

DPH-11 Report on Absolute Vertical Accuracy

The USGS Lidar Base Specification Version 2.1 states: "Absolute vertical accuracy of the lidar data and the derived DEM will be assessed and reported in accordance with ASPRS (2014). Vegetated and nonvegetated land cover types shall be assessed for absolute vertical accuracy.

Three absolute accuracy values shall be assessed and reported:

1. NVA for the point data
2. VVA for the point data
3. NVA for the DEM
4. VVA for the DEM

The minimum NVA and VVA requirements for all data, using the ASPRS methodology, are listed in table 4. Both the NVA and VVA required values shall be met. NVA for the point data shall be assessed by comparing check points surveyed for NVA assessment to a triangulated irregular network (TIN) constructed from ground-classified lidar points in those areas. VVA for the point data shall be assessed by comparing check points surveyed for VVA assessment to a triangulated irregular network (TIN) constructed from ground-classified lidar points in those areas. NVA and VVA for the DEM are assessed by comparing check points to the final bare-earth surface. The minimum required thresholds for absolute and relative accuracy may be increased by the USGS–NGP when any of the following conditions are met:

- A demonstrable, substantial, and prohibitive increase in cost is needed to obtain this accuracy, which is often the case in heavily vegetated project areas.
- An alternate specification is needed to conform to previously contracted phases of a single larger overall collection effort such as for multiyear statewide collections
- The USGS–NGP agrees that the use of an alternate specification is reasonable and in the best interest of all stakeholders."

Table 4. Absolute vertical accuracy for light detection and ranging data and digital elevation models.

[QL, quality level, $RMSE_z$, root mean square error in the z direction; NVA, nonvegetated vertical accuracy; VVA, vegetated vertical accuracy; m, meter; \leq , less than or equal to]

Quality level	$RMSE_z$ (nonvegetated) (m)	NVA at the 95-percent confidence level (m)	VVA at the 95th percentile (m)
QL0	≤ 0.050	≤ 0.098	≤ 0.15
QL1	≤ 0.100	≤ 0.196	≤ 0.30
QL2	≤ 0.100	≤ 0.196	≤ 0.30
QL3	≤ 0.200	≤ 0.392	≤ 0.60

The purpose of this section is to report on the absolute vertical accuracy of the lidar data and DEMs generated from it by testing for NVA (Nonvegetated Vertical Accuracy) and VVA (Vegetated Vertical Accuracy) against surveyed ground check points.

DPH-11 Report on Absolute Vertical Accuracy - continued

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\me_tadata\shapefiles\CO_SanLuisJuanMiguel_Block5_61nva_42vva_utm13.shp](#)

Units: Meter (/Feet)

Vertical Accuracy Class tested: 10-cm

Check Points in defined project area (DPA):	103
Check Points with Lidar Coverage	103
Check Points with Lidar Coverage (NVA)	61
Check Points with Lidar Coverage (VVA)	42
Average Z Error (NVA)	0.005/0.017
Maximum Z Error (NVA)	0.148/0.484
Median Z Error (NVA)	0.001/0.005
Minimum Z Error (NVA)	-0.095/-0.310
Standard deviation of Vertical Error (NVA)	0.051/0.168
Skewness of Vertical Error (NVA)	0.499
Kurtosis of Vertical Error (NVA)	-0.102
Non-vegetated Vertical Accuracy (NVA) RMSE(z) ¹	0.051/0.167 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/- ¹	0.100/0.328 PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-	0.100/0.328
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM) ²	0.053/0.172 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level (DEM) +/- ²	0.103/0.338 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (TIN) +/- ¹	0.263/0.862 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (DEM) +/- ²	0.261/0.855 PASS

This data set was tested to meet ASPRS Positional Accuracy Standard for Digital Geospatial Data (2014) for a 10-cm RMSEz Vertical Accuracy Class. Actual NVA accuracy was found to be RMSEz = 5.1cm, equating to +/- 10.0cm at the 95% confidence level. Actual VVA accuracy was found to be +/- 26.1cm at the 95th percentile.

¹ This value is calculated from TIN-based testing of the lidar point cloud data.

² This value is calculated from RAM-based grid testing of the lidar data. The grid cells are sized according to the Quality Level selected, and are defined in the USGS NGP Lidar Base Specification Version 2.1 (Table 6).

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The purpose of this section is to report the results of measuring the lidar point cloud data against surveyed ground NVA (nonvegetated vertical accuracy) check points. All XY coordinates and Z values reported are in the selected data units.

NVA (lidar data)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
6068	401805.449	4178473.246	Yes	2331.607	2331.553	-0.054	2331.54	2331.555	2331.573	6154	-670	1,1,1		
6069	461850.4	4142249.872	Yes	2418.88	2418.935	0.055	2418.928	2418.943	2418.949	10290	2228	1,1,1		
6070	427995.711	4226709.273	Yes	2565.656	2565.698	0.042	2565.661	2565.668	2565.704	15861	-1923	1,1,1		
6073	389570.421	4165464.647	Yes	2387.032	2387.087	0.055	2387.073	2387.075	2387.104	12914	2221	1,1,1		
6077	408186.68	4154942.129	Yes	2319.34	2319.41	0.070	2319.383	2319.408	2319.418	11358	858	1,1,1		
6079	398244.688	4135594.155	Yes	2421.827	2421.857	0.030	2421.844	2421.855	2421.866	12641	170	1,1,1		
6080	398425.391	4146376.597	Yes	2336.434	2336.513	0.079	2336.504	2336.517	2336.539	12011	-79	1,1,1		
6080A	397278.032	4149621.564	Yes	2346.126	2346.197	0.071	2346.178	2346.193	2346.219	11437	-965	1,1,1		
6085	396859.262	4160060.469	Yes	2339.236	2339.384	0.148	2339.383	2339.422	2339.425	8584	1097	1,1,1		
6086	411292.675	4143049.849	Yes	2311.635	2311.606	-0.029	2311.593	2311.615	2311.621	14607	553	1,1,1		
6091	448968.391	4168920.9	Yes	2373.422	2373.372	-0.050	2373.366	2373.384	2373.4	12150	-2816	1,1,1		
6092	427061.897	4210162.128	Yes	2319.555	2319.546	-0.009	2319.544	2319.547	2319.547	16698	244	1,1,1		
6093	446864.365	4157787.377	Yes	2347.058	2347.079	0.021	2347.071	2347.083	2347.117	12697	763	1,1,1		
6100	439025.995	4168660.381	Yes	2297.948	2297.897	-0.051	2297.873	2297.891	2297.909	12631	2625	1,1,1		
6102	423447.632	4165467.605	Yes	2303.669	2303.687	0.018	2303.649	2303.666	2303.704	12303	-2938	1,1,1		
6104	421317.381	4192485.25	Yes	2299.775	2299.754	-0.021	2299.734	2299.763	2299.792	10777	1274	1,1,1		
6105	410746.794	4244606.966	Yes	2553.041	2553.013	-0.028	2553.005	2553.014	2553.015	13953	427	1,1,1		
6106	442837.406	4197908.295	Yes	2502.022	2501.996	-0.026	2501.968	2501.978	2502.037	15789	-1025	1,1,1		
6109	399606.763	4205932.364	Yes	2330.075	2330.037	-0.038	2330.033	2330.04	2330.041	10450	-1490	1,1,1		
6112	389576.669	4103249.094	Yes	2582.837	2582.884	0.047	2582.857	2582.888	2582.899	10482	-704	1,1,1		
6114	417057.309	4233600.809	Yes	2433.464	2433.461	-0.003	2433.452	2433.462	2433.463	13983	79	1,1,1		
6115	393907.891	4178564.542	Yes	2351.59	2351.617	0.027	2351.614	2351.63	2351.633	10384	2344	1,1,1		
6117	388625.64	4149995.969	Yes	2522.914	2522.986	0.072	2522.961	2522.987	2522.988	17312	515	1,1,1		
6121	392998.994	4116284.63	Yes	2507.929	2508.043	0.114	2508.026	2508.033	2508.049	11773	2915	1,1,1		
6123	438841.869	4207290.894	Yes	2519.936	2519.924	-0.012	2519.894	2519.925	2519.934	14900	983	1,1,1		
6125	420348.697	4204553.706	Yes	2305.354	2305.327	-0.027	2305.316	2305.333	2305.354	9947	-2199	1,1,1		
6128	395819.07	4188224.057	Yes	2333.301	2333.241	-0.060	2333.229	2333.233	2333.254	5781	950	1,1,1		
6130	399249.705	4216446.171	Yes	2356.833	2356.819	-0.014	2356.813	2356.821	2356.829	9505	48	1,1,1		
6135	433870.83	4152566.25	Yes	2294.457	2294.468	0.011	2294.467	2294.471	2294.49	17950	-220	1,1,1		
6135A	433834.426	4149337.861	Yes	2294.867	2294.873	0.006	2294.862	2294.877	2294.879	16236	-243	1,1,1		

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
6141	428587.246	4204819.962	Yes	2314.436	2314.518	0.082	2314.499	2314.514	2314.521	17930	390	1,1,1		
6143	421060.657	4142894.686	Yes	2299.125	2299.057	-0.068	2299.031	2299.063	2299.064	10182	-32	1,1,1		
6145	422427.394	4178399.534	Yes	2304.022	2304.048	0.026	2304.038	2304.046	2304.055	11446	-1639	1,1,1		
6148	395055.324	4124218.191	Yes	2462.958	2463.077	0.119	2463.071	2463.091	2463.099	16866	-988	1,1,1		
6151	447491.794	4164766.516	Yes	2367.412	2367.413	0.001	2367.383	2367.387	2367.42	12890	2445	1,1,1		
6151A	447997.871	4165758.661	Yes	2379.66	2379.704	0.044	2379.695	2379.72	2379.723	11095	397	1,1,1		
6156	441167.215	4198678.593	Yes	2399.64	2399.665	0.025	2399.664	2399.665	2399.678	14754	-1016	1,1,1		
6157	399362.281	4197846.181	Yes	2315.919	2315.87	-0.049	2315.837	2315.85	2315.907	11461	-1107	1,1,1		
6162	470934.456	4150452.797	Yes	2506.36	2506.368	0.008	2506.35	2506.35	2506.379	11926	-88	1,1,1		
6165	400080.245	4239076.996	Yes	2885.406	2885.409	0.003	2885.382	2885.409	2885.415	15049	-3026	1,1,1		
6166	405465.159	4230274.345	Yes	2615.258	2615.245	-0.013	2615.236	2615.245	2615.263	13732	-1876	1,1,1		
6168	391925.289	4220503.92	Yes	2443.419	2443.412	-0.007	2443.386	2443.424	2443.43	5260	2127	1,1,1		
6169	454019.014	4175078.931	Yes	2478.995	2479.005	0.010	2478.991	2478.992	2479.018	8739	2107	1,1,1		
6172	479715.696	4161815.313	Yes	2760.588	2760.582	-0.006	2760.572	2760.611	2760.616	10113	-961	1,1,1		
6180	399901.484	4102562.521	Yes	2482.976	2483.013	0.037	2483.012	2483.019	2483.023	10431	2297	1,1,1		
6183	408351.482	4168750.078	Yes	2322.189	2322.201	0.012	2322.198	2322.222	2322.222	9509	833	1,1,1		
6183A	408397.985	4170357.152	Yes	2321.633	2321.627	-0.006	2321.615	2321.634	2321.651	8779	685	1,1,1		
6196	438685.897	4147727.81	Yes	2307.12	2307.062	-0.058	2307.058	2307.085	2307.085	17663	1995	1,1,1		
6199	450467.063	4146168.548	Yes	2349.406	2349.361	-0.045	2349.357	2349.362	2349.368	9678	-1510	1,1,1		
6200	456155.493	4150940.512	Yes	2479.526	2479.47	-0.056	2479.464	2479.476	2479.518	13908	-1200	1,1,1		
6202	424200.815	4155797.788	Yes	2301.782	2301.818	0.036	2301.807	2301.815	2301.821	12278	722	1,1,1		
6202A	403121.826	4126902.678	Yes	2371.375	2371.442	0.067	2371.431	2371.434	2371.45	12127	2720	1,1,1		
6207	409237.681	4205604.175	Yes	2311.499	2311.442	-0.057	2311.421	2311.421	2311.468	12560	-779	1,1,1		
6207A	410838.542	4205595.22	Yes	2309.82	2309.788	-0.032	2309.765	2309.775	2309.8	16981	-1329	1,1,1		
6209	419377.474	4217360.114	Yes	2327.459	2327.481	0.022	2327.462	2327.482	2327.485	17362	2041	1,1,1		
6210	401190.141	4250656.666	Yes	2705.022	2705.013	-0.009	2705.007	2705.013	2705.056	13798	532	1,1,1		
6218	427292.004	4217193.253	Yes	2364.423	2364.468	0.045	2364.462	2364.483	2364.498	20521	-388	1,1,1		
6220	408754.272	4188099.431	Yes	2311.344	2311.284	-0.060	2311.266	2311.28	2311.295	8623	236	1,1,1		
6220A	408663.431	4186467.568	Yes	2312.556	2312.494	-0.062	2312.487	2312.494	2312.497	9480	497	1,1,1		
6223	412895.165	4220918.491	Yes	2388.733	2388.638	-0.095	2388.616	2388.653	2388.693	11228	1797	1,1,1		
6227	426021.24	4183245.343	Yes	2298.463	2298.416	-0.047	2298.401	2298.404	2298.42	10237	1425	1,1,1		

DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the lidar point cloud data against surveyed ground VVA (vegetated vertical accuracy) check points. All XY coordinates and Z values reported are in the selected data units.

VVA (lidar data)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
7065	402005.542	4178761.36	Yes	2330.699	2330.823	0.124	2330.784	2330.813	2330.894	9417	-1590	2,1,1		
7065A	402001.494	4178604.617	Yes	2330.544	2330.612	0.068	2330.586	2330.611	2330.632	12638	-1595	1,2,1		
7066	461892.831	4142634.476	Yes	2424.098	2424.193	0.095	2424.15	2424.176	2424.229	8082	2232	2,3,3		
7067	428086.032	4226862.825	Yes	2577.363	2577.429	0.066	2577.424	2577.432	2577.451	15999	-643	2,1,2		
7067A	428790.17	4226028.875	Yes	2609.004	2609.112	0.108	2609.056	2609.144	2609.379	6531	-423	2,3,2		
7070	389293.003	4165821.309	Yes	2388.514	2388.661	0.147	2388.602	2388.666	2388.69	13668	2021	1,1,1		
7074	407617.176	4155144.919	Yes	2319.622	2319.887	0.265	2319.833	2319.9	2320.093	15801	2295	1,1,1		
7076	398232.878	4137651.953	Yes	2405.91	2405.989	0.079	2405.925	2405.927	2406	13008	282	2,2,2		
7077	399235.282	4146405.273	Yes	2334.503	2334.616	0.113	2334.601	2334.612	2334.625	9474	-2168	2,2,2		
7081	397033.097	4160063.52	Yes	2338.684	2338.799	0.115	2338.785	2338.799	2338.821	17024	446	1,1,1		
7086	448560.115	4167494.624	Yes	2383.189	2383.26	0.071	2383.252	2383.31	2383.321	12037	1706	1,1,1		
7087	427054.962	4210129.44	Yes	2318.456	2318.599	0.143	2318.592	2318.6	2318.615	16292	259	1,1,1		
7088	446889.11	4157994.164	Yes	2346.962	2347.101	0.139	2347.09	2347.096	2347.114	17499	879	1,1,1		
7094	438076.206	4168699.414	Yes	2294.809	2294.926	0.117	2294.884	2294.924	2294.957	15522	-453	1,1,1		
7094A	437418.103	4168688.133	Yes	2293.746	2293.785	0.039	2293.731	2293.78	2293.89	7488	-821	2,2,2		
7096	424402.428	4165465.634	Yes	2302.235	2302.365	0.130	2302.341	2302.366	2302.459	14616	1093	1,1,1		
7098	421304.414	4193224.128	Yes	2299.03	2299.096	0.066	2298.944	2298.962	2299.127	13636	1152	1,1,1		
7099	410937.631	4244311.898	Yes	2547.018	2547.094	0.076	2547.031	2547.11	2547.114	15020	-323	1,1,1		
7100	442890.617	4196891	Yes	2463.463	2463.513	0.050	2463.505	2463.511	2463.546	12062	-1730	2,1,1		
7103	401560.904	4205917.211	Yes	2320.911	2320.865	-0.046	2320.553	2320.963	2320.98	9208	1322	2,2,2		
7106	390148.619	4103115.44	Yes	2574.772	2574.722	-0.050	2574.703	2574.706	2574.737	4930	-2340	2,2,3		
7108	416968.573	4233635.305	Yes	2433.657	2433.701	0.044	2433.669	2433.698	2433.701	15086	-220	2,2,2		
7110	388449.361	4150044.876	Yes	2526.381	2526.464	0.083	2526.449	2526.455	2526.48	13222	-185	1,2,1		
7114	392819.487	4116024.118	Yes	2500.592	2500.969	0.377	2500.907	2500.915	2501.425	16989	1747	1,1,1		
7114A	393009.589	4116491.582	Yes	2499.919	2500.112	0.193	2500.099	2500.109	2500.207	12470	2936	1,2,1		
7116	438813.189	4207301.598	Yes	2518.622	2518.677	0.055	2518.662	2518.682	2518.694	15501	1434	1,1,1		
7118	420376.727	4205338.527	Yes	2304.963	2305.129	0.166	2305.118	2305.12	2305.17	14102	-1803	1,1,1		
7121	399046.425	4188220.86	Yes	2325.468	2325.536	0.068	2325.525	2325.544	2325.587	13051	-263	1,1,1		
7121A	396485.328	4188195.464	Yes	2329.762	2329.799	0.037	2329.77	2329.793	2329.816	8441	-1325	1,2,2		
7123	399844.359	4215610.162	Yes	2348.71	2348.823	0.113	2348.752	2348.846	2348.849	9564	-2569	1,2,2		

Check Points Vertical Accuracy - continued

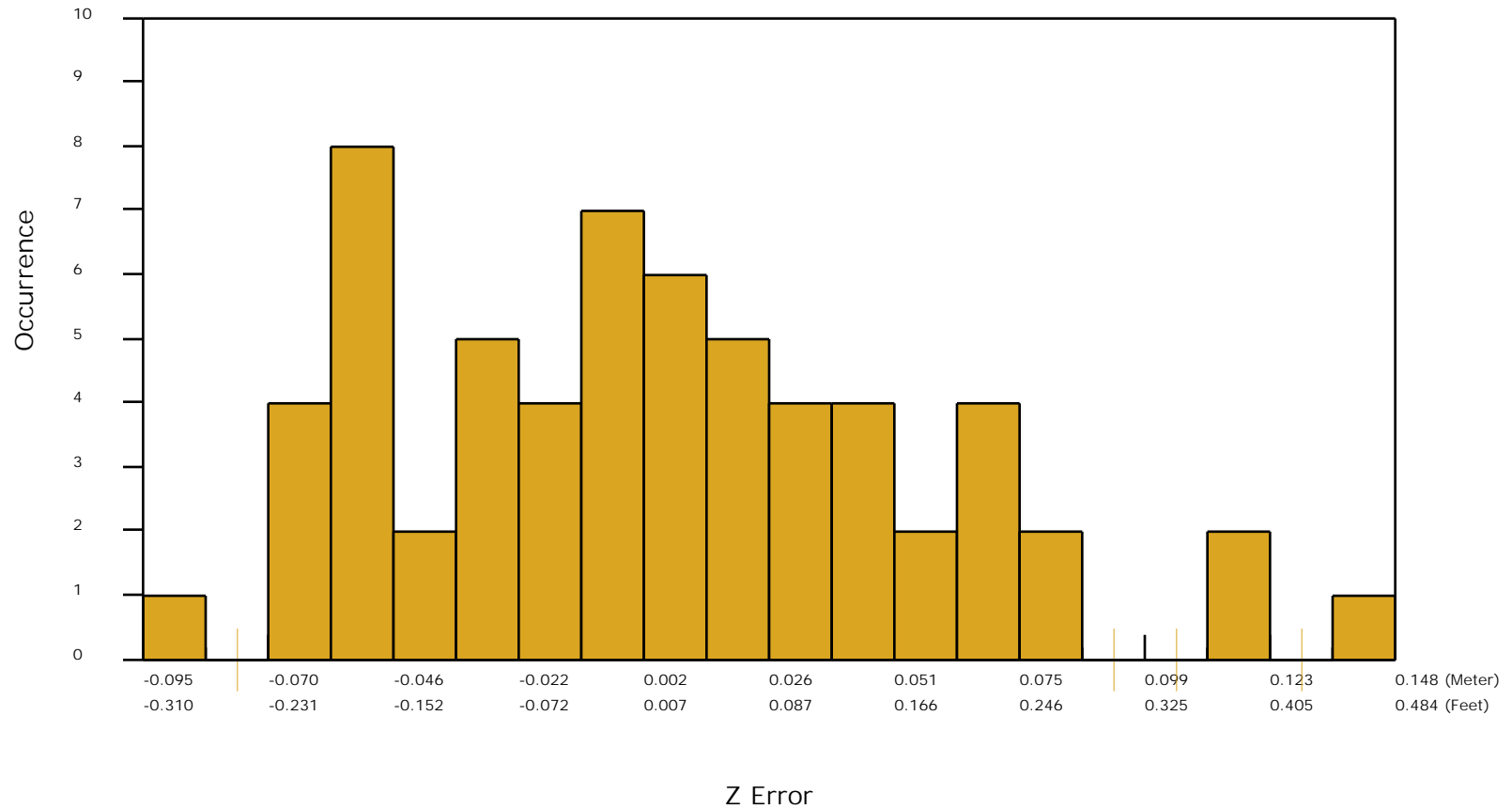
ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
7126	432314.109	4152522.37	Yes	2295.491	2295.61	0.119	2295.559	2295.576	2295.653	16096	609	1,1,1		
7126A	433875.007	4150966.383	Yes	2294.318	2294.514	0.196	2294.471	2294.532	2294.557	16911	-159	1,1,1		
7132	428606.515	4204786.865	Yes	2314.112	2314.234	0.122	2314.194	2314.213	2314.261	14827	442	1,1,1		
7134	420784.952	4142115.105	Yes	2297.679	2297.697	0.018	2297.667	2297.696	2297.756	12492	-1098	1,1,1		
7136	423073.854	4178380.211	Yes	2301.678	2301.838	0.160	2301.812	2301.845	2301.851	14620	-222	1,1,1		
7139	397419.044	4125663.701	Yes	2407.102	2407.161	0.059	2407.143	2407.143	2407.256	12008	-1535	2,1,2		
7146	441158.577	4198507.491	Yes	2398.664	2398.645	-0.019	2398.597	2398.646	2398.702	10309	-254	3,3,2		
7147	399699.478	4197833.525	Yes	2313.774	2313.725	-0.049	2313.714	2313.718	2313.813	10677	-2282	1,1,2		
7152	470326.045	4149784.071	Yes	2500.304	2500.528	0.224	2500.504	2500.553	2500.618	10740	-2240	1,1,1		
7155	400179.134	4238854.156	Yes	2873.185	2873.365	0.180	2873.251	2873.258	2873.489	10884	-2811	2,1,2		
7156	407486.793	4230235.165	Yes	2581.663	2581.686	0.023	2581.651	2581.703	2581.716	11559	-1277	2,2,2		
7162	409587.336	4097607.576	Yes	2417.52	2417.799	0.279	2417.603	2417.928	2417.982	11982	1192	1,2,1		

DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a frequency distribution chart of the non-vegetated vertical accuracy (NVA) of the lidar point cloud data measured against surveyed ground check points.

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\tilecls_New](#)

NVA (lidar data)

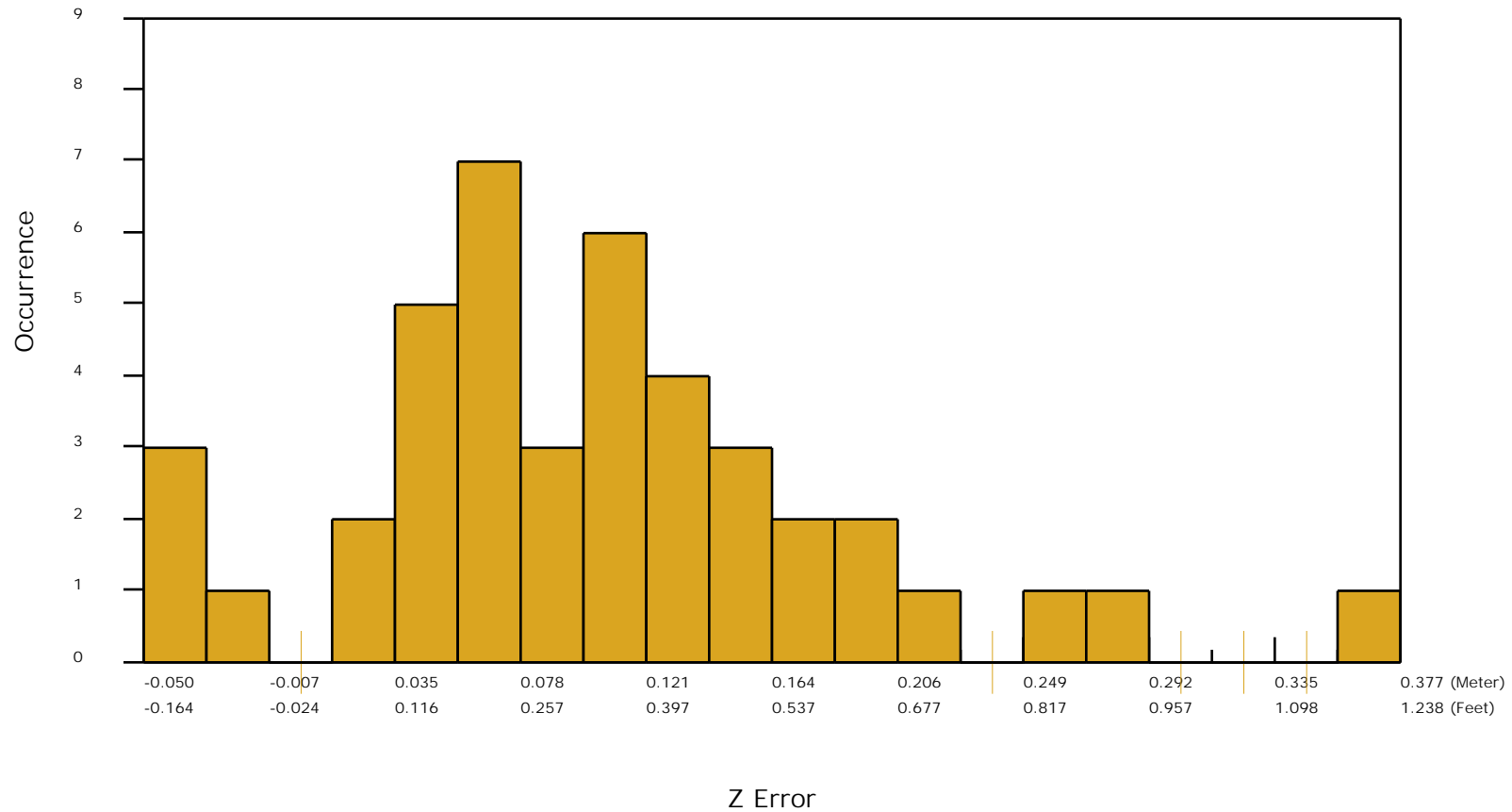


DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a frequency distribution chart of the vegetated vertical accuracy (VVA) of the lidar point cloud data measured against surveyed ground check points.

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\tilecls_New](#)

VVA (lidar data)



DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the DEM data against surveyed ground NVA (nonvegetated vertical accuracy) check points. All XY coordinates and Z values reported are in the selected data units.

NVA (DEM)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
6068	401805.449	4178473.246	Yes	2331.607	2331.541	-0.066		
6069	461850.4	4142249.872	Yes	2418.88	2418.945	0.065		
6070	427995.711	4226709.273	Yes	2565.656	2565.663	0.007		
6073	389570.421	4165464.647	Yes	2387.032	2387.085	0.053		
6077	408186.68	4154942.129	Yes	2319.34	2319.408	0.068		
6079	398244.688	4135594.155	Yes	2421.827	2421.865	0.038		
6080	398425.391	4146376.597	Yes	2336.434	2336.517	0.083		
6080A	397278.032	4149621.564	Yes	2346.126	2346.175	0.049		
6085	396859.262	4160060.469	Yes	2339.236	2339.385	0.149		
6086	411292.675	4143049.849	Yes	2311.635	2311.620	-0.015		
6091	448968.391	4168920.9	Yes	2373.422	2373.389	-0.033		
6092	427061.897	4210162.128	Yes	2319.555	2319.552	-0.003		
6093	446864.365	4157787.377	Yes	2347.058	2347.090	0.032		
6100	439025.995	4168660.381	Yes	2297.948	2297.889	-0.059		
6102	423447.632	4165467.605	Yes	2303.669	2303.699	0.030		
6104	421317.381	4192485.25	Yes	2299.775	2299.764	-0.011		
6105	410746.794	4244606.966	Yes	2553.041	2553.018	-0.023		
6106	442837.406	4197908.295	Yes	2502.022	2502.015	-0.007		
6109	399606.763	4205932.364	Yes	2330.075	2330.041	-0.034		
6112	389576.669	4103249.094	Yes	2582.837	2582.898	0.061		
6114	417057.309	4233600.809	Yes	2433.464	2433.461	-0.003		
6115	393907.891	4178564.542	Yes	2351.59	2351.624	0.034		
6117	388625.64	4149995.969	Yes	2522.914	2522.962	0.048		
6121	392998.994	4116284.63	Yes	2507.929	2508.053	0.124		
6123	438841.869	4207290.894	Yes	2519.936	2519.900	-0.036		
6125	420348.697	4204553.706	Yes	2305.354	2305.331	-0.023		
6128	395819.07	4188224.057	Yes	2333.301	2333.232	-0.069		
6130	399249.705	4216446.171	Yes	2356.833	2356.817	-0.016		
6135	433870.83	4152566.25	Yes	2294.457	2294.460	0.003		
6135A	433834.426	4149337.861	Yes	2294.867	2294.880	0.013		

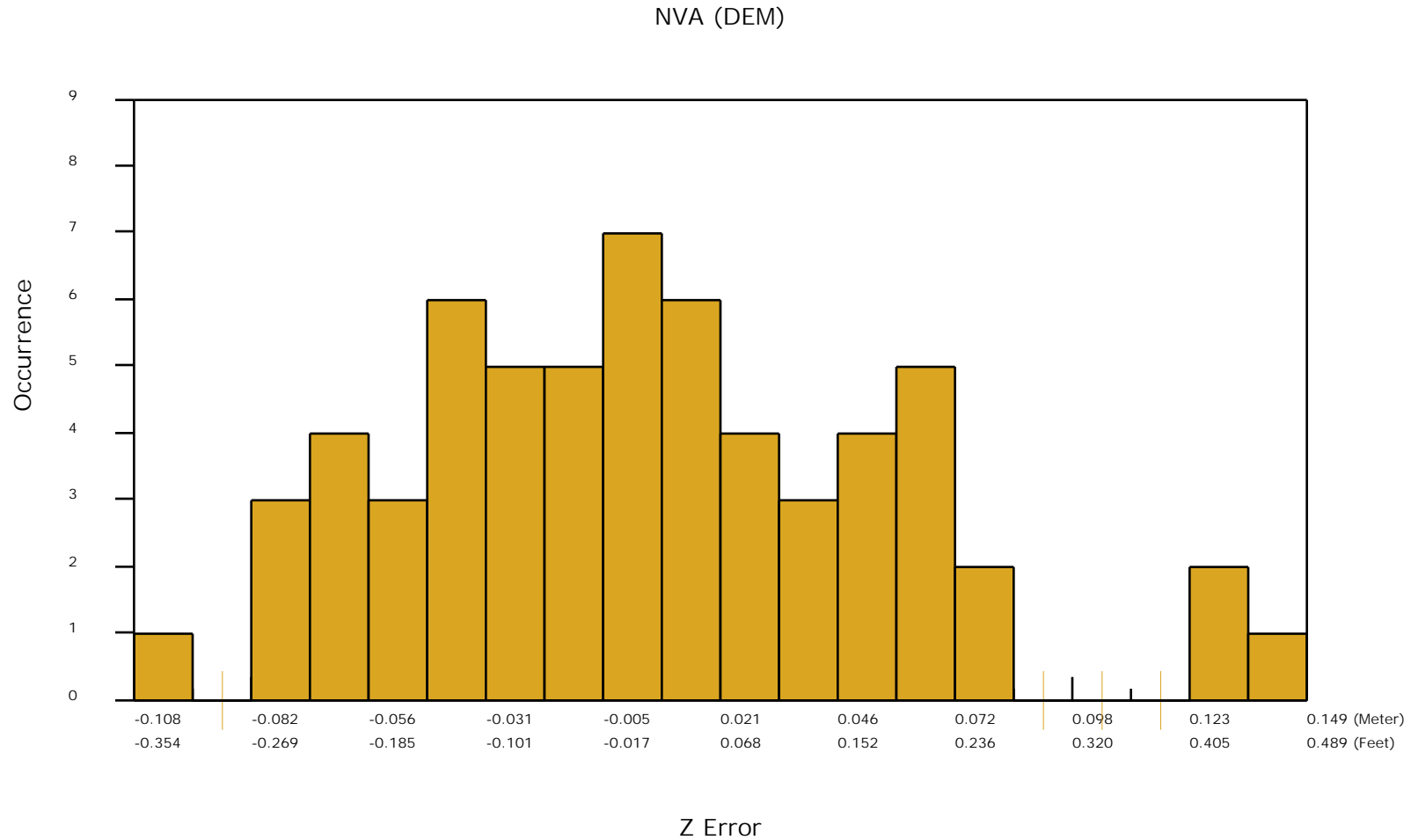
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
6141	428587.246	4204819.962	Yes	2314.436	2314.509	0.073		
6143	421060.657	4142894.686	Yes	2299.125	2299.045	-0.080		
6145	422427.394	4178399.534	Yes	2304.022	2304.040	0.018		
6148	395055.324	4124218.191	Yes	2462.958	2463.083	0.125		
6151	447491.794	4164766.516	Yes	2367.412	2367.391	-0.021		
6151A	447997.871	4165758.661	Yes	2379.66	2379.680	0.020		
6156	441167.215	4198678.593	Yes	2399.64	2399.671	0.031		
6157	399362.281	4197846.181	Yes	2315.919	2315.846	-0.073		
6162	470934.456	4150452.797	Yes	2506.36	2506.373	0.013		
6165	400080.245	4239076.996	Yes	2885.406	2885.411	0.005		
6166	405465.159	4230274.345	Yes	2615.258	2615.238	-0.020		
6168	391925.289	4220503.92	Yes	2443.419	2443.383	-0.036		
6169	454019.014	4175078.931	Yes	2478.995	2479.047	0.052		
6172	479715.696	4161815.313	Yes	2760.588	2760.594	0.006		
6180	399901.484	4102562.521	Yes	2482.976	2483.013	0.037		
6183	408351.482	4168750.078	Yes	2322.189	2322.199	0.010		
6183A	408397.985	4170357.152	Yes	2321.633	2321.651	0.018		
6196	438685.897	4147727.81	Yes	2307.12	2307.072	-0.048		
6199	450467.063	4146168.548	Yes	2349.406	2349.372	-0.034		
6200	456155.493	4150940.512	Yes	2479.526	2479.470	-0.056		
6202	424200.815	4155797.788	Yes	2301.782	2301.807	0.025		
6202A	403121.826	4126902.678	Yes	2371.375	2371.445	0.070		
6207	409237.681	4205604.175	Yes	2311.499	2311.464	-0.035		
6207A	410838.542	4205595.22	Yes	2309.82	2309.803	-0.017		
6209	419377.474	4217360.114	Yes	2327.459	2327.466	0.007		
6210	401190.141	4250656.666	Yes	2705.022	2705.003	-0.019		
6218	427292.004	4217193.253	Yes	2364.423	2364.489	0.066		
6220	408754.272	4188099.431	Yes	2311.344	2311.294	-0.050		
6220A	408663.431	4186467.568	Yes	2312.556	2312.494	-0.062		
6223	412895.165	4220918.491	Yes	2388.733	2388.625	-0.108		
6227	426021.24	4183245.343	Yes	2298.463	2298.406	-0.057		

DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a frequency distribution chart of the non-vegetated vertical accuracy (NVA) of the DEM data measured against surveyed ground check points.

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\tilecls_New](#)



DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the DEM data against surveyed ground VVA (vegetated vertical accuracy) check points. All XY coordinates and Z values reported are in the selected data units.

VVA (DEM)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
7065	402005.542	4178761.36	Yes	2330.699	2330.824	0.125		
7065A	402001.494	4178604.617	Yes	2330.544	2330.625	0.081		
7066	461892.831	4142634.476	Yes	2424.098	2424.157	0.059		
7067	428086.032	4226862.825	Yes	2577.363	2577.440	0.077		
7067A	428790.17	4226028.875	Yes	2609.004	2609.151	0.147		
7070	389293.003	4165821.309	Yes	2388.514	2388.615	0.101		
7074	407617.176	4155144.919	Yes	2319.622	2319.921	0.299		
7076	398232.878	4137651.953	Yes	2405.91	2406.026	0.116		
7077	399235.282	4146405.273	Yes	2334.503	2334.630	0.127		
7081	397033.097	4160063.52	Yes	2338.684	2338.822	0.138		
7086	448560.115	4167494.624	Yes	2383.189	2383.305	0.116		
7087	427054.962	4210129.44	Yes	2318.456	2318.611	0.155		
7088	446889.11	4157994.164	Yes	2346.962	2347.087	0.125		
7094	438076.206	4168699.414	Yes	2294.809	2294.899	0.090		
7094A	437418.103	4168688.133	Yes	2293.746	2293.828	0.082		
7096	424402.428	4165465.634	Yes	2302.235	2302.361	0.126		
7098	421304.414	4193224.128	Yes	2299.03	2299.079	0.049		
7099	410937.631	4244311.898	Yes	2547.018	2547.103	0.085		
7100	442890.617	4196891	Yes	2463.463	2463.462	-0.001		
7103	401560.904	4205917.211	Yes	2320.911	2320.800	-0.111		
7106	390148.619	4103115.44	Yes	2574.772	2574.735	-0.037		
7108	416968.573	4233635.305	Yes	2433.657	2433.708	0.051		
7110	388449.361	4150044.876	Yes	2526.381	2526.453	0.072		
7114	392819.487	4116024.118	Yes	2500.592	2500.855	0.263		
7114A	393009.589	4116491.582	Yes	2499.919	2500.121	0.202		
7116	438813.189	4207301.598	Yes	2518.622	2518.688	0.066		
7118	420376.727	4205338.527	Yes	2304.963	2305.119	0.156		
7121	399046.425	4188220.86	Yes	2325.468	2325.559	0.091		
7121A	396485.328	4188195.464	Yes	2329.762	2329.804	0.042		
7123	399844.359	4215610.162	Yes	2348.71	2348.800	0.090		

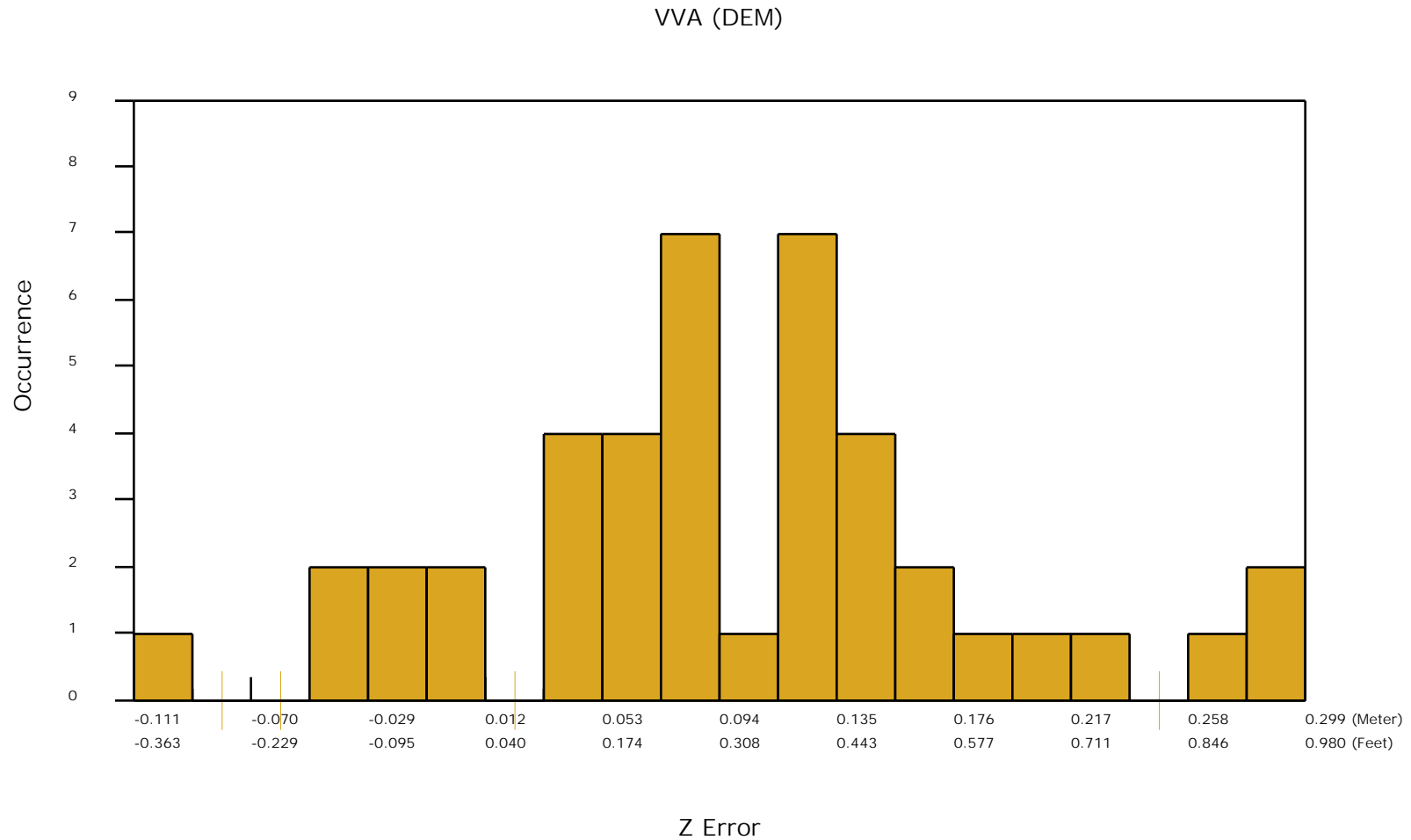
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
7126	432314.109	4152522.37	Yes	2295.491	2295.631	0.140		
7126A	433875.007	4150966.383	Yes	2294.318	2294.537	0.219		
7132	428606.515	4204786.865	Yes	2314.112	2314.227	0.115		
7134	420784.952	4142115.105	Yes	2297.679	2297.682	0.003		
7136	423073.854	4178380.211	Yes	2301.678	2301.862	0.184		
7139	397419.044	4125663.701	Yes	2407.102	2407.141	0.039		
7146	441158.577	4198507.491	Yes	2398.664	2398.639	-0.025		
7147	399699.478	4197833.525	Yes	2313.774	2313.725	-0.049		
7152	470326.045	4149784.071	Yes	2500.304	2500.472	0.168		
7155	400179.134	4238854.156	Yes	2873.185	2873.250	0.065		
7156	407486.793	4230235.165	Yes	2581.663	2581.637	-0.026		
7162	409587.336	4097607.576	Yes	2417.52	2417.799	0.279		

DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a frequency distribution chart of the vegetated vertical accuracy (VVA) of the DEM data measured against surveyed ground check points.

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\tilecls_New](#)

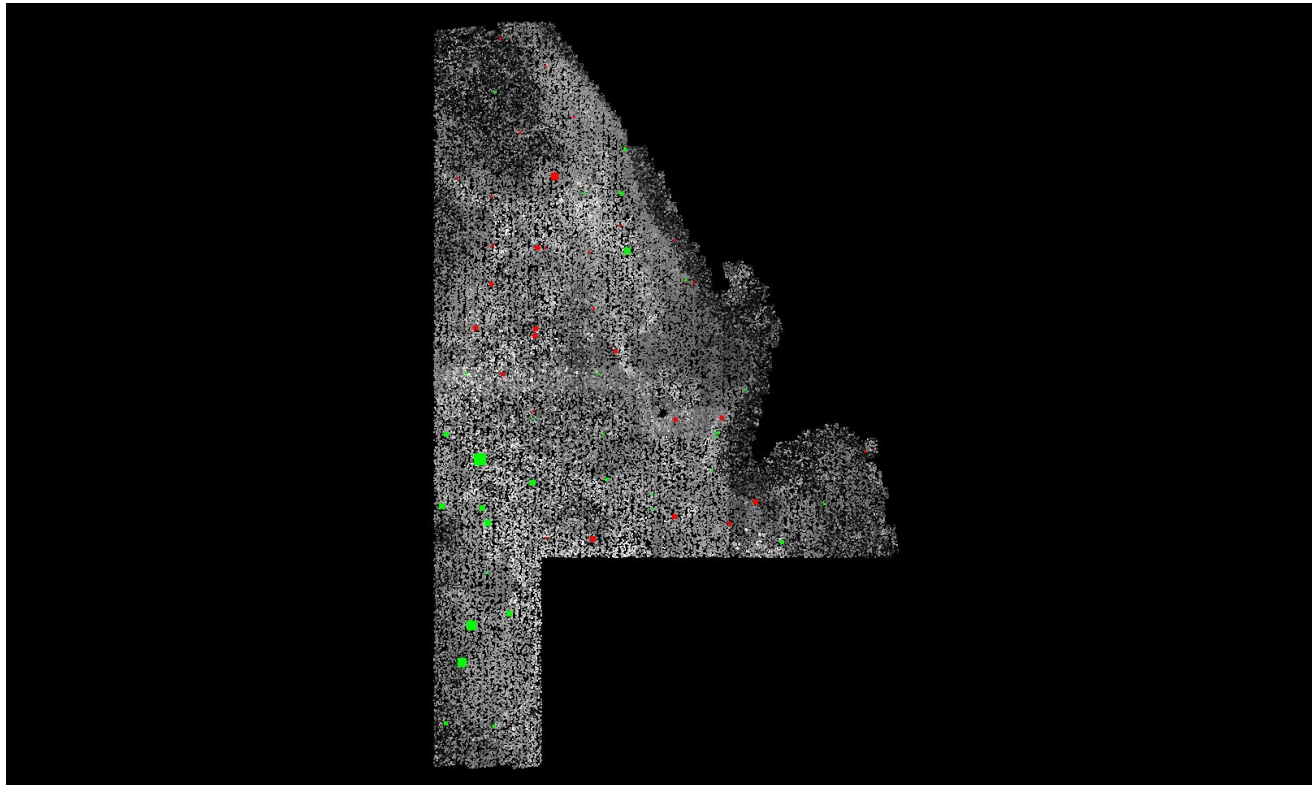


DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a graphic of lidar data points colored by intensity with NVA check points rendered "thematically" showing the green and red squares sized by Z error.

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\tilecls_New](Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\tilecls_New)

[Result Path - D:\00_San_Miguel\San_Luis_Juan_Miguel_B5_OC\DPH_11\ColorByIntensity_CheckPoints_NVA.jpg](D:\00_San_Miguel\San_Luis_Juan_Miguel_B5_OC\DPH_11\ColorByIntensity_CheckPoints_NVA.jpg)



■ Green represents where the lidar surface is above the check point (positive elevation error).

■ Red represents where the lidar surface is below the check point (negative elevation error).

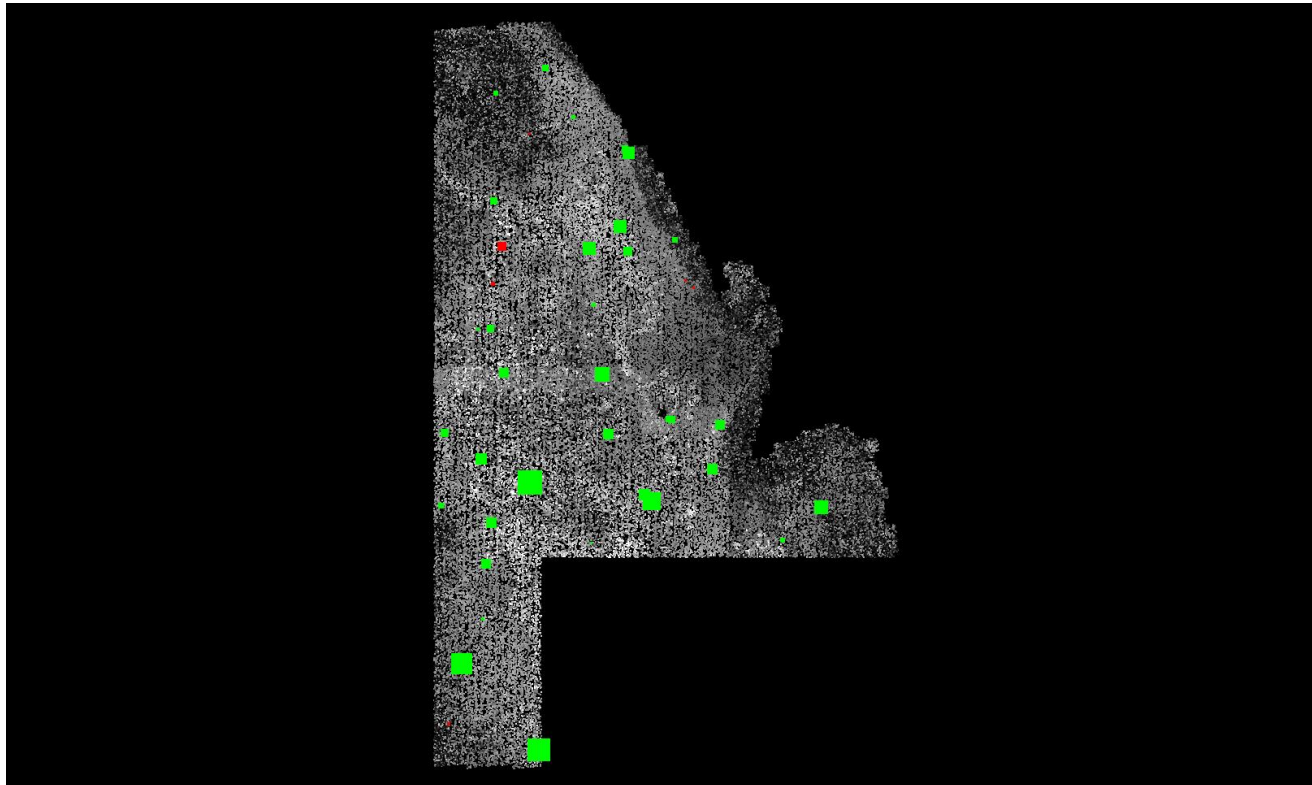
The size of the square symbol represents the absolute value magnitude of error.

DPH-11 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a graphic of lidar data points colored by intensity with VVA check points rendered "thematically" showing the green and red squares sized by Z error.

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\tilecls_New](#)

[Result Path - D:\00_San_Miguel\San_Luis_Juan_Miguel_B5_OC\DPH_11\ColorByIntensity_CheckPoints_VVA.jpg](#)



■ Green represents where a DEM of the lidar surface is above the check point (positive elevation error).

■ Red represents where a DEM of the lidar surface is below the check point (negative elevation error).

The size of the square symbol represents the absolute value magnitude of error.