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Ground Control & Check Point Survey Report for USFS Intermountain LiDAR

For

USGS

August 2023

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1. Introduction

1.1 Project Summary:

Aero-Graphics Inc. is under contract with the USGS to provide surveyed ground control and check points to support the acquisition of aerial lidar U.S. Forest Service in Idaho, Nevada, and Utah. The survey field work was conducted June 10, 2023 to July 12, 2023. The ground control and check point locations were selected by Aero-Graphics prior to the survey commencing. The points were distributed across the project areas as evenly as the terrain and access would allow.

Existing benchmarks were located and surveyed as part of the fieldwork to verify the accuracy of survey and tie the new data to existing data. The results are shown in section 2.4 of this report.

The final horizontal coordinates are referenced to NAD83(2011) CONUS Albers meters. The final vertical elevations are referenced to NAVD88 (Geoid18) meters.

Contract Number: 140G0221D0015

1.2 Surveyor:

Questions regarding this report can be addressed to:

Karl Jensen, PLS, CP
Surveying Manager
Aero-Graphics, Inc
40 W Oakland Ave
Salt Lake City, Utah 84115
801-487-3273
801-891-2779 direct



Utah Licensed Professional Land Surveyor #7643406, exp date 3/31/2025

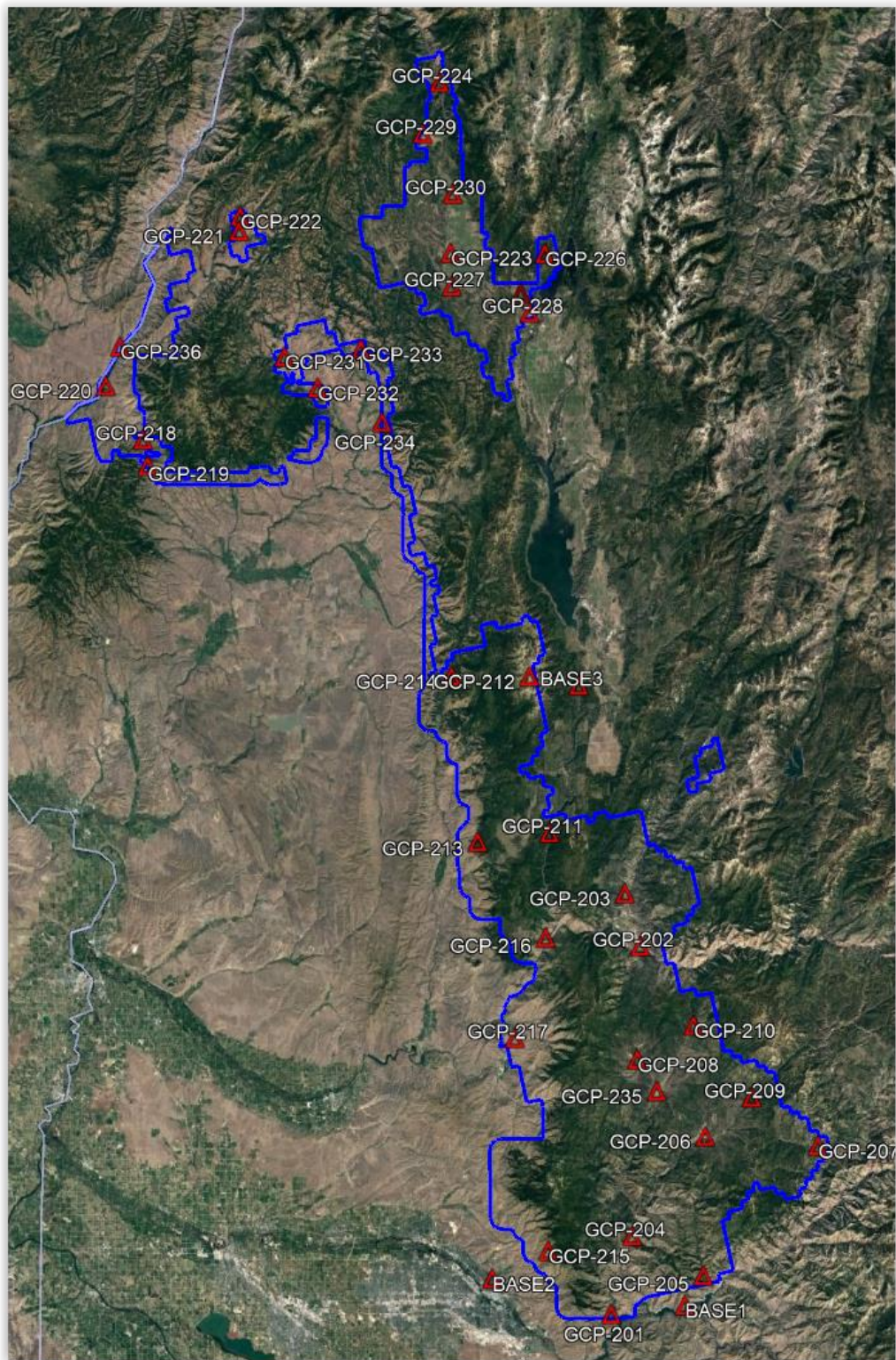
Colorado Licensed Professional Land Surveyor #PLS-0038527, exp date 10/31/2025

ASPRS Certified Photogrammetrist, exp date 9/17/2023

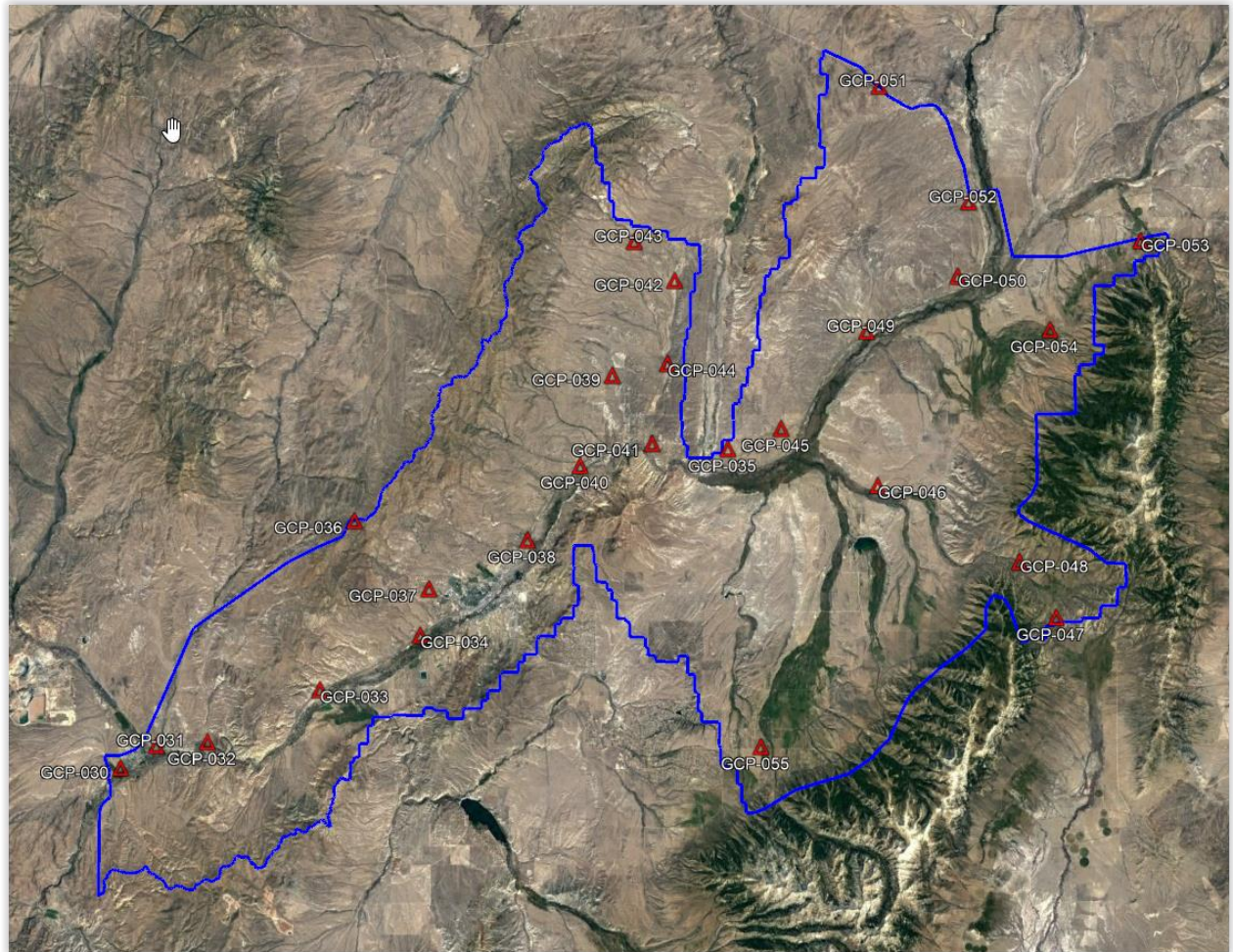
1.3 Project Area:

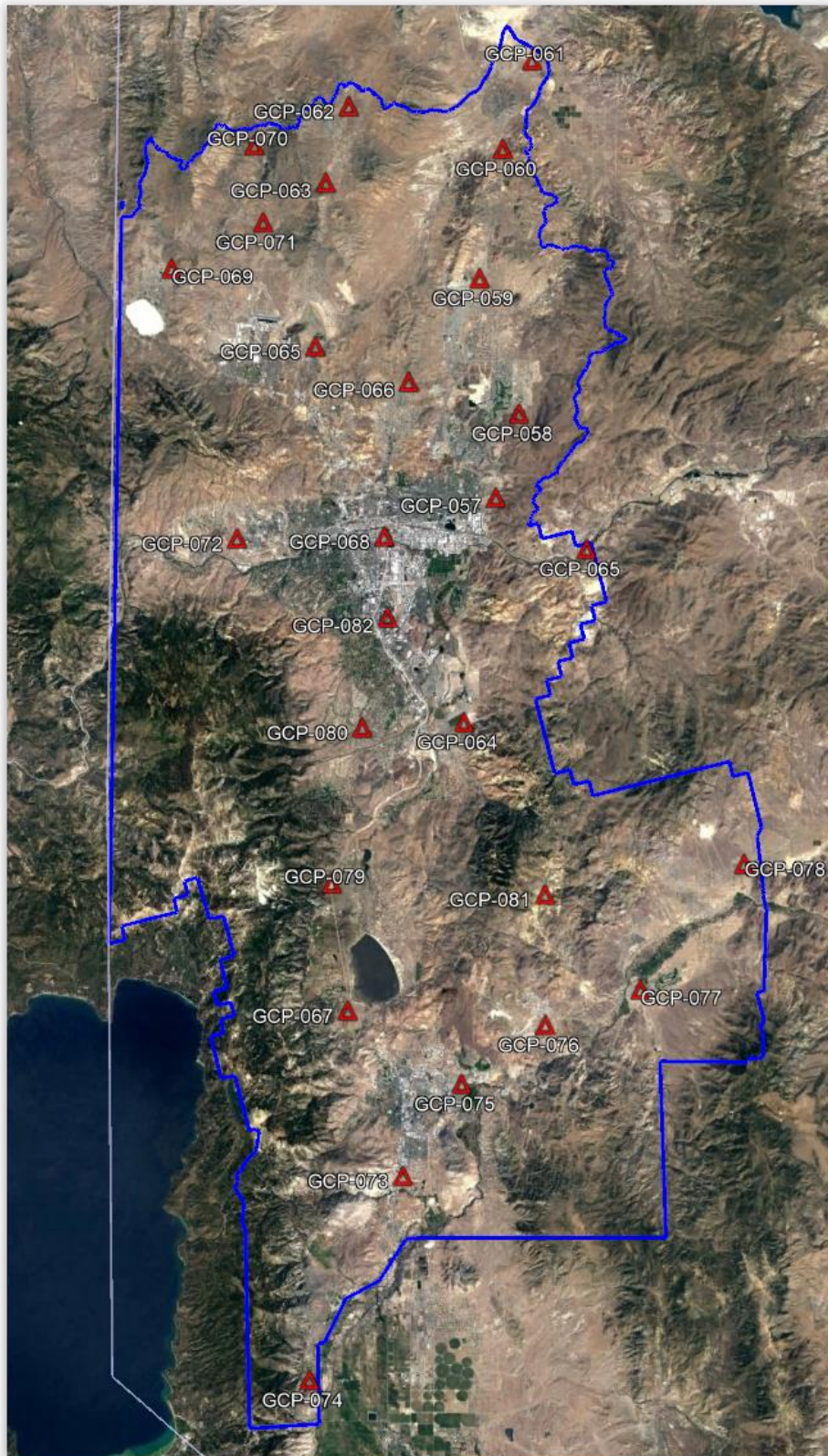
CONTROL POINT LOCATIONS

IDAHO

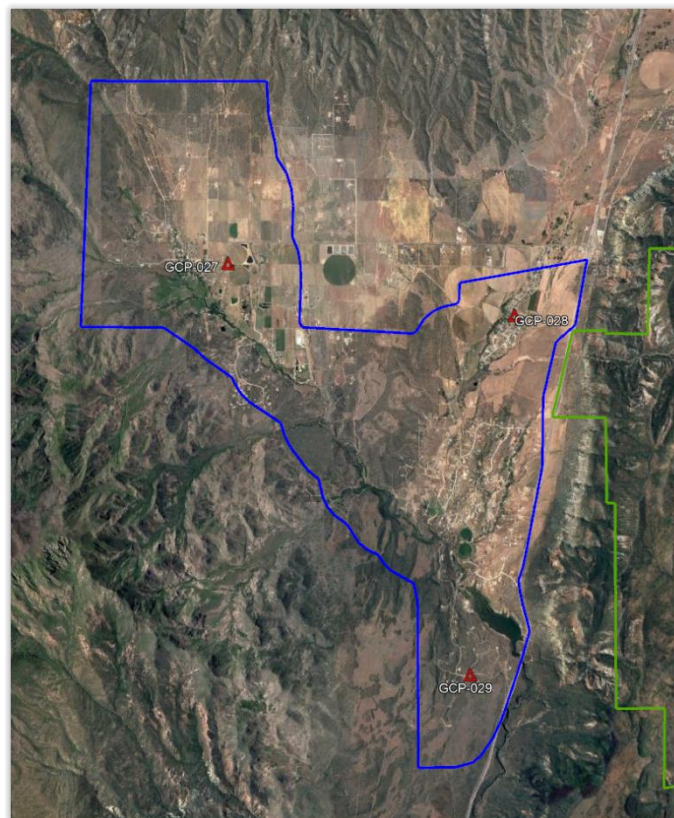
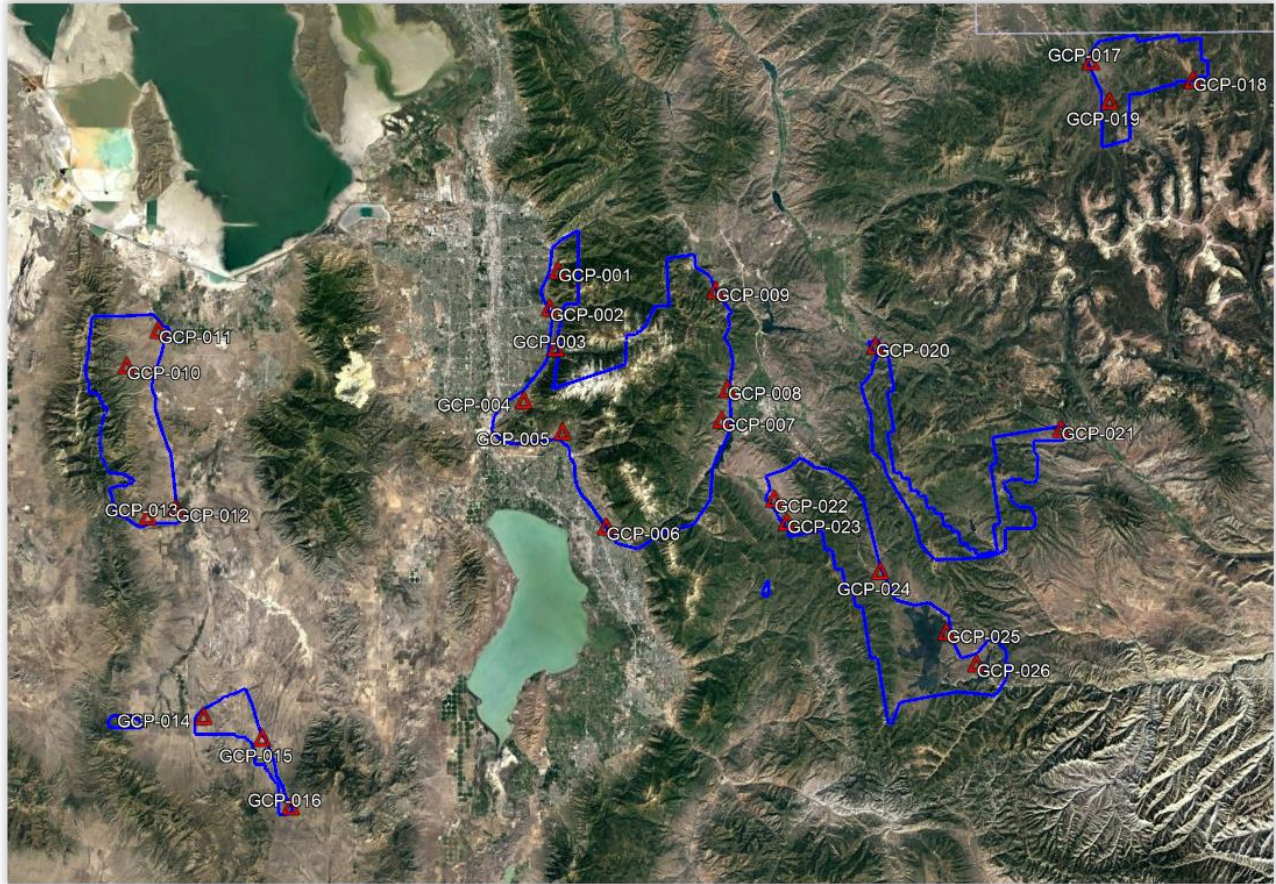


NEVADA



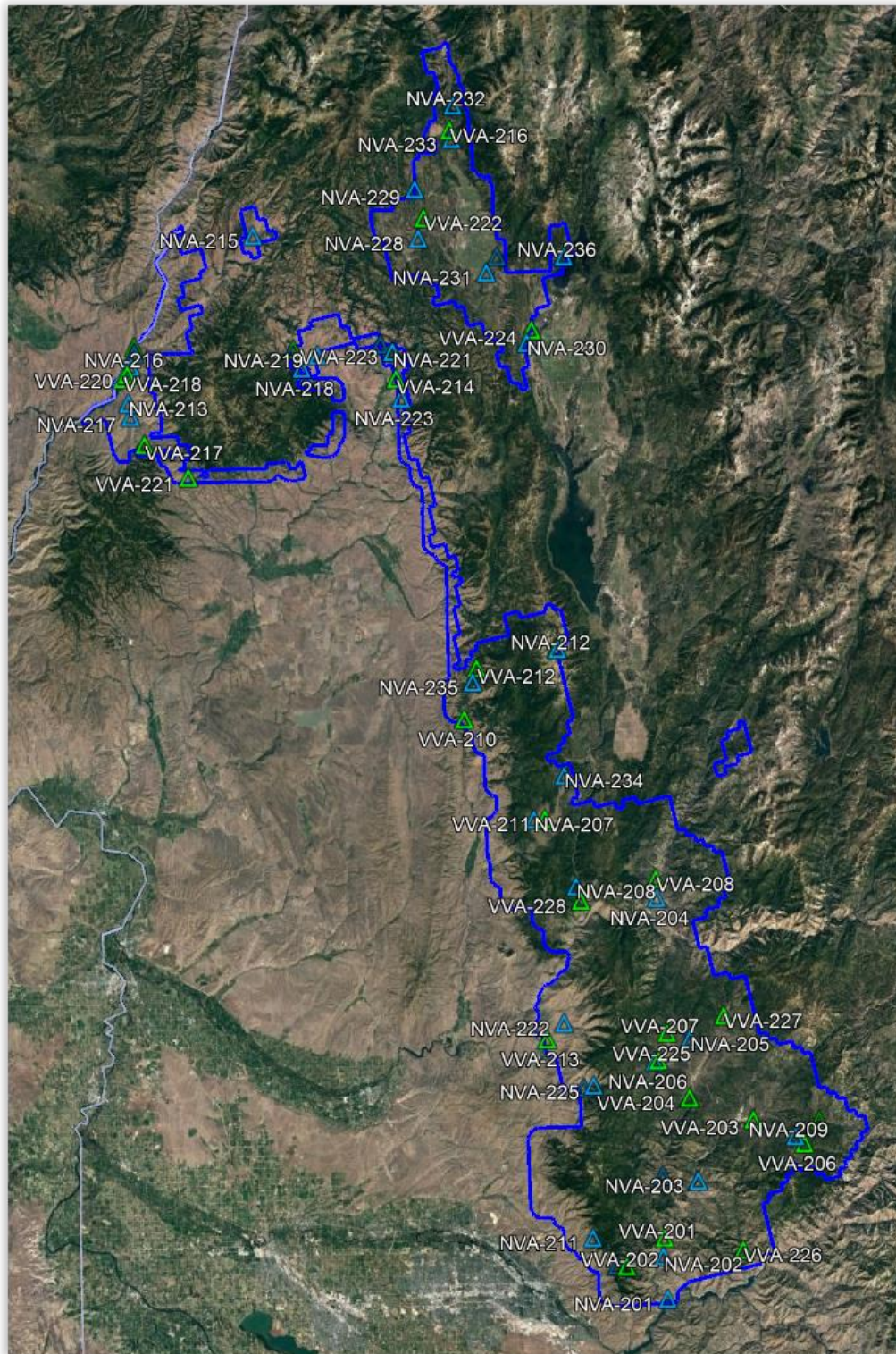


UTAH

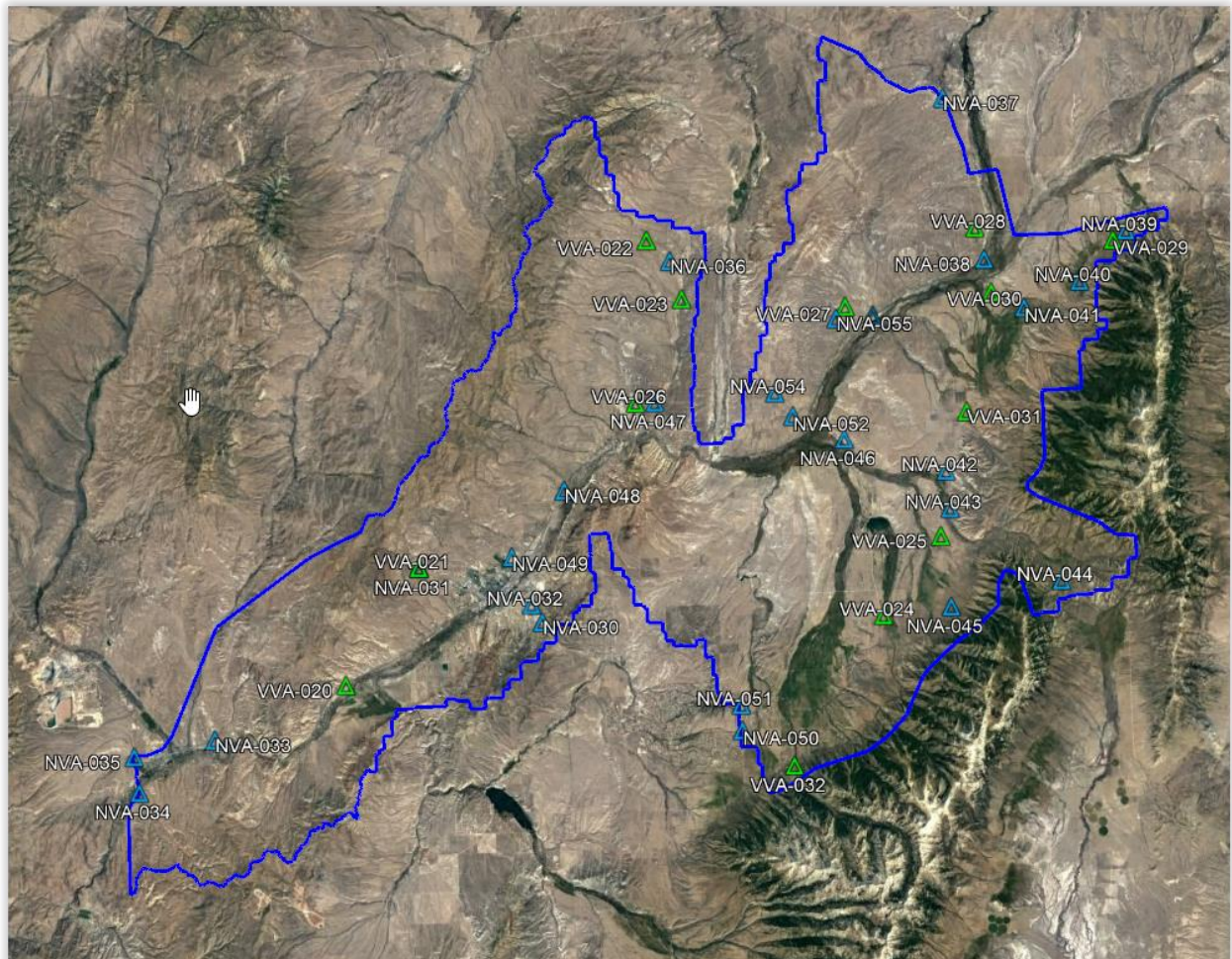


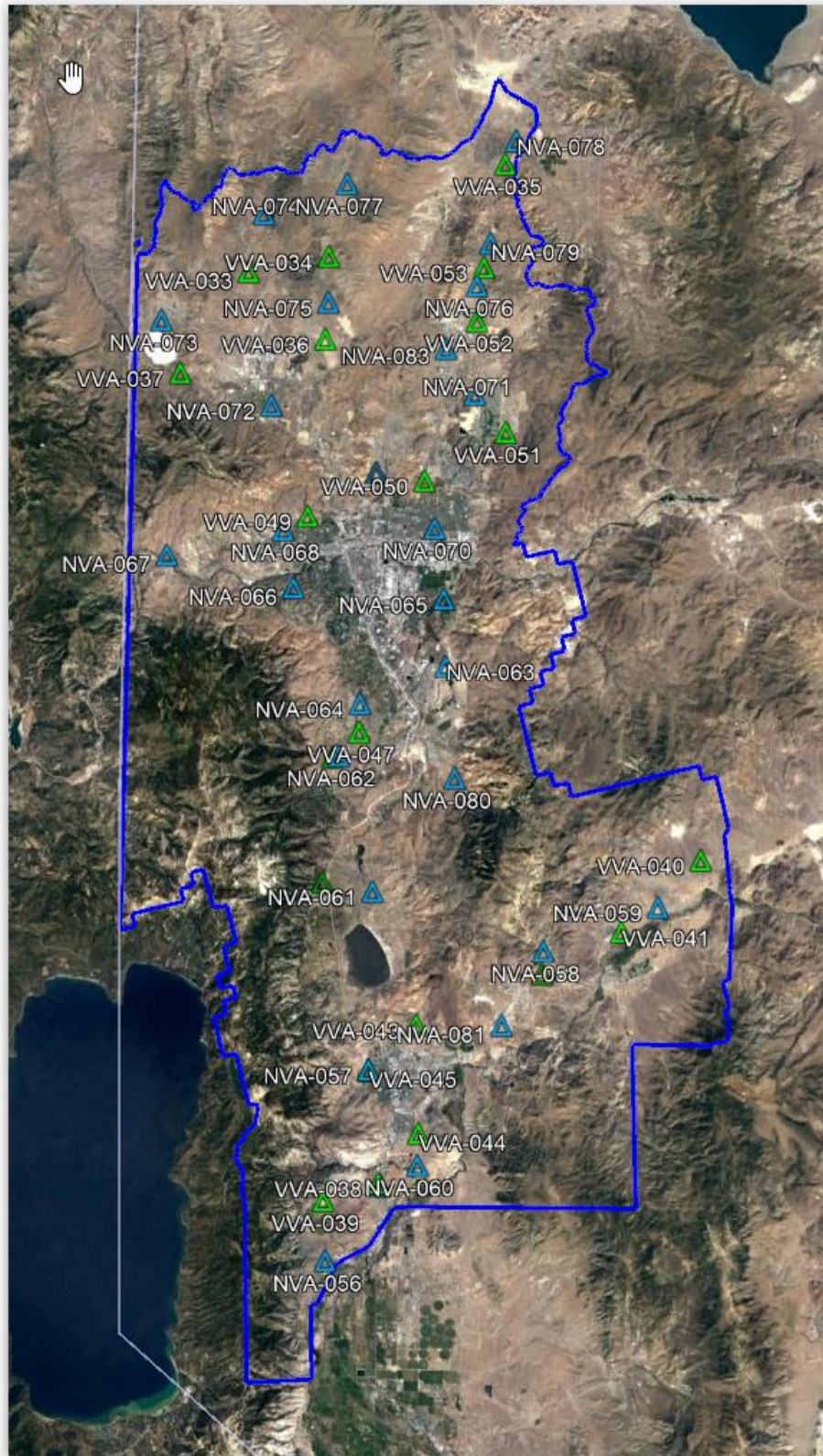
CHECK POINT LOCATIONS

IDAHO

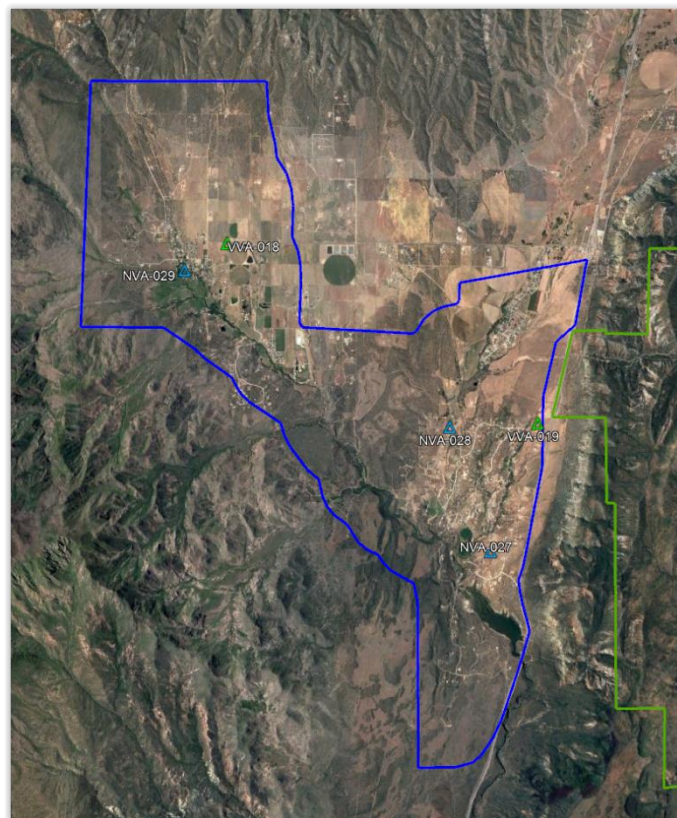


NEVADA





UTAH



2. Project Details

2.1 Survey Equipment

The equipment listed below was used to survey the ground points for this LiDAR project.

TOPCON Dual Frequency/ Dual Constellation GNSS Receivers:

HiPER SR, S/N: 1209-20643	HiPER SR, S/N: 1209-15744
HiPER SR, S/N: 1064-16270	HiPER SR, S/N: 1209-11478
HiPER SR, S/N: 1209-10832	HiPER SR, S/N: 1209-14758
HiPER SR, S/N: 1209-18284	HiPER SR, S/N: 1209-18273
HiPER SR, S/N: 1209-21192	HiPER SR, S/N: 1209-14621
HiPER SR, S/N: 1209-18862	

Two-meter fixed height range pole for each Topcon GNSS HiPER receiver with attached bipod legs for stability.

2.2 Surveyed Point Details

The 118 ground control points and 185 check points were well distributed throughout the project areas. Five (5) photographs were taken of each point, looking north, east, south, west, and close on the occupied point/marker. A mag nail or spike was set at each location where possible.

2.3 Surveyed Point Network

Static Surveying and VRS Surveying methods were used during the ground survey to observe the control points. Each method is detailed below.

LiDAR identifiable features or surveyor set\painted targets were used as control points.

STATIC:

Static (or Rapid-Static) Surveying is a method that Aero-Graphics has employed for many years to collect ground control and check points. A base station location is selected, usually at one or more control locations or at a benchmark, and a GNSS receiver is left there for the duration of the day to complete the survey. The other GNSS receivers are then used as rovers to survey the other point locations.

The duration of the rover receivers will vary depending upon the distance from the base receiver. Normally the rover will not be further than 10 km from the base. The greater the distance the rover is from the base receiver, the longer the recording duration of the rover needs to be. Each rover location is surveyed for a minimum of 20 minutes or greater.

Static Surveying was used to collect the control and check points.

The individual point locations are post-processed after the field survey is completed. The GNSS data collected by the receivers is downloaded and processed in Topcon's Magnet software. The base station coordinates are used to differentially correct the other point's locations.

The NGS Online Positioning User Service (OPUS) was used to process the base station location data. A minimum of 2+ hours of GNSS data was collected for base stations to be processed through OPUS.

THE UTAH REFERENCE NETWORK (VRS):

The Utah Reference Network Virtual Reference Station (VRS) was used to survey control points where a cell phone signal was available. The field surveyor's data collector and roving GNSS receiver utilized the real-time broadcast positional correction to observe and survey the points.

The maximum baseline restriction for the roving receiver is 70km while using this method.

2.4 Field Procedures and Analysis

Each control point and check point were observed once with a static GNSS receiver. Each observation for static surveying occupied the point for a minimum of 20 minutes in duration. Points used as base station for post processing were occupied for a minimum of 2 hours.

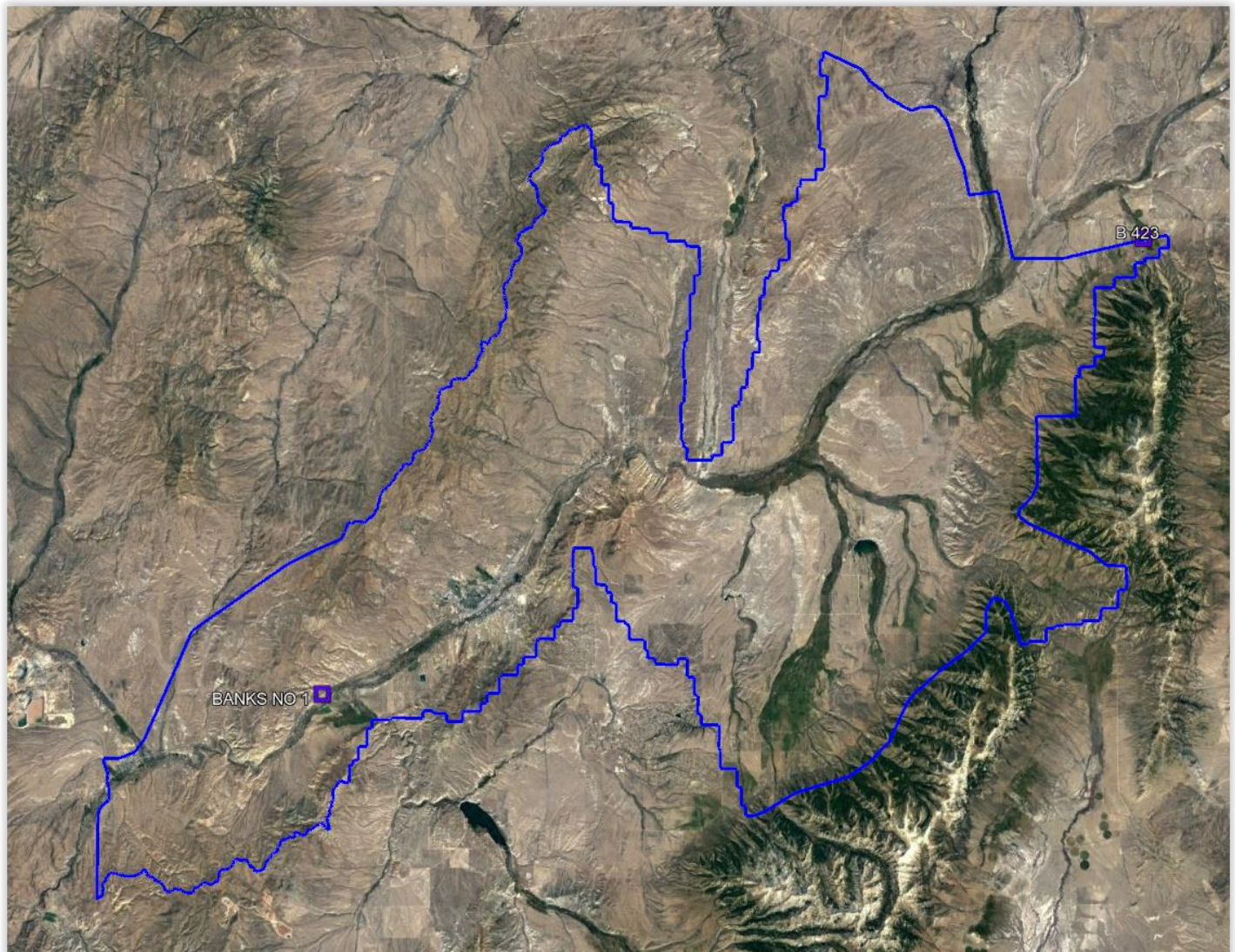
Eleven (11) benchmark monuments were surveyed as part of the field procedures for this project. The benchmarks were researched and located prior to field work commencing. Monuments that were surveyed were chosen for accessibility and probable existence.

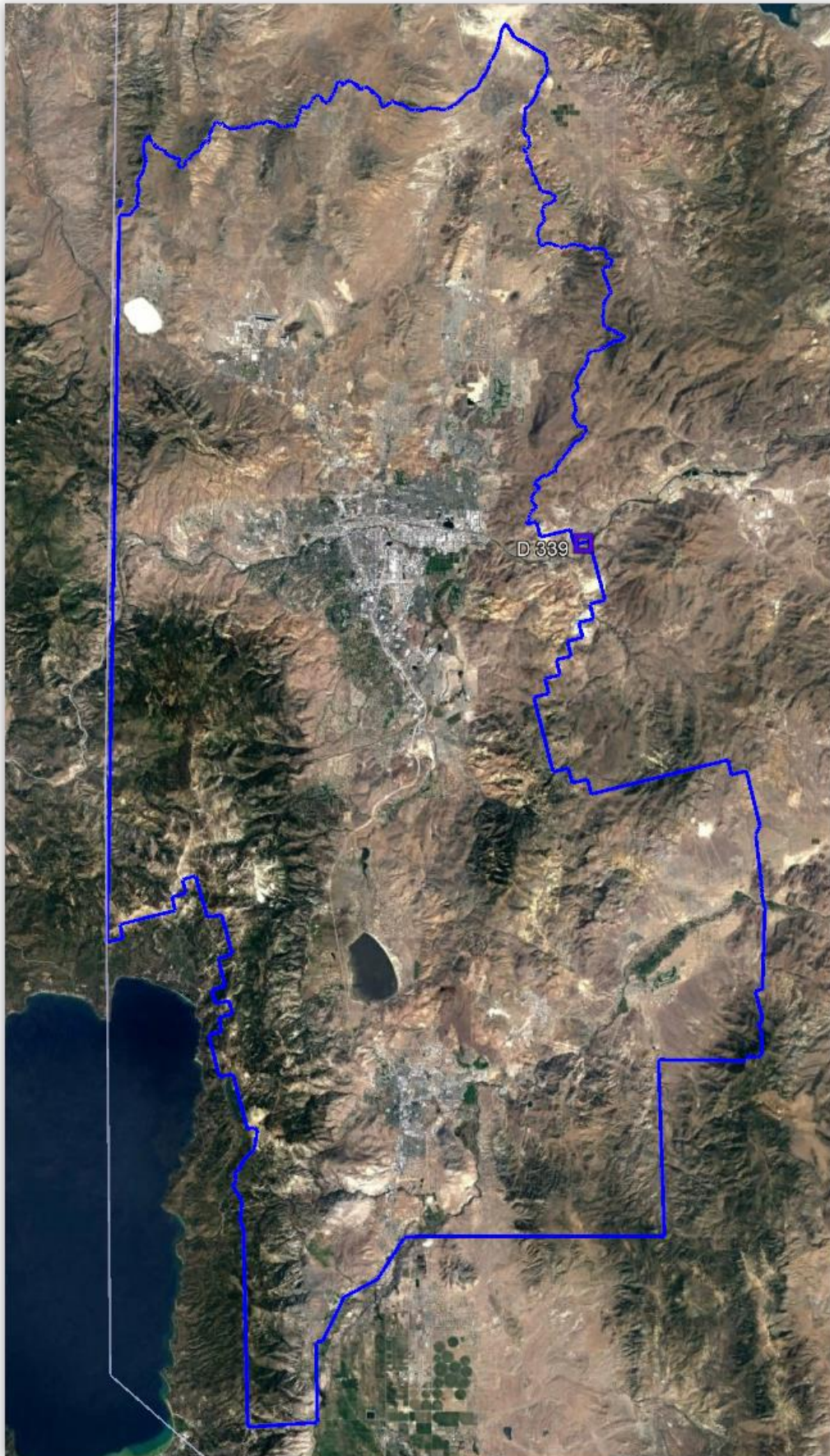
The benchmarks were occupied to provide a QC/QA for the survey methods used. The observed values and record values are shown below along with the differences.

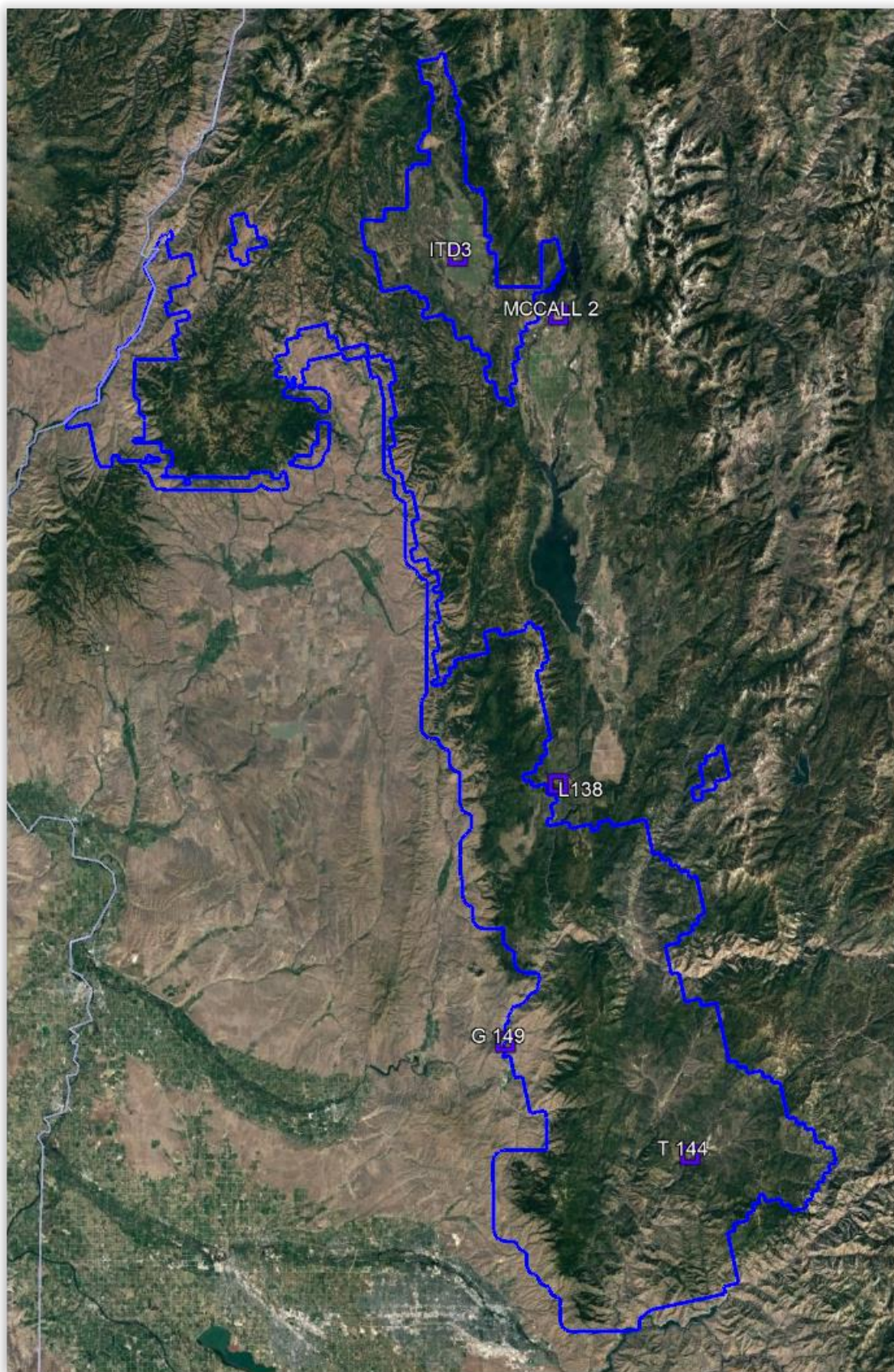
Benchmark Monuments

Point ID	SURVEYED VALUES			DATASHEET VALUES			DIFFERENCE		
	NORTHING	EASTING	ORTHO HGT	NORTHING	EASTING	ORTHO HGT	NORTHING	EASTING	ORTHO HGT
B 423	2169685.950	-1581667.389	1746.417	2169685.968	-1581667.381	1746.389	0.018	0.008	-0.028
BANKS NO 3	2146925.811	-1655409.306	1526.363	2146925.893	-1655409.621	1526.200	0.082	-0.315	-0.163
BUTLER	2052773.122	-1326353.575	1564.487	2052773.151	-1326353.585	1564.496	0.029	-0.010	0.009
D 339	2081986.762	-1991423.663	1334.723	2081992.362	-1991426.506	1334.667	5.600	-2.843	-0.056
G 149	2500906.812	-1602563.360	812.975	2500887.646	-1602556.881	812.860	-19.166	6.479	-0.115
ITD3	2612661.893	-1585421.321	1181.646	2612661.917	-1585421.287	1181.616	0.024	0.034	-0.030
ITD3	2612661.897	-1585421.311	1181.634	2612661.917	-1585421.287	1181.616	0.020	0.024	-0.018
L138	2535625.003	-1587333.105	1532.411	2535625.031	-1587333.161	1532.234	0.028	-0.056	-0.177
M 162	2088970.517	-1234073.529	2498.377	2088960.453	-1234073.500	2498.290	-10.064	0.029	-0.087
MCCALL 2	2601258.571	-1573102.776	1534.982	2601258.579	-1573102.738	1534.923	0.008	0.038	-0.059
MIDWAY	2048784.478	-1296174.179	1767.230	2048784.404	-1296173.917	1767.456	-0.074	0.262	0.226
T 144	2479518.952	-1580157.986	1172.191	2479518.956	-1580157.974	1172.157	0.004	0.012	-0.034

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2.5 Data Processing Procedures

The data from the static GNSS receivers was downloaded each day and a copy was uploaded to the office FTP server.

Base station observations were uploaded to OPUS only after the rapid or precise ephemeris was available for processing. Whether the base station was located on a benchmark or at a new point location, all GNSS data sets with a duration longer than two (2) hours were processed through OPUS.

The static surveyed points were post-processed using Topcon's Magnet software. Some of the static point observations of less than two (2) hours in duration were processed with OPUS Rapid Static (OPUS-RS) as a QA/QC on the static post processing.

3. Final Coordinates

Point ID	NAD83(2011) CONUS Albers NORTHING Meter	NAD83(2011) CONUS Albers EASTING Meter	ORTHO HGT (Geoid18) Meter
B 423	2169685.950	-1581667.389	1746.417
BANKS NO 1	2146925.811	-1655409.306	1526.363
BUTLER	2052773.122	-1326353.575	1564.487
D 339	2081986.762	-1991423.663	1334.723
G 149	2500906.812	-1602563.360	812.975
ITD3	2612661.893	-1585421.321	1181.646
ITD3	2612661.897	-1585421.311	1181.634
L138	2535625.003	-1587333.105	1532.411
M 162	2088970.517	-1234073.529	2498.377
MCCALL 2	2601258.571	-1573102.776	1534.982
MIDWAY	2048784.478	-1296174.179	1767.230
T 144	2479518.952	-1580157.986	1172.191
GCP-001	2072881.920	-1317087.819	1596.228
GCP-002	2067598.788	-1319158.937	1474.034
GCP-003	2061471.208	-1319262.632	1617.348
GCP-004	2054503.872	-1325196.336	1425.827
GCP-005	2048914.797	-1320267.001	1535.614
GCP-006	2033869.835	-1316205.071	1461.666
GCP-007	2046886.964	-1296812.191	1696.437
GCP-008	2051358.791	-1295197.751	1740.238
GCP-009	2066175.888	-1294598.128	2100.277
GCP-010	2069005.085	-1382344.765	1655.300
GCP-011	2073608.638	-1376914.330	1354.712
GCP-012	2046763.994	-1378648.420	1546.249
GCP-013	2046204.668	-1382869.053	1715.390
GCP-014	2015260.118	-1379556.564	1723.167
GCP-015	2010695.780	-1371503.629	1708.508
GCP-016	1999885.063	-1368925.429	1847.830
GCP-017	2091135.098	-1234350.111	2457.086
GCP-018	2085891.164	-1220089.890	3130.658
GCP-019	2084828.576	-1232627.936	2586.873
GCP-020	2054207.788	-1272645.990	2047.362
GCP-021	2037531.909	-1247659.376	2297.376
GCP-022	2033998.731	-1291080.791	1774.379
GCP-023	2030280.139	-1289771.452	1895.638
GCP-024	2020836.455	-1277388.721	2362.089
GCP-025	2010269.087	-1269213.225	2338.689
GCP-026	2004878.920	-1265591.925	2322.881

GCP-027	1741959.508	-1507024.180	1615.447
GCP-028	1739993.363	-1501835.688	1542.179
GCP-029	1733290.233	-1503925.346	1507.561
GCP-030	2144185.527	-1673059.863	1494.822
GCP-031	2145380.700	-1669785.424	1508.203
GCP-032	2144815.038	-1665593.762	1506.627
GCP-033	2147099.942	-1655634.963	1531.799
GCP-034	2149798.661	-1646631.986	1535.590
GCP-035	2159622.930	-1618677.743	1630.360
GCP-036	2160229.479	-1649837.449	1981.821
GCP-037	2153425.489	-1645101.590	1611.296
GCP-038	2155686.902	-1636346.299	1554.718
GCP-039	2167580.783	-1626657.467	1654.102
GCP-040	2160806.381	-1630822.044	1572.175
GCP-041	2161368.984	-1624661.007	1577.851
GCP-042	2174214.204	-1619989.596	1678.051
GCP-043	2178059.207	-1622559.548	1747.383
GCP-044	2167588.167	-1622022.157	1609.978
GCP-045	2160348.502	-1614049.723	1611.983
GCP-046	2154045.042	-1607310.777	1622.806
GCP-047	2140267.636	-1595368.433	1961.291
GCP-048	2145408.592	-1597319.946	1906.200
GCP-049	2166762.280	-1605484.525	1611.624
GCP-050	2169669.280	-1597207.410	1647.572
GCP-051	2186445.752	-1600198.750	1742.837
GCP-052	2175500.809	-1595038.718	1663.755
GCP-053	2169365.288	-1581914.181	1753.254
GCP-054	2163703.445	-1590776.083	1752.579
GCP-055	2134883.521	-1621244.925	1806.418
GCP-056	2086738.639	-1996578.294	1317.723
GCP-057	2092071.754	-1993553.571	1431.604
GCP-058	2101968.901	-1993837.634	1400.879
GCP-059	2110409.007	-1990026.154	1378.292
GCP-060	2115993.935	-1986498.955	1371.123
GCP-061	2115880.467	-1999636.231	1294.032
GCP-062	2111079.070	-2002501.645	1582.857
GCP-063	2071975.985	-2002610.384	1563.549
GCP-064	2100109.327	-2006054.267	1400.296
GCP-065	2081678.021	-1991381.917	1502.261
GCP-066	2096090.414	-2000411.583	1503.245
GCP-067	2054342.711	-2015422.632	1540.991
GCP-068	2085999.070	-2004722.016	1354.098
GCP-069	2107870.852	-2014335.717	1580.416
GCP-070	2114810.557	-2006638.016	1713.949
GCP-071	2109446.356	-2007392.302	1586.313

GCP-072	2088364.337	-2014631.298	1524.558
GCP-073	2042129.555	-2014591.802	1446.635
GCP-074	2029842.985	-2024405.768	1442.017
GCP-075	2047386.547	-2009064.289	1412.487
GCP-076	2049984.170	-2002420.833	1459.747
GCP-077	2050740.246	-1995428.537	1334.771
GCP-078	2057521.536	-1986283.374	1335.698
GCP-079	2063288.281	-2014277.180	1554.218
GCP-080	2073350.761	-2009531.703	1583.362
GCP-081	2058907.884	-2000201.526	1898.386
GCP-082	2080419.295	-2005910.180	1352.772
GCP-201	2622336.964	-1615295.388	959.855
GCP-202	2624360.381	-1614682.114	954.856
GCP-203	2457488.250	-1595794.168	940.224
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GCP-218	2512988.002	-1593484.842	1258.099
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GCP-221	2591834.140	-1635327.335	1311.656
GCP-222	2604567.597	-1638969.571	1330.814
GCP-223	2612739.927	-1586013.753	1178.465
GCP-224	2637333.000	-1582397.734	946.319
GCP-225	2604810.874	-1577331.691	1681.612
GCP-226	2609631.580	-1572711.057	1874.147
GCP-227	2607979.936	-1586872.673	1223.024
GCP-228	2601817.200	-1576643.093	1534.287
GCP-229	2630478.777	-1586326.297	1186.681
GCP-230	2621024.756	-1583917.463	1165.775
GCP-231	2603136.858	-1612697.928	1139.375
GCP-232	2597723.869	-1608966.422	973.484
GCP-233	2601880.642	-1601630.352	975.601
GCP-234	2590887.648	-1600875.182	991.418

GCP-235	2487822.942	-1582529.607	1252.715
GCP-236	2609738.990	-1635784.512	554.156
NVA-001	2070275.627	-1297255.125	2055.955
NVA-002	2048263.973	-1295743.229	1687.230
NVA-003	2060929.851	-1296284.109	2720.440
NVA-004	2036425.773	-1317103.163	1482.302
NVA-005	2046003.269	-1319509.658	1559.954
NVA-005R	2046003.258	-1319509.650	1559.930
NVA-006	2052864.737	-1329089.394	1425.943
NVA-006R	2052864.741	-1329089.418	1425.945
NVA-007	2057641.172	-1322444.654	1523.592
NVA-007R	2057641.144	-1322444.665	1523.585
NVA-008	2066114.464	-1318330.802	1506.933
NVA-008R	2066114.476	-1318330.779	1506.929
NVA-009	2074247.016	-1317932.815	1491.888
NVA-009R	2074247.025	-1317932.804	1491.923
NVA-010	2056540.671	-1378397.688	1644.486
NVA-011	2064388.791	-1379197.454	1604.099
NVA-012	2052074.126	-1378218.370	1582.159
NVA-013	2069091.193	-1382791.189	1678.823
NVA-014	2001125.480	-1370647.182	1862.037
NVA-015	2007166.093	-1370553.590	1735.114
NVA-016	2014103.406	-1375380.065	1708.610
NVA-017	2086740.831	-1226926.974	2660.818
NVA-018	2086499.058	-1222977.488	2884.107
NVA-019	2088502.070	-1234021.192	2507.167
NVA-020	2036372.383	-1248884.887	2412.445
NVA-021	2052470.046	-1272228.969	2106.806
NVA-022	2032905.633	-1291528.521	1777.366
NVA-023	2009356.704	-1275568.295	2333.281
NVA-024	2001514.940	-1264849.404	2323.022
NVA-025	2008697.622	-1274006.251	2320.292
NVA-026	2010337.056	-1276236.639	2359.008
NVA-027	1735569.379	-1503106.361	1467.717
NVA-027R	1735569.380	-1503106.374	1467.662
NVA-028	1738086.960	-1503439.252	1496.215
NVA-028R	1738086.945	-1503439.296	1496.147
NVA-029	1741979.164	-1507862.631	1614.298
NVA-029R	1741979.164	-1507862.643	1614.303
NVA-030	2148178.673	-1638285.264	1694.402
NVA-030R	2148178.664	-1638285.303	1694.350
NVA-031	2155041.578	-1647150.568	1683.518
NVA-031R	2155041.493	-1647150.648	1683.530
NVA-032	2149835.789	-1638802.751	1608.264
NVA-032R	2149835.769	-1638802.760	1608.261

NVA-033	2145091.302	-1667134.000	1513.496
NVA-033R	2145091.309	-1667134.119	1513.520
NVA-034	2142310.286	-1674267.680	1490.726
NVA-034R	2142310.286	-1674267.680	1490.726
NVA-035	2145332.926	-1673965.558	1514.074
NVA-035R	2145333.022	-1673965.549	1514.095
NVA-036	2175057.506	-1620758.818	1691.307
NVA-037	2182900.821	-1595440.664	1668.630
NVA-038	2168937.026	-1595356.111	1628.890
NVA-038R	2168937.031	-1595356.102	1628.885
NVA-039	2168435.079	-1583364.881	1735.720
NVA-040	2165231.342	-1588182.644	1753.166
NVA-041	2164194.262	-1593122.262	1682.587
NVA-042	2152434.768	-1602716.888	1661.929
NVA-042R	2152434.774	-1602716.901	1661.906
NVA-043	2149295.231	-1603148.679	1673.494
NVA-043R	2149295.232	-1603148.675	1673.436
NVA-044	2141245.958	-1595732.429	1950.890
NVA-045	2141280.375	-1605091.918	1826.245
NVA-046	2157077.796	-1610271.897	1603.640
NVA-046R	2157077.760	-1610271.883	1603.722
NVA-047	2163849.920	-1624793.588	1590.003
NVA-047R	2163849.969	-1624793.619	1589.999
NVA-048	2158471.553	-1633890.144	1564.773
NVA-049	2154090.759	-1639449.632	1595.072
NVA-049R	2154090.760	-1639449.638	1595.065
NVA-050	2135359.807	-1624360.611	1773.113
NVA-051	2137453.055	-1623941.427	1757.105
NVA-052	2159971.386	-1613960.111	1613.017
NVA-052R	2159971.381	-1613960.117	1613.063
NVA-053	2166581.041	-1605490.685	1611.088
NVA-054	2162241.579	-1614942.959	1635.744
NVA-055	2167054.373	-1608504.415	1630.403
NVA-056	2035126.995	-2021402.113	1488.890
NVA-057	2048343.882	-2014839.287	1470.109
NVA-058	2053949.362	-2000097.760	1498.702
NVA-059	2055123.036	-1991019.422	1323.017
NVA-060	2040470.213	-2013050.748	1429.400
NVA-061	2061357.571	-2011333.344	1541.256
NVA-062	2071873.093	-2011307.349	1704.803
NVA-062R	2071873.121	-2011307.352	1704.830
NVA-063	2076563.214	-2001998.584	1351.738
NVA-063R	2076563.212	-2001998.596	1351.760
NVA-064	2075338.095	-2008847.254	1475.137
NVA-064R	2075338.185	-2008847.346	1475.107

NVA-065	2081522.953	-2000932.053	1338.366
NVA-065R	2081522.945	-2000932.095	1338.447
NVA-066	2085016.293	-2011571.229	1413.766
NVA-066R	2085016.307	-2011571.217	1413.809
NVA-067	2089657.835	-2020115.043	1480.684
NVA-068	2089435.340	-2011267.394	1517.231
NVA-068R	2089435.333	-2011267.392	1517.262
NVA-069	2092012.353	-2003515.981	1460.708
NVA-069R	2092012.365	-2003515.978	1460.715
NVA-070	2086883.331	-2000305.492	1342.470
NVA-070R	2086883.339	-2000305.510	1342.493
NVA-071	2095987.687	-1994985.049	1368.839
NVA-071R	2095987.691	-1994985.046	1368.819
NVA-072	2098766.707	-2009873.509	1544.005
NVA-072R	2098766.695	-2009873.507	1543.942
NVA-073	2106971.017	-2016264.545	1544.762
NVA-074	2112917.188	-2006950.150	1660.680
NVA-074R	2112917.292	-2006950.039	1660.608
NVA-075	2105306.630	-2003909.771	1543.450
NVA-075R	2105306.590	-2003909.756	1543.468
NVA-076	2103920.140	-1992883.161	1402.587
NVA-076R	2103920.174	-1992883.146	1402.550
NVA-077	2113665.278	-2000416.412	1584.324
NVA-077R	2113665.254	-2000416.469	1584.228
NVA-078	2113899.045	-1987415.638	1321.263
NVA-078R	2113899.025	-1987415.637	1321.191
NVA-079	2106782.609	-1991139.713	1414.643
NVA-079R	2106782.583	-1991139.736	1414.595
NVA-080	2068211.948	-2003362.812	1476.330
NVA-080R	2068211.943	-2003362.810	1476.395
NVA-081	2049246.077	-2004433.747	1488.739
NVA-082	2039619.891	-2016075.377	1498.475
NVA-083	2099859.437	-1996247.755	1396.381
NVA-083R	2099859.407	-1996247.763	1396.314
NVA-201	2457138.788	-1593850.254	934.324
NVA-201R	2457138.771	-1593850.248	934.337
NVA-202	2463357.871	-1592998.370	1001.591
NVA-202R	2463357.864	-1592998.364	1001.587
NVA-203	2472836.884	-1585489.004	1070.112
NVA-203R	2472836.873	-1585489.009	1070.097
NVA-204	2514072.508	-1581480.225	927.158
NVA-205	2493136.260	-1581719.619	1420.733
NVA-206	2491169.973	-1587454.002	1343.290
NVA-207	2529410.094	-1595968.886	1476.628
NVA-207R	2529410.084	-1595968.903	1476.605

NVA-208	2518544.703	-1592385.870	996.282
NVA-209	2475826.316	-1570384.915	1756.119
NVA-210	2463716.480	-1599786.396	1469.076
NVA-211	2468498.161	-1602207.669	1658.587
NVA-212	2552447.479	-1586818.041	2535.825
NVA-213	2601851.617	-1638503.847	687.146
NVA-214	2608742.534	-1635970.218	582.696
NVA-215	2621078.959	-1615169.882	1281.237
NVA-216	2607017.649	-1636937.557	648.784
NVA-217	2599901.010	-1638616.695	778.600
NVA-218	2600752.779	-1612906.047	1082.717
NVA-218R	2600752.783	-1612906.075	1082.703
NVA-219	2602056.913	-1610235.121	1035.717
NVA-219R	2602056.908	-1610235.145	1035.754
NVA-220	2601414.011	-1601018.821	973.454
NVA-220R	2601414.017	-1601018.838	973.492
NVA-221	2599941.198	-1599579.815	1008.024
NVA-221R	2599941.197	-1599579.818	1008.042
NVA-222	2499671.767	-1598812.552	985.284
NVA-223	2593088.533	-1599965.850	969.102
NVA-223R	2593088.546	-1599965.867	969.139
NVA-224	2474775.560	-1590282.356	1052.892
NVA-225	2489949.554	-1596843.379	1181.678
NVA-226	2609721.481	-1581622.224	1244.500
NVA-226R	2609721.511	-1581622.211	1244.480
NVA-227	2489986.946	-1598307.131	1125.960
NVA-228	2614966.078	-1592034.864	1272.026
NVA-228R	2614966.096	-1592034.874	1272.024
NVA-229	2622003.279	-1590836.387	1287.476
NVA-229R	2622003.289	-1590836.399	1287.460
NVA-230	2596487.989	-1580471.477	1533.443
NVA-230R	2596487.977	-1580471.475	1533.421
NVA-231	2607817.507	-1583653.791	1220.989
NVA-231R	2607817.492	-1583653.797	1220.975
NVA-232	2632526.063	-1582547.019	1045.670
NVA-232R	2632526.042	-1582546.735	1046.153
NVA-233	2627775.368	-1583927.372	1168.799
NVA-233R	2627775.333	-1583927.107	1169.320
NVA-234	2534519.307	-1590225.858	1509.344
NVA-234R	2534519.307	-1590225.890	1509.281
NVA-235	2550748.847	-1599790.686	1199.814
NVA-236	2607323.605	-1572255.274	1529.744
NVA-236R	2607323.627	-1572255.264	1529.769
VVA-001	2053875.044	-1326505.252	1421.707
VVA-002	2049364.944	-1318775.437	1599.230

VVA-003	2060578.286	-1296145.572	2681.152
VVA-004	2046813.412	-1296642.380	1688.126
VVA-005	2033981.370	-1315412.950	1515.128
VVA-006	2043747.771	-1319279.460	1560.796
VVA-007	2047177.546	-1386504.770	1854.068
VVA-008	2059257.422	-1379069.241	1643.352
VVA-009	2075402.325	-1380981.978	1532.331
VVA-010	2016303.670	-1379224.304	1705.850
VVA-011	2000520.005	-1369753.741	1852.521
VVA-012	2085821.795	-1233669.620	2554.079
VVA-013	2086072.916	-1220086.732	3130.758
VVA-014	2036010.215	-1247839.373	2319.008
VVA-015	2053745.525	-1272794.411	2047.859
VVA-016	2018672.848	-1276817.523	2339.696
VVA-017	2005947.540	-1265941.936	2331.635
VVA-018	1742340.943	-1506970.625	1626.114
VVA-019	1737858.370	-1501775.053	1529.248
VVA-020	2146947.742	-1655403.009	1526.255
VVA-021	2155083.972	-1647161.517	1684.052
VVA-022	2177212.472	-1622208.468	1725.606
VVA-023	2171753.056	-1620556.221	1652.402
VVA-024	2141904.803	-1610682.287	1735.623
VVA-025	2147216.104	-1604462.822	1713.020
VVA-026	2164202.127	-1626370.317	1606.711
VVA-027	2167859.547	-1607526.248	1645.418
VVA-028	2171688.503	-1595470.434	1652.090
VVA-029	2167911.321	-1584623.725	1742.755
VVA-030	2166089.350	-1595464.449	1645.709
VVA-031	2156867.057	-1599869.969	1697.609
VVA-032	2131476.727	-1620888.792	1914.979
VVA-033	2108952.917	-2009113.598	1607.849
VVA-034	2108624.883	-2003051.471	1674.060
VVA-035	2112355.903	-1988619.733	1341.038
VVA-036	2102683.123	-2004790.504	1500.580
VVA-037	2102757.817	-2015864.555	1551.886
VVA-038	2039854.558	-2016175.847	1500.193
VVA-039	2039587.722	-2020448.819	1576.649
VVA-040	2057811.722	-1987079.911	1348.869
VVA-041	2053941.248	-1994108.610	1328.626
VVA-042	2052279.141	-2000598.042	1466.826
VVA-043	2050788.332	-2010601.076	1472.765
VVA-044	2042794.441	-2012394.844	1457.991
VVA-045	2048303.732	-2014844.396	1468.779
VVA-046	2062942.502	-2014769.952	1556.890
VVA-047	2073269.643	-2009423.426	1581.969

VVA-048	2071882.973	-2011789.370	1731.470
VVA-049	2090003.936	-2009265.119	1494.966
VVA-050	2090536.769	-2000176.650	1388.215
VVA-051	2092638.294	-1993457.187	1373.729
VVA-052	2101336.032	-1993523.085	1380.424
VVA-053	2105141.589	-1992054.375	1429.371
VVA-201	2465941.701	-1592187.712	1022.944
VVA-202	2463270.227	-1598479.538	1221.174
VVA-203	2479553.180	-1575646.824	1201.586
VVA-204	2484840.662	-1583825.064	1275.633
VVA-205	2477312.748	-1566471.551	1496.817
VVA-206	2474516.464	-1569372.030	1876.183
VVA-207	2494815.930	-1584747.259	1362.427
VVA-208	2516801.532	-1580933.998	939.660
VVA-209	2552603.486	-1586942.431	2515.523
VVA-210	2545862.319	-1602241.537	1095.149
VVA-211	2529091.867	-1594416.799	1478.498
VVA-212	2552593.715	-1598751.038	1258.577
VVA-213	2497957.116	-1601730.680	829.110
VVA-214	2596062.017	-1600010.307	971.737
VVA-215	2603728.494	-1613390.895	1166.317
VVA-216	2629102.776	-1583897.295	1179.485
VVA-217	2595419.193	-1637607.534	1311.539
VVA-218	2605568.301	-1638393.821	652.720
VVA-219	2609683.757	-1635786.529	553.855
VVA-220	2606045.262	-1637677.905	673.031
VVA-221	2589323.493	-1632555.885	1197.057
VVA-222	2617645.887	-1590578.502	1233.094
VVA-223	2599945.450	-1599558.429	1007.930
VVA-224	2598148.422	-1579329.993	1501.255
VVA-225	2491224.776	-1586901.335	1317.815
VVA-226	2461534.516	-1581571.888	1103.906
VVA-227	2495242.533	-1576206.919	1330.244
VVA-228	2516319.002	-1592214.462	949.145

4. GNSS Observations

Point ID	DATE SURVEYED	JULIAN DATE	SURVEY METHOD
B 423	July 10, 2023	191	Static
BANKS NO 1	July 7, 2023	188	Static
BUTLER	June 8, 2023	159	VRS
D 339	July 2, 2023	183	Static
G 149	June 25, 2023	176	OPUS
ITD3	June 26, 2023	177	OPUS
ITD3	June 27, 2023	178	OPUS
L138	June 29, 2023	180	Static
M 162	July 12, 2023	193	Static
MCCALL 2	July 1, 2023	182	OPUS
MIDWAY	June 10, 2023	161	Static
T 144	June 23, 2023	174	OPUS
GCP-001	June 7, 2023	158	VRS
GCP-002	June 7, 2023	158	VRS
GCP-003	June 7, 2023	158	VRS
GCP-004	June 8, 2023	159	VRS
GCP-005	June 8, 2023	159	VRS
GCP-006	June 8, 2023	159	VRS
GCP-007	June 10, 2023	161	Static
GCP-008	June 10, 2023	161	OPUS
GCP-009	June 10, 2023	161	OPUS
GCP-010	June 12, 2023	163	Static
GCP-011	June 12, 2023	163	OPUS
GCP-012	June 13, 2023	164	OPUS
GCP-013	June 13, 2023	164	Static
GCP-014	June 14, 2023	165	Static
GCP-015	June 14, 2023	165	OPUS
GCP-016	June 14, 2023	165	Static
GCP-017	July 12, 2023	193	OPUS
GCP-018	July 12, 2023	193	Static
GCP-019	July 12, 2023	193	Static
GCP-020	July 11, 2023	192	OPUS
GCP-021	July 11, 2023	192	Static
GCP-022	July 17, 2023	198	VRS
GCP-023	July 17, 2023	198	VRS
GCP-024	June 15, 2023	166	OPUS
GCP-025	June 15, 2023	166	Static
GCP-026	June 15, 2023	166	Static
GCP-027	July 13, 2023	194	VRS
GCP-028	July 13, 2023	194	VRS

GCP-029	July 13, 2023	194	VRS
GCP-030	July 7, 2023	188	Static
GCP-031	July 7, 2023	188	Static
GCP-032	July 7, 2023	188	Static
GCP-033	July 7, 2023	188	Static
GCP-034	July 6, 2023	187	OPUS
GCP-035	July 9, 2023	190	OPUS
GCP-036	July 6, 2023	187	Static
GCP-037	July 6, 2023	187	Static
GCP-038	July 6, 2023	187	Static
GCP-039	July 7, 2023	188	Static
GCP-040	July 6, 2023	187	OPUS
GCP-041	July 6, 2023	187	Static
GCP-042	July 7, 2023	188	Static
GCP-043	July 7, 2023	188	Static
GCP-044	July 7, 2023	188	Static
GCP-045	July 9, 2023	190	Static
GCP-046	July 8, 2023	189	Static
GCP-047	July 8, 2023	189	Static
GCP-048	July 8, 2023	189	Static
GCP-049	July 9, 2023	190	Static
GCP-050	July 9, 2023	190	Static
GCP-051	July 9, 2023	190	Static
GCP-052	July 9, 2023	190	Static
GCP-053	July 10, 2023	191	Static
GCP-054	July 10, 2023	191	Static
GCP-055	July 8, 2023	189	Static
GCP-056	July 2, 2023	183	Static
GCP-057	June 22, 2023	173	Static
GCP-058	June 21, 2023	172	Static
GCP-059	June 21, 2023	172	Static
GCP-060	June 21, 2023	172	Static
GCP-061	June 21, 2023	172	Static
GCP-062	June 23, 2023	174	Static
GCP-063	June 23, 2023	174	Static
GCP-064	July 2, 2023	183	Static
GCP-065	June 23, 2023	174	Static
GCP-066	June 22, 2023	173	OPUS
GCP-067	July 3, 2023	184	OPUS
GCP-068	June 25, 2023	176	OPUS
GCP-069	June 24, 2023	175	Static
GCP-070	June 23, 2023	174	Static
GCP-071	June 23, 2023	174	Static
GCP-072	June 24, 2023	175	Static
GCP-073	July 4, 2023	185	Static

GCP-074	July 4, 2023	185	OPUS
GCP-075	July 3, 2023	184	OPUS
GCP-076	July 3, 2023	184	OPUS
GCP-077	July 3, 2023	184	Static
GCP-078	July 3, 2023	184	Static
GCP-079	July 2, 2023	183	Static
GCP-080	July 2, 2023	183	Static
GCP-081	July 3, 2023	184	Static
GCP-082	June 25, 2023	176	Static
GCP-201	June 20, 2023	171	OPUS
GCP-202	June 25, 2023	176	Static
GCP-203	June 25, 2023	176	Static
GCP-204	June 20, 2023	171	Static
GCP-205	June 21, 2023	172	Static
GCP-206	June 23, 2023	174	Static
GCP-207	June 23, 2023	174	Static
GCP-208	June 24, 2023	175	OPUS
GCP-209	June 23, 2023	174	Static
GCP-210	June 24, 2023	175	Static
GCP-211	June 29, 2023	180	Static
GCP-212	June 29, 2023	180	Static
GCP-213	June 29, 2023	180	Static
GCP-214	June 28, 2023	179	Static
GCP-215	June 24, 2023	175	Static
GCP-216	June 25, 2023	176	OPUS
GCP-217	June 25, 2023	176	OPUS
GCP-218	June 30, 2023	181	OPUS
GCP-219	June 30, 2023	181	Static
GCP-220	June 30, 2023	181	Static
GCP-221	July 1, 2023	182	Static
GCP-222	July 1, 2023	182	Static
GCP-223	June 26, 2023	177	OPUS
GCP-224	June 26, 2023	177	Static
GCP-225	July 1, 2023	182	OPUS
GCP-226	July 1, 2023	182	Static
GCP-227	June 26, 2023	177	Static
GCP-228	July 1, 2023	182	Static
GCP-229	June 26, 2023	177	Static
GCP-230	June 26, 2023	177	Static
GCP-231	June 28, 2023	179	Static
GCP-232	June 28, 2023	179	OPUS
GCP-233	June 27, 2023	178	Static
GCP-234	June 27, 2023	178	Static
GCP-235	June 23, 2023	174	Static
GCP-236	June 30, 2023	181	OPUS

NVA-001	June 10, 2023	161	OPUS
NVA-002	June 10, 2023	161	Static
NVA-003	June 10, 2023	161	Static
NVA-004	June 8, 2023	159	VRS
NVA-005	June 8, 2023	159	VRS
NVA-005R	June 9, 2023	160	VRS
NVA-006	June 8, 2023	159	VRS
NVA-006R	June 8, 2023	159	VRS
NVA-007	June 7, 2023	158	VRS
NVA-007R	June 8, 2023	159	VRS
NVA-008	June 7, 2023	158	VRS
NVA-008R	June 8, 2023	159	VRS
NVA-009	June 7, 2023	158	VRS
NVA-009R	June 8, 2023	159	VRS
NVA-010	June 12, 2023	163	Static
NVA-011	June 12, 2023	163	Static
NVA-012	June 13, 2023	164	Static
NVA-013	June 12, 2023	163	Static
NVA-014	June 14, 2023	165	Static
NVA-015	June 14, 2023	165	OPUS
NVA-016	June 14, 2023	165	Static
NVA-017	July 12, 2023	193	OPUS
NVA-018	July 12, 2023	193	Static
NVA-019	July 12, 2023	193	Static
NVA-020	July 11, 2023	192	Static
NVA-021	July 11, 2023	192	Static
NVA-022	July 17, 2023	198	VRS
NVA-023	June 15, 2023	166	Static
NVA-024	June 15, 2023	166	Static
NVA-025	June 15, 2023	166	Static
NVA-026	June 15, 2023	166	OPUS
NVA-027	July 13, 2023	194	VRS
NVA-027R	July 14, 2023	195	VRS
NVA-028	July 13, 2023	194	VRS
NVA-028R	July 14, 2023	195	VRS
NVA-029	July 13, 2023	194	VRS
NVA-029R	July 14, 2023	195	VRS
NVA-030	July 6, 2023	187	Static
NVA-030R	July 8, 2023	189	Static
NVA-031	July 6, 2023	187	Static
NVA-031R	July 10, 2023	191	Static
NVA-032	July 6, 2023	187	Static
NVA-032R	July 8, 2023	189	Static
NVA-033	July 7, 2023	188	OPUS
NVA-033R	July 9, 2023	190	Static

NVA-034	July 7, 2023	188	Static
NVA-034R	July 9, 2023	190	Static
NVA-035	July 7, 2023	188	OPUS
NVA-035R	July 9, 2023	190	Static
NVA-036	July 7, 2023	188	Static
NVA-037	July 9, 2023	190	Static
NVA-038	July 9, 2023	190	OPUS
NVA-038R	July 10, 2023	191	OPUS
NVA-039	July 10, 2023	191	Static
NVA-040	July 10, 2023	191	Static
NVA-041	July 10, 2023	191	Static
NVA-042	July 8, 2023	189	Static
NVA-042R	July 10, 2023	191	Static
NVA-043	July 8, 2023	189	OPUS
NVA-043R	July 10, 2023	191	Static
NVA-044	July 8, 2023	189	Static
NVA-045	July 8, 2023	189	Static
NVA-046	July 8, 2023	189	Static
NVA-046R	July 10, 2023	191	Static
NVA-047	July 6, 2023	187	Static
NVA-047R	July 7, 2023	188	OPUS
NVA-048	July 6, 2023	187	Static
NVA-049	July 6, 2023	187	OPUS
NVA-049R	July 10, 2023	191	Static
NVA-050	July 8, 2023	189	OPUS
NVA-051	July 8, 2023	189	Static
NVA-052	July 8, 2023	189	Static
NVA-052R	July 10, 2023	191	Static
NVA-053	July 9, 2023	190	Static
NVA-054	July 9, 2023	190	Static
NVA-055	July 9, 2023	190	Static
NVA-056	July 4, 2023	185	Static
NVA-057	July 3, 2023	184	Static
NVA-058	July 3, 2023	184	Static
NVA-059	July 3, 2023	184	Static
NVA-060	July 4, 2023	185	Static
NVA-061	July 2, 2023	183	Static
NVA-062	July 2, 2023	183	Static
NVA-062R	July 5, 2023	186	Static
NVA-063	June 25, 2023	176	Static
NVA-063R	July 5, 2023	186	OPUS
NVA-064	July 2, 2023	183	Static
NVA-064R	July 5, 2023	186	Static
NVA-065	June 25, 2023	176	Static
NVA-065R	July 2, 2023	183	OPUS

NVA-066	June 24, 2023	175	Static
NVA-066R	June 25, 2023	176	Static
NVA-067	June 24, 2023	175	Static
NVA-068	June 24, 2023	175	OPUS
NVA-068R	June 25, 2023	176	Static
NVA-069	June 24, 2023	175	OPUS
NVA-069R	June 25, 2023	176	OPUS
NVA-070	June 22, 2023	173	Static
NVA-070R	June 24, 2023	175	Static
NVA-071	June 21, 2023	172	Static
NVA-071R	June 22, 2023	173	OPUS
NVA-072	June 23, 2023	174	OPUS
NVA-072R	June 24, 2023	175	OPUS
NVA-073	June 24, 2023	175	Static
NVA-074	June 23, 2023	174	Static
NVA-074R	June 25, 2023	176	Static
NVA-075	June 23, 2023	174	Static
NVA-075R	June 25, 2023	176	Static
NVA-076	June 21, 2023	172	Static
NVA-076R	June 22, 2023	173	Static
NVA-077	June 23, 2023	174	Static
NVA-077R	June 25, 2023	176	Static
NVA-078	June 21, 2023	172	Static
NVA-078R	June 22, 2023	173	Static
NVA-079	June 21, 2023	172	Static
NVA-079R	June 22, 2023	173	Static
NVA-080	July 2, 2023	183	OPUS
NVA-080R	July 5, 2023	186	Static
NVA-081	July 3, 2023	184	Static
NVA-082	July 4, 2023	185	Static
NVA-083	June 21, 2023	172	OPUS
NVA-083R	June 22, 2023	173	Static
NVA-201	June 20, 2023	171	OPUS
NVA-201R	June 21, 2023	172	OPUS
NVA-202	June 20, 2023	171	Static
NVA-202R	June 21, 2023	172	OPUS
NVA-203	June 20, 2023	171	Static
NVA-203R	June 23, 2023	174	OPUS
NVA-204	June 25, 2023	176	OPUS
NVA-205	June 24, 2023	175	Static
NVA-206	June 24, 2023	175	Static
NVA-207	June 29, 2023	180	Static
NVA-207R	June 29, 2023	180	Static
NVA-208	June 25, 2023	176	Static
NVA-209	June 23, 2023	174	OPUS

NVA-210	June 20, 2023	171	Static
NVA-211	June 24, 2023	175	Static
NVA-212	June 29, 2023	180	Static
NVA-213	June 30, 2023	181	Static
NVA-214	June 30, 2023	181	Static
NVA-215	July 1, 2023	182	OPUS
NVA-216	June 30, 2023	181	Static
NVA-217	June 30, 2023	181	Static
NVA-218	June 28, 2023	179	Static
NVA-218R	July 1, 2023	182	OPUS
NVA-219	June 28, 2023	179	Static
NVA-219R	July 1, 2023	182	Static
NVA-220	June 27, 2023	178	Static
NVA-220R	June 28, 2023	179	Static
NVA-221	June 27, 2023	178	Static
NVA-221R	June 28, 2023	179	Static
NVA-222	June 25, 2023	176	Static
NVA-223	June 27, 2023	178	Static
NVA-223R	June 28, 2023	179	OPUS
NVA-224	June 20, 2023	171	Static
NVA-225	June 25, 2023	176	Static
NVA-226	June 26, 2023	177	Static
NVA-226R	June 27, 2023	178	Static
NVA-227	June 25, 2023	176	Static
NVA-228	June 26, 2023	177	Static
NVA-228R	June 27, 2023	178	Static
NVA-229	June 26, 2023	177	Static
NVA-229R	June 27, 2023	178	Static
NVA-230	July 1, 2023	182	Static
NVA-230R	July 1, 2023	182	OPUS
NVA-231	June 26, 2023	177	Static
NVA-231R	June 27, 2023	178	Static
NVA-232	June 26, 2023	177	Static
NVA-232R	June 27, 2023	178	OPUS
NVA-233	June 26, 2023	177	OPUS
NVA-233R	June 27, 2023	178	Static
NVA-234	June 29, 2023	180	Static
NVA-234R	June 29, 2023	180	Static
NVA-235	June 28, 2023	179	Static
NVA-236	July 1, 2023	182	Static
NVA-236R	July 1, 2023	182	OPUS
VVA-001	June 8, 2023	159	VRS
VVA-002	June 8, 2023	159	VRS
VVA-003	June 10, 2023	161	Static
VVA-004	June 10, 2023	161	Static

VVA-005	June 8, 2023	159	VRS
VVA-006	June 8, 2023	159	VRS
VVA-007	June 13, 2023	164	Static
VVA-008	June 12, 2023	163	Static
VVA-009	June 12, 2023	163	Static
VVA-010	June 14, 2023	165	Static
VVA-011	June 14, 2023	165	Static
VVA-012	July 12, 2023	193	Static
VVA-013	July 12, 2023	193	Static
VVA-014	July 11, 2023	192	OPUS
VVA-015	July 11, 2023	192	Static
VVA-016	June 15, 2023	166	Static
VVA-017	June 15, 2023	166	Static
VVA-018	July 13, 2023	194	VRS
VVA-019	July 13, 2023	194	VRS
VVA-020	July 7, 2023	188	Static
VVA-021	July 6, 2023	187	Static
VVA-022	July 7, 2023	188	Static
VVA-023	July 7, 2023	188	Static
VVA-024	July 8, 2023	189	Static
VVA-025	July 8, 2023	189	Static
VVA-026	July 6, 2023	187	Static
VVA-027	July 9, 2023	190	Static
VVA-028	July 9, 2023	190	Static
VVA-029	July 10, 2023	191	Static
VVA-030	July 10, 2023	191	Static
VVA-031	July 8, 2023	189	Static
VVA-032	July 8, 2023	189	Static
VVA-033	June 23, 2023	174	Static
VVA-034	June 23, 2023	174	OPUS
VVA-035	June 21, 2023	172	Static
VVA-036	June 23, 2023	174	OPUS
VVA-037	June 24, 2023	175	Static
VVA-038	July 4, 2023	185	OPUS
VVA-039	July 4, 2023	185	Static
VVA-040	July 3, 2023	184	Static
VVA-041	July 3, 2023	184	Static
VVA-042	July 3, 2023	184	Static
VVA-043	July 3, 2023	184	Static
VVA-044	July 4, 2023	185	OPUS
VVA-045	July 3, 2023	184	Static
VVA-046	July 2, 2023	183	Static
VVA-047	July 2, 2023	183	Static
VVA-048	July 2, 2023	183	Static
VVA-049	June 24, 2023	175	OPUS

VVA-050	June 22, 2023	173	Static
VVA-051	June 21, 2023	172	Static
VVA-052	June 21, 2023	172	Static
VVA-053	June 21, 2023	172	OPUS
VVA-201	June 20, 2023	171	OPUS
VVA-202	June 20, 2023	171	Static
VVA-203	June 23, 2023	174	OPUS
VVA-204	June 23, 2023	174	Static
VVA-205	June 23, 2023	174	Static
VVA-206	June 23, 2023	174	Static
VVA-207	June 24, 2023	175	OPUS
VVA-208	June 25, 2023	176	Static
VVA-209	June 29, 2023	180	Static
VVA-210	June 28, 2023	179	OPUS
VVA-211	June 29, 2023	180	OPUS
VVA-212	June 28, 2023	179	Static
VVA-213	June 25, 2023	176	OPUS
VVA-214	June 27, 2023	178	Static
VVA-215	June 28, 2023	179	Static
VVA-216	June 26, 2023	177	Static
VVA-217	June 30, 2023	181	Static
VVA-218	June 30, 2023	181	Static
VVA-219	June 30, 2023	181	OPUS
VVA-220	June 30, 2023	181	Static
VVA-221	June 30, 2023	181	Static
VVA-222	June 26, 2023	177	Static
VVA-223	June 27, 2023	178	OPUS
VVA-224	July 1, 2023	182	Static
VVA-225	June 24, 2023	175	Static
VVA-226	June 21, 2023	172	Static
VVA-227	June 24, 2023	175	Static
VVA-228	June 25, 2023	176	Static

5. Deliverables

Along with this report, the deliverables include an Excel Spreadsheet including all control and check point data, an Excel Spreadsheet with the surveyor's field notes, and photos for each surveyed point.