

Ground Control Point Survey Report

VA FEMA NCRS South-Central QL2 Virginia/West Virginia LiDAR Mapping Project

Contract # G16PC00020
Task Order Number: G17PD01206

Prepared for:
USGS – United States Geological Survey



Prepared By:

Dewberry Engineers Inc.

4601 Forbes Boulevard, Suite 300

Lanham, Maryland, 20706

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

TABLE OF CONTENTS

1.	Introduction	
1.1	Project Summary	3
1.2	Points of Contact(s)	3
1.3	Project Area	4-5
2.	Project Details	
2.1	Survey Equipment.....	6
2.2	Survey Point Details.....	6
2.3	Network Design.....	6
2.4	Field Survey Procedures and Analysis.....	7-8
2.5	Adjustment.....	9
2.6	Data processing Procedures.....	9
3.	Final Coordinates.....	10-11
4.	GPS Observation & Re-Observation Schedule.....	12-13
5.	Point Comparison Report.....	14
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 USGS United States Geological Survey to provide 63 Ground Control Points in the States of Virginia and West Virginia. Under the above referenced USGS Task Order, Dewberry is tasked to complete the quality assurance of LiDAR mapping products. As part of this work Dewberry staff will complete Ground Control Point surveys that will be used to evaluate the mapping accuracy. The ground survey was conducted between the dates of December 26, 2017 and February 7, 2018.

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 Check 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 UTM Zone 17, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2012B (Geoid12B).

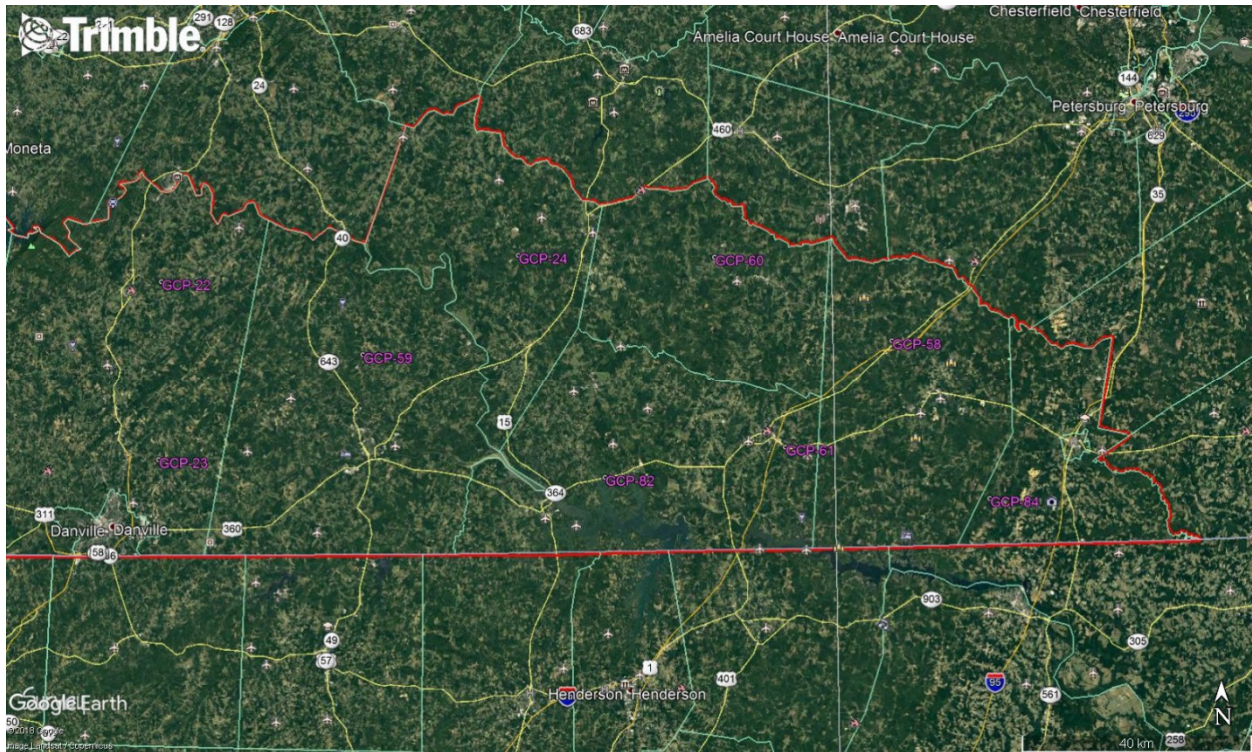
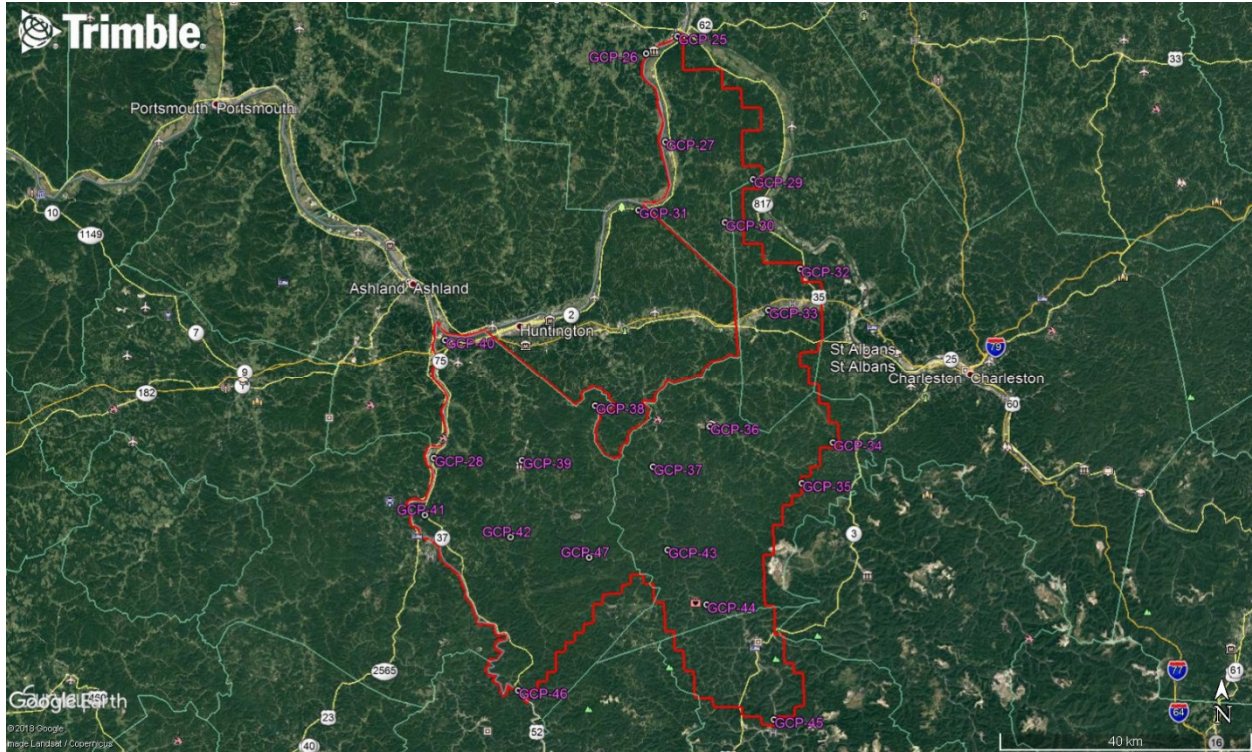
1.2 *Points of Contact*

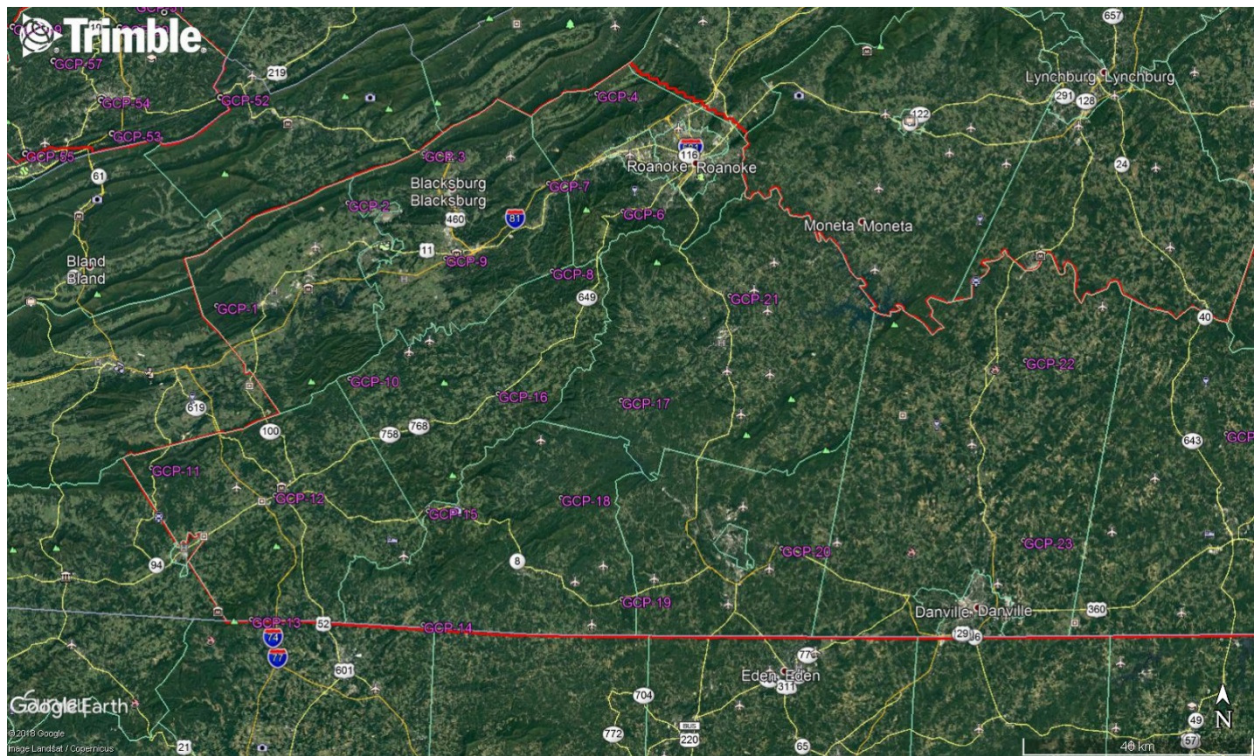
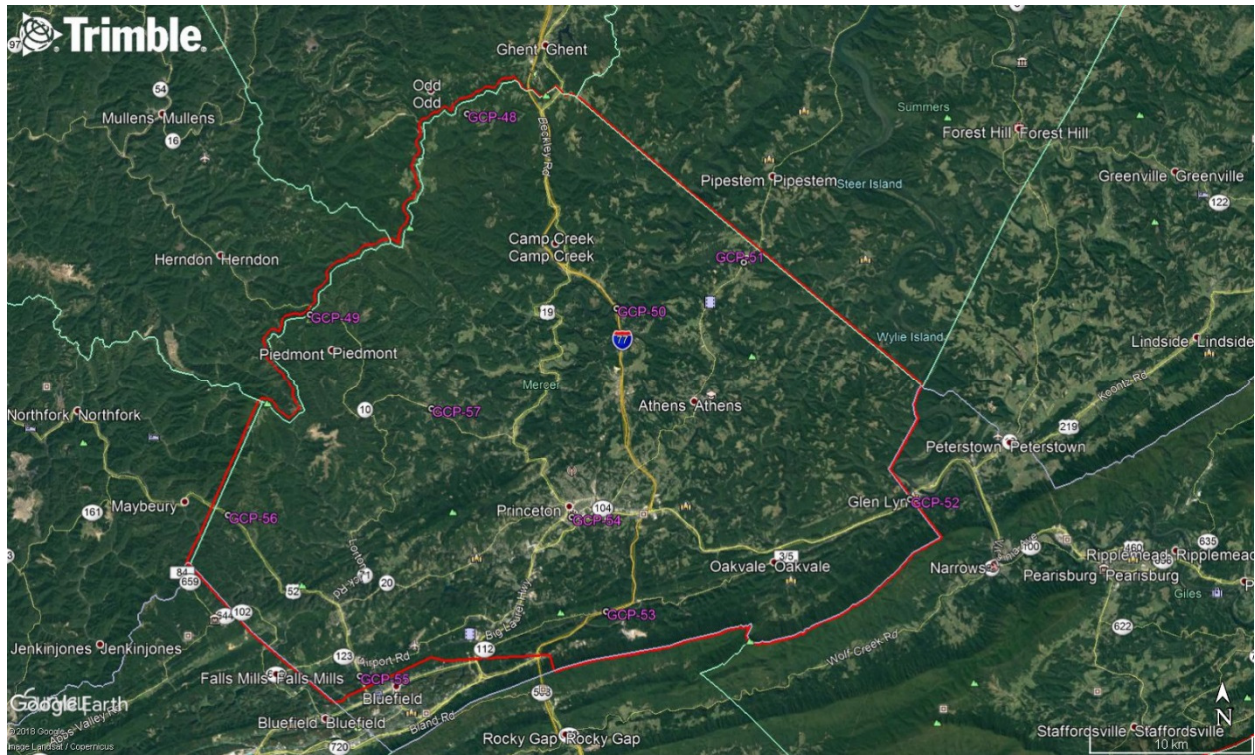
Questions regarding the technical aspects of this report should be addressed to:

Dewberry Engineers Inc.

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

1.3 Project Areas





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 63 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 GPS, Inc. 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.

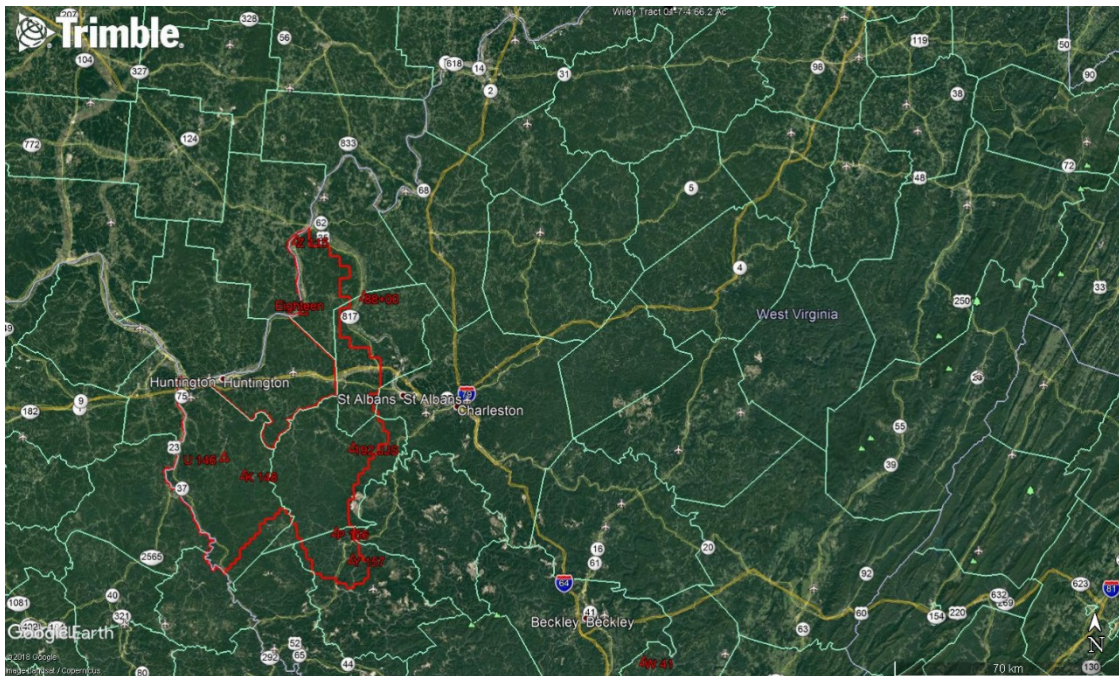
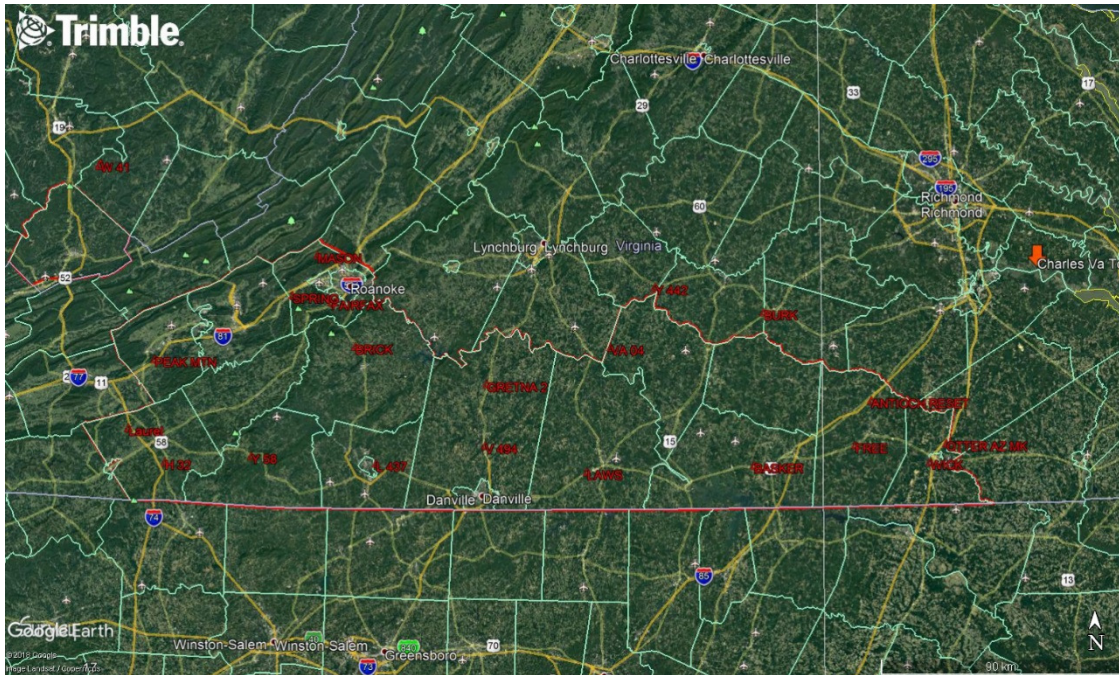
Field GPS observations are detailed on the “Check Point Documentation Reports” submitted as part of this report.

Sixteen (16) existing NGS monument listed in the NSRS database were located for the Virginia and West Virginia areas 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 GX1512, GX0386, HY0441, HY0560, HY0467, DM3999, HX2287, DL9814, HY0613, FX1611, GW0280, GW0453, FZ0560, FZ0561, FZ0006 and FX1105. The results are as follows:

	Observed Values			Data Sheet Values					
PT. #	NORTHING (m)	EASTING (m)	ELEV. (m)	NORTHING (m)	EASTING (m)	ELEV. (m)	ΔX	ΔY	ΔZ
H 30 GX1512	4124933.524	480506.873	780.233	N/A	N/A	780.26	N/A	N/A	0.027
W-283	4133275.168	506983.467	509.879	N/A	N/A	509.87	N/A	N/A	0.009
V109	4254492.569	380052.413	168.209	N/A	N/A	168.232	N/A	N/A	0.023
P 156	4207302.474	408118.936	194.749	N/A	N/A	194.715	N/A	N/A	0.034
D 38	4254231.946	410619.291	209.985	N/A	N/A	210.066	N/A	N/A	0.081
Athens	4142412.728	493994.112	737.007	4142412.728	493994.113	N/A	0	0.001	N/A
590	4269597.055	414393.58	179.739	N/A	N/A	179.719	N/A	N/A	0.020
WVOH	4205629.797	488396.18	628.892	4205629.797	488396.181	N/A	0	0.001	N/A
N156	4237698.805	400455.584	204.363	N/A	N/A	204.336	N/A	N/A	0.027
FREE	4070503.435	243977.075	87.003	4070503.446	243977.075	86.977	0.011	0.000	0.026
NGS BURK	4119047.489	745141.333	183.654	N/A	N/A	183.694	N/A	N/A	0.040
NGS Y442	4127355.344	705244.211	212.284	4127355.334	705244.207	212.306	0.010	0.004	0.022
NGS- H32	4060328.437	527164.824	873.574	N/A	N/A	873.575	N/A	N/A	0.001
NGS- J32	4064083.811	526883.647	849.662	N/A	N/A	849.628	N/A	N/A	0.034
NGS- Y58	4063139.112	558913.372	884.829	4063139.129	558913.327	884.79	0.017	0.045	0.039
OTTER AZ MK	4069693.921	277623.581	42.185	4069693.925	277623.585	42.172	0.004	0.004	0.013

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 KEYNET GPS, Inc 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 TBC or 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 2017) 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*

POINT ID	NORTHING (m)	EASTING (m)	ELEV. (m)
UTM Zone 17 North NAD83 (2011), Meters			
Ground Control Points			
GCP-1	4100224.145	511180.930	661.685
GCP-2	4117775.422	534120.527	545.279
GCP-3	4126423.277	547078.523	670.994
GCP-4	4137163.453	576672.903	585.161
GCP-5	4136359.106	582448.579	386.984
GCP-6	4117092.101	581470.113	414.749
GCP-7	4121671.271	568607.843	369.812
GCP-8	4106632.781	569470.825	467.764
GCP-9	4108549.058	551096.525	668.177
GCP-10	4087711.202	535034.922	841.859
GCP-11	4071954.598	501040.616	710.225
GCP-12	4067641.875	522477.535	748.339
GCP-13	4046365.553	518657.853	475.929
GCP-14	4045955.892	548254.701	444.129
GCP-15	4065419.212	548895.561	900.279
GCP-16	4085510.351	560556.405	758.860
GCP-17	4084708.818	581675.563	406.360
GCP-18	4067956.590	571625.258	461.149
GCP-19	4050816.621	582319.691	322.609
GCP-20	4059877.988	609692.442	219.740
GCP-21	4102877.364	600148.548	376.088
GCP-22	4092590.885	651330.245	233.265
GCP-23	4061850.730	651384.857	235.949
GCP-24	4098014.826	712943.056	142.726
GCP-25	4298576.317	399443.740	171.825
GCP-26	4295932.064	394449.980	170.766
GCP-27	4282002.861	397279.955	179.692
GCP-28	4232801.808	360137.060	202.647
GCP-29	4275942.088	411026.468	287.103
GCP-30	4269256.805	406503.986	226.447
GCP-31	4271375.719	392886.453	170.035
GCP-32	4261812.225	418286.670	235.999
GCP-33	4255196.725	413345.950	210.624

GCP-34	4234412.336	423020.555	291.847
GCP-35	4228109.198	418042.265	240.637
GCP-36	4237199.643	403647.836	204.367
GCP-37	4231011.395	394640.957	181.809
GCP-38	4240681.451	385645.893	186.680
GCP-39	4232298.582	374019.709	184.715
GCP-40	4251405.942	362154.105	166.950
GCP-41	4223940.783	358589.881	178.307
GCP-42	4220327.879	372068.010	196.566
GCP-43	4217985.951	396768.662	184.946
GCP-44	4209348.148	402799.660	192.277
GCP-45	4191192.915	413182.000	204.747
GCP-46	4196293.205	372911.173	187.637
GCP-47	4216968.616	384392.400	212.268
GCP-48	4159290.574	485104.361	917.338
GCP-49	4147344.279	475434.181	928.447
GCP-50	4147486.753	493992.284	658.227
GCP-51	4150158.575	501741.199	770.953
GCP-52	4135651.444	511685.862	465.945
GCP-53	4129174.940	493107.081	674.245
GCP-54	4134891.136	491093.781	729.403
GCP-55	4125508.560	478118.157	779.465
GCP-56	4135294.684	470252.221	772.837
GCP-57	4141535.517	482687.451	765.312
GCP-58	4084380.016	777640.501	117.203
GCP-59	4080570.037	686416.250	170.585
GCP-60	4098258.813	746808.659	170.434
GCP-61	4065689.376	759492.950	143.754
GCP-62	4060016.329	728508.145	93.097
GCP-63	4057400.941	794948.763	58.781

4. GPS OBSERVATIONS

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
GCP-1	2/5/2018	36	12:10	N\A	N/A
GCP-2	2/4/2018	35	13:39	N\A	N/A
GCP-3	2/6/2018	37	17:25	N\A	N/A
GCP-4	2/6/2018	37	13:21	2/6/2018	13:24
GCP-5	2/6/2018	37	14:12	2/6/2018	14:15
GCP-6	2/6/2018	37	7:50	2/6/2018	7:53
GCP-7	2/6/2018	37	10:30	2/7/2018	6:25
GCP-8	2/6/2018	37	6:44	2/7/2018	15:00
GCP-9	2/4/2018	35	6:45	2/5/2018	8:15
GCP-10	2/2/2018	33	14:48	N/A	N/A
GCP-11	2/1/2018	32	16:13	N/A	N/A
GCP-12	2/1/2018	32	10:07	2/2/2018	16:12
GCP-13	2/1/2018	32	12:40	N/A	N/A
GCP-14	1/30/2018	30	16:20	N/A	N/A
GCP-15	1/30/2018	30	14:12	N/A	N/A
GCP-16	2/2/2018	33	12:17	2/3/2018	10:56
GCP-17	1/31/2018	31	15:51	2/2/2018	9:21
GCP-18	1/31/2018	31	11:48	N/A	N/A
GCP-19	1/31/2018	31	8:30	N/A	N/A
GCP-20	1/31/2018	31	11:15	N/A	N/A
GCP-21	2/7/2018	38	10:45	2/7/2018	10:48
GCP-22	2/7/2018	38	10:27	N/A	N/A
GCP-23	2/1/2018	32	15:34	2/2/2018	17:45
GCP-24	2/3/2018	34	13:20	2/5/2018	13:05
GCP-25	12/27/2017	361	13:28	12/28/2017	9:25
GCP-26	12/27/2017	361	15:00	12/27/2017	15:08
GCP-27	12/28/2017	362	11:52	N/A	N/A
GCP-28	1/15/2018	15	15:37	1/16/2018	10:21
GCP-29	12/27/2017	361	9:36	N/A	N/A
GCP-30	12/29/2017	363	8:25	12/29/2017	8:31
GCP-31	12/28/2017	362	13:42	1/3/2018	8:33
GCP-32	12/27/2017	361	8:55	12/27/2017	9:13
GCP-33	12/29/2017	363	10:50	1/3/2018	11:45
GCP-34	1/3/2018	3	15:58	1/16/2018	13:20

GCP-35	1/4/2018	4	8:15	N/A	N/A
GCP-36	1/4/2018	4	13:20	N/A	N/A
GCP-37	1/9/2018	9	12:40	1/11/2018	15:15
GCP-38	1/17/2018	17	17:16	N/A	N/A
GCP-39	1/16/2018	16	14:14	1/17/2018	14:03
GCP-40	1/15/2018	15	10:47	N/A	N/A
GCP-41	1/15/2018	15	17:13	N/A	N/A
GCP-42	1/17/2018	17	12:31	1/18/2018	11:09
GCP-43	1/10/2018	10	13:08	N/A	N/A
GCP-44	1/10/2018	10	10:38	N/A	N/A
GCP-45	1/11/2018	11	9:17	1/15/2018	12:20
GCP-46	1/18/2018	18	13:20	1/18/2018	13:23
GCP-47	1/18/2018	18	13:20	N/A	N/A
GCP-48	12/28/2017	362	17:07	N/A	N/A
GCP-49	12/29/2017	363	14:22	N/A	N/A
GCP-50	12/28/2017	362	14:55	1/4/2018	15:23
GCP-51	12/28/2017	362	11:45	1/4/2018	12:56
GCP-52	12/27/2017	361	16:00	N/A	N/A
GCP-53	12/27/2017	361	9:22	1/3/2018	16:22
GCP-54	12/27/2017	361	10:32	1/3/2018	15:14
GCP-55	12/26/2017	360	13:35	N/A	N/A
GCP-56	12/26/2017	360	16:36	N/A	N/A
GCP-57	12/29/2017	363	11:41	N/A	N/A
GCP-58	1/31/2018	31	16:25	N/A	N/A
GCP-59	2/6/2018	37	19:18	2/7/2018	13:24
GCP-60	2/1/2018	32	13:05	2/3/2018	15:29
GCP-61	1/31/2018	31	13:05	N/A	N/A
GCP-62	2/1/2018	32	16:30	N/A	N/A
GCP-63	1/30/2018	30	17:15	1/31/2018	10:20

5. POINT COMPARISON

Point ID	Point CK	Delta North (M)	Delta East (M)	Vertical Difference (M)
GCP-4	GCP-4CK	0.002	-0.002	0.006
GCP-5	GCP-5CK	0.002	0.000	0.009
GCP-6	GCP-6CK	0.001	0.001	0.008
GCP-7	GCP-7CK	0.001	0.001	-0.004
GCP-8	GCP-8CK	0.000	-0.001	-0.008
GCP-9	GCP-9CK	-0.002	0.001	-0.003
GCP-12	GCP-12CK	0.004	-0.001	0.004
GCP-16	GCP-16CK	-0.005	0.001	0.007
GCP-17	GCP-17CK	-0.003	-0.007	-0.004
GCP-21	GCP-21CK	0.003	-0.011	0.009
GCP-23	GCP-23CK	-0.002	0.003	0.005
GCP-24	GCP-24CK	-0.002	-0.001	0.010
GCP-25	GCP-25 CK	0.001	0.003	0.006
GCP-26	GCP-26 CK	0.001	0.002	0.002
GCP-28	GCP-28 CK	0.002	0.015	0.012
GCP-30	GCP-30 CK	0.001	0.002	0.001
GCP-31	GCP-31 CK	0.001	0.002	0.009
GCP-32	GCP-32 CK	0.003	0.002	0.000
GCP-33	GCP-33 CK	0.000	0.003	0.011
GCP-34	GCP-34 CK	0.002	0.002	0.014
GCP-37	GCP-37 CK	0.012	0.004	0.005
GCP-39	GCP-39 CK	0.002	0.008	0.007
GCP-42	GCP-42 CK	0.004	0.005	0.002
GCP-45	GCP-45 CK	0.001	0.004	0.009
GCP-46	GCP-46 CK	0.005	0.002	0.004
GCP-50	GCP-50 CK	0.026	0.006	0.008
GCP-51	GCP-51 CK	0.017	0.007	0.002
GCP-53	GCP-53 CK	0.004	0.003	0.013
GCP-54	GCP-54 CK	0.023	0.009	0.003
GCP-59	GCP-59CK	0.001	-0.009	-0.006
GCP-60	GCP-60CK	0.003	-0.008	0.009
GCP-63	GCP-63CK	-0.01	-0.004	0.007