

Ground Control Point Survey Report

“WV FEMA HQ QL2 2018 LiDAR”

USGS Contract: G16PC00020

Task Order Number: 140G0218F0174

Prepared for:

United States Geological Survey (USGS)



Prepared By:

Dewberry Engineers Inc

4601 Forbes Boulevard, Suite 300

Lanham, Maryland, 20706

Phone (301)364-1855 Fax (301)731-0188

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6.	Deliverables	Sent via Electronic Transfer
	Including: a) Point Documentation Report & Photos of Survey Points	
	b) Final Coordinate List in Excel Format	
	c) NGS Data Sheets for Project Controls	

1. INTRODUCTION

1.1 *Project Summary*

Dewberry Engineers Inc. is under contract to the United States Geological Survey to provide 62 Ground Control Points in the State of West Virginia. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of LiDAR products. As part of this work Dewberry staff will complete Ground Control Point surveys that will be used to evaluate vertical and horizontal accuracy. The ground survey was conducted November 23, 2018 thru January 17, 2019.

Existing NGS Control Points were located and surveyed to check the accuracy of the RTK/GPS survey equipment with the results shown in Section 2.4 of this Report.

As an internal QA/QC procedure and to verify that the Ground Control Points meet the 95% confidence level approximately 50% of the points were re-observed and are shown in Section 5 of this report.

Final horizontal coordinates are referenced to Albers Equal Area, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012B (Geoid12B).

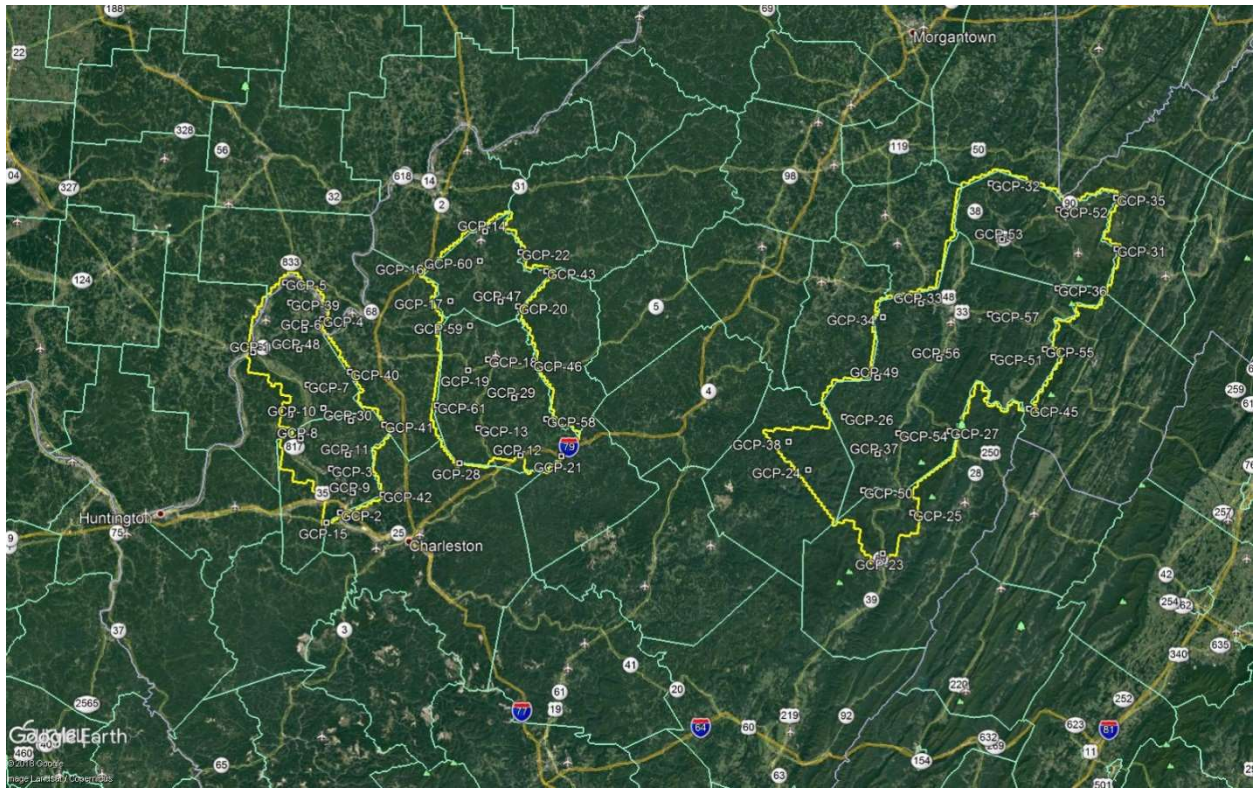
1.2 *Points of Contact*

Questions regarding the technical aspects of this report should be addressed to:

Dewberry Engineers Inc

Gary D. Simpson, L.S.
Senior Associate
4601 Forbes Boulevard
Suite 300
Lanham, Maryland 20706
(301) 364-1855 direct
(301) 731-0188 fax

1.3 Project Area



PROJECT DETAILS

2.1 Survey Equipment

In performing the GPS observations Trimble R-10 GNSS receiver/antenna attached to a two meter fixed height pole with a Trimble TSC3 Data Collector to collect GPS raw data were used to perform the field surveys.

2.2 Survey Point Detail

The 62 Ground Control Points were well distributed throughout the project area.

A sketch was made for each location and a nail was set at the point where possible or at an identifiable point. The Ground Control Point locations are detailed on the “Check Point Documentation Report” sheets attached to this report.

2.3 Network Design

The GPS survey performed by Dewberry Engineers Inc office located in Lanham, MD was tied to a Real Time Network operated by KEYNET. The network is a series of “real-time” continuously operating, high precision GPS reference stations. All of the reference stations have been linked together using Trimble GPSNet software, creating a Virtual Reference Station System (VRS).

The Trimble NetR5 Reference Station is a multi-channel, multi-frequency GNSS (Global Navigation Satellite System) receiver designed for use as a stand-alone reference station or as part of a GNSS infrastructure solution. Trimble R-Track technology in the NetR5 receiver supports the modernized GPS L2C and L5 signals as well as GLONASS L1/L2 signals.

2.4 Field Survey Procedures and Analysis

Dewberry field surveyors used Trimble R-10 GNSS receivers, which is a geodetic quality dual frequency GPS receiver, to collect data at each surveyed location.

All locations were occupied once with approximately 50% of the locations being re-observed. All re-observations matched the initially derived station positions within the allowable tolerance of $\pm 5\text{cm}$ or within the 95% confidence level. Each occupation which utilized the VRS network was occupied for approximately three (3) minutes in duration and measured to 180 epochs.

Each occupation which utilized OPUS (if used) was occupied between 20 and 30 minutes. Field GPS observations are detailed on the “Control Point Documentation Reports” submitted as part of this report.

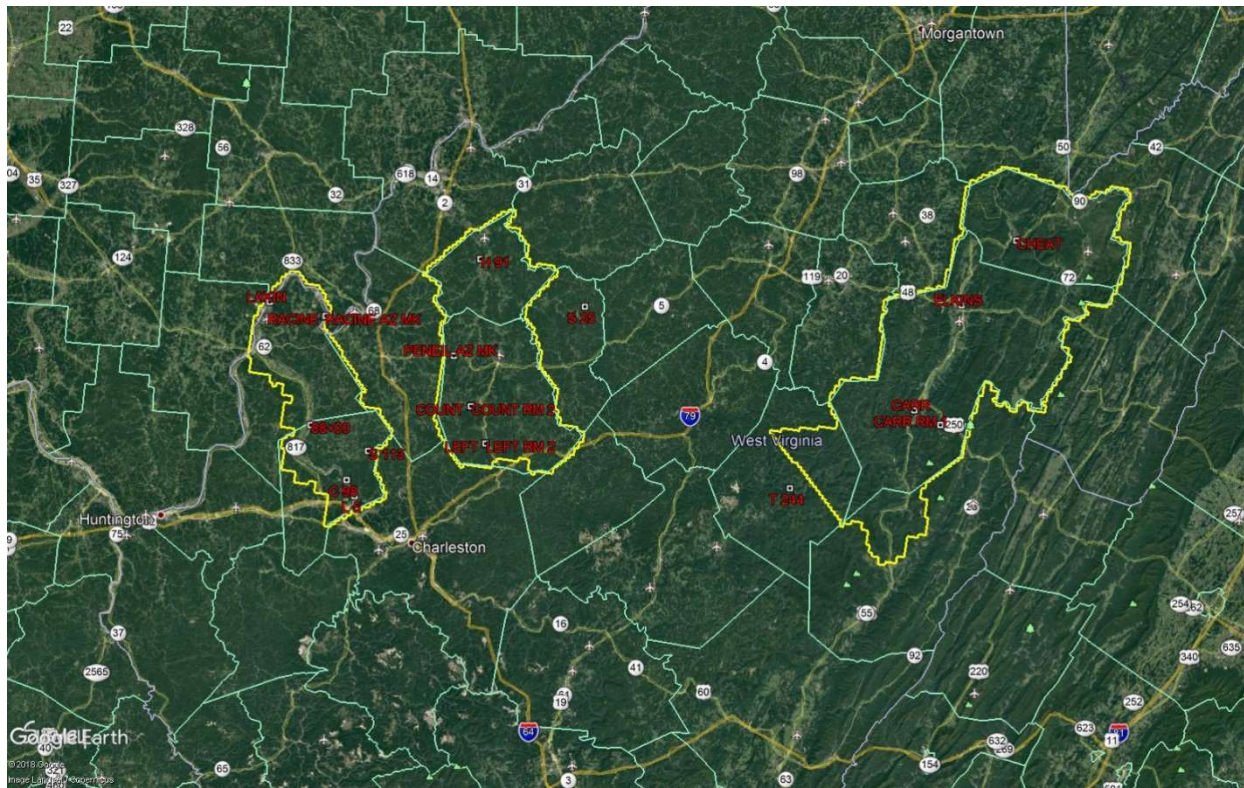
Ten (10) existing NGS monument listed in the NSRS database were located as an additional QA/QC method to check the horizontal and vertical accuracy of the VRS network as well as being the primary project control monuments designated as JX0995, HX1776, HX1744, HX2269, HX2413, HX2816, HX2541, HW3677, HX0525, and JW1754. The results are as follows:

(*) Indicates a vertical NGS Mark (**) Indicates a horizontal NGS Mark

UTM 17 North									
PT. #	Observed Values			Data Sheet Values			ΔX	ΔY	ΔZ
	NORTHING (m)	EASTING (m)	ELEV. (m)	NORTHING (m)	EASTING (m)	ELEV. (m)			
H-91	4324066.343	465047.473	189.819	N/A	N/A	189.86	N/A	N/A	-0.041
LEFT RM 2	4272539.274	465916.252	339.614	N/A	N/A	339.576	N/A	N/A	0.038
PENIEL AZ MK	4297136.430	457289.928	302.492	4297136.380	457289.926	302.481	0.050	0.002	0.011
C98	4262789.571	426720.583	178.717	N/A	N/A	178.752	N/A	N/A	-0.035
D113	4279257.791	428753.105	285.425	N/A	N/A	285.429	N/A	N/A	-0.004
RACINE	4308706.782	421300.303	182.070	4308706.803	421300.318	182.087	-0.021	-0.015	-0.017
S113	4270816.913	432865.621	305.705	N/A	N/A	305.656	N/A	N/A	0.049
GPS 1	4276335.041	593578.042	1159.863	4276335.011	593578.077	1159.910	0.030	-0.035	-0.047
T 244	4259169.72	551142.53	445.871	4259169.709	551142.530	445.836	0.011	0.000	0.035
CHEAT	4327608.873	615697.707	506.48	4327608.840	615697.755	506.480	0.033	-0.048	0.000

The above results indicate that the VRS network is providing positional values within the 5cm parameters for this survey.

NGS Monuments



2.5 Adjustment

The survey data was collected using Virtual Reference Stations (VRS) methodology within a Virtual Reference System (VRS).

The system is designed to provide a true Network RTK performance, the RTKNet software enables high-accuracy positioning in real time across a geographic region. The RTKNet software package uses real-time data streams from the KEYNET system user and generates correction models for high-accuracy RTK GPS corrections throughout the network. Therefore, corrections were applied to the points as they were being collected, thus negating the need for a post process adjustment.

2.6 Data Processing Procedures

After field data is collected the information is downloaded from the data collectors into the office software. The Software program used is called Trimble Business Center.

Downloaded data is run through the TBC program to obtain the following reports; points report, point comparison report and a point detail report. The reports are reviewed for point accuracy and precision.

After review of the point data an “ASCII” or “txt” file which is the industry standard is created. Point files are loaded into our CADD program (Carlson Survey 2014) to make a visual check of the point data (Pt. #, Coordinates, Elev. and Description). The data can now be imported into the final product.

3. FINAL COORDINATES/ELEVATIONS

Albers Equal Area, NAD83 (2011), NAVD88, Meters			
Point ID	Northing	Easting	Elevation
GCP-1	1843018.700	1187740.241	171.413
GCP-2	1801339.041	1218714.145	182.384
GCP-3	1813379.037	1214353.095	179.814
GCP-4	1855226.495	1205625.313	176.558
GCP-5	1864041.963	1193696.967	183.342
GCP-6	1851461.909	1201144.727	223.779
GCP-7	1836072.348	1204350.079	173.796
GCP-8	1820722.961	1204656.815	174.743
GCP-9	1807468.934	1221456.456	178.999
GCP-10	1830171.769	1209746.318	184.142
GCP-11	1818035.653	1218528.443	296.901
GCP-12	1824967.053	1266611.307	223.487
GCP-13	1830879.803	1253830.630	216.471
GCP-14	1886685.282	1247386.875	196.274
GCP-15	1797926.957	1215327.378	276.563
GCP-16	1874567.785	1233903.239	336.956
GCP-17	1865490.354	1239985.667	216.300
GCP-18	1850681.435	1253598.505	305.297
GCP-19	1846794.555	1248508.516	235.638
GCP-20	1866870.199	1259729.433	205.356
GCP-21	1826411.469	1278018.029	235.215
GCP-22	1881229.104	1255670.516	286.442
GCP-23	1812218.585	1371307.569	1074.271
GCP-24	1832667.344	1347131.782	935.601
GCP-25	1824885.854	1377803.930	1449.596
GCP-26	1849078.942	1354833.812	818.333
GCP-27	1849346.379	1384869.217	1098.903
GCP-28	1820256.417	1249962.857	327.118
GCP-29	1840408.760	1262994.808	350.727
GCP-30	1827729.983	1217943.066	285.468
GCP-31	1907761.924	1424104.977	1205.016
GCP-32	1920995.556	1386166.188	458.035
GCP-33	1884223.976	1371615.520	625.944
GCP-34	1878624.910	1361646.137	594.328
GCP-35	1922089.757	1422081.493	1070.124
GCP-36	1894096.856	1409087.794	670.617

GCP-37	1840030.365	1365678.399	995.405
GCP-38	1839821.625	1340496.777	749.985
GCP-39	1858565.824	1196002.613	195.118
GCP-40	1841427.605	1215569.273	288.970
GCP-41	1828128.483	1227437.057	312.984
GCP-42	1808230.289	1229820.010	179.635
GCP-43	1878052.241	1266003.907	303.305
GCP-44	1826947.687	1200738.039	177.247
GCP-45	1858944.391	1405974.121	1179.718
GCP-46	1851435.461	1266176.658	219.020
GCP-47	1867716.596	1254809.096	199.099
GCP-48	1845844.514	1200849.932	204.716
GCP-49	1861516.297	1362543.836	995.929
GCP-50	1822864.365	1363407.053	1259.307
GCP-50A	1829369.824	1369063.581	840.949
GCP-51	1872032.341	1393970.747	868.030
GCP-52	1916457.511	1406109.002	908.356
GCP-53	1905647.623	1391558.641	501.174
GCP-54	1846656.678	1370734.161	664.417
GCP-55	1876380.800	1407997.091	840.984
GCP-56	1869457.245	1378937.346	599.639
GCP-57	1884040.549	1391247.593	698.866
GCP58	1836286.619	1272260.970	264.963
GCP-59	1859436.377	1247173.775	206.454
GCP-60	1878109.161	1247204.738	194.969
GCP-61	1835628.979	1241233.807	315.826

4. GPS OBSERVATIONS

GCP-1	1/11/2019	11	7:00	N/A	N/A
GCP-2	1/15/2019	15	20:55	N/A	N/A
GCP-3	1/14/2019	14	8:00	1/15/2019	10:40
GCP-4	1/10/2019	10	14:45	1/11/2019	13:10
GCP-5	1/11/2019	11	10:00	1/13/2019	8:25
GCP-6	1/10/2019	10	16:00	N/A	N/A
GCP-7	1/12/2019	12	17:00	1/13/2019	10:45
GCP-8	1/12/2019	12	12:51	N/A	N/A
GCP-9	1/14/2019	14	14:15	1/15/2019	9:55
GCP-10	1/12/2019	12	13:45	1/3/2019	11:15
GCP-11	1/14/2019	14	12:40	N/A	N/A
GCP-12	1/17/2019	17	9:46	1/17/2019	16:47
GCP-13	1/16/2019	16	9:54	1/17/2019	15:58
GCP-14	1/14/2019	14	9:00	1/17/2019	8:30
GCP-15	1/15/2019	15	9:15	N/A	N/A
GCP-16	1/15/2019	15	9:30	1/15/2019	9:33
GCP-17	1/14/2019	14	16:49	N/A	N/A
GCP-18	1/15/2019	15	14:23	1/16/2019	16:48
GCP-19	1/15/2019	15	15:15	N/A	N/A
GCP-20	1/14/2019	14	14:54	1/17/2019	10:57
GCP-21	1/17/2019	17	12:27	1/17/2019	17:04
GCP-22	1/14/2019	14	10:38	1/17/2019	9:00
GCP-23	1/21/2019	21	12:27	N/A	N/A
GCP-24	1/23/2019	23	8:30	1/23/2019	14:04
GCP-25	1/21/2019	21	10:44	1/21/2019	10:47
GCP-26	12/1/2018	335	18:28	N/A	N/A
GCP-27	1/19/2019	19	10:20	N/A	N/A
GCP-28	1/15/2019	15	14:44	1/16/2019	7:38
GCP-29	1/15/2019	15	11:45	1/15/2019	11:48
GCP-30	1/13/2019	13	13:00	1/15/2019	14:00
GCP-31	11/25/2018	329	10:10	N/A	N/A
GCP-32	1/18/2019	18	12:02	1/18/2019	12:09
GCP-33	11/23/2018	327	16:25	N/A	N/A
GCP-34	1/27/2019	27	12:50	N/A	N/A
GCP-35	1/18/2019	18	14:47	1/18/2019	14:56
GCP-36	1/18/2019	18	17:08	N/A	N/A
GCP-37	1/21/2019	21	16:44	1/27/2019	8:18
GCP-38	1/22/2019	22	11:54	1/22/2019	12:25

GCP-39	1/11/2019	11	11:30	1/13/2019	9:00
GCP-40	1/12/2019	12	15:30	N/A	N/A
GCP-41	1/13/2019	13	14:20	N/A	N/A
GCP-42	1/14/2019	14	15:45	1/15/2019	8:05
GCP-43	1/14/2019	14	12:48	1/14/2019	12:51
GCP-44	1/12/2019	12	9:20	N/A	N/A
GCP-45	1/17/2019	17	12:15	N/A	N/A
GCP-46	1/15/2019	15	15:26	1/15/2019	15:29
GCP-47	1/14/2019	14	17:19	1/14/2019	17:22
GCP-48	1/11/2019	11	15:30	N/A	N/A
GCP-49	1/21/2019	21	14:00	N/A	N/A
GCP-50	1/21/2019	21	14:39	N/A	N/A
GCP-50A	1/25/2019	25	11:08	N/A	N/A
GCP-51	1/17/2019	17	15:20	N/A	N/A
GCP-52	1/18/2019	18	13:24	N/A	N/A
GCP-53	1/18/2019	18	12:40	N/A	N/A
GCP-54	1/19/2019	19	12:14	N/A	N/A
GCP-55	11/24/2018	328	9:35	N/A	N/A
GCP-56	1/19/2019	19	8:59	N/A	N/A
GCP-57	11/23/2018	327	10:20	N/A	N/A
GCP-58	1/16/2019	16	15:56	N/A	N/A
GCP-59	1/15/2019	15	12:42	1/16/2019	14:11
GCP-60	1/14/2019	14	13:58	1/16/2019	12:03
GCP-61	1/17/2019	17	11:04	1/17/2019	11:07

5. POINT COMPARISON

GCP-2	GCP-2CK	-0.008	-0.007	-0.026
GCP-3	GCP-3CK	0.003	0.003	-0.016
GCP-4	GCP-4CK	-0.026	0.009	0.015
GCP-5	GCP-5CK	-0.017	0.021	-0.017
GCP-7	GCP-7CK	-0.001	0.003	-0.005
GCP-9	GCP-9CK	-0.006	0.008	0.014
GCP-10	GCP-10CK	-0.023	0.018	-0.034
GCP-12	GCP-12CK	0.021	-0.003	0.006
GCP-13	GCP-13CK	0.019	0.014	-0.022
GCP-14	GCP-14CK	0.002	0.011	0.019
GCP-16	GCP-16CK	-0.011	0.006	0.001
GCP-19	GCP-19CK	-0.003	-0.004	-0.013
GCP-20	GCP-20CK	0.013	0.003	0.038
GCP-21	GCP-21CK	0.003	0.012	0.023
GCP-22	GCP-22CK	0.007	-0.006	0.001
GCP-24	GCP-24CK	0.001	0.012	-0.011
GCP-25	GCP-25CK	-0.002	0.000	-0.006
GCP-28	GCP-28CK	0.005	0.009	0.022
GCP-29	GCP-29CK	-0.010	-0.010	0.008
GCP-30	GCP-30CK	0.004	0.024	0.000
GCP-32	GCP-32CK	0.008	0.000	-0.003
GCP-35	GCP-35CK	-0.007	-0.003	-0.014
GCP-37	GCP-37CK	-0.016	-0.005	0.028
GCP-38	GCP-38CK	0.016	-0.008	-0.038
GCP-39	GCP-39CK	0.001	0.017	-0.021
GCP-42	GCP-42CK	-0.002	-0.014	-0.008
GCP-43	GCP-43CK	0.007	0.001	0.007
GCP-46	GCP-46CK	-0.008	0.004	0.002
GCP-47	GCP-47CK	0.000	-0.017	-0.028
GCP-59	GCP-59CK	-0.016	-0.002	0.012
GCP-60	GCP-60CK	0.003	0.005	0.007
GCP-61	GCP-61CK	0.001	0.005	0.008