

# Check Point Survey Report

## Utah Flaming Gorge LDAR Project

USGS Contract: G16PC00020

Task Order Number: 140G0220F0147

Prepared for:

*United States Geological Survey (USGS)*



Prepared By:

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	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

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## 1.1 *Project Summary*

Dewberry Engineers Inc. is under contract to the United States Geological Survey to provide 159 Check Points in the State of Utah. 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 September 2020 thru November 2020.

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 UTM 12N, NAD83 (2011) in meters. Final Vertical elevations are referenced to NAVD88 in meters using Geoid model 2018B (Geoid18).

## 1.2 *Points of Contact*

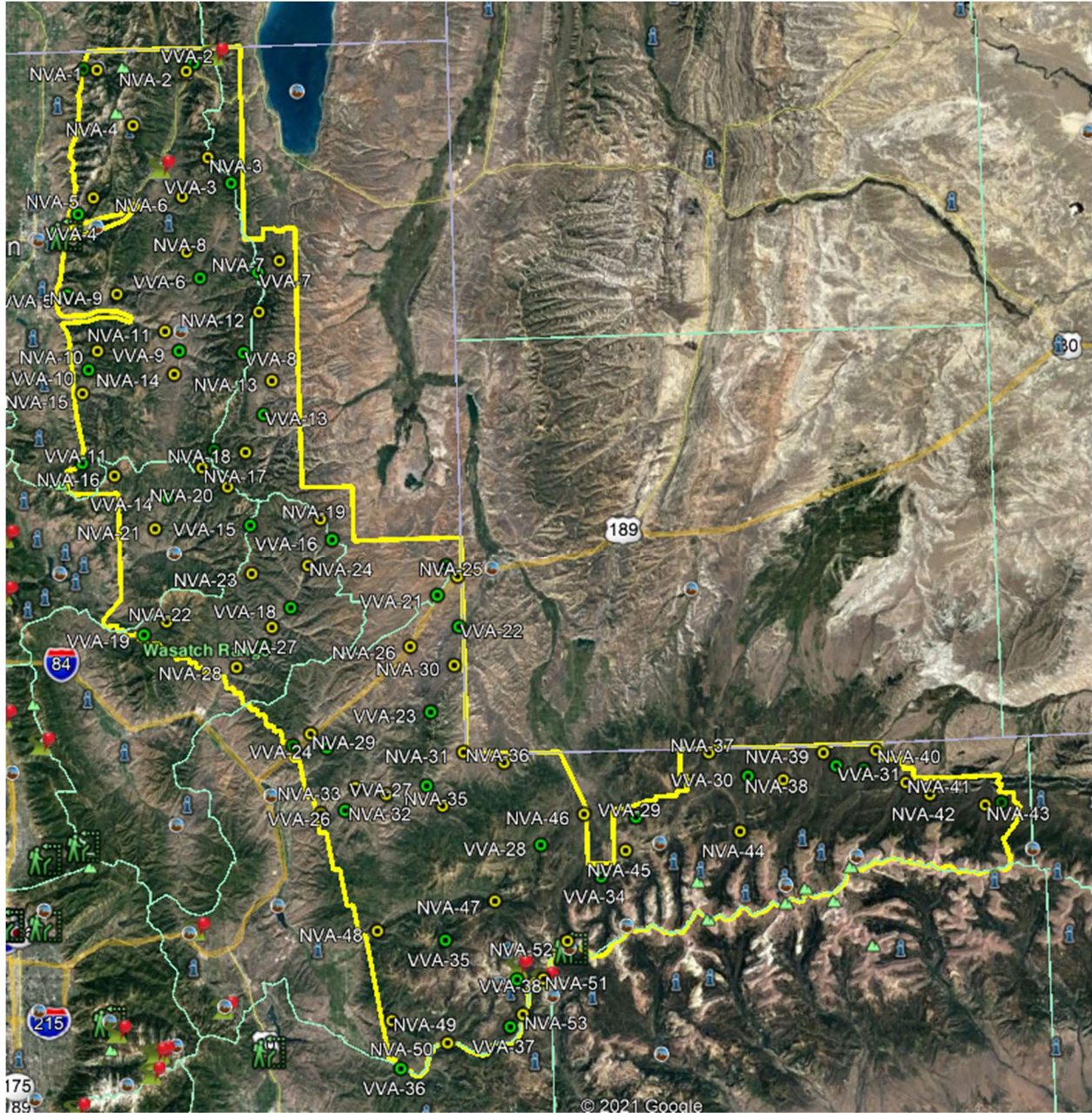
Questions regarding the technical aspects of this report should be addressed to:

### **Dewberry Engineers Inc.**

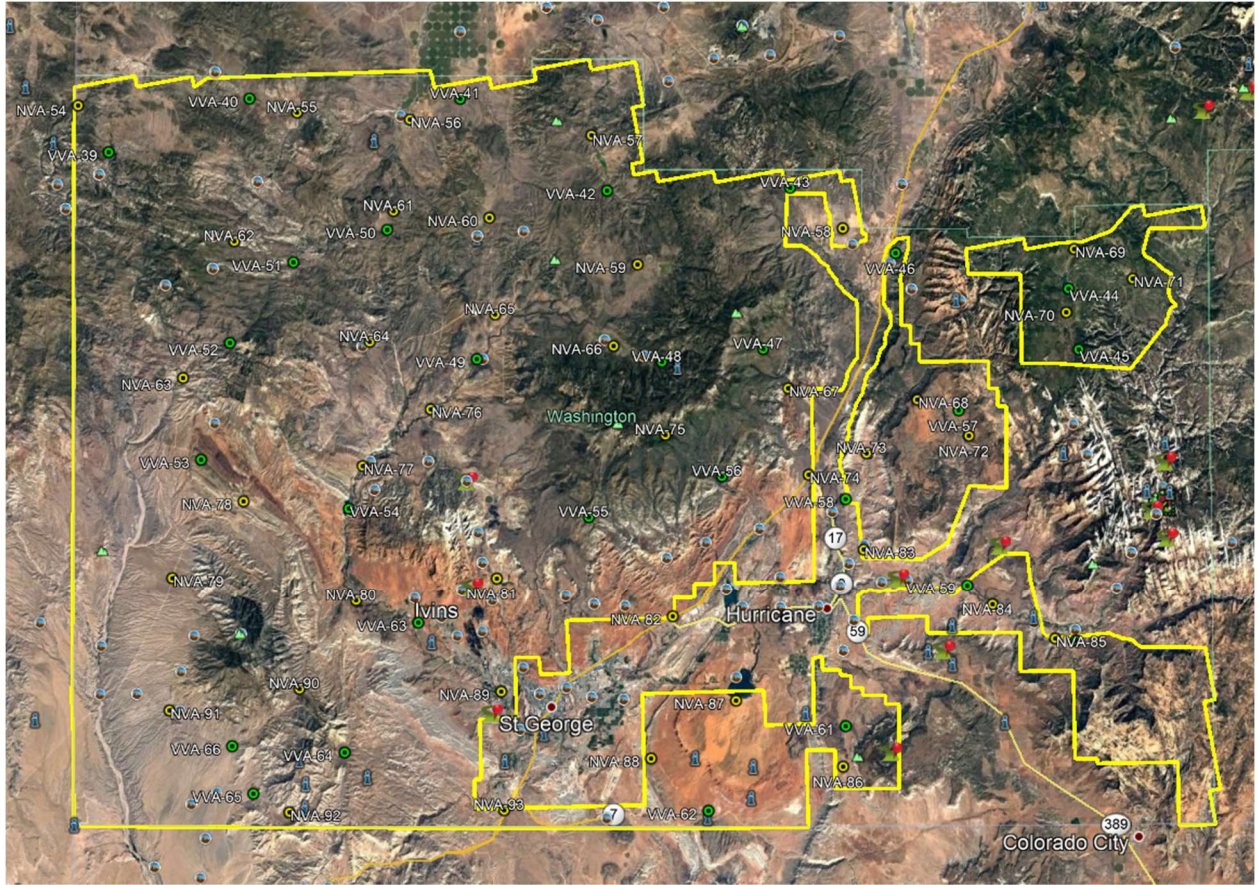
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### 1.3 Project Area







## **PROJECT DETAILS**

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### **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 159 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 “Control 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. 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 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. The 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.

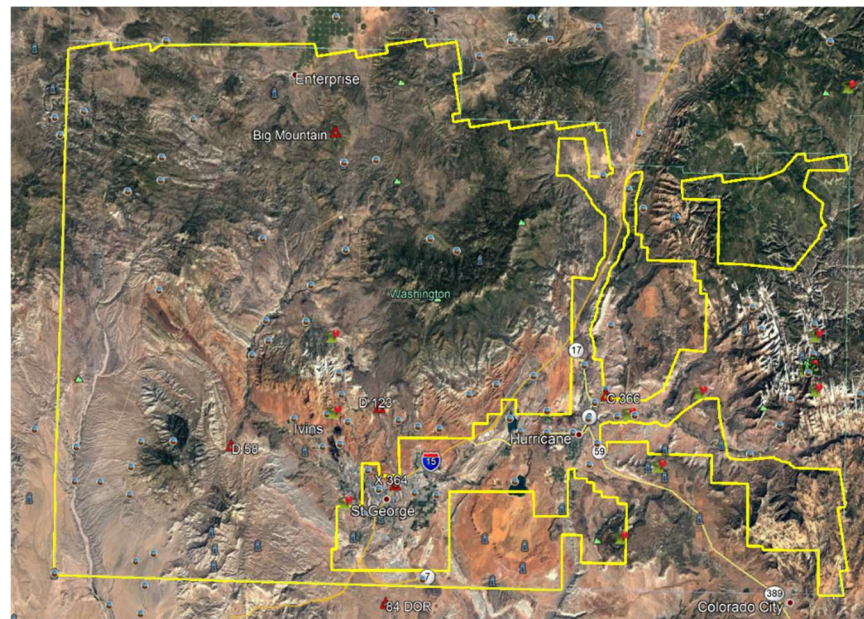
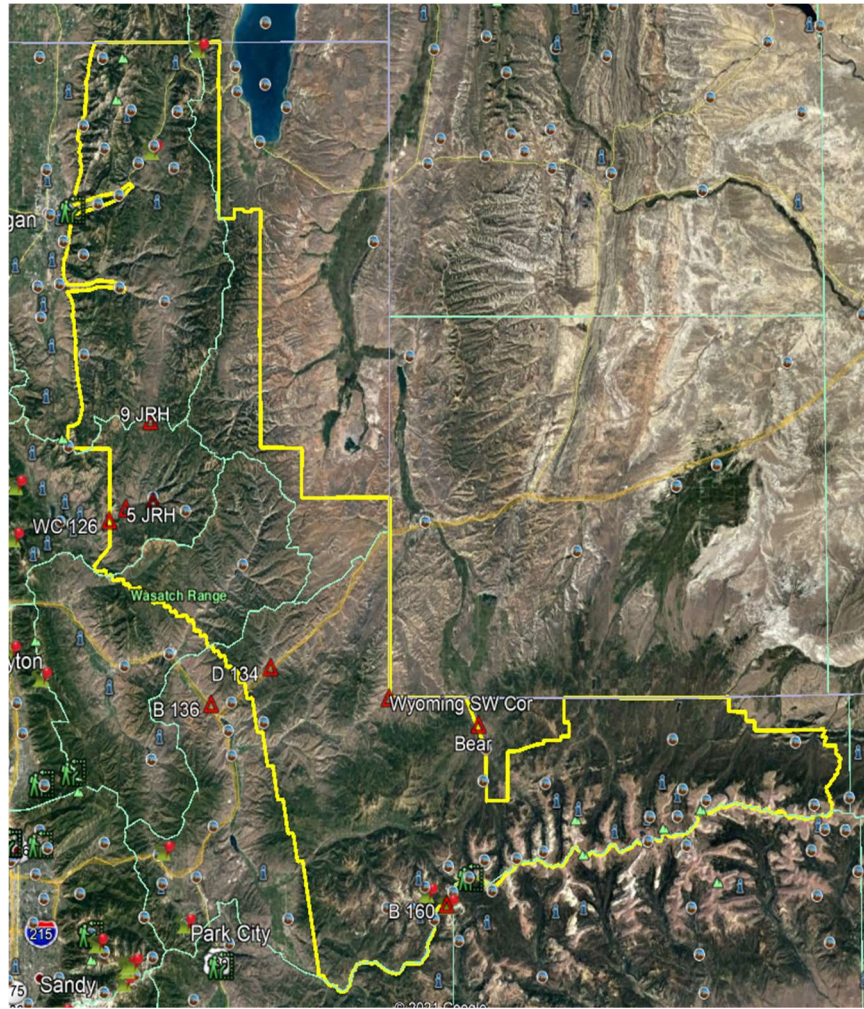
Eight (8) existing NGS monument listed in the NSRS database were located for the Louisiana area as an additional QA/QC method to check the horizontal and vertical accuracy of the VRS network as well as being the primary project control monuments designated as DR5480, AI5797, AI5801, LO0220, MR0316, LO0707, LO0170, DR5561. The results are as follows:

PT. #	Observed Values			Data Sheet Values			$\Delta X$	$\Delta Y$	$\Delta Z$
	NORTHING	EASTING	ELEVS.(m)	NORTHING	EASTING	ELEVS.(m)			
5 JRH	4570706.260	445787.659	1616.925	4570706.268	445787.643	1616.880	-0.008	0.016	0.045
9 JRH	4585525.737	450517.473	2179.650	4585525.745	450517.477	2179.630	-0.008	-0.004	0.020
CAUSEY	4571925.450	451033.789	1761.452	4571925.456	451033.793	1761.450	-0.006	-0.004	0.002
B136	4537500.725	462048.064	1660.420	4537500.728	462048.051	1660.417	-0.003	0.013	0.003
D134	4543738.557	473437.024	1799.253	N/A	N/A	1799.265	N/A	N/A	-0.012
WYSWCOR	4538522.692	496062.450	2181.149	4538522.649	496062.494	2181.140	0.043	-0.044	0.009
B160	4503394.898	507007.417	3154.781	N/A	N/A	3154.736	N/A	N/A	0.045
WC126	4568707.917	442622.596	1567.610	4568707.921	442622.612	1567.570	-0.004	-0.016	0.040

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 network 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 2019) 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***

POINT ID	NORTHING (m)	EASTING (m)	ELEV. (m)
<b>UTM 12N, NAD83 (2011), NAVD 88, Meters, Geoid 18</b>			
NVA-1	4647182.679	441248.992	1829.417
NVA-2	4646509.423	455314.371	2202.495
NVA-3	4632932.096	458332.612	2606.517
NVA-4	4638321.077	446700.377	2456.915
NVA-5	4627204.830	440185.569	1867.241
NVA-6	4626958.495	454152.638	2209.988
NVA-7	4616507.080	469117.773	2278.657
NVA-8	4618301.202	454610.730	2221.003
NVA-9	4612066.137	443495.082	1636.213
NVA-10	4603274.507	440206.685	2161.400
NVA-11	4606063.268	450917.877	1666.859
NVA-12	4608607.609	465698.737	2687.065
NVA-13	4597842.267	467442.601	2393.226
NVA-14	4599322.820	452150.284	1814.892
NVA-15	4596733.598	437679.020	1646.844
NVA-16	4575933.384	445068.264	2016.062
NVA-17	4584573.972	456132.708	2664.829
NVA-18	4586848.421	463043.801	2466.114
NVA-19	4586797.912	461085.228	2589.379
NVA-20	4581558.968	460038.566	2574.723
NVA-21	4575540.627	448661.204	1768.068
NVA-22	4568673.436	442871.006	1577.570
NVA-23	4550346.671	482424.986	1898.973
NVA-24	4591144.485	460296.529	2655.021
NVA-25	4566491.744	495645.594	2060.518
NVA-26	4555823.528	487827.871	1945.544
NVA-27	4559363.239	466372.919	1837.692
NVA-28	4553575.263	460992.304	1730.017
NVA-29	4542446.730	471818.062	1779.677
NVA-30	4552648.571	494710.659	2141.218
NVA-31	4539087.119	495880.120	2152.465
NVA-32	4533436.915	483050.701	1921.815
NVA-33	4534058.133	478724.460	1857.472
NVA-34	4530188.494	473177.385	1788.234
NVA-35	4536748.187	493573.894	2096.702
NVA-36	4537306.962	502094.349	2363.744

NVA-37	4537898.822	534138.857	2697.238
NVA-38	4533395.058	545632.675	2953.421
NVA-39	4537411.140	552030.056	2813.337
NVA-40	4537571.249	560253.855	2646.481
NVA-41	4532428.739	564747.538	2741.919
NVA-42	4530444.951	568505.700	2789.142
NVA-43	4528579.586	577119.535	2815.902
NVA-44	4526007.852	538824.265	2849.430
NVA-45	4523079.239	520696.085	2783.163
NVA-46	4528951.352	514353.968	2541.328
NVA-47	4515497.105	500205.963	2400.387
NVA-48	4511599.229	481483.079	2074.442
NVA-49	4497537.375	483344.752	2127.574
NVA-50	4493828.589	491964.626	2299.285
NVA-51	4503397.112	507289.051	3171.142
NVA-52	4509150.883	511163.434	3092.422
NVA-53	4497955.646	503903.813	2717.744
NVA-54	4164623.604	230812.916	1883.690
NVA-55	4162502.558	250431.860	1668.057
NVA-56	4161598.470	260530.011	1628.963
NVA-57	4159716.278	276810.094	1812.977
NVA-58	4150799.900	299114.169	1611.804
NVA-59	4148073.986	280622.745	2129.998
NVA-60	4152601.473	267451.637	1782.953
NVA-61	4153471.645	258856.811	1898.298
NVA-62	4151170.546	244484.795	1943.602
NVA-63	4139085.908	239543.858	1300.188
NVA-64	4141849.134	256408.720	1507.744
NVA-65	4143976.348	267728.271	1581.723
NVA-66	4140833.546	278328.822	2002.973
NVA-67	4136659.619	293825.584	1655.992
NVA-68	4135330.013	305387.675	1751.877
NVA-69	4148389.459	319854.125	2513.304
NVA-70	4142755.087	318976.439	2445.039
NVA-71	4145594.406	325043.102	2510.402
NVA-72	4131991.968	309927.471	1630.236
NVA-73	4129057.088	305182.524	1741.912
NVA-74	4128909.661	295454.606	1170.471
NVA-75	4126231.935	283479.068	1412.055



NVA-76	4135673.876	261709.520	1364.396
NVA-77	4130780.205	255467.851	1122.587
NVA-78	4127938.776	244681.440	1207.702
NVA-79	4121235.268	238087.274	1169.497
NVA-80	4118777.157	254663.443	983.269
NVA-81	4120413.079	267229.261	1160.805
NVA-82	4116478.101	282816.689	971.442
NVA-83	4122097.038	300201.620	1133.853
NVA-84	4116806.376	311633.034	1098.927
NVA-85	4113608.284	317181.557	1144.258
NVA-86	4102692.246	297827.792	1446.708
NVA-87	4108806.766	288518.988	940.543
NVA-88	4103885.208	280693.533	917.669
NVA-89	4110226.063	267337.533	818.981
NVA-90	4110963.011	249237.629	1400.854
NVA-91	4109352.470	237494.966	1091.996
NVA-92	4099961.609	248026.457	1197.285
NVA-93	4099394.614	267169.972	810.298
<b>POINT ID</b>	<b>NORTHING (m)</b>	<b>EASTING (m)</b>	<b>ELEV. (m)</b>
<b>UTM 12N, NAD83 (2011), NAVD 88, Meters, Geoid 18</b>			
VVA-1	4647390.680	439121.892	1681.141
VVA-2	4647713.542	456474.214	2184.102
VVA-3	4628842.893	461906.138	2302.837
VVA-4	4624744.147	437692.411	1656.343
VVA-5	4612171.680	435642.128	1792.020
VVA-6	4614196.209	456626.926	2095.514
VVA-7	4614765.793	465706.637	2468.491
VVA-8	4602351.069	463093.826	2537.788
VVA-9	4602909.344	453032.284	1726.017
VVA-10	4600346.681	438661.136	1846.732
VVA-11	4596654.614	439323.974	1645.277
VVA-12	4587301.219	458088.053	2728.458
VVA-13	4592654.125	466057.967	2330.633
VVA-14	4580088.985	450588.761	1962.657
VVA-15	4569298.737	444502.950	1592.955
VVA-16	4581080.975	461490.580	2598.471
VVA-17	4565856.912	493975.479	2062.665
VVA-18	4559083.649	468841.259	1842.521

VVA-19	4555467.365	462559.807	1735.187
VVA-20	4556525.374	464857.110	1753.736
VVA-21	4563666.173	492403.043	2063.103
VVA-22	4558593.319	495728.693	2107.153
VVA-23	4559705.232	494204.733	2122.451
VVA-24	4543925.356	474424.709	1813.660
VVA-25	4540516.386	468913.692	1751.483
VVA-26	4530580.532	477000.200	1821.898
VVA-27	4534025.671	489910.401	2068.248
VVA-28	4524112.569	507167.763	2712.272
VVA-29	4528250.370	522428.298	2877.727
VVA-30	4534094.884	540159.218	2966.025
VVA-31	4535361.904	553995.489	2937.375
VVA-32	4534757.803	558207.445	2716.093
VVA-33	4528914.704	579672.660	2861.557
VVA-34	4519089.015	516786.913	2684.090
VVA-35	4509868.392	492143.469	2370.727
VVA-36	4489785.912	485354.361	2118.126
VVA-37	4496023.789	501911.573	2890.948
VVA-38	4503363.641	503105.350	3056.257
VVA-39	4159458.311	233369.262	1862.138
VVA-40	4163977.028	246086.819	1704.969
VVA-41	4163314.995	265025.896	1633.604
VVA-42	4154779.349	278020.581	1891.761
VVA-43	4154581.616	294497.967	1742.374
VVA-44	4144831.878	319132.470	2484.693
VVA-45	4139336.973	319912.570	2406.577
VVA-46	4148328.466	304279.398	1634.648
VVA-47	4129673.547	295597.239	1212.009
VVA-48	4139324.120	282573.292	2116.180
VVA-49	4140011.041	265987.562	1496.994
VVA-50	4151796.529	258251.565	1915.652
VVA-51	4149046.420	249736.072	1662.639
VVA-52	4142111.608	243852.204	1400.936
VVA-53	4131740.612	240990.481	1249.319
VVA-54	4127032.679	254119.722	1094.549
VVA-55	4125668.972	275629.041	1607.602
VVA-56	4128958.076	287678.245	1417.033
VVA-57	4134237.081	309033.193	1675.405

<b>VVA-58</b>	<b>4126593.972</b>	<b>298767.831</b>	<b>1167.445</b>
<b>VVA-59</b>	<b>4118596.371</b>	<b>309445.593</b>	<b>1098.974</b>
<b>VVA-60</b>	<b>4113367.367</b>	<b>319018.960</b>	<b>1269.078</b>
<b>VVA-61</b>	<b>4106295.484</b>	<b>298159.441</b>	<b>1411.140</b>
<b>VVA-62</b>	<b>4099054.769</b>	<b>285669.354</b>	<b>908.968</b>
<b>VVA-63</b>	<b>4116598.102</b>	<b>260069.546</b>	<b>908.651</b>
<b>VVA-64</b>	<b>4105209.769</b>	<b>253149.592</b>	<b>1359.957</b>
<b>VVA-65</b>	<b>4101716.639</b>	<b>244778.934</b>	<b>1036.865</b>
<b>VVA-66</b>	<b>4106005.468</b>	<b>243039.413</b>	<b>1127.091</b>



#### 4. GPS OBSERVATIONS

POINT ID	OBSERV. DATE	JULIAN DATE	TIME OF DAY (AST)	RE-OBSERV. DATE	RE-OBSERV. TIME
NVA-1	9/19/2020	263	12:16	N/A	N/A
NVA-2	9/18/2020	262	11:17	N/A	N/A
NVA-3	9/19/2020	263	15:28	N/A	N/A
NVA-4	9/18/2020	262	13:59	N/A	N/A
NVA-5	9/18/2020	262	16:28	N/A	N/A
NVA-6	9/19/2020	263	16:24	N/A	N/A
NVA-7	9/21/2020	265	15:33	N/A	N/A
NVA-8	9/19/2020	263	17:41	N/A	N/A
NVA-9	9/20/2020	264	12:16	N/A	N/A
NVA-10	10/30/2020	304	12:26	N/A	N/A
NVA-11	9/20/2020	264	13:10	9/21/2020	12:53
NVA-12	9/23/2020	267	14:57	N/A	N/A
NVA-13	9/23/2020	267	13:21	N/A	N/A
NVA-14	9/20/2020	264	15:45	9/21/2020	10:47
NVA-15	10/30/2020	304	14:29	N/A	N/A
NVA-16	10/29/2020	303	16:53	N/A	N/A
NVA-17	9/22/2020	266	17:53	9/23/2020	11:30
NVA-18	10/29/2020	303	14:25	N/A	N/A
NVA-19	10/29/2020	303	15:23	N/A	N/A
NVA-20	10/28/2020	302	17:26	10/29/2020	12:45
NVA-21	9/22/2020	266	14:50	9/23/2020	9:19
NVA-22	10/28/2020	302	15:48	10/29/2020	11:30
NVA-23	10/28/2020	302	12:42	N/A	N/A
NVA-24	10/29/2020	303	15:58	N/A	N/A
NVA-25	10/16/2020	290	11:24	10/20/2020	13:32
NVA-26	10/16/2020	290	12:25	10/20/2020	14:57
NVA-27	10/27/2020	301	14:20	10/28/2020	14:16
NVA-28	10/27/2020	301	13:31	10/28/2020	13:32
NVA-29	10/16/2020	290	13:59	10/20/2020	16:09
NVA-30	10/15/2020	289	10:57	10/20/2020	11:34
NVA-31	10/15/2020	289	11:41	10/20/2020	12:10
NVA-32	10/26/2020	300	13:05	N/A	N/A
NVA-33	10/26/2020	300	12:35	10/26/2020	17:01
NVA-34	10/26/2020	300	11:55	10/26/2020	16:30
NVA-35	10/26/2020	300	14:55	N/A	N/A
NVA-36	10/15/2020	289	12:35	10/20/2020	12:33

NVA-37	10/21/2020	295	18:11	10/22/2020	12:07
NVA-38	10/21/2020	295	12:15	N/A	N/A
NVA-39	10/19/2020	293	18:59	10/21/2020	23:34
NVA-40	10/18/2020	292	17:16	10/19/2020	12:39
NVA-41	10/18/2020	292	12:08	N/A	N/A
NVA-42	10/17/2020	291	18:26	N/A	N/A
NVA-43	10/17/2020	291	14:43	N/A	N/A
NVA-44	10/21/2020	295	16:48	N/A	N/A
NVA-45	10/22/2020	296	18:22	N/A	N/A
NVA-46	10/15/2020	289	16:57	10/23/2020	11:07
NVA-47	10/25/2020	299	14:59	N/A	N/A
NVA-48	10/25/2020	299	12:01	10/25/2020	16:54
NVA-49	10/24/2020	298	16:17	N/A	N/A
NVA-50	10/24/2020	298	15:22	N/A	N/A
NVA-51	10/23/2020	297	15:55	10/24/2020	11:11
NVA-52	10/23/2020	297	14:58	10/24/2020	10:24
NVA-53	10/24/2020	298	12:50	N/A	N/A
NVA-54	9/26/2020	270	15:25	N/A	N/A
NVA-55	9/26/2020	270	12:52	9/27/2020	13:15
NVA-56	9/26/2020	270	12:30	9/27/2020	12:55
NVA-57	10/6/2020	280	12:37	10/7/2020	13:58
NVA-58	10/8/2020	282	9:12	10/9/2020	10:08
NVA-59	10/6/2020	280	14:16	10/7/2020	15:16
NVA-60	9/26/2020	270	10:31	9/27/2020	11:11
NVA-61	10/6/2020	280	11:24	10/7/2020	12:54
NVA-62	10/5/2020	279	15:21	N/A	N/A
NVA-63	10/5/2020	279	11:30	N/A	N/A
NVA-64	9/28/2020	272	16:08	9/29/2020	18:11
NVA-65	9/26/2020	270	10:11	9/27/2020	10:54
NVA-66	10/6/2020	280	15:06	10/7/2020	15:59
NVA-67	10/8/2020	282	9:46	10/9/2020	11:15
NVA-68	10/10/2020	284	11:39	N/A	N/A
NVA-69	10/11/2020	285	10:17	N/A	N/A
NVA-70	10/11/2020	285	12:22	N/A	N/A
NVA-71	10/11/2020	285	14:31	N/A	N/A
NVA-72	10/10/2020	284	10:53	N/A	N/A
NVA-73	10/10/2020	284	14:05	N/A	N/A
NVA-74	10/8/2020	282	10:18	10/9/2020	11:58
NVA-75	10/8/2020	282	12:04	10/9/2020	13:15

NVA-76	9/26/2020	270	9:24	9/27/2020	10:19
NVA-77	9/28/2020	272	15:32	9/29/2020	19:15
NVA-78	10/5/2020	279	9:33	N/A	N/A
NVA-79	10/5/2020	279	8:29	N/A	N/A
NVA-80	9/28/2020	272	14:50	9/29/2020	18:44
NVA-81	9/26/2020	270	8:40	9/27/2020	9:46
NVA-82	9/28/2020	272	9:52	9/29/2020	9:31
NVA-83	10/3/2020	277	14:54	10/4/2020	10:31
NVA-84	10/3/2020	277	12:52	N/A	N/A
NVA-85	10/3/2020	277	11:08	10/4/2020	11:22
NVA-86	10/4/2020	278	13:37	N/A	N/A
NVA-87	10/6/2020	280	9:29	10/7/2020	10:39
NVA-88	9/28/2020	272	10:53	9/28/2020	10:09
NVA-89	9/28/2020	272	13:00	9/29/2020	12:03
NVA-90	9/30/2020	274	10:12	N/A	N/A
NVA-91	9/30/2020	274	14:03	N/A	N/A
NVA-92	9/30/2020	274	12:15	N/A	N/A
NVA-93	9/28/2020	272	12:29	9/29/2020	11:29
VVA-1	9/19/2020	263	11:33	N/A	N/A
VVA-2	9/18/2020	262	10:36	N/A	N/A
VVA-3	9/19/2020	263	15:51	N/A	N/A
VVA-4	9/18/2020	262	16:01	9/19/2020	13:43
VVA-5	9/20/2020	264	10:39	N/A	N/A
VVA-6	9/19/2020	263	18:43	N/A	N/A
VVA-7	9/21/2020	265	14:04	N/A	N/A
VVA-8	8/23/2020	236	15:53	N/A	N/A
VVA-9	9/20/2020	264	15:05	9/21/2020	11:21
VVA-10	10/30/2020	304	13:00	N/A	N/A
VVA-11	10/30/2020	304	14:51	10/30/2020	15:06
VVA-12	9/23/2020	267	12:12	N/A	N/A
VVA-13	9/23/2020	267	12:35	N/A	N/A
VVA-14	9/23/2020	267	15:30	9/23/2019	9:52
VVA-15	10/28/2020	300	16:22	10/29/2020	11:45
VVA-16	10/28/2020	300	17:46	10/29/2020	13:17
VVA-17	10/16/2020	290	17:14	10/20/2020	14:20
VVA-18	10/27/2020	299	14:52	N/A	N/A
VVA-19	10/28/2020	300	13:55	10/28/2020	16:00
VVA-20	10/27/2020	299	13:55	N/A	N/A
VVA-21	10/16/2020	290	16:39	10/20/2020	14:04



VVA-22	10/15/2020	289	10:28	10/20/2020	11:17
VVA-23	10/28/2020	300	12:08	N/A	N/A
VVA-24	10/16/2020	290	15:23	10/20/2020	15:51
VVA-25	10/16/2020	290	14:14	10/20/2020	16:23
VVA-26	10/26/2020	298	12:13	10/26/2020	16:16
VVA-27	10/26/2020	298	13:02	N/A	N/A
VVA-28	10/15/2020	289	14:40	N/A	N/A
VVA-29	10/22/2020	296	16:47	N/A	N/A
VVA-30	10/20/2020	294	13:27	N/A	N/A
VVA-31	10/19/2020	293	15:00	N/A	N/A
VVA-32	10/18/2020	292	16:20	10/19/2020	13:05
VVA-33	10/17/2020	291	15:48	N/A	N/A
VVA-34	10/23/2020	297	11:44	N/A	N/A
VVA-35	10/25/2020	299	13:40	N/A	N/A
VVA-36	10/24/2020	298	17:38	10/25/2020	17:30
VVA-37	10/24/2020	298	14:01	N/A	N/A
VVA-38	10/23/2020	297	17:39	10/24/2020	12:03
VVA-39	10/5/2020	279	16:42	N/A	N/A
VVA-40	9/26/2020	270	13:37	N/A	N/A
VVA-41	9/26/2020	270	11:43	9/27/2020	12:19
VVA-42	10/6/2020	280	13:24	10/7/2020	14:54
VVA-43	10/8/2020	282	8:33	10/9/2020	9:33
VVA-44	10/11/2020	285	11:40	N/A	N/A
VVA-45	10/11/2020	285	13:49	10/11/2020	15:59
VVA-46	10/3/2020	277	16:42	10/4/2020	9:56
VVA-47	10/9/2020	283	10:54	N/A	N/A
VVA-48	10/6/2020	280	15:24	10/7/2020	16:14
VVA-49	9/26/2020	270	9:50	9/27/2020	10:35
VVA-50	10/6/2020	280	11:09	N/A	N/A
VVA-51	10/5/2020	279	14:10	N/A	N/A
VVA-52	10/5/2020	279	12:29	N/A	N/A
VVA-53	10/5/2020	279	9:49	N/A	N/A
VVA-54	9/28/2020	272	15:14	9/29/2020	19:01
VVA-55	10/8/2020	282	12:54	10/9/2020	15:42
VVA-56	10/8/2020	282	11:32	10/9/2020	12:48
VVA-57	10/10/2020	284	10:09	10/12/2020	9:15
VVA-58	10/3/2020	277	15:36	10/3/2020	17:41
VVA-59	10/3/2020	277	13:44	N/A	N/A
VVA-60	10/3/2020	277	10:47	10/4/2020	11:45

<b>VVA-61</b>	<b>10/4/2020</b>	<b>278</b>	<b>13:18</b>	<b>10/12/2020</b>	<b>11:35</b>
<b>VVA-62</b>	<b>9/28/2020</b>	<b>272</b>	<b>11:19</b>	<b>9/28/2020</b>	<b>13:23</b>
<b>VVA-63</b>	<b>9/28/2020</b>	<b>272</b>	<b>14:31</b>	<b>9/29/2020</b>	<b>18:32</b>
<b>VVA-64</b>	<b>9/30/2020</b>	<b>274</b>	<b>11:15</b>	<b>N/A</b>	<b>N/A</b>
<b>VVA-65</b>	<b>9/30/2020</b>	<b>274</b>	<b>13:04</b>	<b>9/30/2020</b>	<b>15:07</b>
<b>VVA-66</b>	<b>9/30/2020</b>	<b>274</b>	<b>13:40</b>	<b>9/30/2020</b>	<b>15:43</b>

## 5. POINT COMPARISON

Point ID	Point CK	Delta North (M)	Delta East (M)	Vertical Difference (M)
NVA-001	NVA-001 CK	N/A	N/A	N/A
NVA-002	NVA-002 CK	N/A	N/A	N/A
NVA-003	NVA-003 CK	N/A	N/A	N/A
NVA-004	NVA-004 CK	N/A	N/A	N/A
NVA-005	NVA-005 CK	N/A	N/A	N/A
NVA-006	NVA-006 CK	N/A	N/A	N/A
NVA-007	NVA-007 CK	N/A	N/A	N/A
NVA-008	NVA-008 CK	N/A	N/A	N/A
NVA-009	NVA-009 CK	N/A	N/A	N/A
NVA-010	NVA-010 CK	N/A	N/A	N/A
NVA-011	NVA-011 CK	-0.003	0.004	0.026
NVA-012	NVA-012 CK	N/A	N/A	N/A
NVA-013	NVA-013 CK	N/A	N/A	N/A
NVA-014	NVA-014 CK	0.036	-0.006	-0.035
NVA-015	NVA-015 CK	N/A	N/A	N/A
NVA-016	NVA-016 CK	N/A	N/A	N/A
NVA-017	NVA-017 CK	0.024	-0.003	-0.014
NVA-018	NVA-018 CK	N/A	N/A	N/A
NVA-019	NVA-019 CK	N/A	N/A	N/A
NVA-020	NVA-020 CK	0.013	-0.005	0.012
NVA-021	NVA-021 CK	0.012	0.001	-0.002
NVA-022	NVA-022 CK	-0.014	0.018	0.013
NVA-023	NVA-023 CK	N/A	N/A	N/A
NVA-024	NVA-024 CK	N/A	N/A	N/A
NVA-025	NVA-025 CK	0.005	0.013	-0.005
NVA-026	NVA-026 CK	-0.010	0.007	0.021
NVA-027	NVA-027 CK	-0.005	0.006	0.002
NVA-028	NVA-028 CK	0.012	-0.009	0.017
NVA-029	NVA-029 CK	-0.011	0.017	-0.015
NVA-030	NVA-030 CK	-0.016	-0.011	0.009
NVA-031	NVA-031 CK	-0.004	0.004	-0.037
NVA-032	NVA-032 CK	N/A	N/A	N/A
NVA-033	NVA-033 CK	-0.008	-0.005	0.018
NVA-034	NVA-034 CK	-0.009	0.016	-0.006
NVA-035	NVA-035 CK	N/A	N/A	N/A
NVA-036	NVA-036 CK	0.018	-0.016	0.028
NVA-037	NVA-037 CK	0.002	-0.012	0.003
NVA-038	NVA-038 CK	N/A	N/A	N/A



NVA-039	NVA-039 CK	-0.031	-0.011	-0.010
NVA-040	NVA-040 CK	0.015	-0.015	-0.035
NVA-041	NVA-041 CK	N/A	N/A	N/A
NVA-042	NVA-042 CK	N/A	N/A	N/A
NVA-043	NVA-043 CK	N/A	N/A	N/A
NVA-044	NVA-044 CK	N/A	N/A	N/A
NVA-045	NVA-045 CK	N/A	N/A	N/A
NVA-046	NVA-046 CK	0.014	-0.010	0.003
NVA-047	NVA-047 CK	N/A	N/A	N/A
NVA-048	NVA-048 CK	0.000	0.011	0.014
NVA-049	NVA-049 CK	N/A	N/A	N/A
NVA-050	NVA-050 CK	N/A	N/A	N/A
NVA-051	NVA-051 CK	-0.017	0.023	-0.006
NVA-052	NVA-052 CK	0.000	0.009	0.044
NVA-053	NVA-053 CK	N/A	N/A	N/A
NVA-054	NVA-054 CK	N/A	N/A	N/A
NVA-055	NVA-055 CK	0.008	0.007	0.007
NVA-056	NVA-056 CK	0.011	-0.019	0.007
NVA-057	NVA-057 CK	0.044	0.008	0.029
NVA-058	NVA-058 CK	0.014	0.000	-0.026
NVA-059	NVA-059 CK	0.025	-0.001	0.029
NVA-060	NVA-060 CK	0.007	0.017	0.008
NVA-061	NVA-061 CK	-0.020	-0.009	-0.032
NVA-062	NVA-062 CK	N/A	N/A	N/A
NVA-063	NVA-063 CK	N/A	N/A	N/A
NVA-064	NVA-064 CK	0.002	0.004	0.008
NVA-065	NVA-065 CK	-0.006	0.004	0.037
NVA-066	NVA-066 CK	0.026	0.005	0.045
NVA-067	NVA-067 CK	-0.027	-0.007	-0.016
NVA-068	NVA-068 CK	N/A	N/A	N/A
NVA-069	NVA-069 CK	N/A	N/A	N/A
NVA-070	NVA-070 CK	N/A	N/A	N/A
NVA-071	NVA-071 CK	N/A	N/A	N/A
NVA-072	NVA-072 CK	N/A	N/A	N/A
NVA-073	NVA-073 CK	N/A	N/A	N/A
NVA-074	NVA-074 CK	-0.026	0.011	0.000
NVA-075	NVA-075 CK	-0.018	-0.001	-0.031
NVA-076	NVA-076 CK	0.007	0.004	0.021
NVA-077	NVA-077 CK	-0.007	-0.021	0.028
NVA-078	NVA-078 CK	N/A	N/A	N/A
NVA-079	NVA-079 CK	N/A	N/A	N/A

NVA-080	NVA-080 CK	0.001	0.008	0.037
NVA-081	NVA-081 CK	0.001	0.005	-0.001
NVA-082	NVA-082 CK	-0.019	0.000	0.040
NVA-083	NVA-083 CK	0.016	0.001	0.045
NVA-084	NVA-084 CK	N/A	N/A	N/A
NVA-085	NVA-085 CK	-0.035	0.022	-0.021
NVA-086	NVA-086 CK	N/A	N/A	N/A
NVA-087	NVA-087 CK	0.014	0.015	-0.014
NVA-088	NVA-088 CK	0.004	0.023	-0.022
NVA-089	NVA-089 CK	0.009	-0.003	0.022
NVA-090	NVA-090 CK	N/A	N/A	N/A
NVA-091	NVA-091 CK	N/A	N/A	N/A
NVA-092	NVA-092 CK	N/A	N/A	N/A
NVA-093	NVA-093 CK	-0.002	-0.010	-0.009
VVA-1	VVA-1 CK	N/A	N/A	N/A
VVA-2	VVA-2 CK	N/A	N/A	N/A
VVA-3	VVA-3 CK	N/A	N/A	N/A
VVA-4	VVA-4 CK	-0.003	-0.007	0.007
VVA-5	VVA-5 CK	N/A	N/A	N/A
VVA-6	VVA-6 CK	N/A	N/A	N/A
VVA-7	VVA-7 CK	N/A	N/A	N/A
VVA-8	VVA-8 CK	N/A	N/A	N/A
VVA-9	VVA-9 CK	-0.011	0.024	0.013
VVA-10	VVA-10 CK	0.005	0.002	-0.011
VVA-11	VVA-11 CK	N/A	N/A	N/A
VVA-12	VVA-12 CK	N/A	N/A	N/A
VVA-13	VVA-13 CK	N/A	N/A	N/A
VVA-14	VVA-14 CK	0.002	-0.009	-0.003
VVA-15	VVA-15 CK	-0.014	0.012	0.019
VVA-16	VVA-16 CK	-0.005	-0.004	-0.006
VVA-17	VVA-17 CK	0.005	-0.006	0.009
VVA-18	VVA-18 CK	N/A	N/A	N/A
VVA-19	VVA-19 CK	-0.010	-0.008	0.021
VVA-20	VVA-20 CK	N/A	N/A	N/A
VVA-21	VVA-21 CK	0.009	0.000	-0.021
VVA-22	VVA-22 CK	-0.008	-0.009	0.010
VVA-23	VVA-23 CK	N/A	N/A	N/A
VVA-24	VVA-24 CK	-0.007	-0.007	-0.013
VVA-25	VVA-25 CK	-0.007	0.016	-0.014
VVA-26	VVA-26 CK	0.010	0.002	-0.001
VVA-27	VVA-27 CK	N/A	N/A	N/A

VVA-28	VVA-28 CK	N/A	N/A	N/A
VVA-29	VVA-29 CK	N/A	N/A	N/A
VVA-30	VVA-30 CK	N/A	N/A	N/A
VVA-31	VVA-31 CK	N/A	N/A	N/A
VVA-32	VVA-32 CK	0.038	-0.006	-0.025
VVA-33	VVA-33 CK	N/A	N/A	N/A
VVA-34	VVA-34 CK	N/A	N/A	N/A
VVA-35	VVA-35 CK	N/A	N/A	N/A
VVA-36	VVA-36 CK	-0.008	-0.001	0.024
VVA-37	VVA-37 CK	N/A	N/A	N/A
VVA-38	VVA-38 CK	0.000	-0.013	0.039
VVA-39	VVA-39 CK	N/A	N/A	N/A
VVA-40	VVA-40 CK	N/A	N/A	N/A
VVA-41	VVA-41 CK	0.005	0.008	-0.026
VVA-42	VVA-42 CK	-0.038	0.010	0.039
VVA-43	VVA-43 CK	-0.011	0.002	-0.003
VVA-44	VVA-44 CK	N/A	N/A	N/A
VVA-45	VVA-45 CK	-0.019	0.003	-0.002
VVA-46	VVA-46 CK	-0.002	-0.016	-0.003
VVA-47	VVA-47 CK	N/A	N/A	N/A
VVA-48	VVA-48 CK	0.007	-0.023	-0.007
VVA-49	VVA-49 CK	0.022	-0.003	0.009
VVA-50	VVA-50 CK	N/A	N/A	N/A
VVA-51	VVA-51 CK	N/A	N/A	N/A
VVA-52	VVA-52 CK	N/A	N/A	N/A
VVA-53	VVA-53 CK	N/A	N/A	N/A
VVA-54	VVA-54 CK	-0.020	0.014	0.009
VVA-55	VVA-55 CK	-0.019	-0.015	0.032
VVA-56	VVA-56 CK	0.002	0.005	-0.015
VVA-57	VVA-57 CK	-0.007	0.004	0.001
VVA-58	VVA-58 CK	0.004	-0.001	-0.007
VVA-59	VVA-59 CK	N/A	N/A	N/A
VVA-60	VVA-60 CK	-0.012	-0.020	-0.035
VVA-61	VVA-61 CK	0.005	-0.001	0.000
VVA-62	VVA-62 CK	-0.003	-0.006	-0.013
VVA-63	VVA-63 CK	-0.004	0.026	-0.001
VVA-64	VVA-64 CK	N/A	N/A	N/A
VVA-65	VVA-65 CK	-0.002	0.000	0.002
VVA-66	VVA-66 CK	-0.006	-0.005	-0.009