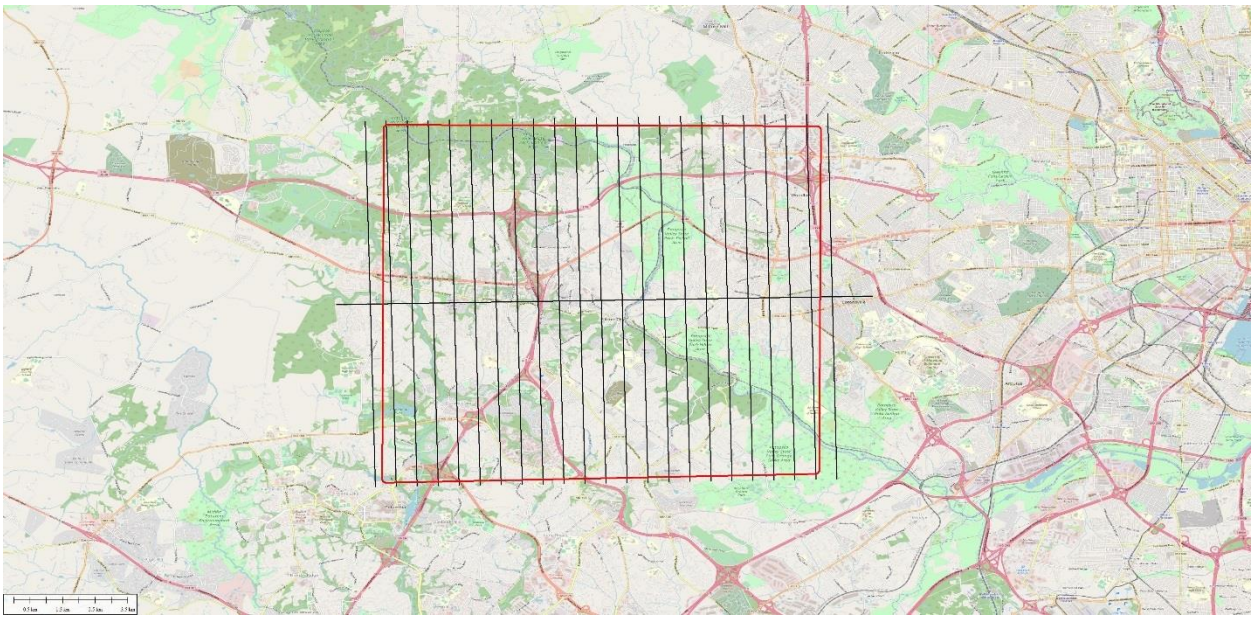
REPORT OF SURVEY
United States Geological Survey
Ground Control Report
Ellicott City Maryland
QL1 LIDAR



Performed by:

TerraSurv

For:

Fugro Geospatial

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USGS MARYLND QL1 LIDAR

INTRODUCTION

Terrasurv, Inc of Pittsburgh, PA was tasked by Fugro Geospatial with performing a control survey in support of LiDAR data collection covering an area around Ellicott City in Howard County, MD. The project consisted of two parts: ground control (GCP, 4 points requested) and quality control (VVA/NVA, 25 points requested). The map below in figure 1 shows the layout of the project. The four GCP points are shown as green dots, the twenty NVA as red dots, and the five VVA (woods) points are shown as yellow X's.

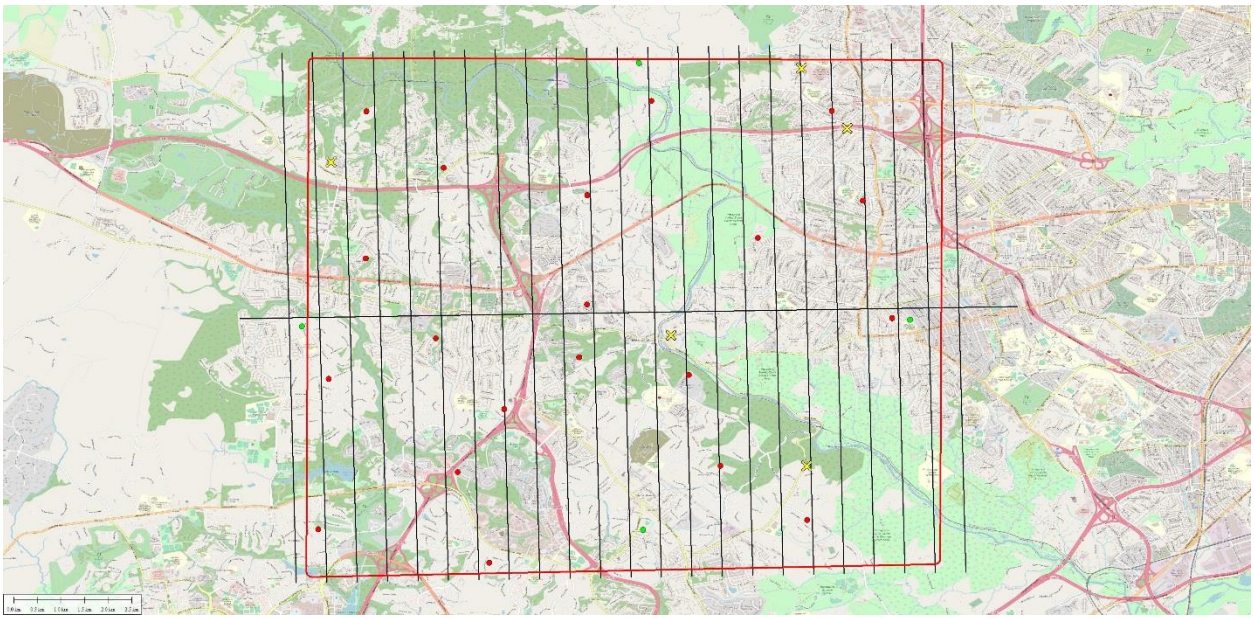

Figure 1 – Project Area

CONTROL

The National Spatial Reference System (NSRS) was used to provide control for the network. A The Keynet (Trimble) Virtual Reference Station (VRS) network was used to provide the tie to the NSRS. 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 GEOID12B. One existing NSRS ground station was included in the network as a check, summarized in table 1.

Table 1 - NSRS Control

Station Name	PID	Horizontal Accuracy	Vertical Order	Type of Mark
34 39 001	JB7034	1.11 cm	2-I	Concrete monument with survey disk

STATIONS

Table 2 lists the stations established in this survey, including the NSRS station and the traverse stations that were set to enable survey of VVA points in wooded areas.

Table 2 - Station Summary

Station Name	GPSID	USGS Quadrangle	Description
34 39 001	JV7034	SYKESVILLE	NSRS Benchmark
UMBC	UMBC	BALTIMORE WEST	VRS CORS
MD-NVA-019	18089AS	SAVAGE	pavement in cul-de-sac at 90° turn from N-S to E-W in Darting Bird Lane
MD-NVA-020	18089AT	ELLICOTT CITY	pavement in cul-de-sac at west end of Sugar Court
MD-NVA-021	18089AU	SAVAGE	pavement in cul-de-sac at NE end of Owens Court
MD-NVA-022	18089AV	SAVAGE	pavement in cul-de-sac at east end of Golden Sky Court
MD-NVA-023	18089AW	ELLICOTT CITY	pavement in cul-de-sac at east end of Stansway Court
MD-NVA-024	18089AX	ELLICOTT CITY	pavement in cul-de-sac at NE end of Plum Hill Court
MD-NVA-025	18089AY	ELLICOTT CITY	pavement in cul-de-sac at east end of Nelson House Road
MD-NVA-026	18089AZ	ELLICOTT CITY	pavement in cul-de-sac at west end of Hoffield Court
MD-NVA-027	18089BA	SAVAGE	pavement in cul-de-sac at intersection of Winding Way and W Hill Road
MD-NVA-028	18089BB	ELLICOTT CITY	pavement in cul-de-sac at west end of Temora Manor Lane
MD-NVA-029	18089BC	ELLICOTT CITY	pavement in cul-de-sac at east end of Drawdee Court
MD-NVA-030	18089BD	ELLICOTT CITY	pavement in cul-de-sac at north end of Windflower Court
MD-NVA-031	18089BE	ELLICOTT CITY	pavement in cul-de-sac at north end of Beechnut Court
MD-NVA-032	18089BF	SAVAGE	pavement in cul-de-sac at north end of Shelley Lane
MD-NVA-033	18089BG	ELLICOTT CITY	pavement in cul-de-sac at east end of Kennebunk Road
MD-NVA-034	18089BH	ELLICOTT CITY	pavement in cul-de-sac at NE end of Kings Court
MD-NVA-035	18089BI	ELLICOTT CITY	pavement in cul-de-sac at NE end of Kaitlins Court
MD-NVA-036	18089BJ	ELLICOTT CITY	pavement in cul-de-sac at west end of Samantha Way
MD-NVA-037	18089BK	ELLICOTT CITY	pavement in cul-de-sac at south end of Knoll Stone Court
MD-NVA-038	18089BL	ELLICOTT CITY	pavement in cul-de-sac at east end of Bending Sky Way
	18089CE	ELLICOTT CITY	Traverse station
	18089CF	ELLICOTT CITY	Traverse station
MD-VVA-F-11	18089CG	ELLICOTT CITY	woods between west end of Isabeles Way and west end of Queensland Drive
	18089CI	ELLICOTT CITY	Traverse station
	18089CJ	ELLICOTT CITY	Traverse station
MD-VVA-F-18	18089CK	ELLICOTT CITY	woods behind townhomes at Fairbrooks Road extended north
	18089CL	SAVAGE	Traverse station
	18089CM	SAVAGE	Traverse station
MD-VVA-F-17	18089CN	SAVAGE	woods on east side of Ilchester Road
	18089CO	ELLICOTT CITY	Traverse station
	18089CP	ELLICOTT CITY	Traverse station
MD-VVA-F-16	18089CQ	ELLICOTT CITY	woods on north side of park road
	18089CR	BALTIMORE WEST	Traverse station
	18089CS	BALTIMORE WEST	Traverse station
MD-VVA-F-19	18089CT	BALTIMORE WEST	woods on north side of intersection of Adamsville Road and Johnnycake Road
GCP05	18089E	ELLICOTT CITY	pavement in cul-de-sac at west end of Windfall Terrace
GCP06	18089F	SAVAGE	pavement in cul-de-sac at north end of Meadow Creek Terrace
GCP07	18089G	ELLICOTT CITY	dirt/broken pavement in middle of field entrance road on NE side of Dogwood Road
GCP08	18089H	BALTIMORE WEST	infield grass between pitcher's mound and first base in ball field on south side of Summit Avenue

METHODOLOGY

The field survey was done by using a Trimble R10 dual frequency, multi-constellation GNSS receivers in a real time (RTK/VRS) mode. Corrections were obtained from the KeyNetGPS VRS network over the cellular network. These corrections are applied in real time, and used by the rover receiver to converge to a cm level solution. Each station was occupied once, then re-initialized and occupied a second time immediately after the first occupation. The solutions are stored as vectors from the nearest physical CORS (UMBC). Table 3 summarizes the VRS occupations (precisions in meters):

Table 3 – VRS/RTK Occupation Summary

GPS BASE	GPSID	UTC Start	UTC End	Horz Prec	Vert Prec	# of SV's	PDOP
UMBC	18089E	12/18/2018 13:37:30	13:40:29	0.012	0.017	11	1.8
UMBC	18089E	12/18/2018 13:42:01	13:45:03	0.005	0.008	10	1.8
UMBC	18089BD	12/18/2018 13:49:22	13:52:21	0.005	0.007	11	1.6
UMBC	18089BD	12/18/2018 13:52:48	13:55:47	0.006	0.010	11	1.6
UMBC	18089CA	12/18/2018 14:08:34	14:10:03	0.011	0.031	10	1.9
UMBC	18089CA	12/18/2018 14:13:43	14:16:13	0.006	0.008	9	2.3
UMBC	18089CA	12/18/2018 14:16:46	14:18:45	0.006	0.009	10	2.0
UMBC	18089CB	12/18/2018 14:22:10	14:24:39	0.005	0.007	11	1.8
UMBC	18089CB	12/18/2018 14:25:01	14:27:11	0.008	0.011	10	2.1
UMBC	18089AS	12/18/2018 14:55:44	14:58:43	0.005	0.008	11	1.7
UMBC	18089AS	12/18/2018 14:59:11	15:02:16	0.008	0.012	12	1.5
UMBC	18089AV	12/18/2018 15:11:19	15:14:18	0.007	0.010	12	1.6
UMBC	18089AV	12/18/2018 15:14:36	15:17:36	0.004	0.006	7	2.2
UMBC	18089BA	12/18/2018 15:23:10	15:26:09	0.004	0.007	12	1.7
UMBC	18089BA	12/18/2018 15:26:28	15:29:27	0.004	0.007	12	1.7
UMBC	18089BB	12/18/2018 15:37:53	15:40:52	0.005	0.010	9	2.8
UMBC	18089BB	12/18/2018 15:41:15	15:44:14	0.005	0.010	10	2.3
UMBC	18089AX	12/18/2018 15:51:56	15:54:55	0.006	0.011	12	1.7
UMBC	18089AX	12/18/2018 15:55:27	15:58:26	0.005	0.009	12	1.9
UMBC	18089BH	12/18/2018 16:10:22	16:13:21	0.010	0.021	10	3.3
UMBC	18089BH	12/18/2018 16:13:39	16:16:38	0.010	0.023	10	3.4
UMBC	18089BK	12/18/2018 16:25:55	16:28:54	0.004	0.009	12	2.4
UMBC	18089BK	12/18/2018 16:29:40	16:32:39	0.005	0.010	12	2.4
UMBC	18089BJ	12/18/2018 16:40:46	16:43:45	0.005	0.009	13	2.0
UMBC	18089BJ	12/18/2018 16:44:06	16:47:05	0.005	0.008	11	2.4
UMBC	18089CE	12/18/2018 17:26:52	17:29:51	0.008	0.017	12	2.0
UMBC	18089CE	12/18/2018 17:30:26	17:33:25	0.011	0.014	13	1.6
UMBC	18089CF	12/18/2018 17:34:53	17:37:52	0.005	0.006	16	1.5
UMBC	18089CF	12/18/2018 17:38:37	17:41:36	0.006	0.008	14	1.6
UMBC	18089AW	12/18/2018 18:02:55	18:05:54	0.005	0.006	12	1.8
UMBC	18089AW	12/18/2018 18:06:15	18:09:14	0.006	0.009	10	2.4
UMBC	18089BI	12/18/2018 18:17:03	18:20:02	0.005	0.006	15	1.4
UMBC	18089BI	12/18/2018 18:20:23	18:23:22	0.003	0.005	15	1.4
UMBC	18089G	12/18/2018 18:31:22	18:34:21	0.005	0.007	15	1.4
UMBC	18089G	12/18/2018 18:34:38	18:37:37	0.007	0.011	14	1.4
UMBC	18089CI	12/18/2018 18:47:05	18:50:04	0.008	0.015	12	2.2
UMBC	18089CI	12/18/2018 18:50:24	18:53:23	0.004	0.008	9	2.9
UMBC	18089CJ	12/18/2018 19:00:27	19:03:26	0.007	0.014	12	2.1
UMBC	18089CJ	12/18/2018 19:04:47	19:07:17	0.005	0.009	11	2.9
UMBC	18089BG	12/18/2018 19:27:20	19:30:19	0.004	0.006	13	1.7
UMBC	18089BG	12/18/2018 19:30:44	19:33:43	0.004	0.006	14	1.6
UMBC	18089AZ	12/18/2018 19:44:09	19:47:08	0.004	0.006	13	1.5
UMBC	18089AZ	12/18/2018 19:47:31	19:50:30	0.003	0.004	12	1.5
UMBC	18089H	12/18/2018 20:01:19	20:04:18	0.003	0.004	15	1.2
UMBC	18089H	12/18/2018 20:04:51	20:07:50	0.003	0.003	16	1.2
UMBC	18089AT	12/18/2018 20:14:55	20:17:54	0.009	0.012	11	1.9
UMBC	18089AT	12/18/2018 20:18:20	20:21:19	0.004	0.006	10	2.2
UMBC	18089BC	12/18/2018 20:33:47	20:36:46	0.005	0.007	12	1.6
UMBC	18089BC	12/18/2018 20:37:29	20:40:28	0.004	0.007	11	1.8

GPS BASE	GPSID	UTC Start	UTC End	Horz Prec	Vert Prec	# of SV's	PDOP
UMBC	18089BL	12/18/2018 20:52:00	20:54:59	0.007	0.012	11	1.8
UMBC	18089BL	12/18/2018 20:55:19	20:58:18	0.005	0.008	10	2.3
UMBC	18089BF	12/18/2018 21:08:57	21:11:56	0.004	0.007	13	1.5
UMBC	18089BF	12/18/2018 21:12:22	21:15:21	0.003	0.006	13	1.5
UMBC	18089F	12/18/2018 21:23:21	21:26:20	0.008	0.016	13	1.6
UMBC	18089F	12/18/2018 21:27:45	21:30:44	0.007	0.014	12	1.7
UMBC	18089AU	12/18/2018 21:39:06	21:42:05	0.003	0.005	13	1.7
UMBC	18089AU	12/18/2018 21:43:43	21:46:42	0.004	0.007	14	1.5
UMBC	18089CL	12/19/2018 13:31:26	13:34:25	0.005	0.008	10	1.8
UMBC	18089CL	12/19/2018 13:34:44	13:37:45	0.005	0.008	5	13.2
UMBC	18089CM	12/19/2018 13:39:49	13:42:48	0.006	0.010	10	2.0
UMBC	18089CM	12/19/2018 13:43:30	13:46:30	0.004	0.008	5	4.3
UMBC	18089BE	12/19/2018 14:27:42	14:30:41	0.005	0.007	11	2.1
UMBC	18089BE	12/19/2018 14:31:18	14:34:17	0.005	0.007	6	3.2
UMBC	18089AY	12/19/2018 14:41:02	14:44:01	0.008	0.011	13	1.6
UMBC	18089AY	12/19/2018 14:46:56	14:48:20	0.005	0.007	12	1.7
UMBC	18089CO	12/19/2018 15:04:38	15:07:37	0.006	0.009	13	1.5
UMBC	18089CO	12/19/2018 15:07:59	15:10:58	0.008	0.013	11	2.1
UMBC	18089CP	12/19/2018 15:12:58	15:15:57	0.003	0.006	12	1.9
UMBC	18089CP	12/19/2018 15:17:43	15:20:44	0.004	0.007	5	3.9
UMBC	18089CP	12/19/2018 15:21:08	15:24:08	0.005	0.008	12	1.8
UMBC	18089CR	12/19/2018 15:49:05	15:52:04	0.008	0.017	13	2.1
UMBC	18089CR	12/19/2018 15:52:30	15:55:29	0.007	0.014	11	2.1
UMBC	18089CS	12/19/2018 15:57:10	16:00:09	0.005	0.012	13	1.8
UMBC	18089CS	12/19/2018 16:01:12	16:04:11	0.005	0.011	11	3.0
UMBC	JV7034	12/19/2018 16:37:44	16:40:43	0.020	0.020	13	1.7
UMBC	JV7034	12/19/2018 16:41:06	16:44:06	0.005	0.009	12	1.9

As mentioned, each station was occupied twice in succession. The Earth Centered Earth Fixed (ECEF) vector differences were rotated into a local horizon system (N, E, Up) for analysis, as summarized in table 4.

Table 4 - Repeat Baseline Analysis (meters)

Station	Delta N	Delta E	Horiz	Delta U	Length
18089AS	0.008	-0.010	0.013	-0.019	13086.000
18089AT	0.009	-0.005	0.010	0.010	3743.000
18089AU	0.000	-0.003	0.003	0.006	5429.000
18089AV	-0.008	0.002	0.008	-0.005	10572.000
18089AW	-0.002	-0.002	0.003	0.004	9370.000
18089AX	-0.009	0.008	0.012	0.006	10913.000
18089AY	0.004	-0.005	0.006	-0.003	8540.000
18089AZ	-0.006	0.001	0.006	0.006	5624.000
18089BA	-0.002	-0.004	0.005	0.004	10617.000
18089BB	0.003	0.009	0.010	0.015	9735.000
18089BC	0.009	0.004	0.010	0.006	6482.000
18089BD	-0.002	0.006	0.006	0.007	12609.000
18089BE	0.003	0.006	0.006	0.005	8589.000
18089BF	0.002	-0.001	0.002	0.000	6356.000
18089BG	-0.005	0.002	0.005	-0.005	7412.000
18089BH	0.008	-0.002	0.008	0.027	12341.000
18089BI	-0.002	-0.001	0.002	-0.001	9594.000
18089BJ	-0.003	-0.001	0.003	0.007	13397.000
18089BK	-0.005	0.001	0.006	-0.007	11746.000
18089BL	0.006	0.005	0.008	-0.004	6713.000
18089CA	-0.002	0.006	0.006	-0.029	12237.000
18089CA	-0.008	-0.001	0.008	-0.013	12237.000
18089CA	-0.006	-0.006	0.008	0.016	12237.000
18089CB	0.002	-0.005	0.005	-0.009	12218.000
18089CE	0.015	0.010	0.018	-0.014	13509.000

Station	Delta N	Delta E	Horiz	Delta U	Length
18089CF	-0.007	0.005	0.009	0.001	13457.000
18089CI	0.001	-0.004	0.004	0.009	8419.000
18089CJ	0.001	0.001	0.002	-0.017	8454.000
18089CL	-0.005	-0.004	0.006	0.005	4986.000
18089CM	0.007	0.002	0.007	0.008	5007.000
18089CO	-0.002	-0.002	0.003	0.003	7607.000
18089CP	0.007	0.003	0.008	0.043	7669.000
18089CP	0.006	0.002	0.007	0.023	7669.000
18089CP	-0.001	-0.001	0.001	-0.020	7669.000
18089CR	-0.007	0.002	0.007	-0.012	6270.000
18089CS	-0.003	0.001	0.003	0.004	6228.000
18089E	0.000	0.002	0.002	0.000	13120.000
18089F	0.000	-0.003	0.003	0.001	7967.000
18089G	-0.005	-0.003	0.006	-0.005	10280.000
18089H	-0.001	0.002	0.003	0.002	3467.000
JV7034	-0.010	-0.009	0.013	-0.014	17037.000

WOODS VVA CHECK POINTS

The five woods checkpoints (VVA) were surveyed by establishing a pair of intervisible stations in an open area using the Trimble R10 GNSS receiver. A Trimble S6 total station was then used to traverse to the woods point. Table 5 lists the conventional observations (mark-to-mark, grads and meters).

Table 5 - Conventional Observations to VVA (meters and gons)

Stand point	Back sight	Fore point	HI	HT	Direction	M-to-M Zenith Distance	M-to-M Distance
18089CC	18089CA	18089CA	0.196	0.067	0.0012	99.2083	47.551
18089CC	18089CA	18089CD	0.196	2.100	254.0456	114.3260	16.150
18089CE	18089CF	18089CF	1.563	2.067		97.6605	54.123
18089CE	18089CF	18089CG	1.563	2.067	313.0653	107.2369	23.913
18089CI	18089CJ	18089CJ	1.729	2.067		100.6540	58.754
18089CI	18089CJ	18089CK	1.729	2.067	115.7485	107.3137	51.069
18089CL	18089CM	18089CM	1.598	2.100		94.8975	36.396
18089CL	18089CM	18089CN	1.598	2.100	313.3787	105.6902	44.482
18089CO	18089CP	18089CP	1.552	2.100		97.6343	70.416
18089CO	18089CP	18089CQ	1.552	2.100	37.5633	97.8234	83.338
18089CR	18089CS	18089CS	1.641	2.100		101.0704	42.751
18089CR	18089CS	18089CT	1.641	2.100	261.0673	97.4920	24.941

LEAST SQUARES ADJUSTMENTS

Geolab was used to adjust the VRS vectors positions and the conventional observations to the forested VVA points. No scaling of the apriori GPS statistics was done. Station errors (centering, HI and HT) of 0.005 m were input. The GEOID12B model was used.

The preliminary adjustment constrained the CORS **UMBC** in all three dimensions (NAD83 (2011) latitude, longitude, and ellipsoidal height. The misclosures at the existing NSRS station are listed in table 6.

Table 6 - NSRS Misclosures

Station Name	GPSID	Horz Accy	Vert Order	Delta Horiz meters	Delta Ellip H meters	Delta NAVD88 Meters
34 39 001	JV7034	1.11 cm	2-I	0.002 m	+0.043 m	+0.021 m

The final adjustment constrained the CORS **UMBC** horizontally (NAD83 (2011) latitude and longitude) and the NSRS station fixed vertically (NAVD88 orthometric height). The estimated variance factor was 0.37. This adjustment provided the adjusted positions and heights for the stations in the network. Table 7 lists the station confidence regions (error ellipses) at the 95% level (in meters):

Table 7 - Station Confidence Regions (95% level - Meters)

Station Name	Semi-Major Axis	Azimuth	Semi-Minor Axis	Vertical
18089AS	0.0091	8	0.0087	0.0147
18089AT	0.0090	3	0.0087	0.0142
18089AU	0.0079	3	0.0077	0.0134
18089AV	0.0087	19	0.0082	0.0140
18089AW	0.0089	23	0.0081	0.0139
18089AX	0.0087	179	0.0080	0.0149
18089AY	0.0091	174	0.0084	0.0144
18089AZ	0.0080	172	0.0078	0.0131
18089BA	0.0083	12	0.0079	0.0136
18089BB	0.0085	14	0.0079	0.0149
18089BC	0.0083	35	0.0081	0.0137
18089BD	0.0087	164	0.0082	0.0142
18089BE	0.0085	170	0.0080	0.0138
18089BF	0.0079	27	0.0078	0.0135
18089BG	0.0081	1	0.0079	0.0134
18089BH	0.0115	169	0.0095	0.0222
18089BI	0.0082	31	0.0078	0.0133
18089BJ	0.0085	165	0.0079	0.0143
18089BK	0.0085	165	0.0079	0.0148
18089BL	0.0087	42	0.0085	0.0148
18089CE	0.0100	35	0.0064	0.0131
18089CF	0.0086	32	0.0063	0.0130
18089CG	0.0108	78	0.0070	0.0133
18089CI	0.0088	5	0.0062	0.0134
18089CJ	0.0086	3	0.0062	0.0134
18089CK	0.0150	132	0.0068	0.0136
18089CL	0.0084	116	0.0059	0.0128
18089CM	0.0084	116	0.0059	0.0128
18089CN	0.0159	12	0.0064	0.0130
18089CO	0.0094	6	0.0053	0.0124
18089CP	0.0067	6	0.0052	0.0123
18089CQ	0.0104	69	0.0061	0.0127
18089CR	0.0091	38	0.0063	0.0142
18089CS	0.0082	39	0.0063	0.0141
18089CT	0.0137	71	0.0070	0.0144
18089E	0.0101	149	0.0089	0.0155
18089F	0.0096	14	0.0090	0.0178
18089G	0.0090	33	0.0082	0.0145
18089H	0.0078	174	0.0077	0.0128
JV7034	0.0104	13	0.0082	HELD

SUMMARY

A LiDAR ground control network consisting of 4 ground control points (GCP) and 25 QA/QC check points was established in central Maryland. The estimated accuracy of the control network is ±0.03 m with respect to the NAD83 (2011) epoch 2010.0 reference frame and the NAVD88 vertical datum.

Adjusted Coordinates

Horizontal Datum: NAD83 (2011) epoch 2010.0
Vertical Datum: Ellipsoidal Height=NAVD88+GEOID12B
Units: meters
UTM Zone: 18

Table 8 - Adjusted Latitude/Longitude/Elevation/Ellipsoidal Height/UTM coordinates

Station Name	GPSID	Latitude	Longitude	Ellipsoidal Height	NAVD 1988	UTM Northing	UTM Easting
34 39 001	JV7034	39°18'16.18605" N	76°53'57.03257" W	116.146	148.180	4352287.194	336248.247
UMBC	UMBC	39°15'24.36090" N	76°42'41.46865" W	65.960	98.426	4346666.829	352329.279
MD-NVA-019	18089AS	39°13'53.02479" N	76°51'34.37113" W	76.067	108.223	4344102.913	339498.606
MD-NVA-020	18089AT	39°16'17.37221" N	76°45'01.92439" W	119.118	151.439	4348365.527	348994.408
MD-NVA-021	18089AU	39°13'59.53639" N	76°45'59.87079" W	91.927	124.270	4344143.092	347522.888
MD-NVA-022	18089AV	39°13'30.46909" N	76°49'37.24668" W	97.233	129.452	4343350.368	342292.899
MD-NVA-023	18089AW	39°17'41.41009" N	76°48'30.32770" W	105.858	138.040	4351054.617	344052.151
MD-NVA-024	18089AX	39°16'03.55806" N	76°50'13.86526" W	79.148	111.314	4348087.832	341510.587
MD-NVA-025	18089AY	39°15'50.62699" N	76°48'36.07609" W	74.504	106.719	4347641.943	343846.113
MD-NVA-026	18089AZ	39°17'37.67604" N	76°45'21.54053" W	109.083	141.360	4350850.378	348572.395
MD-NVA-027	18089BA	39°14'32.33900" N	76°49'59.15163" W	79.038	111.232	4345268.413	341806.244
MD-NVA-028	18089BB	39°15'15.16165" N	76°49'27.30562" W	84.594	116.794	4346573.206	342596.307
MD-NVA-029	18089BC	39°17'12.25642" N	76°46'33.52666" W	91.889	124.137	4350100.368	346832.526
MD-NVA-030	18089BD	39°15'35.85029" N	76°51'27.17753" W	89.221	121.358	4347269.470	339736.133
MD-NVA-031	18089BE	39°16'26.70054" N	76°48'30.64709" W	74.412	106.620	4348751.483	343998.451
MD-NVA-032	18089BF	39°14'36.33601" N	76°46'59.24173" W	107.098	139.388	4345305.508	346121.725
MD-NVA-033	18089BG	39°18'38.95972" N	76°45'42.97262" W	109.609	141.852	4352749.728	348095.787
MD-NVA-034	18089BH	39°16'58.26459" N	76°51'01.92038" W	82.629	114.759	4349797.899	340393.448
MD-NVA-035	18089BI	39°18'45.77774" N	76°47'46.52753" W	72.612	104.796	4353018.157	345140.827
MD-NVA-036	18089BJ	39°18'38.66878" N	76°51'01.40516" W	105.660	137.768	4352893.117	340469.129
MD-NVA-037	18089BK	39°18'00.07981" N	76°50'08.68058" W	105.053	137.189	4351677.673	341707.738
MD-NVA-038	18089BL	39°15'38.64276" N	76°47'20.86952" W	68.694	100.952	4347236.632	345641.208
MD-VVA-F-11	18089CG	39°18'04.76242" N	76°51'25.42719" W	102.656	134.760	4351859.575	339872.327
MD-VVA-F-18	18089CK	39°19'08.65979" N	76°46'04.07819" W	93.484	125.707	4353675.245	347608.216
MD-VVA-F-17	18089CN	39°14'52.39740" N	76°46'04.03497" W	36.801	69.123	4345774.721	347454.863
MD-VVA-F-16	18089CQ	39°17'45.17419" N	76°47'06.24216" W	91.079	123.300	4351130.646	346068.750
MD-VVA-F-19	18089CT	39°18'17.79186" N	76°44'59.46532" W	91.965	124.241	4352076.890	349125.154
GCP05	18089E	39°16'11.81110" N	76°51'45.32381" W	95.974	128.094	4348387.080	339324.030
GCP06	18089F	39°13'52.76136" N	76°47'52.11125" W	111.316	143.586	4343987.182	344827.613
GCP07	18089G	39°19'12.13690" N	76°47'54.65045" W	101.292	133.468	4353834.678	344962.456
GCP08	18089H	39°16'15.33087" N	76°44'50.35468" W	123.250	155.580	4348297.235	349270.441