG	04/30/2021 21:20:26	21:22:25	0.015	0.017	13	1.4
21012VG	04/30/2021 21:22:45	21:24:43	0.015	0.016	9	1.5
21012VF	04/30/2021 21:30:40	21:32:39	0.014	0.014	12	1.7
21012VF	04/30/2021 21:33:01	21:35:00	0.017	0.022	11	1.6
21012WP	04/30/2021 21:40:54	21:42:53	0.024	0.031	9	2.6
21012WP	04/30/2021 21:44:19	21:46:20	0.017	0.021	9	2.5

As mentioned, each station was occupied twice (or more if needed) in succession. The Earth Centered Earth Fixed (ECEF) vector differences were rotated into a local horizon system (N, E, Up) for analysis. Stations which had observations that differed by more than 0.03 m in the vertical component were re-observed until agreement was achieved. Figure 4 summarizes the repeat baseline analysis.



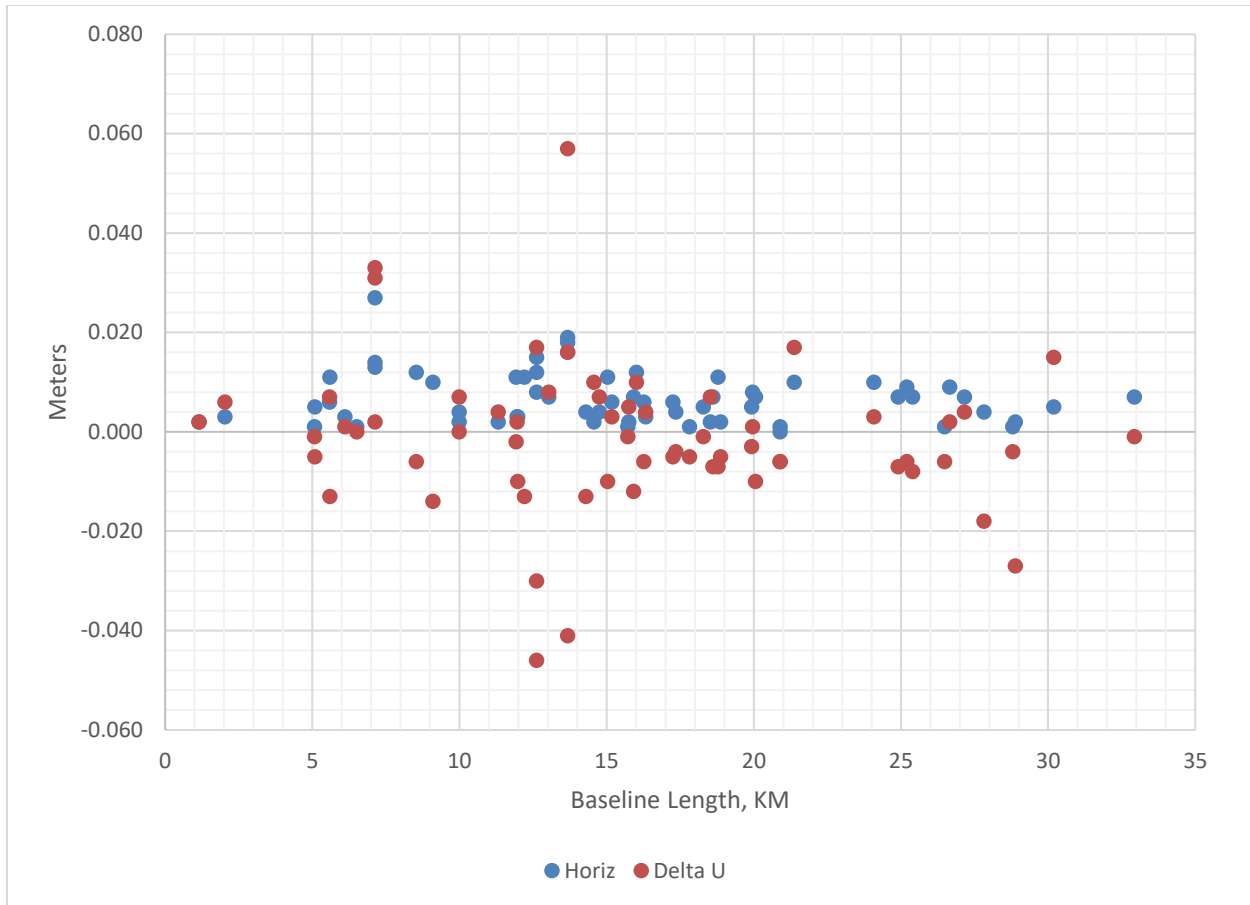


Figure 3 - Repeat Baseline Analysis

## LEAST SQUARES ADJUSTMENTS

Geolab was used to adjust the VRS/RTK vectors. No scaling of the a priori GPS statistics was done. Station errors (centering, HI and HT) of 0.005 m were input. The GEOID18 model was used.

The adjustment constrained the VRS CORS positions (as computed and broadcast by the network) in all three dimensions (NAD83 (2011) latitude, longitude, and ellipsoidal height). The error factor was 0.16. This adjustment provided the adjusted positions (NAD83 (2011) epoch 2010.0) and GPS derived orthometric heights (NAVD88) for the stations in the network. The adjusted latitude/longitudes were transformed to UTM Zone 14 grid coordinates. At the request of the client, the positions were also transformed to NAD83 (NSRS2007) using the NGS Coordinate Conversion and Transformation (NCAT) tool.

## SUMMARY

A LiDAR ground control network was established in north central North Dakota. The estimated accuracy of the control network is  $\pm 0.05$  m with respect to the NAD83 (2011) epoch 2010.0 reference frame and the NAVD88 vertical datum (using GEOID18). Table 5 lists the NAD83

(2011) and NAD83 (NSRS2007) UTM Zone 14 coordinates, NAVD88 GPS derived orthometric heights, NAD83 (2011) ellipsoidal heights, and the vertical accuracies at the 95% confidence level, in meters.

**Table 4 – Adjusted Coordinates and Elevations (meters)**

Station Name	GPSID	NAD83 (2011)		NAD83 (NSRS2007)		NAVD88		
		UTM14 Northing	UTM14 Easting	UTM14 Northing	UTM14 Easting	Ellip Height	Ortho Height	Vertical Accuracy
GCP01	21012UY	5423556.862	392305.348	5423556.862	392305.328	706.939	728.437	0.010
GCP02	21012UZ	5422584.592	408603.680	5422584.592	408603.660	643.042	664.331	0.010
GCP03	21012VA	5408643.135	392724.412	5408643.135	392724.393	470.865	492.355	0.006
GCP04	21012VB	5390807.249	393185.063	5390807.249	393185.045	425.226	446.722	0.009
GCP05	21012VC	5392070.063	410829.919	5392070.063	410829.898	441.649	463.092	0.010
GCP06	21012VD	5398712.885	401686.198	5398712.885	401686.178	451.066	472.470	0.010
GCP07	21012VE	5414673.441	408469.784	5414673.440	408469.763	650.010	671.274	0.010
GCP08	21012VF	5382485.362	406223.778	5382485.361	406223.759	429.469	450.975	0.010
NVA01	21012VG	5384064.655	404342.873	5384064.654	404342.854	425.534	447.024	0.010
NVA02	21012VH	5389027.709	401166.487	5389027.708	401166.468	427.675	449.134	0.010
NVA03	21012VI	5384191.004	399454.933	5384191.003	399454.914	427.656	449.144	0.013
NVA04	21012VJ	5388884.445	409184.882	5388884.445	409184.862	432.941	454.406	0.010
NVA05	21012VK	5403304.191	411472.754	5403304.191	411472.734	467.243	488.598	0.008
NVA06	21012VL	5408414.130	398835.636	5408414.131	398835.616	487.010	508.401	0.007
NVA07	21012VM	5423512.740	400485.266	5423512.741	400485.246	639.164	660.532	0.010
NVA08	21012VN	5425796.649	402336.496	5425796.649	402336.475	637.663	659.032	0.010
NVA09	21012VO	5413432.536	391200.947	5413432.536	391200.927	491.322	512.842	0.006
NVA10	21012VP	5419662.293	399391.978	5419662.294	399391.958	629.526	650.883	0.010
NVA11	21012VQ	5415331.022	395584.717	5415331.022	395584.697	608.028	629.444	0.008
NVA12	21012VR	5401995.449	398551.275	5401995.449	398551.256	451.482	472.899	0.008
NVA13	21012VS	5397348.596	390429.971	5397348.596	390429.953	427.920	449.440	0.009
NVA14	21012VT	5380807.728	410663.873	5380807.727	410663.852	436.082	457.621	0.011
NVA15	21012VU	5390686.535	397982.330	5390686.535	397982.311	429.096	450.559	0.010
NVA16	21012VV	5398573.512	408178.817	5398573.511	408178.797	454.913	476.299	0.009
NVA17	21012VW	5405068.577	405054.946	5405068.576	405054.926	473.488	494.837	0.007
NVA18	21012VX	5407857.349	395420.181	5407857.349	395420.162	472.742	494.186	0.008
NVA19	21012VY	5403726.353	392200.120	5403726.353	392200.100	448.354	469.852	0.009
NVA20	21012VZ	5414725.953	403583.975	5414725.953	403583.954	663.064	684.356	0.008
NVA21	21012WA	5406612.291	409922.947	5406612.290	409922.926	493.041	514.366	0.008
NVA22	21012WB	5415018.341	392373.535	5415018.341	392373.515	528.670	550.162	0.007
NVA23	21012WC	5397243.577	395260.365	5397243.577	395260.346	430.535	451.999	0.009
NVA24	21012WD	5395515.350	400276.208	5395515.350	400276.188	436.723	458.151	0.008
NVA25	21012WE	5426341.963	405554.148	5426341.963	405554.128	653.724	675.067	0.009
NVA26	21012WF	5392189.102	406075.584	5392189.102	406075.564	442.663	464.096	0.011
NVA27	21012WG	5406692.458	403491.555	5406692.458	403491.535	482.871	504.221	0.006
NVA28	21012WH	5414733.618	402016.548	5414733.618	402016.528	654.298	675.606	0.008

Station Name	GPSID	NAD83 (2011)		NAD83 (NSRS2007)		Ellip Height	NAVD88	
		UTM14 Northing	UTM14 Easting	UTM14 Northing	UTM14 Easting		Ortho Height	Vertical Accuracy
NVA29	21012WI	5422940.626	397269.157	5422940.626	397269.137	655.399	676.808	0.011
NVA30	21012WJ	5392205.995	404444.322	5392205.995	404444.302	439.709	461.143	0.009
VVAF01	21012WK	5410723.951	409960.670	5410723.951	409960.650	588.196	609.478	0.012
VVAF02	21012WL	5411804.409	400376.009	5411804.408	400375.990	585.121	606.465	0.008
VVAF03	21012WM	5421490.955	391562.286	5421490.955	391562.266	680.900	702.405	0.010
VVAF04	21012WN	5426175.194	395867.087	5426175.195	395867.067	717.969	739.420	0.014
VVAF05	21012WO	5426603.052	411878.818	5426603.052	411878.797	667.858	689.173	0.014
VVAF06	21012WP	5379213.927	408358.906	5379213.926	408358.886	433.075	454.614	0.014
VVAF07	21012WQ	5420344.501	406983.244	5420344.501	406983.224	645.986	667.267	0.011
VVAF08	21012WR	5418168.271	394010.344	5418168.271	394010.324	652.894	674.338	0.008
VVAF09	21012WS	5421680.991	403660.355	5421680.991	403660.334	658.670	679.983	0.015
VVAF10	21012WT	5413248.767	406814.251	5413248.767	406814.231	633.919	655.195	0.009
VVAF11	21012WU	5417790.075	411703.811	5417790.075	411703.790	636.905	658.169	0.010
VVANF01	21012WV	5403679.074	395248.538	5403679.074	395248.519	451.258	472.711	0.010
VVANF02	21012WW	5393919.949	398047.930	5393919.949	398047.911	428.032	449.482	0.008
VVANF03	21012WX	5394056.278	391634.774	5394056.278	391634.756	426.181	447.687	0.009
VVANF04	21012WY	5382546.543	402654.050	5382546.542	402654.031	427.646	449.143	0.011
VVANF05	21012WZ	5387437.999	409034.388	5387437.998	409034.368	429.066	450.543	0.010
VVANF06	21012XA	5401822.737	406625.936	5401822.737	406625.916	462.500	483.865	0.009
VVANF07	21012XB	5390742.637	396410.342	5390742.637	396410.323	422.809	444.282	0.009
VVANF08	21012XC	5387341.591	405935.958	5387341.590	405935.939	426.412	447.881	0.009
VVANF09	21012XD	5384066.472	410683.511	5384066.471	410683.490	426.714	448.228	0.011