

Check Point Survey Report
“COMMONWEALTH of PUERTO RICO, QL2 LiDAR PROJECT”
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Task Order Number: G15PD00885

Prepared for:
United States Geological Survey (USGS)



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1. INTRODUCTION

1.1 *Project Summary*

Dewberry Consultants LLC is under contract to the United States Geological Survey to provide 215 Check Points in the Commonwealth of Puerto Rico. 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 Check Point surveys that will be used to evaluate vertical and horizontal accuracy. The ground survey was conducted January 30, and February 5, 2016.

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 Puerto Rico State Plane, Zone 5200, NAD83 (2011) in meters. Final Vertical elevations are referenced to PRVDO2 in meters using Geoid model 2012B (Geoid12B).

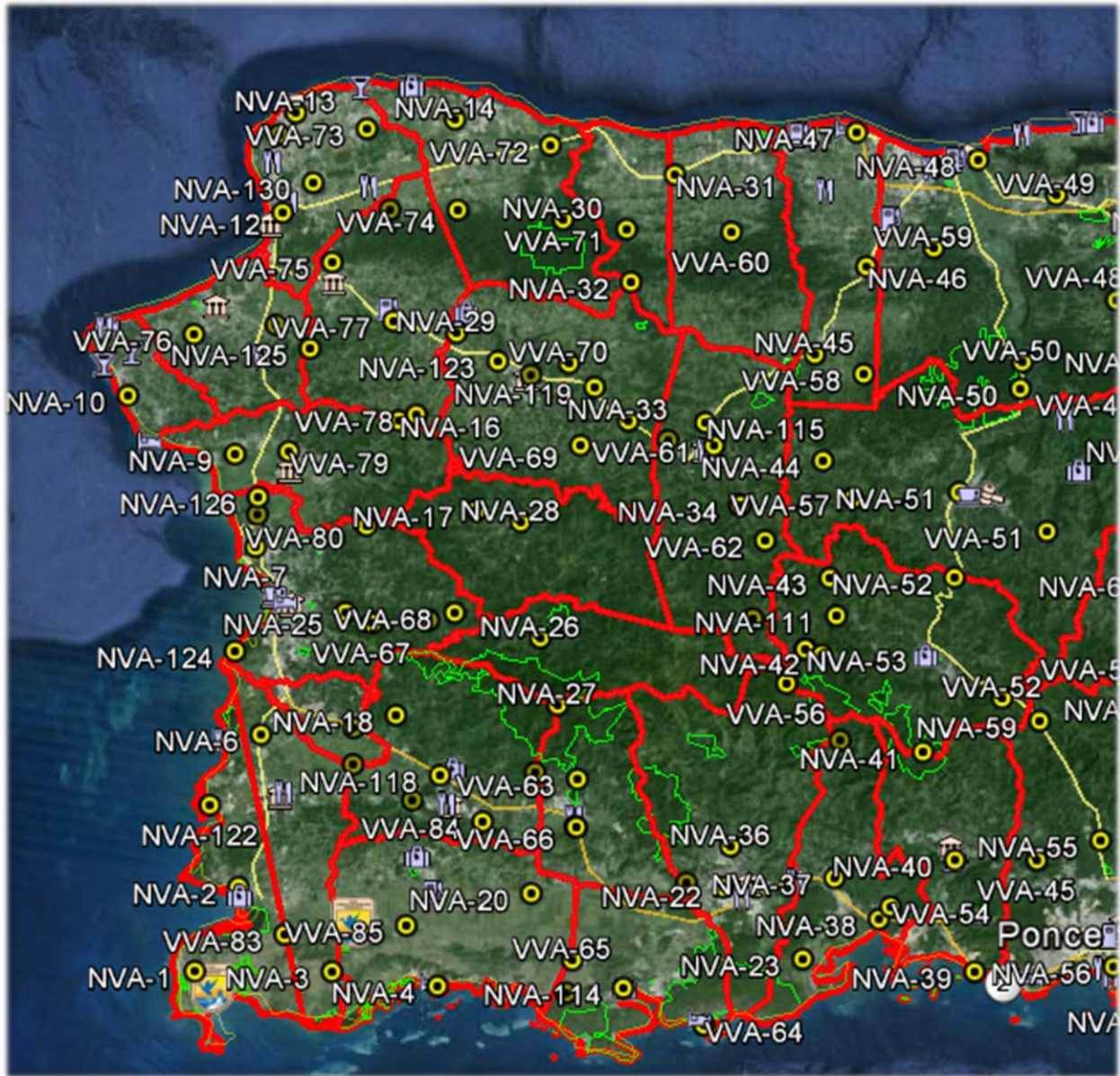
1.2 *Points of Contact*

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

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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 215 LiDAR Check 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 Check 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 Consultants LLC office located in Lanham, MD was tied to a Real Time Network operated by HLCM Group. 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 ± 5 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.

Thirteen (13) existing NGS monuments listed in the NSRS database were located as an additional QA/QC method to check the accuracy of the VRS network as well as being the primary project control monuments designated as DN8632, DO1063, AB9846, DE5485, AB9838, DE5470, AB9842, AB9844, DI1789, DE5532, AB9841, DN8538 and DI1785. The results are as follows:

NGS POINT. ID	Observed Values (m)			Data Sheet Values (m)			Differential (m)		
	NORTHING	EASTING	ELEVS.	NORTHING	EASTING	ELEVS.	ΔX	ΔY	ΔZ
B 1018	253301.934	320807.744	0.956	253301.100	320807.800	1.013	N/A	N/A	-0.057
L 1017	255455.798	284113.274	3.433	255457.700	284115.800	3.392	N/A	N/A	0.041
HUMACAO 2	233305.105	264562.753	33.204	233305.097	264562.784	33.252	0.008	-0.031	-0.048
BERRIOS	267123.114	201085.701	43.256	267123.127	201085.711	43.368	-0.013	-0.010	N/A
UTUADO	248478.171	170061.955	166.508	248478.155	170061.924	166.476	0.016	0.031	0.032
SANABRIA	265276.028	230024.220	3.929	265276.022	230024.231	3.927	0.006	-0.011	0.002
MAGAS	220084.464	164710.331	8.414	220084.456	164710.279	8.450	0.008	0.052	-0.036
COCO	218681.540	219613.401	45.296	218681.520	219613.395	45.410	0.020	0.006	N/A
GPS 62	246946.524	123063.992	3.976	246946.523	123063.991	3.988	0.001	0.001	-0.012
M 1005	270891.014	140261.255	108.166	270891.011	140261.243	108.204	0.003	0.012	-0.038
LAJAS 2	226494.729	144332.157	87.879	226494.700	144332.154	87.909	0.029	0.003	-0.030
975 2695 H	229319.911	301787.900	3.661	229318.500	301789.100	3.654	N/A	N/A	0.007
UPRM GPS 13	242403.871	125328.955	18.040	242403.846	125328.960	18.280	0.025	-0.005	N/A

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 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 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***

POINT ID	NORTHING (m)	EASTING (m)	ELEV. (m)
NVA POINTS			
NVA-1	216505.018	118838.113	11.000
NVA-2	222115.070	121778.117	11.435
NVA-3	216495.756	128061.518	59.312
NVA-4	215553.612	135137.078	1.335
NVA-5	227941.719	133458.703	33.135
NVA-6	232289.285	123292.495	41.791
NVA-7	244788.763	122930.840	23.215
NVA-8	246945.816	123053.129	2.670
NVA-9	250955.721	121553.087	1.472
NVA-10	254847.859	114351.294	6.837
NVA-11	259565.109	124292.732	20.534
NVA-12	267028.103	124745.174	123.259
NVA-13	273691.828	125599.601	66.854
NVA-14	273245.212	136285.844	71.556
NVA-15	267218.986	131956.440	169.226
NVA-16	253199.709	132542.075	227.335
NVA-17	247245.819	137786.750	355.967
NVA-18	233614.558	132399.784	44.168
NVA-19	229835.307	141728.339	212.070
NVA-20	221751.930	141438.307	11.194
NVA-21	215123.510	143775.370	37.481
NVA-22	222191.741	154295.013	58.334
NVA-23	217407.188	159606.973	6.017
NVA-24	222492.997	151836.230	49.187
NVA-25	240438.600	129004.374	105.120
NVA-26	238789.276	142144.100	426.399
NVA-27	234382.655	143361.022	784.062
NVA-28	246475.806	140784.666	306.691
NVA-29	259041.718	136426.530	71.757
NVA-30	266558.025	143570.949	186.025
NVA-31	269562.096	151017.857	103.235
NVA-32	262419.410	148115.255	202.462
NVA-33	253189.554	147955.133	375.035
NVA-34	247610.718	155463.237	523.144

NVA-35	240100.539	156342.312	603.664
NVA-36	224927.924	154788.430	74.931
NVA-37	222823.971	161739.454	54.014
NVA-38	220080.256	164708.268	8.650
NVA-39	216583.098	171112.687	4.654
NVA-40	224041.401	169796.164	40.086
NVA-41	231317.998	167699.617	896.531
NVA-42	237715.334	160940.407	574.502
NVA-43	242800.429	161465.083	668.391
NVA-44	250566.269	160985.526	399.344
NVA-45	257628.565	160419.774	313.937
NVA-46	263462.571	163844.957	187.702
NVA-47	272393.673	163163.607	11.858
NVA-48	270571.055	171289.263	1.470
NVA-49	261239.930	180550.879	194.053
NVA-50	255348.218	174137.747	324.174
NVA-51	248492.037	170069.926	166.715
NVA-52	242841.299	169770.935	237.884
NVA-53	238093.780	159842.809	658.329
NVA-54	236099.764	181091.899	884.306
NVA-55	225353.310	179529.201	191.063
NVA-56	216938.686	180406.013	3.159
NVA-57	218228.550	191004.761	8.293
NVA-58	227365.361	192973.836	75.007
NVA-59	233348.171	175453.194	579.594
NVA-60	242694.632	183553.402	439.892
NVA-61	250405.538	182565.201	457.149
NVA-62	257531.255	185212.626	187.214
NVA-63	266902.846	188375.998	17.886
NVA-64	272023.745	184659.967	3.229
NVA-65	268075.613	196538.944	25.801
NVA-66	258665.892	195648.307	104.429
NVA-67	250967.217	192802.209	408.447
NVA-68	232271.070	204833.476	577.564
NVA-69	236236.027	191999.373	804.265
NVA-70	224621.735	197473.857	137.466
NVA-71	215209.506	202210.811	10.414
NVA-72	222986.349	207581.266	124.090
NVA-73	234592.460	213951.003	659.172

NVA-74	243164.708	204359.563	516.334
NVA-75	248740.950	204078.907	609.819
NVA-76	261040.823	205159.111	145.771
NVA-77	269479.703	209284.181	9.480
NVA-78	263940.818	218928.884	10.537
NVA-79	251571.675	220515.547	100.242
NVA-80	245800.461	218136.454	649.988
NVA-81	239173.291	228980.153	471.920
NVA-82	226309.054	222849.996	463.569
NVA-83	218667.049	219615.764	44.006
NVA-84	216003.038	235473.520	27.124
NVA-85	228041.671	235139.849	573.530
NVA-86	234472.327	234447.713	401.197
NVA-87	237651.704	244015.751	376.620
NVA-88	258408.991	233935.022	31.114
NVA-89	262973.323	238414.390	16.574
NVA-90	264586.656	248675.579	3.113
NVA-91	256050.798	257537.402	44.664
NVA-92	245317.464	254310.070	56.910
NVA-93	238635.710	250744.652	100.807
NVA-94	224924.889	255668.162	24.350
NVA-95	220850.497	252712.551	45.976
NVA-96	230133.945	264434.370	30.429
NVA-97	235488.173	264239.756	20.257
NVA-98	242743.599	263329.934	97.058
NVA-99	242367.908	273532.537	21.585
NVA-100	247711.563	283179.357	20.105
NVA-101	253507.245	282850.346	10.512
NVA-102	260409.466	274816.592	6.017
NVA-103	265435.220	262892.679	1.661
NVA-104	260615.786	261962.081	8.532
NVA-105	233439.132	298218.466	1.741
NVA-106	234337.874	303581.238	21.612
NVA-107	229328.939	300361.169	7.877
NVA-108	250926.844	321076.748	20.100
NVA-109	253321.489	319349.083	3.867
NVA-110	252253.928	322384.381	3.266
NVA-111	240308.938	161912.197	486.318
NVA-112	215241.338	181930.855	2.377

NVA-113	247651.308	155430.011	523.731
NVA-114	215464.010	147596.230	5.271
NVA-115	253087.345	153113.992	382.868
NVA-116	226240.491	144386.488	85.726
NVA-117	251912.584	150620.168	373.976
NVA-118	229612.483	135327.479	41.407
NVA-119	255426.456	145684.907	288.812
NVA-120	232761.553	129543.468	31.687
NVA-121	256244.172	141410.080	80.673
NVA-122	227581.776	119859.086	5.474
NVA-123	257154.484	139200.561	67.232
NVA-124	237841.003	121545.361	1.406
NVA-125	257992.704	126608.800	178.781
NVA-126	248099.278	123096.046	3.476
NVA-128	272232.749	124501.856	77.358
NVA-130	269017.495	126800.340	126.102
VVA POINTS			
VVA-01	254839.686	319494.664	133.840
VVA-02	252632.210	323422.286	56.464
VVA-03	253557.969	320855.319	6.842
VVA-04	255155.577	317591.913	2.126
VVA-05	252180.723	320061.544	7.965
VVA-06	229627.269	299330.083	27.732
VVA-07	230682.104	311955.683	6.772
VVA-08	234123.088	304974.461	43.320
VVA-09	230831.694	299690.632	77.463
VVA-10	256955.730	280811.034	15.727
VVA-11	250398.489	277248.052	83.147
VVA-12	242642.687	278085.169	3.828
VVA-13	226675.299	266049.279	84.893
VVA-14	223368.707	260360.814	16.143
VVA-15	234747.660	251324.028	285.449
VVA-16	241416.211	257612.290	151.989
VVA-17	251502.284	261995.309	532.492
VVA-18	258765.311	266859.395	31.146
VVA-19	261604.512	255578.964	5.567
VVA-20	252827.996	247267.768	211.214
VVA-21	250547.212	254462.004	144.247
VVA-22	243404.427	239733.421	97.145

VVA-23	230424.041	244180.877	545.988
VVA-24	218423.030	244742.094	11.344
VVA-25	218278.692	233791.089	80.550
VVA-26	238242.538	235225.735	382.628
VVA-27	248642.722	234989.344	426.939
VVA-28	259564.622	241762.023	44.233
VVA-29	258325.135	223172.116	53.624
VVA-30	249212.741	225807.387	413.754
VVA-31	241869.080	221296.097	204.476
VVA-32	229142.000	227542.068	522.277
VVA-33	222989.362	222171.338	212.948
VVA-34	217134.547	215853.750	17.831
VVA-35	220384.112	201705.552	50.922
VVA-36	229655.046	211178.837	278.659
VVA-37	234666.052	220550.275	386.220
VVA-38	247012.566	210394.862	621.085
VVA-39	256077.078	209262.166	124.690
VVA-40	265181.097	195957.846	77.934
VVA-41	252455.723	198913.950	71.666
VVA-42	237419.404	201238.900	859.602
VVA-43	231830.452	196067.577	354.310
VVA-44	218998.062	185534.944	4.067
VVA-45	224034.380	175270.817	79.869
VVA-46	243524.249	194308.233	663.463
VVA-47	254723.380	183234.054	233.016
VVA-48	263205.205	182537.027	150.766
VVA-49	268245.896	176528.311	14.325
VVA-50	257135.631	174272.965	125.684
VVA-51	245897.730	175920.912	264.027
VVA-52	234856.436	172950.634	765.859
VVA-53	237228.707	183656.815	1158.672
VVA-54	220903.836	165479.721	13.048
VVA-55	232080.177	162172.702	629.532
VVA-56	235839.903	158611.483	730.646
VVA-57	248070.836	162979.960	632.870
VVA-58	256324.209	163684.273	300.710
VVA-59	264704.921	168339.493	126.857
VVA-60	265748.082	154818.418	162.055
VVA-61	251566.632	153693.460	306.997

VVA-62	245283.716	157143.806	567.356
VVA-63	229394.929	144566.116	225.620
VVA-64	212985.081	152999.646	0.267
VVA-65	217315.097	144181.902	15.605
VVA-66	226189.035	144477.608	86.302
VVA-67	239751.886	130816.222	188.686
VVA-68	240442.863	136367.595	321.816
VVA-69	251570.250	144756.862	201.950
VVA-70	257027.100	143975.933	295.522
VVA-71	265926.244	147810.452	196.409
VVA-72	271518.712	142682.005	83.382
VVA-73	272616.132	130378.930	58.688
VVA-74	267198.661	136510.158	188.381
VVA-75	263734.154	128077.180	198.625
VVA-76	258931.917	118779.396	66.248
VVA-77	259812.754	132187.016	89.050
VVA-78	253587.329	133730.314	187.050
VVA-79	251138.096	125171.198	11.750
VVA-80	246201.051	130399.198	268.572
VVA-81	239948.891	134626.475	348.695
VVA-82	230310.539	129487.178	19.077
VVA-83	218969.726	124887.961	7.322
VVA-84	226536.944	138192.875	63.891
VVA-85	219592.509	133040.845	15.638

4. GPS OBSERVATIONS

Control Points					
POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA-1	2/3/2016	34	8:51	2/4/2016	14:10
NVA-2	2/3/2016	34	8:03	2/4/2016	14:47
NVA-3	2/3/2016	34	9:39	2/4/2016	13:06
NVA-4	2/3/2016	34	11:05	2/4/2016	12:22
NVA-5	2/2/2016	33	16:25	2/4/2016	10:36
NVA-6	2/3/2016	34	7:04	2/4/2016	8:21
NVA-7	2/3/2016	34	15:21	2/4/2016	5:31
NVA-8	1/31/2016	31	8:32	1/31/2016	21:37
NVA-9	1/31/2016	31	9:14	1/31/2016	21:15
NVA-10	1/31/2016	31	10:20	1/31/2016	20:41
NVA-11	1/31/2016	31	12:11	1/31/2016	18:30
NVA-12	1/31/2016	31	13:13	N/A	N/A
NVA-13	1/30/2016	30	6:36	1/31/2016	6:21
NVA-14	1/30/2016	30	17:09	1/31/2016	7:38
NVA-15	1/31/2016	31	16:45	N/A	N/A
NVA-16	2/1/2016	32	8:03	2/1/2016	18:31
NVA-17	2/2/2016	33	7:36	N/A	N/A
NVA-18	2/2/2016	33	17:05	2/4/2016	9:51
NVA-19	2/2/2016	33	15:12	N/A	N/A
NVA-20	2/3/2016	34	13:21	2/4/2016	11:59
NVA-21	2/3/2016	34	11:26	2/4/2016	5:36
NVA-22	2/2/2016	33	13:53	2/4/2016	6:59
NVA-23	2/2/2016	33	18:03	2/4/2016	6:41
NVA-24	2/2/2016	33	13:35	2/4/2016	7:21
NVA-25	2/4/2015	35	7:06	N/A	N/A
NVA-26	2/4/2016	35	9:07	N/A	N/A
NVA-27	2/4/2016	35	10:00	N/A	N/A
NVA-28	2/2/2016	33	7:56	N/A	N/A
NVA-29	2/1/2016	32	9:24	2/1/2016	19:06
NVA-30	1/31/2016	31	15:34	N/A	N/A
NVA-31	1/30/2016	30	15:40	N/A	N/A
NVA-32	2/1/2016	32	11:04	N/A	N/A
NVA-33	2/2/2016	33	9:13	N/A	N/A

NVA-34	2/2/2016	33	9:46	N/A	N/A
NVA-35	2/2/2016	33	10:33	N/A	N/A
NVA-36	2/2/2016	33	12:54	2/4/2016	8:01
NVA-37	2/2/2016	33	18:30	2/4/2016	8:31
NVA-38	2/2/2016	33	17:03	2/4/2016	8:50
NVA-39	2/2/2016	33	16:29	2/4/2016	9:39
NVA-40	2/3/2016	34	17:31	N/A	N/A
NVA-41	2/3/2016	34	15:44	N/A	N/A
NVA-42	2/1/2016	32	15:25	N/A	N/A
NVA-43	2/1/2016	32	14:14	N/A	N/A
NVA-44	2/1/2016	32	12:49	2/4/2016	7:37
NVA-45	1/30/2016	30	13:05	N/A	N/A
NVA-46	1/30/2016	30	12:13	N/A	N/A
NVA-47	1/30/2016	30	10:10	N/A	N/A
NVA-48	1/30/2016	30	9:28	N/A	N/A
NVA-49	2/2/2016	33	8:59	N/A	N/A
NVA-50	1/31/2016	31	13:10	1/31/2016	18:27
NVA-51	1/31/2016	31	14:29	1/31/2016	17:46
NVA-52	1/31/2016	31	15:11	1/31/2016	17:22
NVA-53	2/1/2016	32	15:06	N/A	N/A
NVA-54	2/2/2016	33	12:47	N/A	N/A
NVA-55	2/3/2016	34	13:52	N/A	N/A
NVA-56	2/2/2016	33	15:30	2/4/2016	10:12
NVA-57	2/2/2016	33	14:15	2/4/2016	10:39
NVA-58	2/3/2016	34	7:34	2/4/2016	6:59
NVA-59	2/3/2016	34	14:08	N/A	N/A
NVA-60	2/1/2016	32	13:13	N/A	N/A
NVA-61	2/1/2016	32	10:59	2/1/2016	20:06
NVA-62	2/1/2016	32	9:46	2/1/2016	19:36
NVA-63	1/31/2016	31	10:34	1/31/2016	20:15
NVA-64	1/31/2016	31	11:08	1/31/2016	19:59
NVA-65	1/30/2016	30	16:22	N/A	N/A
NVA-66	1/30/2016	30	14:57	N/A	N/A
NVA-67	2/1/2016	32	12:59	N/A	N/A
NVA-68	2/2/2016	33	11:29	2/4/2016	9:16
NVA-69	2/3/2016	34	9:17	N/A	N/A
NVA-70	2/2/2016	33	12:46	2/4/2016	6:20
NVA-71	2/4/2016	35	12:41	N/A	N/A
NVA-72	2/2/2016	33	12:10	2/4/2016	8:13

NVA-73	2/2/2016	33	13:05	2/4/2016	10:01
NVA-74	2/1/2016	32	17:37	N/A	N/A
NVA-75	2/1/2016	32	16:43	N/A	N/A
NVA-76	1/30/2016	30	13:47	N/A	N/A
NVA-77	1/31/2016	31	9:25	N/A	N/A
NVA-78	1/30/2016	30	6:38	N/A	N/A
NVA-79	1/30/2016	30	11:35	N/A	N/A
NVA-80	2/2/2016	33	8:22	N/A	N/A
NVA-81	2/3/2016	34	13:03	2/4/2016	10:12
NVA-82	2/3/2016	34	18:35	2/4/2016	11:16
NVA-83	2/3/2016	34	17:37	2/4/2016	12:15
NVA-84	2/4/2016	35	12:52	2/4/2016	13:16
NVA-85	2/4/2016	35	10:38	N/A	N/A
NVA-86	2/4/2016	35	9:02	N/A	N/A
NVA-87	2/1/2016	32	16:46	N/A	N/A
NVA-88	2/2/2016	33	11:48	2/4/2016	6:13
NVA-89	1/30/2016	30	8:49	N/A	N/A
NVA-90	2/2/2016	33	10:20	N/A	N/A
NVA-91	2/3/2016	34	8:17	N/A	N/A
NVA-92	2/2/2016	33	14:54	N/A	N/A
NVA-93	2/1/2016	32	17:29	N/A	N/A
NVA-94	2/1/2015	32	13:48	N/A	N/A
NVA-95	2/1/2016	32	15:02	N/A	N/A
NVA-96	2/1/2016	32	12:28	N/A	N/A
NVA-97	2/2/2016	33	15:40	2/4/2016	12:41
NVA-98	2/2/2016	33	17:31	2/4/2016	13:10
NVA-99	2/1/2016	32	11:12	N/A	N/A
NVA-100	2/1/2016	32	10:23	2/1/2016	20:21
NVA-101	2/1/2016	32	9:37	2/1/2016	19:46
NVA-102	2/1/2016	32	8:00	2/1/2016	18:21
NVA-103	2/2/2016	33	9:07	N/A	N/A
NVA-104	2/2/2016	33	8:46	2/4/2016	19:59
NVA-105	1/30/2016	30	10:18	1/30/2016	10:24
NVA-106	1/30/2016	30	11:03	1/30/2016	11:12
NVA-107	1/30/2016	30	7:56	1/30/2016	8:06
NVA-108	1/31/2016	31	8:45	1/31/2016	8:53
NVA-109	1/31/2016	31	8:23	1/31/2016	8:30
NVA-110	1/30/2016	30	17:59	1/30/2016	18:09
NVA-111	2/5/2016	36	16:48	N/A	N/A

NVA-112	2/5/2016	36	14:00	N/A	N/A
NVA-113	2/5/2016	36	17:25	N/A	N/A
NVA-114	2/5/2016	36	16:17	N/A	N/A
NVA-115	2/5/2016	36	17:45	N/A	N/A
NVA-116	2/5/2016	36	16:50	N/A	N/A
NVA-117	2/5/2016	36	18:06	N/A	N/A
NVA-118	2/5/2016	36	16:59	N/A	N/A
NVA-119	2/5/2016	36	18:31	N/A	N/A
NVA-120	2/5/2016	36	17:16	N/A	N/A
NVA-121	2/5/2016	36	18:49	N/A	N/A
NVA-122	2/5/2016	36	17:43	N/A	N/A
NVA-123	2/5/2016	36	19:10	N/A	N/A
NVA-124	2/5/2016	36	18:09	N/A	N/A
NVA-125	2/5/2016	36	19:55	N/A	N/A
NVA-126	2/5/2016	36	18:42	N/A	N/A
NVA-128	2/5/2016	36	19:23	N/A	N/A
NVA-130	2/5/2016	36	18:46	N/A	N/A
VVA-1	1/31/2016	31	8:08	1/31/2016	8:13
VVA-2	1/30/2016	30	18:11	1/30/2016	18:19
VVA-3	1/31/2016	31	7:35	1/31/2016	7:41
VVA-4	1/31/2016	31	10:07	1/31/2016	10:15
VVA-5	1/31/2016	31	9:00	N/A	N/A
VVA-6	1/30/2016	30	9:25	1/30/2016	9:36
VVA-7	1/30/2016	30	13:12	1/30/2016	13:18
VVA-8	1/30/2016	30	12:30	1/30/2016	12:37
VVA-9	1/30/2016	30	9:40	1/30/2016	9:52
VVA-10	2/1/2016	32	8:27	2/1/2016	18:59
VVA-11	2/1/2016	32	10:02	2/1/2016	20:03
VVA-12	2/1/2016	32	10:58	2/1/2016	21:21
VVA-13	2/1/2016	32	13:02	N/A	N/A
VVA-14	2/1/2016	32	14:13	N/A	N/A
VVA-15	2/1/2016	32	17:04	N/A	N/A
VVA-16	2/2/2016	33	15:19	2/4/2016	11:51
VVA-17	2/3/2016	34	8:44	N/A	N/A
VVA-18	2/2/2016	33	8:06	N/A	N/A
VVA-19	2/2/2016	33	9:59	2/4/2016	16:33
VVA-20	2/3/2016	34	10:08	2/4/2016	15:13
VVA-21	2/3/2016	34	9:37	2/4/2016	14:31
VVA-22	2/2/2016	33	14:23	2/4/2016	7:51

VVA-23	2/1/2016	32	15:47	N/A	N/A
VVA-24	2/4/2016	35	12:30	N/A	N/A
VVA-25	2/4/2016	35	11:33	2/4/2016	9:06
VVA-26	2/3/2016	34	12:16	2/4/2016	8:21
VVA-27	2/2/2016	33	13:15	2/4/2016	7:10
VVA-28	2/2/2016	33	11:08	2/4/2016	5:37
VVA-29	1/30/2016	30	10:38	N/A	N/A
VVA-30	2/2/2016	33	7:29	N/A	N/A
VVA-31	2/3/2015	34	13:50	N/A	N/A
VVA-32	2/4/2016	35	9:20	N/A	N/A
VVA-33	2/3/2016	34	18:15	2/4/2016	11:39
VVA-34	2/3/2016	34	17:15	2/4/2016	12:33
VVA-35	2/4/2016	35	13:04	N/A	N/A
VVA-36	2/3/2016	34	16:21	N/A	N/A
VVA-37	2/3/2016	34	14:32	2/4/2016	10:38
VVA-38	2/2/2016	33	9:02	N/A	N/A
VVA-39	1/30/2016	30	12:25	2/4/2016	9:01
VVA-40	1/30/2016	30	15:51	N/A	N/A
VVA-41	2/1/2016	32	15:56	N/A	N/A
VVA-42	2/2/2016	33	10:43	N/A	N/A
VVA-43	2/3/2016	34	8:29	N/A	N/A
VVA-44	2/2/2016	33	14:39	2/4/2016	10:21
VVA-45	2/4/2016	35	7:31	N/A	N/A
VVA-46	2/1/2016	32	14:16	2/1/2016	20:31
VVA-47	2/1/2016	32	10:21	2/1/2016	19:51
VVA-48	2/1/2016	32	8:33	2/1/2016	18:41
VVA-49	1/31/2016	31	12:20	1/31/2016	19:20
VVA-50	1/31/2016	31	13:40	1/31/2016	18:42
VVA-51	1/31/2016	31	17:10	N/A	N/A
VVA-52	2/3/2016	34	14:32	N/A	N/A
VVA-53	2/3/2016	34	12:15	N/A	N/A
VVA-54	2/2/2016	33	17:38	2/4/2016	8:03
VVA-55	2/3/2016	34	18:52	N/A	N/A
VVA-56	2/1/2016	32	16:26	N/A	N/A
VVA-57	2/1/2016	32	13:17	N/A	N/A
VVA-58	1/30/2016	30	12:44	N/A	N/A
VVA-59	1/30/2016	30	11:40	N/A	N/A
VVA-60	1/30/2016	30	14:08	N/A	N/A
VVA-61	2/1/2016	32	12:18	N/A	N/A

VVA-62	2/2/2016	33	10:05	N/A	N/A
VVA-63	2/4/2016	35	10:31	N/A	N/A
VVA-64	2/3/2016	34	12:08	2/4/2016	6:20
VVA-65	2/3/2016	34	12:42	N/A	N/A
VVA-66	2/2/2016	33	14:50	2/4/2016	11:16
VVA-67	2/3/2016	34	7:42	2/4/2016	6:49
VVA-68	2/3/2016	34	8:21	2/4/2016	7:33
VVA-69	2/2/2016	33	8:33	N/A	N/A
VVA-70	2/1/2016	32	9:54	2/1/2016	19:49
VVA-71	2/1/2016	32	11:34	N/A	N/A
VVA-72	1/30/2016	30	16:22	1/31/2016	8:21
VVA-73	1/30/2016	30	17:51	1/31/2016	7:15
VVA-74	1/31/2016	31	16:20	N/A	N/A
VVA-75	1/31/2016	31	17:08	N/A	N/A
VVA-76	1/31/2016	31	11:42	1/31/2016	19:22
VVA-77	1/31/2016	31	17:44	N/A	N/A
VVA-78	2/1/2016	32	8:33	2/1/2016	18:41
VVA-79	2/1/2016	32	6:45	2/1/2016	17:47
VVA-80	2/2/2016	33	6:59	N/A	N/A
VVA-81	2/3/2016	34	8:01	2/4/2016	7:18
VVA-82	2/2/2016	33	16:40	2/4/2016	9:17
VVA-83	2/3/2016	34	8:32	2/4/2016	13:33
VVA-84	2/2/2016	33	15:40	2/4/2016	10:53
VVA-85	2/3/2016	34	10:29	2/4/2016	12:47

5. POINT COMPARISON

LiDAR QA				
POINT ID	POINT CK	DELTA NORTH (m)	DELTA EAST (m)	VERT. DIFF (m)
NVA				
NVA-1	NVA-1 CK	-0.005	0.001	-0.013
NVA-2	NVA-2 CK	-0.001	0.000	0.006
NVA-3	NVA-3 CK	0.001	0.000	0.003
NVA-4	NVA-4 CK	0.008	0.002	-0.007
NVA-5	NVA-5 CK	-0.004	0.003	-0.008
NVA-6	NVA-6 CK	0.000	0.000	-0.010
NVA-7	NVA-7 CK	-0.002	-0.002	0.001
NVA-8	NVA-8 CK	0.000	0.002	-0.010
NVA-9	NVA-9 CK	0.002	-0.004	0.001
NVA-10	NVA-10 CK	0.010	-0.003	0.006
NVA-11	NVA-11 CK	0.005	-0.002	-0.017
NVA-13	NVA-13 CK	0.003	0.001	0.001
NVA-14	NVA-14 CK	-0.012	0.014	0.006
NVA-16	NVA-16 CK	0.001	0.004	0.011
NVA-18	NVA-18 CK	0.001	-0.006	0.018
NVA-20	NVA-20 CK	-0.004	-0.009	-0.027
NVA-21	NVA-21 CK	0.009	-0.001	0.018
NVA-22	NVA-22 CK	0.002	0.003	-0.009
NVA-23	NVA-23 CK	-0.002	0.001	0.003
NVA-24	NVA-24 CK	0.001	-0.009	0.015
NVA-29	NVA-29 CK	0.005	-0.002	-0.006
NVA-36	NVA-36 CK	0.009	-0.001	0.010
NVA-37	NVA-37 CK	0.004	0.018	-0.002
NVA-38	NVA-38 CK	-0.004	0.006	-0.017
NVA-39	NVA-39 CK	0.017	-0.008	-0.016
NVA-44	NVA-44 CK	0.004	0.007	0.001
NVA-50	NVA-50 CK	0.010	-0.020	-0.024
NVA-51	NVA-51 CK	-0.004	0.004	-0.003
NVA-52	NVA-52 CK	-0.001	-0.004	-0.018
NVA-56	NVA-56 CK	0.007	0.003	-0.004
NVA-57	NVA-57 CK	0.009	0.012	0.010
NVA-58	NVA-58 CK	-0.002	-0.004	0.001
NVA-61	NVA-61 CK	-0.001	-0.002	0.008
NVA-62	NVA-62 CK	0.000	0.001	0.004

NVA-63	NVA-63 CK	-0.002	0.000	-0.011
NVA-64	NVA-64 CK	0.006	-0.004	-0.012
NVA-68	NVA-68 CK	-0.007	0.001	-0.014
NVA-70	NVA-70 CK	-0.005	-0.003	-0.011
NVA-72	NVA-72 CK	-0.002	0.008	0.006
NVA-73	NVA-73 CK	-0.001	0.001	-0.008
NVA-81	NVA-81 CK	0.005	0.007	0.026
NVA-82	NVA-82 CK	0.010	0.005	0.022
NVA-83	NVA-83 CK	0.001	-0.002	-0.013
NVA-84	NVA-84 CK	-0.015	-0.012	-0.026
NVA-88	NVA-88 CK	0.000	0.002	-0.031
NVA-97	NVA-97 CK	0.004	-0.006	-0.009
NVA-98	NVA-98 CK	0.002	0.004	0.007
NVA-100	NVA-100 CK	-0.003	0.007	0.014
NVA-101	NVA-101 CK	-0.005	-0.001	-0.001
NVA-102	NVA-102 CK	-0.004	-0.002	0.01
NVA-104	NVA-104 CK	-0.001	0.003	-0.012
NVA-105	NVA-105 CK	-0.006	0.003	-0.012
NVA-106	NVA-106 CK	-0.001	-0.002	-0.01
NVA-107	NVA-107 CK	0.011	0.016	-0.002
NVA-108	NVA-108 CK	-0.004	0.003	0.009
NVA-109	NVA-109 CK	-0.006	0.001	-0.012
NVA-110	NVA-110 CK	0.005	0.003	-0.009
VVA				
VVA-1	VVA-1 CK	0.008	0.007	0.009
VVA-2	VVA-2CK	0.001	0.001	0.006
VVA-3	VVA-3 CK	-0.006	-0.004	0.010
VVA-4	VVA-4CK	0.001	0.001	0.008
VVA-6	VVA-6 CK	0.003	0.012	0.007
VVA-7	VVA-7CK	-0.005	-0.005	0.018
VVA-8	VVA-8 CK	0.003	-0.005	-0.009
VVA-9	VVA-9 CK	0.002	0.002	0.015
VVA-10	VVA-10 CK	-0.002	0.005	-0.007
VVA-11	VVA-11CK	-0.015	-0.021	-0.022
VVA-12	VVA-12 CK	0.008	0.005	-0.059
VVA-16	VVA-16 CK	0.003	-0.015	0.003
VVA-20	VVA-20 CK	-0.003	0.003	0.017
VVA-21	VVA-21 CK	0.001	0.001	0.015
VVA-22	VVA-22 CK	-0.017	-0.009	-0.014

VVA-25	VVA-25 CK	-0.051	-0.006	-0.005
VVA-26	VVA-26 CK	-0.017	-0.009	-0.073
VVA-27	VVA-27 CK	-0.009	-0.001	0.012
VVA-28	VVA-28 CK	-0.014	-0.004	0.007
VVA-33	VVA-33 CK	0.005	-0.008	0.002
VVA-34	VVA-34 CK	-0.006	0.000	-0.001
VVA-37	VVA-37 CK	0.004	-0.007	-0.013
VVA-39	VVA-39 CK	-0.008	0.002	0.021
VVA-44	VVA-44 CK	-0.004	-0.008	0.014
VVA-46	VVA-46 CK	-0.006	0.001	-0.018
VVA-47	VVA-47 CK	0.003	0.027	0.011
VVA-48	VVA-48 CK	0.004	-0.001	0.010
VVA-49	VVA-49 CK	-0.003	0.001	-0.002
VVA-50	VVA-50 CK	0.000	-0.018	-0.019
VVA-54	VVA-54 CK	0.000	-0.001	-0.008
VVA-64	VVA-64 CK	-0.001	0.000	0.015
VVA-66	VVA-66 CK	-0.003	0.002	-0.010
VVA-67	VVA-67 CK	-0.001	-0.003	0.010
VVA-68	VVA-68 CK	-0.007	0.004	0.000
VVA-70	VVA-70 CK	-0.001	0.000	0.009
VVA-72	VVA-72 CK	0.010	-0.005	-0.018
VVA-73	VVA-73 CK	0.004	-0.012	-0.001
VVA-76	VVA-76 CK	0.003	-0.003	0.016
VVA-78	VVA-78 CK	-0.002	0.000	0.007
VVA-79	VVA-79 CK	0.001	0.001	0.001
VVA-81	VVA-81 CK	0.008	0.009	-0.032
VVA-82	VVA-82 CK	0.009	-0.004	-0.006
VVA-83	VVA-83 CK	0.002	0.004	0.009
VVA-84	VVA-84 CK	-0.003	-0.008	-0.044
VVA-85	VVA-85 CK	-0.003	0.004	-0.009