

Check Point Survey Report

VA West Chesapeake Bay Watershed QL2 Virginia/West Virginia LiDAR Project

Contract # G16PC00020
Task Order Number: G17PD00327

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
2.	Project Details	
2.1	Survey Equipment.....	5
2.2	Survey Point Details.....	5
2.3	Network Design.....	5
2.4	Field Survey Procedures and Analysis.....	6-7
2.5	Adjustment.....	8
2.6	Data processing Procedures.....	8
3.	Final Coordinates.....	9-14
4.	GPS Observation & Re-Observation Schedule.....	15-20
5.	Point Comparison Report.....	21-23
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 224 Check 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 mapping products. As part of this work Dewberry staff will complete Check Point surveys that will be used to evaluate the mapping accuracy. The ground survey was conducted between the dates of December 22, 2017 and February 8, 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).

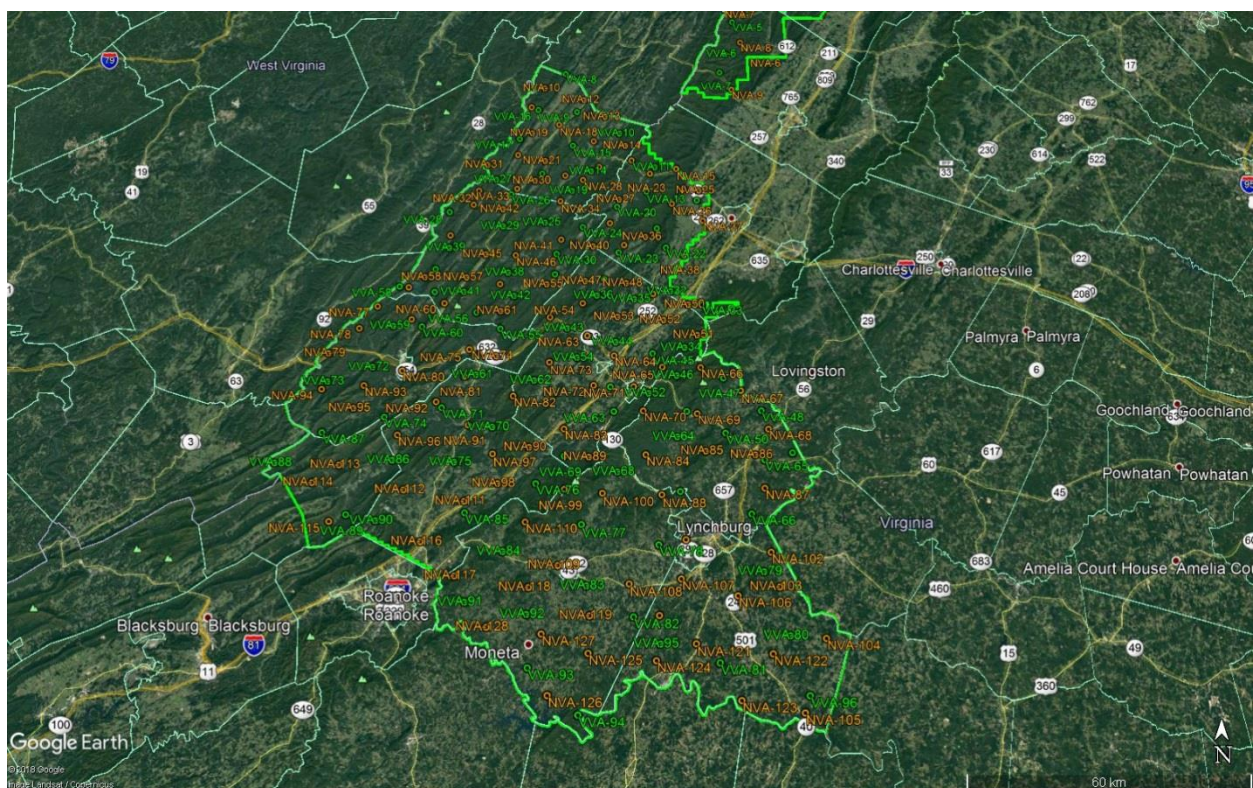
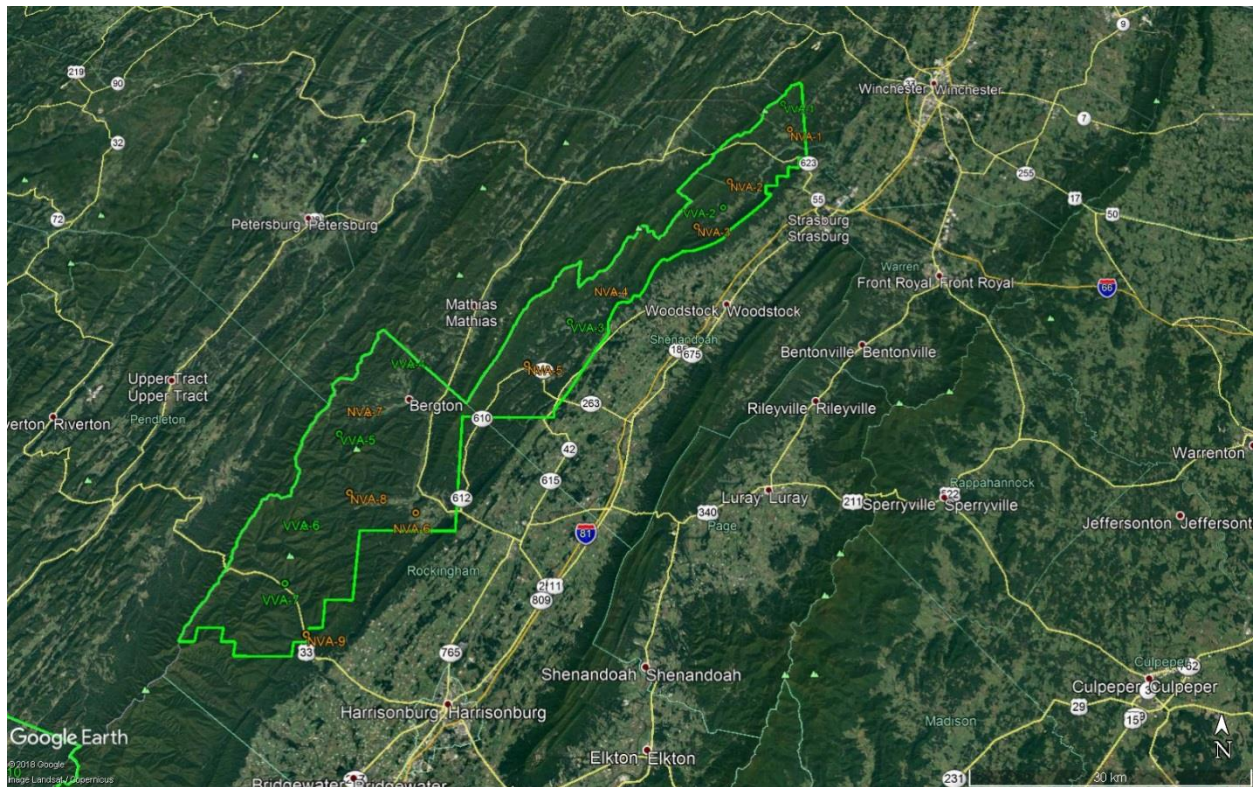
1.2 *Points of Contact*

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 224 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 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.

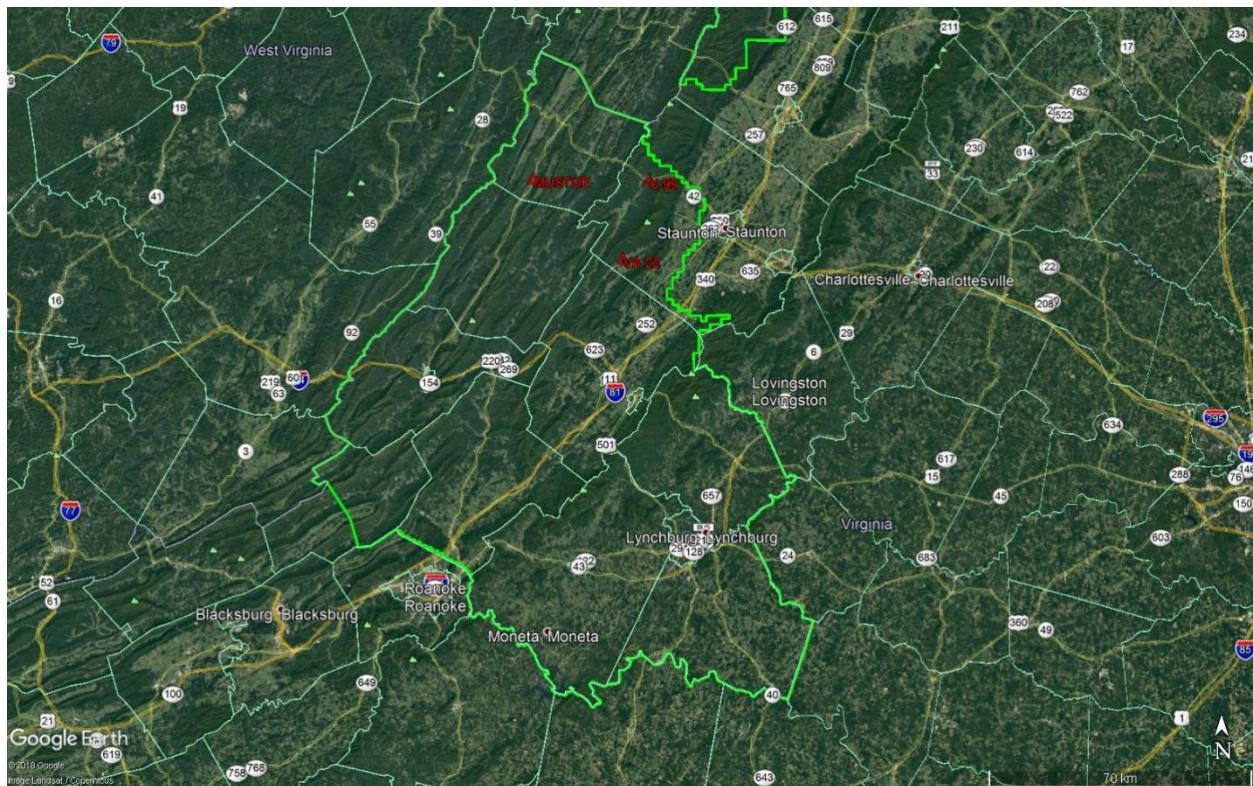
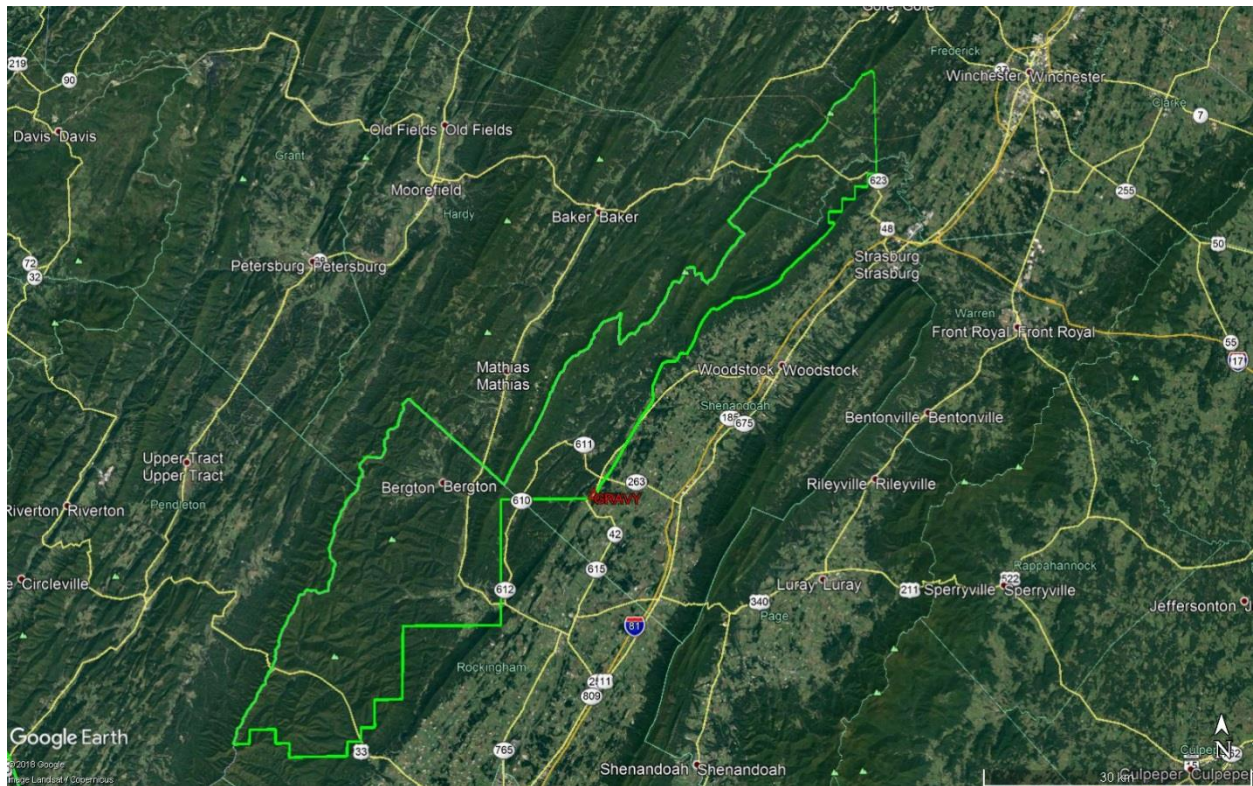
Field GPS observations are detailed on the “Check Point Documentation Reports” submitted as part of this report.

Four (4) 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 HW3523, HW3420, HW1545 & HW3674. The results are as follows:

	Observed Values			Data Sheet Values					
PT. #	NORTHING	EASTING	ELEVS.	NORTHING	EASTING	ELEVS.	ΔX	ΔY	ΔZ
MUSTOE	4237006.608	616456.340	682.599	4237006.591	616456.335	682.600	0.017	0.005	0.001
NGS GRAVEY	N/A	N/A	400.606	4291820.691	695204.139	400.600	N/A	N/A	0.006
U-99	4237130.677	648008.781	575.752	4237130.667	648008.790	575.702	0.010	0.009	0.050
VA-22	4215370.452	641188.807	476.109	4215370.436	641188.805	476.100	0.016	0.002	0.009

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			
Check Points - NVA			
NVA-1	4333032.766	725111.933	256.029
NVA-2	4324490.533	716953.307	399.712
NVA-3	4317571.506	712631.651	404.339
NVA-4	4307764.821	702444.391	308.729
NVA-5	4297793.585	692059.128	396.207
NVA-6	4278914.289	680432.484	375.500
NVA-7	4290920.407	673621.143	484.053
NVA-8	4281069.861	672549.918	475.803
NVA-9	4264820.008	669817.932	517.895
NVA-10	4263936.795	619327.507	1045.222
NVA-11	4257475.422	616136.937	1140.726
NVA-12	4260400.289	630032.789	709.653
NVA-13	4254977.640	635818.448	773.543
NVA-14	4245702.907	641461.194	663.070
NVA-15	4238750.558	654865.718	516.709
NVA-16	4241124.756	643176.318	683.462
NVA-17	4247086.191	633072.849	663.864
NVA-18	4252055.083	623737.139	880.195
NVA-19	4249318.067	616809.995	864.568
NVA-20	4242268.206	613345.986	782.194
NVA-21	4240491.171	620584.217	768.522
NVA-22	4239019.216	634733.294	577.802
NVA-23	4237172.518	648036.932	576.995
NVA-24	4232718.062	656776.496	514.426
NVA-25	4232332.754	660719.138	436.221
NVA-26	4228073.540	653766.380	546.967
NVA-27	4229060.849	640168.913	527.101
NVA-28	4234935.014	630655.031	537.474
NVA-29	4236154.278	626009.050	565.867
NVA-30	4234332.101	618271.559	818.550
NVA-31	4239008.189	605582.939	889.815
NVA-32	4231071.128	603903.155	1012.717
NVA-33	4231889.184	613723.473	642.110
NVA-34	4228456.112	625135.348	493.876
NVA-35	4221980.638	637984.194	495.594

NVA-36	4218128.024	647088.803	492.959
NVA-37	4223254.619	661699.340	478.012
NVA-38	4212944.842	656775.221	566.057
NVA-39	4215638.971	641728.382	467.310
NVA-40	4215111.186	633835.983	460.083
NVA-41	4216931.122	625751.926	521.907
NVA-42	4225600.176	610459.621	615.895
NVA-43	4227050.256	602757.190	617.329
NVA-44	4217745.917	597584.456	545.323
NVA-45	4212345.739	606925.980	706.643
NVA-46	4212309.563	614485.428	493.903
NVA-47	4205226.184	632180.861	425.264
NVA-48	4204765.872	642460.086	403.734
NVA-49	4201873.215	649183.883	434.202
NVA-50	4198950.758	657851.300	512.829
NVA-51	4190597.064	659955.955	630.491
NVA-52	4194687.279	651823.855	510.717
NVA-53	4195324.572	640506.501	345.602
NVA-54	4198987.477	631833.176	535.852
NVA-55	4204145.185	622665.322	531.387
NVA-56	4203979.933	610993.841	453.535
NVA-57	4205718.617	602535.942	715.298
NVA-58	4205561.611	591097.184	488.159
NVA-59	4203604.689	589091.232	489.606
NVA-60	4198341.599	597714.370	748.981
NVA-61	4196521.456	611665.184	368.860
NVA-62	4194894.583	623964.108	591.866
NVA-63	4190154.567	633268.818	343.430
NVA-64	4184972.004	639915.110	318.348
NVA-65	4182062.516	651576.831	840.589
NVA-66	4180603.285	659568.289	1047.476
NVA-67	4176384.738	670348.971	225.085
NVA-68	4166730.947	676691.202	225.456
NVA-69	4170272.103	659917.622	241.875
NVA-70	4170946.729	646878.648	656.118
NVA-71	4176919.793	644760.016	249.867
NVA-72	4177081.470	635185.387	310.431
NVA-73	4182885.901	624344.447	376.998
NVA-74	4184371.208	611337.746	337.399
NVA-75	4186051.150	604771.825	365.225
NVA-76	4193917.281	589981.438	442.286

NVA-77	4197229.950	581312.443	641.831
NVA-78	4191169.907	577453.885	507.252
NVA-79	4184381.394	570737.089	677.783
NVA-80	4180151.306	589017.774	389.072
NVA-81	4178915.338	604106.987	300.998
NVA-82	4173843.060	616148.074	650.686
NVA-83	4165864.619	628581.681	332.254
NVA-84	4159784.245	647819.023	303.541
NVA-85	4160897.672	661867.465	319.705
NVA-86	4160257.492	673407.757	224.125
NVA-87	4152087.421	675624.021	224.009
NVA-88	4150180.764	651688.811	293.512
NVA-89	4158881.955	634621.849	397.504
NVA-90	4161125.166	620577.346	382.731
NVA-91	4166495.093	605943.928	287.704
NVA-92	4172223.796	597884.319	292.235
NVA-93	4176108.201	580278.598	548.551
NVA-94	4174959.048	570304.860	500.537
NVA-95	4170233.177	578398.723	457.969
NVA-96	4163704.974	589512.795	340.532
NVA-97	4159386.307	612174.119	290.980
NVA-98	4152201.602	613740.844	261.600
NVA-99	4151764.049	626727.428	697.927
NVA-100	4150224.676	638046.257	314.375
NVA-101	4139757.959	657190.479	236.821
NVA-102	4137277.438	676430.075	238.160
NVA-103	4129443.163	678020.092	251.789
NVA-104	4118347.295	687788.854	197.018
NVA-105	4102640.816	682487.603	167.433
NVA-106	4127282.726	668691.461	271.777
NVA-107	4130812.720	656136.427	283.750
NVA-108	4129488.214	644534.475	266.473
NVA-109	4133371.669	628538.169	296.834
NVA-110	4143133.321	620687.601	435.625
NVA-111	4147850.369	606446.225	360.344
NVA-112	4150329.765	592279.381	379.610
NVA-113	4156053.021	576741.316	483.994
NVA-114	4151726.462	570983.823	486.561
NVA-115	4142576.953	576033.909	423.266
NVA-116	4138248.824	597265.616	379.745
NVA-117	4130571.274	605575.964	606.498

NVA-118	4128308.268	622229.639	292.307
NVA-119	4122317.442	635975.523	288.345
NVA-120	4122631.987	651337.480	252.477
NVA-121	4116682.683	659406.292	259.119
NVA-122	4114845.282	676063.982	196.508
NVA-123	4104925.901	669050.001	138.690
NVA-124	4112913.906	650709.703	227.835
NVA-125	4114226.373	635873.570	249.462
NVA-126	4105243.071	627418.676	254.921
NVA-127	4118188.526	625504.404	252.396
NVA-128	4119453.901	613418.282	287.645
VVA			
VVA-1	4337044.727	724272.398	478.388
VVA-2	4320530.956	716086.757	336.290
VVA-3	4303632.740	697008.882	354.575
VVA-4	4297331.535	678177.047	473.043
VVA-5	4287149.871	670894.235	593.308
VVA-6	4276788.069	668198.164	1080.848
VVA-7	4270368.915	666661.414	596.958
VVA-8	4268911.388	624806.015	816.554
VVA-9	4256274.235	628322.122	799.229
VVA-10	4249654.808	639857.265	690.562
VVA-11	4239186.112	649344.049	597.712
VVA-12	4229383.230	660217.504	459.537
VVA-13	4231688.908	645891.248	565.806
VVA-14	4237683.919	632754.699	582.804
VVA-15	4245556.371	627681.033	737.601
VVA-16	4256724.828	617972.557	974.458
VVA-17	4247205.606	613490.995	791.746
VVA-18	4131115.675	613606.420	336.229
VVA-19	4231498.626	627975.886	510.975
VVA-20	4226914.006	639693.247	510.883
VVA-21	4220577.565	649970.977	545.396
VVA-22	4215007.885	652303.024	538.102
VVA-23	4213578.955	640376.522	547.188
VVA-24	4220712.126	631118.443	621.033
VVA-25	4221867.835	621445.869	466.847
VVA-26	4230175.652	612291.887	639.218
VVA-27	4234483.864	608184.625	668.695
VVA-28	4224567.177	596825.796	633.067
VVA-29	4220596.720	610854.232	772.962

VVA-30	4212894.763	624758.954	549.599
VVA-31	4205776.436	636926.699	417.457
VVA-32	4202591.274	653495.549	556.799
VVA-33	4199017.423	661215.216	485.191
VVA-34	4187201.942	656946.789	500.384
VVA-35	4200287.242	644541.244	383.678
VVA-36	4201219.443	635271.027	409.228
VVA-37	4207025.124	624627.841	498.058
VVA-38	4207201.762	613010.093	429.684
VVA-39	4214083.483	597606.326	515.842
VVA-40	4209713.840	592819.111	545.863
VVA-41	4201343.508	602261.065	1147.777
VVA-42	4200360.432	614666.205	433.600
VVA-43	4191941.163	628279.735	398.732
VVA-44	4188590.153	640178.752	391.870
VVA-45	4185672.236	649196.695	321.753
VVA-46	4179973.061	655166.651	741.694
VVA-47	4179400.012	666347.880	375.797
VVA-48	4171679.288	674265.755	257.539
VVA-49	4160576.875	682732.629	273.861
VVA-50	4165499.512	666566.022	247.930
VVA-51	4170739.039	657454.093	266.510
VVA-52	4175862.630	648724.553	645.361
VVA-53	4176858.887	639128.945	343.958
VVA-54	4184162.136	630973.002	431.557
VVA-55	4192145.844	611289.534	343.076
VVA-56	4192019.681	604467.298	383.589
VVA-57	4203813.030	596540.816	507.474
VVA-58	4205611.521	592177.701	497.424
VVA-59	4192452.433	586151.601	493.236
VVA-60	4191846.790	592758.435	659.288
VVA-61	4179326.270	606864.235	334.954
VVA-62	4177671.209	621936.414	412.054
VVA-63	4170457.435	640173.674	295.357
VVA-64	4164361.105	655059.267	272.681
VVA-65	4159048.045	675601.149	232.444
VVA-66	4146033.728	672187.321	242.329
VVA-67	4150995.744	655897.808	248.703
VVA-68	4155458.865	641359.970	308.338
VVA-69	4158743.455	628512.853	415.206
VVA-70	4165778.667	611726.513	357.446

VVA-71	4170760.329	599319.081	293.050
VVA-72	4180949.580	581789.143	512.637
VVA-73	4176968.811	571398.321	488.297
VVA-74	4167990.163	586029.689	835.242
VVA-75	4157201.542	603392.620	327.488
VVA-76	4152271.007	622612.819	342.773
VVA-77	4143118.667	633630.090	276.100
VVA-78	4138489.917	650847.783	263.034
VVA-79	4132805.536	674624.532	251.716
VVA-80	4118774.913	679942.940	163.350
VVA-81	4111470.208	665489.105	204.529
VVA-82	4122253.244	645609.482	244.619
VVA-83	4128846.439	635145.258	253.570
VVA-84	4136345.620	615820.833	319.233
VVA-85	4145143.101	606823.407	357.959
VVA-86	4157418.984	588945.042	391.581
VVA-87	571742.219	4163714.994	527.822
VVA-88	4156301.919	561704.736	594.324
VVA-89	4144263.512	579672.490	414.374
VVA-90	4142931.324	586588.171	456.009
VVA-91	4124817.234	608191.173	320.210
VVA-92	4122372.900	622020.055	303.132
VVA-93	4110921.510	622853.880	314.930
VVA-94	4101324.808	634134.473	189.980
VVA-95	4116450.315	651638.152	213.480
VVA-96	4106186.900	683690.988	136.630

4. GPS OBSERVATIONS

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA-1	12/31/2017	365	13:07	1/1/2018	16:00
NVA-2	12/31/2017	365	14:25	N/A	N/A
NVA-3	12/31/2017	365	16:12	1/1/2018	12:38
NVA-4	12/31/2017	365	17:20	N/A	N/A
NVA-5	1/1/2018	1	11:16	1/1/2018	11:59
NVA-6	12/22/2017	356	17:04	1/1/2018	8:56
NVA-7	12/22/2017	356	17:13	N/A	N/A
NVA-8	12/22/2017	356	14:52	N/A	N/A
NVA-9	12/22/2017	356	11:09	N/A	N/A
NVA-10	1/14/2018	14	12:56	N/A	N/A
NVA-11	1/14/2018	14	14:17	N/A	N/A
NVA-12	1/14/2018	14	11:22	1/20/2018	17:26
NVA-13	1/14/2018	14	9:57	N/A	N/A
NVA-14	1/12/2018	12	18:23	N/A	N/A
NVA-15	1/12/2018	12	15:48	1/12/2018	15:51
NVA-16	1/12/2018	12	17:36	N/A	N/A
NVA-17	1/14/2018	14	19:51	N/A	N/A
NVA-18	1/14/2018	14	18:47	1/16/2018	8:58
NVA-19	1/14/2018	14	18:10	N/A	N/A
NVA-20	1/14/2018	14	17:32	N/A	N/A
NVA-21	1/15/2018	14	14:49	N/A	N/A
NVA-22	1/16/2018	16	10:48	N/A	N/A
NVA-23	1/12/2018	12	16:10	1/13/2018	9:56
NVA-24	1/13/2018	13	8:51	1/15/2018	9:05
NVA-25	1/13/2018	13	9:12	1/13/2018	17:15
NVA-26	1/13/2018	13	8:27	1/13/2018	16:39
NVA-27	1/13/2018	13	11:45	1/15/2018	12:22
NVA-28	1/16/2018	16	11:52	N/A	N/A
NVA-29	1/16/2018	16	9:56	N/A	N/A
NVA-30	1/15/2018	15	15:23	N/A	N/A
NVA-31	1/14/2018	14	16:21	N/A	N/A
NVA-32	1/21/2018	21	15:10	N/A	N/A
NVA-33	1/15/2018	15	15:57	1/16/2018	8:31
NVA-34	1/16/2018	16	13:00	N/A	N/A
NVA-35	1/13/2018	13	12:41	N/A	N/A

NVA-36	1/13/2018	13	15:24	1/15/2018	9:59
NVA-37	1/13/2018	13	7:19	1/13/2018	17:36
NVA-38	1/22/2018	22	16:25	1/22/2018	16:28
NVA-39	1/13/2018	13	15:49	1/15/2018	10:15
NVA-40	1/13/2018	13	13:14	1/15/2018	11:43
NVA-41	1/16/2018	16	15:05	1/16/2018	15:08
NVA-42	1/16/2018	16	8:07	1/16/2018	8:10
NVA-43	1/21/2018	21	14:35	N/A	N/A
NVA-44	1/21/2018	21	13:24	1/21/2018	13:27
NVA-45	1/16/2018	16	6:59	1/16/2018	7:02
NVA-46	1/16/2018	16	14:06	1/16/2018	14:09
NVA-47	1/13/2018	13	13:47	1/15/2018	10:49
NVA-48	1/22/2018	22	17:42	1/27/2018	8:53
NVA-49	1/22/2018	22	15:07	1/27/2018	8:32
NVA-50	1/25/2018	25	14:50	1/25/2018	14:53
NVA-51	1/25/2018	25	13:16	N/A	N/A
NVA-52	1/25/2018	25	15:20	N/A	N/A
NVA-53	1/20/2018	20	13:57	N/A	N/A
NVA-54	1/22/2018	22	19:14	N/A	N/A
NVA-55	1/23/2018	23	9:25	1/27/2018	10:30
NVA-56	1/23/2018	23	12:05	N/A	N/A
NVA-57	1/20/2018	20	15:36	1/21/2018	18:36
NVA-58	1/21/2018	21	16:43	N/A	N/A
NVA-59	1/21/2018	21	17:21	N/A	N/A
NVA-60	1/20/2018	20	13:33	1/22/2018	8:14
NVA-61	1/23/2018	23	13:34	1/27/2018	11:22
NVA-62	1/22/2018	22	11:25	N/A	N/A
NVA-63	1/22/2018	22	11:52	1/23/2018	8:05
NVA-64	1/22/2018	22	12:14	1/23/2018	7:48
NVA-65	1/23/2018	23	15:17	1/23/2018	15:20
NVA-66	1/25/2018	25	10:42	N/A	N/A
NVA-67	1/24/2018	24	15:19	1/24/2018	15:22
NVA-68	1/24/2018	24	14:33	1/25/2018	9:44
NVA-69	1/22/2018	22	16:13	1/23/2018	16:55
NVA-70	1/23/2018	23	13:51	1/23/2018	13:54
NVA-71	1/22/2018	22	14:22	1/22/2018	14:25
NVA-72	1/26/2018	26	17:23	1/26/2018	17:28
NVA-73	1/27/2018	27	16:08	1/27/2018	20:04
NVA-74	2/8/2018	39	10:58	N/A	N/A

NVA-75	1/22/2018	22	10:32	1/27/2018	11:55
NVA-76	1/20/2018	20	12:46	1/20/2018	12:49
NVA-77	1/20/2017	20	11:07	N/A	N/A
NVA-78	1/20/2018	20	9:59	1/20/2018	10:02
NVA-79	1/20/2018	20	8:56	1/28/2018	10:30
NVA-80	1/22/2018	22	10:00	N/A	N/A
NVA-81	1/27/2018	27	12:39	N/A	N/A
NVA-82	1/27/2018	27	14:39	N/A	N/A
NVA-83	1/22/2018	22	11:41	1/29/2018	18:20
NVA-84	1/22/2018	22	11:06	1/23/2018	13:26
NVA-85	1/22/2018	22	17:58	1/22/2018	18:01
NVA-86	1/23/2018	23	17:41	1/24/2018	14:17
NVA-87	1/24/2018	24	12:54	1/25/2018	9:12
NVA-88	1/22/2018	22	9:45	1/23/2018	12:41
NVA-89	1/29/2018	29	16:37	N/A	N/A
NVA-90	1/29/2018	29	18:37	1/30/2018	13:07
NVA-91	1/27/2018	27	13:08	1/27/2018	18:16
NVA-92	1/29/2018	29	14:57	N/A	N/A
NVA-93	1/28/2018	28	16:11	1/29/2018	11:34
NVA-94	1/28/2018	28	11:05	N/A	N/A
NVA-95	1/28/2018	28	15:47	1/29/2018	12:33
NVA-96	1/20/2018	20	14:07	N/A	N/A
NVA-97	1/27/2018	27	14:01	1/27/2018	18:46
NVA-98	1/30/2018	30	10:52	1/30/2018	10:55
NVA-99	1/30/2018	30	12:13	N/A	N/A
NVA-100	1/29/2018	28	14:55	N/A	N/A
NVA-101	1/22/2018	22	8:49	N/A	N/A
NVA-102	1/21/2018	21	11:41	1/24/2018	11:55
NVA-103	1/21/2018	21	12:19	1/24/2018	11:28
NVA-104	1/21/2018	21	14:12	N/A	N/A
NVA-105	1/21/2018	21	15:16	1/21/2018	15:19
NVA-106	1/21/2018	21	12:47	N/A	N/A
NVA-107	1/20/2018	20	16:57	1/23/2018	11:28
NVA-108	1/20/2018	20	16:36	1/23/2018	11:11
NVA-109	1/20/2018	20	15:39	1/23/2018	10:17
NVA-110	1/29/2018	29	12:57	N/A	N/A
NVA-111	1/30/2018	30	10:33	1/30/2018	10:36
NVA-112	1/29/2018	29	12:40	N/A	N/A
NVA-113	1/29/2018	29	16:58	N/A	N/A

NVA-114	1/29/2018	29	17:43	N/A	N/A
NVA-115	1/29/2018	29	14:30	N/A	N/A
NVA-116	1/29/2018	29	8:22	N/A	N/A
NVA-117	1/29/2018	29	8:30	N/A	N/A
NVA-118	1/29/2018	29	10:55	N/A	N/A
NVA-119	1/20/2018	20	14:52	N/A	N/A
NVA-120	1/20/2018	20	13:14	N/A	N/A
NVA-121	1/20/2018	20	12:15	1/21/2018	17:06
NVA-122	1/21/2018	21	14:33	1/24/2018	10:28
NVA-123	1/21/2018	21	15:45	N/A	N/A
NVA-124	1/20/2018	20	12:36	N/A	N/A
NVA-125	1/20/2018	20	14:28	N/A	N/A
NVA-126	1/29/2018	29	13:11	N/A	N/A
NVA-127	1/29/2018	29	11:35	N/A	N/A
NVA-128	1/29/2018	29	9:50	1/29/2018	9:53
VVA					
VVA-1	12/31/2017	365	12:23	1/1/2018	16:14
VVA-2	12/31/2017	365	14:55	1/1/2018	13:36
VVA-3	12/31/2017	365	17:58	N/A	N/A
VVA-4	1/1/2018	1	9:46	N/A	N/A
VVA-5	12/22/2017	356	16:20	N/A	N/A
VVA-6	12/22/2017	356	13:08	N/A	N/A
VVA-7	1/1/2018	1	7:58	N/A	N/A
VVA-8	1/14/2018	14	11:58	N/A	N/A
VVA-9	1/14/2018	14	10:53	N/A	N/A
VVA-10	1/14/2018	14	9:16	N/A	N/A
VVA-11	1/21/2018	21	16:52	N/A	N/A
VVA-12	1/13/2018	13	7:45	1/13/2018	17:00
VVA-13	1/13/2018	13	11:06	N/A	N/A
VVA-14	1/16/2018	16	11:22	N/A	N/A
VVA-15	1/14/2018	14	19:14	1/15/2018	14:09
VVA-16	1/14/2018	14	14:49	N/A	N/A
VVA-17	1/14/2018	14	15:40	N/A	N/A
VVA-18A	1/30/2018	30	16:47	N/A	N/A
VVA-19	1/16/2018	16	12:25	N/A	N/A
VVA-20	1/13/2018	13	12:06	1/13/2018	12:12
VVA-21	1/13/2018	13	16:16	1/15/2018	9:47
VVA-22	1/22/2018	22	16:55	N/A	N/A

VVA-23	1/13/2018	13	14:54	1/15/2018	10:30
VVA-24	1/16/2018	16	15:30	1/16/2018	15:35
VVA-25	1/16/2018	16	13:35	1/16/2018	13:38
VVA-26	1/15/2018	15	17:13	N/A	N/A
VVA-27	1/14/2018	14	16:51	N/A	N/A
VVA-28	1/21/2018	21	1:46	N/A	N/A
VVA-29	1/16/2018	16	7:27	N/A	N/A
VVA-30	1/23/2018	23	10:37	1/23/2018	10:43
VVA-31	1/27/2018	27	9:29	N/A	N/A
VVA-32	1/22/2018	22	15:39	N/A	N/A
VVA-33	1/25/2018	25	14:11	N/A	N/A
VVA-34	1/25/2018	25	12:34	N/A	N/A
VVA-35	1/22/2018	22	14:37	N/A	N/A
VVA-36	1/22/2018	22	18:29	N/A	N/A
VVA-37	1/23/2018	23	9:52	N/A	N/A
VVA-38	1/23/2018	23	11:30	N/A	N/A
VVA-39	1/21/2018	21	12:55	N/A	N/A
VVA-40	1/21/2018	21	16:10	N/A	N/A
VVA-41	1/22/2018	22	8:40	1/22/2018	8:41
VVA-42	1/23/2018	23	13:05	1/23/2018	13:14
VVA-43	1/23/2018	23	8:21	1/23/2018	8:24
VVA-44	1/22/2018	22	13:06	N/A	N/A
VVA-45	1/25/2018	25	12:00	1/25/2018	12:03
VVA-46	1/23/2018	23	15:48	N/A	N/A
VVA-47	1/24/2018	24	16:20	N/A	N/A
VVA-48	1/24/2018	24	14:55	1/24/2018	14:58
VVA-49	1/24/2018	24	13:38	1/24/2018	13:41
VVA-50	1/23/2018	23	17:23	1/25/2018	10:02
VVA-51	1/22/2018	22	15:42	1/23/2018	16:34
VVA-52	1/23/2018	23	14:25	N/A	N/A
VVA-53	1/22/2018	22	13:01	1/22/2018	13:04
VVA-54	1/27/2018	27	16:31	1/27/2018	20:23
VVA-55	1/23/2018	23	13:54	1/23/2018	13:56
VVA-56A	1/28/2017	28	9:16	1/28/2018	9:21
VVA-57	1/20/2017	20	14:09	N/A	N/A
VVA-58	2/8/2018	39	13:16	N/A	N/A
VVA-59	1/20/2018	20	12:23	1/20/2018	12:25

VVA-60	1/20/2018	20	13:05	1/22/2018	9:18
VVA-61	1/27/2018	27	12:19	1/27/2018	17:55
VVA-62	1/27/2018	27	15:29	1/27/2018	19:37
VVA-63	1/22/2018	22	13:40	N/A	N/A
VVA-64	1/22/2018	22	17:02	N/A	N/A
VVA-65	1/23/2018	23	17:57	1/24/2018	14:00
VVA-66	1/24/2018	24	12:23	1/25/2018	8:43
VVA-67	1/22/2018	22	10:08	1/23/2018	12:17
VVA-68	1/22/2018	22	10:43	1/23/2018	13:00
VVA-69	1/29/2018	29	17:27	N/A	N/A
VVA-70	1/27/2018	27	13:35	N/A	N/A
VVA-71	1/29/2018	29	15:08	N/A	N/A
VVA-72	1/28/2017	28	17:16	N/A	N/A
VVA-73	1/28/2018	28	11:19	1/29/2018	11:22
VVA-74	1/29/2018	29	15:56	N/A	N/A
VVA-75	1/29/2018	29	12:00	1/29/2018	12:05
VVA-76	1/30/2018	30	11:22	N/A	N/A
VVA-77	1/29/2018	29	14:27	N/A	N/A
VVA-78	1/23/2018	23	9:27	1/23/2018	9:30
VVA-79	1/21/2018	21	11:59	1/24/2018	11:41
VVA-80	1/21/2018	21	13:33	1/24/2018	10:48
VVA-81	1/21/2018	21	16:11	1/21/2018	16:14
VVA-82	1/20/2018	20	13:40	N/A	N/A
VVA-83	1/20/2018	20	15:12	1/23/2018	10:38
VVA-84	1/29/2018	29	11:24	1/29/2018	11:27
VVA-85	1/30/2018	30	10:04	1/30/2018	10:07
VVA-86	1/29/2018	29	13:07	N/A	N/A
VVA-87	1/28/2018	28	14:49	N/A	N/A
VVA-88	1/28/2018	28	13:01	N/A	N/A
VVA-89	1/29/2018	29	15:45	1/29/2018	15:50
VVA-90	1/29/2018	29	13:25	1/29/2018	13:30
VVA-91	1/29/2018	29	9:12	1/29/2018	9:15
VVA-92	1/29/2018	29	10:48	1/29/2018	18:32
VVA-93	1/29/2018	29	12:32	1/29/2018	17:38
VVA-94	1/29/2018	29	14:00	1/29/2018	14:07
VVA-95	1/20/2018	20	12:55	1/20/2018	12:58
VVA-96	1/21/2018	21	14:57	1/21/2018	15:00

5. ***POINT COMPARISON***

Point ID	Point CK	Delta North (M)	Delta East (M)	Vertical Diff. (M)
Check Points – NVA				
NVA-1	NVA-1 CK	0.002	0.015	0.015
NVA-3	NVA-3 CK	0.005	0.027	0.033
NVA-5	NVA-5 CK	0.009	0.009	0.008
NVA-6	NVA-6 CK	0.005	0.001	0.030
NVA-12	NVA-12CK	-0.010	0.000	0.019
NVA-15	NVA-15CK	-0.004	-0.007	0.032
NVA-18	NVA-18CK	-0.002	-0.002	-0.014
NVA-23	NVA-23CK	-0.003	-0.002	-0.005
NVA-24	NVA-24CK	0.015	-0.001	-0.012
NVA-25	NVA-25CK	-0.012	-0.002	0.010
NVA-26	NVA-26CK	-0.031	-0.016	0.028
NVA-27	NVA-27CK	0.007	-0.014	0.009
NVA-33	NVA-33CK	-0.004	-0.001	-0.012
NVA-36	NVA-36CK	0.002	-0.008	0.007
NVA-37	NVA-37CK	0.007	0.011	-0.003
NVA-38	NVA-38CK	-0.019	0.000	0.009
NVA-39	NVA-39CK	0.016	-0.034	-0.004
NVA-40	NVA-40CK	-0.002	-0.008	0.002
NVA-41	NVA-41CK	0.002	0.003	-0.017
NVA-42	NVA-42CK	-0.019	-0.006	-0.027
NVA-44	NVA-44CK	0.005	-0.002	0.000
NVA-45	NVA-45CK	0.004	0.008	0.018
NVA-46	NVA-46CK	-0.001	-0.004	-0.008
NVA-47	NVA-47CK	-0.003	-0.017	-0.025
NVA-48	NVA-48CK	-0.003	0.011	0.026
NVA-49	NVA-49CK	0.004	-0.007	-0.039
NVA-50	NVA-50CK	-0.004	-0.003	-0.011
NVA-55	NVA-55CK	-0.001	0.001	0.003
NVA-57	NVA-57K	-0.003	-0.004	-0.009
NVA-60	NVA-60CK	-0.006	0.004	0.025
NVA-61	NVA-61CK	0.000	-0.005	-0.006
NVA-63	NVA-63CK	-0.008	-0.012	0.007
NVA-64	NVA-64CK	0.000	0.001	0.013
NVA-65	NVA-65CK	-0.001	0.003	-0.030
NVA-67	NVA-67CK	-0.007	-0.010	0.017

NVA-68	NVA-68CK	-0.020	-0.003	-0.008
NVA-69	NVA-69CK	-0.009	0.004	0.011
NVA-70	NVA-70CK	-0.007	-0.005	-0.003
NVA-71	NVA-71CK	-0.005	-0.001	0.015
NVA-72	NVA-72CK	-0.002	0.014	0.033
NVA-73	NVA-73CK	-0.002	0.001	0.000
NVA-75	NVA-75CK	-0.011	0.003	0.017
NVA-76	NVA-76CK	-0.006	-0.004	0.007
NVA-78	NVA-78CK	-0.003	0.005	0.026
NVA-79	NVA-79CK	0.001	0.000	0.003
NVA-83	NVA-83CK	0.002	-0.020	0.011
NVA-84	NVA-84CK	-0.009	0.003	0.002
NVA-85	NVA-85CK	0.000	0.001	-0.004
NVA-86	NVA-86CK	0.001	0.011	0.007
NVA-87	NVA-87CK	0.001	0.011	0.007
NVA-88	NVA-88CK	0.001	0.004	0.001
NVA-91	NVA-91CK	0.008	0.007	0.005
NVA-97	NVA-97CK	-0.001	0.010	-0.007
NVA-98	NVA-98CK	0.004	0.004	0.007
NVA-102	NVA-102CK	0.008	0.003	-0.002
NVA-103	NVA-103CK	0.003	0.000	-0.002
NVA-105	NVA-105CK	-0.005	-0.001	0.005
NVA-107	NVA-107CK	-0.004	-0.003	0.004
NVA-108	NVA-108CK	0.001	-0.001	-0.004
NVA-109	NVA-109CK	0.000	0.000	-0.002
NVA-111	NVA-111CK	-0.006	-0.003	0.007
NVA-121	NVA-121CK	-0.003	0.001	0.005
NVA-122	NVA-122CK	0.003	0.003	0.015
NVA-128	NVA-128CK	-0.003	0.001	-0.005
Check Points – VVA				
VVA-1	VVA-1 CK	0.014	0.000	0.021
VVA-6	VVA-6 CK	0.023	0.012	0.030
VVA-12	VVA-12CK	-0.001	-0.002	-0.003
VVA-15	VVA-15CK	-0.009	-0.008	-0.007
VVA-20	VVA-20CK	-0.009	0.003	-0.029
VVA-21	VVA-21CK	0.012	0.001	-0.019
VVA-23	VVA-23CK	-0.006	0.011	0.002
VVA-24	VVA-24CK	0.001	0.002	-0.001
VVA-25	VVA-25CK	0.002	0.002	-0.007

VVA-30	VVA-30CK	0.000	0.018	0.019
VVA-41	VVA-41CK	0.000	0.006	-0.013
VVA-42	VVA-42CK	-0.006	-0.008	-0.028
VVA-43	VVA-43CK	-0.007	-0.008	-0.006
VVA-45	VVA-45CK	-0.013	0.002	0.022
VVA-48	VVA-48CK	-0.006	0.011	-0.022
VVA-49	VVA-49CK	-0.017	-0.007	0.004
VVA-50	VVA-50CK	0.002	-0.002	-0.006
VVA-51	VVA-51CK	0.019	-0.003	0.001
VVA-53	VVA-53CK	-0.008	0.000	-0.025
VVA-54	VVA-54CK	-0.008	0.003	-0.001
VVA-55	VVA-55CK	0.001	0.000	0.000
VVA-56	VVA-56CK	-0.010	-0.004	0.013
VVA-59	VVA-59CK	0.016	0.005	0.010
VVA-60	VVA-60CK	0.011	-0.005	-0.003
VVA-61	VVA-61CK	0.009	-0.009	-0.019
VVA-62	VVA-62CK	0.017	0.008	-0.031
VVA-65	VVA-65CK	-0.004	0.007	0.009
VVA-66	VVA-66CK	-0.002	0.003	0.011
VVA-67	VVA-67CK	-0.008	-0.001	-0.002
VVA-68	VVA-68CK	-0.012	-0.015	-0.011
VVA-73	VVA-73CK	0.002	0.003	0.001
VVA-75	VVA-75CK	-0.008	0.003	0.013
VVA-78	VVA-78CK	-0.007	0.001	0.000
VVA-79	VVA-79CK	0.003	-0.002	0.000
VVA-80	VVA-80CK	-0.017	0.027	0.013
VVA-81	VVA-81CK	-0.001	0.005	0.006
VVA-83	VVA-83CK	0.007	0.002	-0.016
VVA-84	VVA-84CK	0.003	-0.010	-0.009
VVA-85	VVA-85CK	0.004	0.019	-0.017
VVA-89	VVA-89CK	0.000	-0.005	0.031
VVA-90	VVA-90CK	0.002	0.002	-0.015
VVA-91	VVA-91CK	0.016	-0.001	-0.001
VVA-92	VVA-92CK	0.003	-0.001	0.001
VVA-93	VVA-93CK	0.013	0.000	-0.020
VVA-94	VVA-94CK	-0.039	0.001	-0.017
VVA-95	VVA-95CK	-0.017	-0.001	0.023
VVA-96	VVA-96CK	-0.007	-0.007	0.018