

DPH-11 Report on Absolute Vertical Accuracy

The USGS Lidar Base Specification 2022 rev. A 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. Federal Emergency Management Agency (2003) identifies seven land cover types; National Digital Elevation Program (2004) and ASPRS (2004) reiterate the first five of those types. The way in which each of the seven classes was reported under the previous standards and how they are reported under the new ASPRS standards and by this specification are shown in table 3. Four 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.

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[Data Source - D:\00_ISGS\IL_MidNorth_B1_79NVA_59VVA_IL_West.shp](#)

Units: Meter (/US Survey Feet)

Vertical Accuracy Class tested: 10-cm

Check Points in defined project area (DPA):	138
Check Points with Lidar Coverage	138
Check Points with Lidar Coverage (NVA)	79
Check Points with Lidar Coverage (VVA)	59
Average Z Error (NVA)	-0.004/-0.015
Maximum Z Error (NVA)	0.093/0.305
Median Z Error (NVA)	0.006/0.019
Minimum Z Error (NVA)	-0.495/-1.624
Standard deviation of Vertical Error (NVA)	0.074/0.244
Skewness of Vertical Error (NVA)	-4.333
Kurtosis of Vertical Error (NVA)	24.218
Non-vegetated Vertical Accuracy (NVA) RMSE(z) ¹	0.074/0.243 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/- ¹	0.145/0.477 PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-	0.145/0.477
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM) ²	0.073/0.240 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level (DEM) +/- ²	0.144/0.144 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (TIN) +/- ¹	0.116/0.381 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (DEM) +/- ²	0.121/0.397 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 = 7.4cm, equating to +/- 14.5cm at the 95% confidence level. Actual VVA accuracy was found to be +/- 12.1cm 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 2022 rev. A (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
5002	2247623.4	1392982.36	Yes	504.62	504.696	0.076	504.625	504.7	504.723	2960	1893	1,1,1		
5003	2121771.51	1505691.32	Yes	733.48	733.341	-0.139	733.322	733.342	733.368	2489	-1582	1,1,1		
5007	2223753.14	1290567.75	Yes	652.34	652.109	-0.231	652.089	652.105	652.125	2613	-3400	1,1,1		
5011	2248162.27	1566590.47	Yes	791.22	791.32	0.100	791.294	791.376	791.412	2784	2114	1,1,1		
5012	2251504.94	1342148.78	Yes	648.18	648.134	-0.046	648.109	648.132	648.161	2393	2437	1,1,1		
5012A	2268860.53	1338574.15	Yes	619.93	619.986	0.056	619.95	620.002	620.061	3096	-3613	1,1,1		
5015	2117283.24	1666372.02	Yes	741.41	741.337	-0.073	741.235	741.265	741.406	1387	1337	1,1,1		
5016	2224439.98	1347252.67	Yes	734.02	734.057	0.037	733.929	733.942	734.086	2589	-2086	1,1,1		
5020	2221718.5	1455137.82	Yes	637.02	637.095	0.075	637.056	637.125	637.174	1548	-533	1,1,1		
5020A	2222975.02	1456695.92	Yes	639.6	639.585	-0.015	639.556	639.582	639.595	2784	-1937	1,1,1		
5021	2188277.45	1601872.05	Yes	694.05	694.063	0.013	694.021	694.034	694.132	2785	301	1,1,1		
5022	2297582.32	1619678.46	Yes	759.81	759.786	-0.024	759.766	759.792	759.815	2114	-1147	1,1,1		
5025	2134445.92	1583623.05	Yes	594.16	594.287	0.127	594.251	594.307	594.385	1875	-2953	1,5,1		
5025A	2131583.36	1598418.04	Yes	598.33	598.271	-0.059	598.237	598.316	598.342	1967	873	1,1,1		
5027	2141349.64	1624882.72	Yes	675.21	675.142	-0.068	675.041	675.156	675.182	1867	-2754	1,1,1		
5029	2165355.7	1542656.72	Yes	762.57	762.7	0.130	762.649	762.712	762.718	2204	474	1,1,1		
5032	2170527.12	1353206.47	Yes	633.99	634.048	0.058	633.962	634.014	634.093	1697	978	1,1,1		
5038	2157938.77	1581935.83	Yes	660.47	660.559	0.089	660.533	660.563	660.615	3663	-2524	1,1,1		
5039	2044582.73	1462131.07	Yes	547.41	547.53	0.120	547.361	547.558	547.637	2289	-2090	1,1,1		
5039A	2047402.97	1480439.39	Yes	539.66	539.607	-0.053	539.592	539.605	539.691	3582	563	1,1,1		
5044	2220364.07	1651976.28	Yes	802.55	802.49	-0.060	802.347	802.423	802.521	2221	2594	1,1,1		
5053	2315441.33	1577063.65	Yes	795.76	795.786	0.026	795.766	795.769	795.792	3633	-2009	1,1,1		
5056	2155746.51	1386709.41	Yes	655.38	655.222	-0.158	655.146	655.202	655.287	2121	-3016	1,1,1		
5058	2174867.49	1673097.81	Yes	753.93	754.007	0.077	753.998	754.011	754.034	2135	3148	1,1,1		
5058A	2180882.66	1651863.2	Yes	788.42	788.437	0.017	788.433	788.433	788.479	2322	-3308	1,1,1		
5063	2121058.77	1369049.18	Yes	694.48	694.332	-0.148	694.313	694.342	694.359	2197	-2346	1,1,1		
5064	2213485.54	1440014.85	Yes	667.27	667.264	-0.006	667.249	667.272	667.354	3010	-3132	1,1,1		
5065	2243966.69	1532350.74	Yes	769.82	769.677	-0.143	769.664	769.68	769.752	1476	291	1,1,1		
5069	2134001.91	1417947.21	Yes	752.52	752.644	0.124	752.63	752.666	752.682	3400	-3228	1,1,1		
5069A	2155786.46	1420178.35	Yes	722.26	722.464	0.204	722.462	722.462	722.476	2341	-2706	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
5070	2076474.95	1686969.51	Yes	696.41	696.4	-0.010	696.357	696.406	696.422	2371	-852	1,1,1		
5071	2042328.46	1511411.74	Yes	522.92	523.029	0.109	522.932	523.014	523.099	1994	-1039	1,1,1		
5076	2311015.45	1341030.1	Yes	491.02	490.913	-0.107	490.786	490.813	490.993	1889	-254	1,1,1		
5077	2268996.24	1472204.69	Yes	537.77	538.041	0.271	537.942	537.978	538.06	1897	-2186	1,1,1		
5081	2235049.84	1571876.07	Yes	784.61	783.681	-0.929	783.673	783.817	783.853	2848	-2006	1,1,1		
5082	2200009.53	1538596.05	Yes	772.61	772.587	-0.023	772.574	772.603	772.603	3086	-746	1,1,1		
5083	2066192.57	1664906.48	Yes	579.23	579.362	0.132	579.346	579.372	579.392	3063	331	1,1,1		
5084	2131913.07	1348168.72	Yes	663.88	663.96	0.080	663.926	663.972	664.008	2883	-2142	1,1,1		
5087	2296667.66	1504870.5	Yes	632.48	632.33	-0.150	632.279	632.358	632.368	2724	2186	1,1,1		
5088	2049404.27	1485246.95	Yes	539.14	539.158	0.018	539.123	539.143	539.208	2691	2949	1,1,1		
5090	2193624.59	1505171.71	Yes	709.97	710.142	0.172	710.048	710.268	710.297	3017	383	1,1,1		
5092	2202922.1	1414318.24	Yes	642.65	642.58	-0.070	642.568	642.607	642.653	3675	-1416	1,1,1		
5096	2173750.53	1333009.22	Yes	663.57	663.566	-0.004	663.522	663.549	663.581	3893	1584	1,1,1		
5096A	2165757.11	1331701.57	Yes	595.1	595.28	0.180	595.242	595.297	595.327	2412	-1843	1,1,1		
5100	2102186.92	1417384.77	Yes	729.5	729.728	0.228	729.697	729.743	729.854	1964	-352	1,1,1		
5101	2242661.91	1296932.27	Yes	710.42	710.444	0.024	710.412	710.445	710.494	1942	531	1,1,1		
5102	2083242.68	1554353.84	Yes	567.07	567.257	0.187	567.118	567.23	567.312	2124	-1931	1,1,1		
5103	2156955.82	1481107.52	Yes	749.74	749.67	-0.070	749.661	749.664	749.69	1899	-2834	1,1,1		
5107	2107669.18	1700938.94	Yes	733.58	733.521	-0.059	733.45	733.453	733.558	4194	2230	1,1,1		
5108	2113976.1	1468276.07	Yes	761.57	761.397	-0.173	761.347	761.413	761.419	2580	-226	1,1,1		
5110	2298562.67	1445596	Yes	739.97	739.906	-0.064	739.838	739.939	739.946	3087	1824	1,1,1		
5111	2286465.27	1527257.77	Yes	685.66	685.773	0.113	685.704	685.743	685.802	2658	3063	1,1,1		
5112	2278543.55	1279417.74	Yes	459.97	459.744	-0.226	459.684	459.756	459.779	2528	1719	1,1,1		
5112A	2277763.42	1314101.16	Yes	610.84	611.145	0.305	611.121	611.137	611.229	3545	-871	1,1,1		
5114	2290002.74	1336996.7	Yes	486.38	486.327	-0.053	486.282	486.377	486.387	3907	-1611	1,1,1		
5115	2156307.64	1699093.33	Yes	808.27	808.213	-0.057	808.197	808.25	808.253	3349	-540	1,1,1		
5116	2086351.47	1615987.75	Yes	542.92	542.98	0.060	542.922	542.975	543.004	3495	-1627	1,1,1		
5118	2093012.47	1363161.1	Yes	632.11	632.237	0.127	632.187	632.233	632.285	3566	3217	1,1,1		
5119	2204603.15	1366305.61	Yes	646.51	646.466	-0.044	646.442	646.603	646.649	2980	1019	1,1,1		
5124	2088922.41	1321213.34	Yes	642.52	642.643	0.123	642.541	642.646	642.65	2495	-1865	1,1,1		
5127	2266093.85	1423776.26	Yes	636.26	636.334	0.074	636.324	636.337	636.364	2416	-64	1,1,1		
5130	2231598.99	1510539.53	Yes	716.94	716.853	-0.087	716.787	716.869	716.872	2154	1373	1,1,1		
5131	2258105.78	1442258.56	Yes	550.08	550.152	0.072	549.992	550.153	550.173	2093	-2863	1,1,1		
5132	2297851.07	1360039.98	Yes	568.87	567.246	-1.624	567.135	567.259	567.263	3067	2504	1,1,1		
5134	2279272.41	1604969.79	Yes	806.59	806.628	0.038	806.586	806.662	806.668	2691	-1446	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
5136	2265026.79	1588464.51	Yes	834.79	834.96	0.170	834.805	834.811	834.988	1685	2156	1,1,1		
5137	2289968.63	1391462.18	Yes	686.75	686.631	-0.119	686.482	686.6	686.669	2287	-1362	1,1,1		
5141	2230432.84	1479624.62	Yes	650.14	650.275	0.135	650.264	650.274	650.297	2603	2476	1,1,1		
5148	2068374.99	1642265.89	Yes	583.79	583.655	-0.135	583.575	583.657	583.837	2661	3156	1,1,1		
5149	2091349.84	1486512.35	Yes	676.49	676.551	0.061	676.445	676.531	676.593	3327	-682	1,1,1		
5150	2204384.57	1695464.02	Yes	798.13	798.314	0.184	798.214	798.273	798.397	746	-1691	1,1,1		
5155	2298129.2	1554659.71	Yes	601.29	601.332	0.042	601.298	601.351	601.383	2696	2271	1,1,1		
5158	2292310.51	1418018.51	Yes	676.83	676.442	-0.388	676.413	676.465	676.482	3412	-3222	1,1,1		
5160	2107872.24	1557758.92	Yes	719.16	719.187	0.027	719.057	719.211	719.218	3030	1895	1,1,1		
5164	2071081.6	1687014.1	Yes	692.34	692.359	0.019	692.289	692.344	692.44	1813	993	1,1,1		
5167	2076988.48	1529202.55	Yes	549.41	549.387	-0.023	549.287	549.389	549.399	3265	1632	1,1,1		
5168	2067224.77	1501255.44	Yes	577.06	577.168	0.108	577.135	577.161	577.21	1414	3040	1,1,1		
5169	2232715.21	1617458.61	Yes	785.6	785.726	0.126	785.664	785.707	785.773	1647	955	1,1,1		
5175	2143103.2	1650658.53	Yes	740.4	740.365	-0.035	740.35	740.356	740.389	3304	-1193	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
6002	2233278.8	1396225.8	Yes	646.96	646.963	0.003	646.908	646.977	647.036	4695	-759	1,1,1		
6003	2127163.59	1502696.87	Yes	735.51	735.618	0.108	735.546	735.628	735.668	4629	1359	1,1,1		
6007	2244314.57	1295048.3	Yes	670.23	670.243	0.013	670.209	670.264	670.274	2816	-1305	1,2,1		
6011	2233228.09	1562033.46	Yes	771.27	771.615	0.345	771.56	771.593	771.645	4975	-84	1,1,1		
6012	2251705.32	1342436.89	Yes	653.86	654.03	0.170	654.001	654.034	654.073	3544	-64	1,1,2		
6015	2099813.73	1650659.88	Yes	685.36	685.536	0.176	685.494	685.53	685.556	4712	-361	1,1,1		
6016	2222851.33	1347622.33	Yes	713.36	713.55	0.190	713.519	713.535	713.562	4015	-2454	1,1,1		
6020	2223586.44	1456685.42	Yes	640.07	639.795	-0.275	639.759	639.772	639.831	4277	-2550	1,1,1		
6020A	2221644.07	1455054.99	Yes	636.53	636.748	0.218	636.738	636.754	636.859	4600	-452	1,1,1		
6021	2188637.11	1601153.33	Yes	691.61	691.91	0.300	691.902	691.931	691.944	5784	-96	1,1,1		
6022	2297509.28	1621711.07	Yes	761.2	761.141	-0.059	761.081	761.098	761.239	6436	3050	1,1,1		
6025	2136516.33	1581478.64	Yes	616.98	617.473	0.493	617.39	617.473	617.515	4778	-1473	1,1,1		
6025A	2131530.94	1593873.2	Yes	584.62	584.567	-0.053	584.507	584.533	584.595	4067	934	1,2,1		
6027	2135660.39	1655439.11	Yes	720.87	721.146	0.276	721.13	721.163	721.173	3863	-2990	1,2,1		
6029	2167726.68	1542903.4	Yes	766.9	767.05	0.150	766.954	767.049	767.075	5511	-2152	1,1,1		
6032	2159979.5	1353298.34	Yes	639.73	639.127	-0.603	639.09	639.169	639.185	5115	1737	1,1,1		
6038	2189284.33	1564455.85	Yes	745.49	745.849	0.359	745.76	745.852	745.855	4549	-1180	2,1,1		
6039	2045232.51	1462050.44	Yes	547.64	547.725	0.085	547.696	547.712	547.781	4933	-1369	1,1,2		
6044	2218928.56	1652373.2	Yes	798.39	798.515	0.125	798.502	798.545	798.548	4250	2266	1,1,1		
6056	2156670.15	1386268.67	Yes	704.97	704.965	-0.005	704.936	704.969	705.002	4432	-2669	1,1,1		
6058	2175669.16	1675681.52	Yes	784.92	785.089	0.169	785.044	785.077	785.113	5406	2546	1,1,1		
6058A	2182342.19	1651546.16	Yes	792.62	792.75	0.130	792.735	792.738	792.79	4302	-1244	1,1,1		
6063	2122109.88	1369351.23	Yes	693.99	694.146	0.156	694.073	694.185	694.224	2973	-3141	3,1,1		
6064	2216528.1	1440343.08	Yes	674.21	674.454	0.244	674.418	674.447	674.5	5199	1073	1,1,1		
6065	2264381.22	1546455.71	Yes	773.51	773.534	0.024	773.496	773.512	773.552	4421	3422	1,1,1		
6069	2155856.01	1417499.85	Yes	711.61	711.643	0.033	711.606	711.626	711.665	5105	-3206	1,1,1		
6069A	2157296.9	1420228.76	Yes	724.44	724.645	0.205	724.644	724.644	724.661	4979	-1823	1,1,1		
6070	2080616.05	1556734.58	Yes	552.37	552.198	-0.172	552.187	552.204	552.223	3309	982	1,1,1		
6071	2067311.64	1501685.15	Yes	567.61	567.531	-0.079	567.502	567.542	567.617	4160	3210	1,1,1		
6076	2310649.39	1342275.98	Yes	552.23	551.863	-0.367	551.79	551.902	551.918	5216	-670	1,1,1		

Check Points Vertical Accuracy - continued

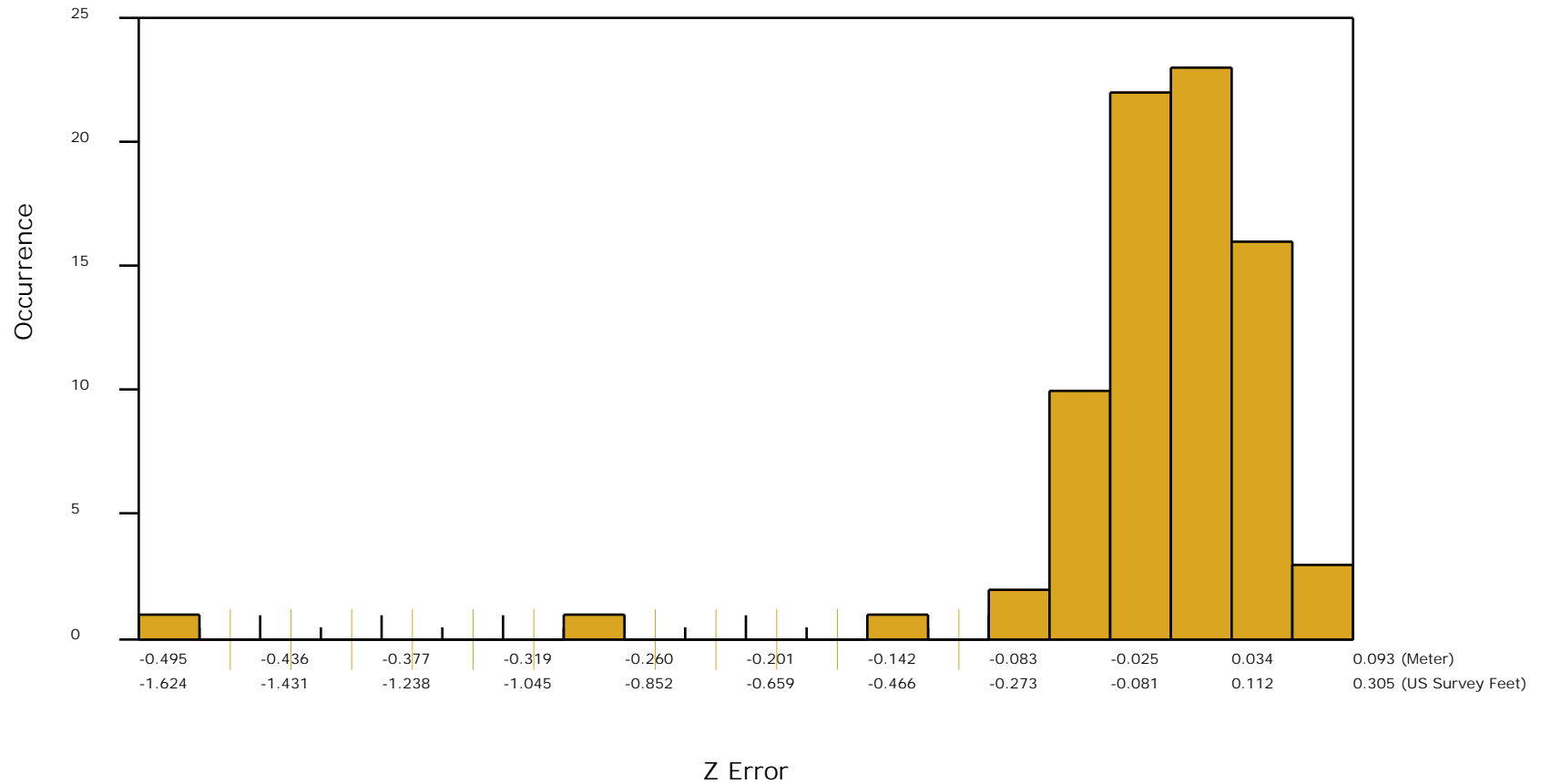
ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
6077	2268638.63	1472439.16	Yes	540.56	540.716	0.156	540.678	540.708	540.724	4574	-1635	1,1,1		
6081	2233583.07	1574161.44	Yes	776.11	776.279	0.169	776.258	776.291	776.301	5238	-379	1,1,1		
6082	2200095.32	1537323.63	Yes	773.93	774.278	0.348	774.273	774.28	774.287	4188	-837	2,1,1		
6083	2066129.56	1657905.72	Yes	577.26	577.475	0.215	577.414	577.45	577.502	4176	344	1,1,1		
6084	2131889.06	1340560.6	Yes	636.54	636.808	0.268	636.747	636.816	636.82	4983	-2017	1,1,1		
6087	2297112.75	1504265.25	Yes	628.15	628.173	0.023	628.122	628.247	628.296	3949	2624	1,1,2		
6088	2049938.17	1486268.73	Yes	543.4	543.594	0.194	543.565	543.585	543.66	4193	3216	1,1,1		
6088A	2055461	1495697.02	Yes	540.84	540.68	-0.160	540.55	540.826	540.862	2537	-331	1,1,1		
6090	2193801.44	1505538.32	Yes	711.11	711.147	0.037	711.134	711.15	711.196	5135	516	1,1,1		
6092	2205113.79	1413804.94	Yes	624.64	624.486	-0.154	624.389	624.471	624.533	4938	1044	1,1,1		
6096	2174263.01	1332754.05	Yes	663.73	664.081	0.351	664.064	664.123	664.146	5560	1037	1,1,1		
6096A	2161405.65	1331739.3	Yes	634.86	635.502	0.642	635.445	635.527	635.534	3964	3039	1,1,1		
6100	2101465.33	1415994.78	Yes	718.6	718.267	-0.333	718.201	718.266	718.27	4989	-1093	1,1,1		
6101	2300784.51	1361507.95	Yes	588.14	588.015	-0.125	587.988	588.007	588.02	5511	-762	1,1,1		
6102	2076681.01	1528977.27	Yes	549.11	549.225	0.115	549.156	549.198	549.3	4303	1306	1,1,1		
6103	2158898.21	1482767.57	Yes	741.56	741.781	0.221	741.744	741.787	741.823	4747	-579	1,1,1		
6107	2122202.39	1693770.52	Yes	774.59	774.748	0.158	774.664	774.762	774.785	4991	2	1,1,1		
6108	2114845.94	1467965.27	Yes	756.85	756.906	0.056	756.901	756.957	756.957	5561	742	1,1,1		
6110	2298499.29	1445773.94	Yes	737.53	737.495	-0.035	737.476	737.499	737.535	4185	1885	1,1,1		
6111	2286833.44	1527579.93	Yes	684.06	684.429	0.369	684.424	684.428	684.431	5303	2716	1,1,1		
6112	2278698.65	1279870.77	Yes	456.51	456.434	-0.076	456.41	456.462	456.466	5220	1952	1,1,1		
6112A	2277794.74	1314105.25	Yes	610.15	610.504	0.354	610.501	610.501	610.586	3689	-898	1,1,1		
6114	2289881.89	1337052.85	Yes	484.5	484.413	-0.087	484.363	484.405	484.445	6063	-1442	1,1,1		
6115	2156382.9	1699658.53	Yes	803.1	803.413	0.313	803.319	803.397	803.42	6024	348	1,1,1		
6116	2089346.19	1615410.13	Yes	572.81	573.017	0.207	572.794	572.935	573.037	4008	1634	1,1,1		
6118	2089319.57	1320959.57	Yes	641.87	641.907	0.037	641.852	641.997	642.02	5822	-1528	1,1,1		
6119	2204594.07	1366457.66	Yes	648.65	648.681	0.031	648.677	648.696	648.736	5225	950	1,1,1		
6124	2201612.17	1694651.97	Yes	788.56	788.615	0.055	788.584	788.732	788.742	4716	-1501	1,1,1		
6125	2069422.27	1641109.45	Yes	577.61	577.754	0.144	577.738	577.784	577.82	4319	2066	1,1,1		

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 - V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls](#)

NVA (lidar data)

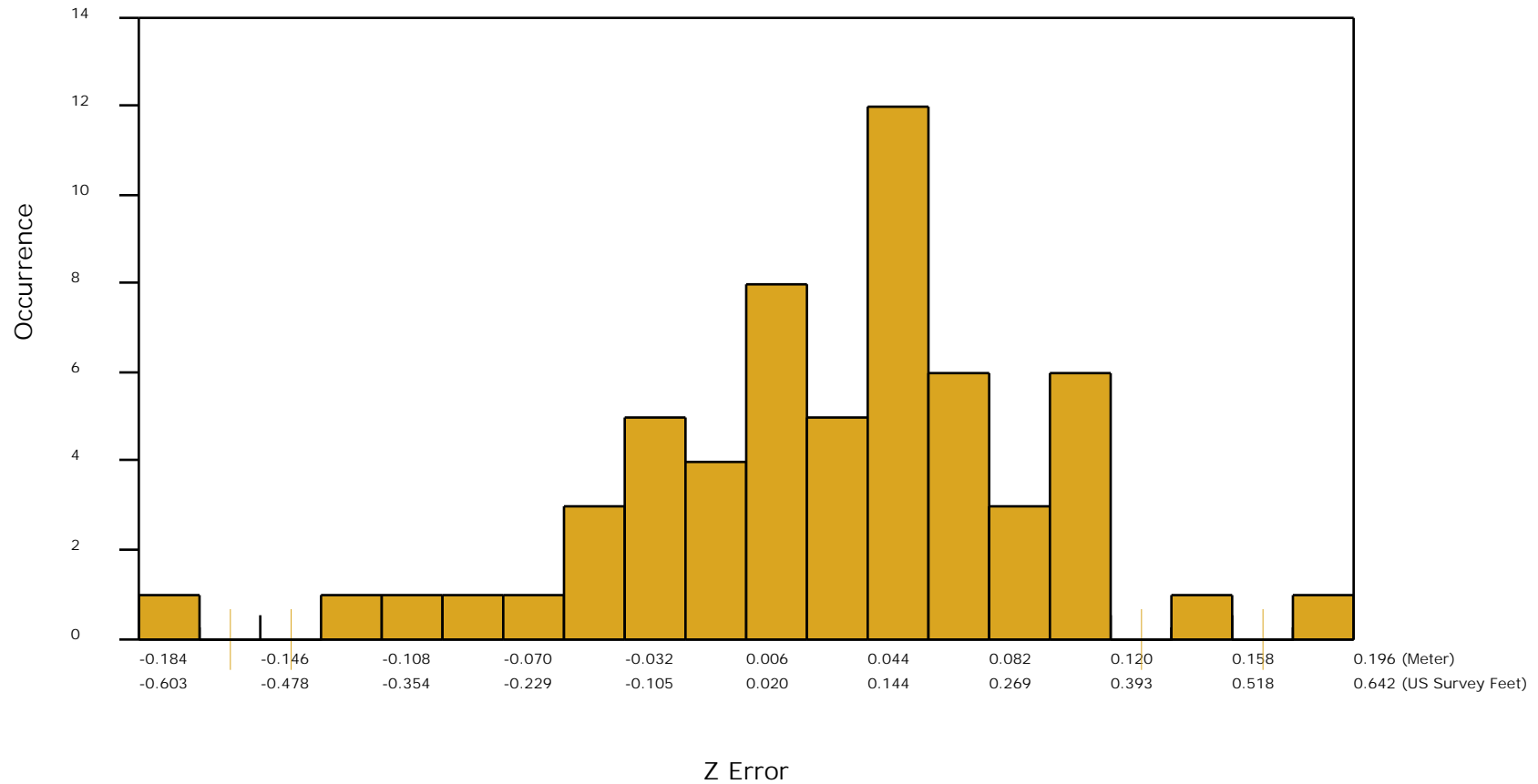


DPH-11 Report on Absolute Vertical Accuracy - continued

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 - V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls](#)

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
5002	2247623.4	1392982.36	Yes	504.62	504.722	0.102		
5003	2121771.51	1505691.32	Yes	733.48	733.328	-0.152		
5007	2223753.14	1290567.75	Yes	652.34	652.119	-0.221		
5011	2248162.27	1566590.47	Yes	791.22	791.313	0.093		
5012	2251504.94	1342148.78	Yes	648.18	648.148	-0.032		
5012A	2268860.53	1338574.15	Yes	619.93	619.990	0.060		
5015	2117283.24	1666372.02	Yes	741.41	741.268	-0.142		
5016	2224439.98	1347252.67	Yes	734.02	733.996	-0.024		
5020	2221718.5	1455137.82	Yes	637.02	637.078	0.058		
5020A	2222975.02	1456695.92	Yes	639.6	639.592	-0.008		
5021	2188277.45	1601872.05	Yes	694.05	694.036	-0.014		
5022	2297582.32	1619678.46	Yes	759.81	759.767	-0.043		
5025	2134445.92	1583623.05	Yes	594.16	594.308	0.148		
5025A	2131583.36	1598418.04	Yes	598.33	598.275	-0.055		
5027	2141349.64	1624882.72	Yes	675.21	675.179	-0.031		
5029	2165355.7	1542656.72	Yes	762.57	762.657	0.087		
5032	2170527.12	1353206.47	Yes	633.99	634.038	0.048		
5038	2157938.77	1581935.83	Yes	660.47	660.548	0.078		
5039	2044582.73	1462131.07	Yes	547.41	547.498	0.088		
5039A	2047402.97	1480439.39	Yes	539.66	539.593	-0.067		
5044	2220364.07	1651976.28	Yes	802.55	802.394	-0.156		
5053	2315441.33	1577063.65	Yes	795.76	795.801	0.041		
5056	2155746.51	1386709.41	Yes	655.38	655.241	-0.139		
5058	2174867.49	1673097.81	Yes	753.93	753.984	0.054		
5058A	2180882.66	1651863.2	Yes	788.42	788.446	0.026		
5063	2121058.77	1369049.18	Yes	694.48	694.326	-0.154		
5064	2213485.54	1440014.85	Yes	667.27	667.273	0.003		
5065	2243966.69	1532350.74	Yes	769.82	769.703	-0.117		
5069	2134001.91	1417947.21	Yes	752.52	752.630	0.110		
5069A	2155786.46	1420178.35	Yes	722.26	722.472	0.212		

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
5070	2076474.95	1686969.51	Yes	696.41	696.398	-0.012		
5071	2042328.46	1511411.74	Yes	522.92	522.966	0.046		
5076	2311015.45	1341030.1	Yes	491.02	491.000	-0.020		
5077	2268996.24	1472204.69	Yes	537.77	538.049	0.279		
5081	2235049.84	1571876.07	Yes	784.61	783.764	-0.846		
5082	2200009.53	1538596.05	Yes	772.61	772.603	-0.007		
5083	2066192.57	1664906.48	Yes	579.23	579.359	0.129		
5084	2131913.07	1348168.72	Yes	663.88	663.977	0.097		
5087	2296667.66	1504870.5	Yes	632.48	632.304	-0.176		
5088	2049404.27	1485246.95	Yes	539.14	539.188	0.048		
5090	2193624.59	1505171.71	Yes	709.97	710.110	0.140		
5092	2202922.1	1414318.24	Yes	642.65	642.572	-0.078		
5096	2173750.53	1333009.22	Yes	663.57	663.570	0.000		
5096A	2165757.11	1331701.57	Yes	595.1	595.326	0.226		
5100	2102186.92	1417384.77	Yes	729.5	729.746	0.246		
5101	2242661.91	1296932.27	Yes	710.42	710.471	0.051		
5102	2083242.68	1554353.84	Yes	567.07	567.154	0.084		
5103	2156955.82	1481107.52	Yes	749.74	749.745	0.005		
5107	2107669.18	1700938.94	Yes	733.58	733.516	-0.064		
5108	2113976.1	1468276.07	Yes	761.57	761.365	-0.205		
5110	2298562.67	1445596	Yes	739.97	739.861	-0.109		
5111	2286465.27	1527257.77	Yes	685.66	685.733	0.073		
5112	2278543.55	1279417.74	Yes	459.97	459.745	-0.225		
5112A	2277763.42	1314101.16	Yes	610.84	611.135	0.295		
5114	2290002.74	1336996.7	Yes	486.38	486.316	-0.064		
5115	2156307.64	1699093.33	Yes	808.27	808.207	-0.063		
5116	2086351.47	1615987.75	Yes	542.92	542.980	0.060		
5118	2093012.47	1363161.1	Yes	632.11	632.234	0.124		
5119	2204603.15	1366305.61	Yes	646.51	646.479	-0.031		
5124	2088922.41	1321213.34	Yes	642.52	642.608	0.088		
5127	2266093.85	1423776.26	Yes	636.26	636.436	0.176		
5130	2231598.99	1510539.53	Yes	716.94	716.863	-0.077		
5131	2258105.78	1442258.56	Yes	550.08	550.077	-0.003		
5132	2297851.07	1360039.98	Yes	568.87	567.224	-1.646		
5134	2279272.41	1604969.79	Yes	806.59	806.629	0.039		

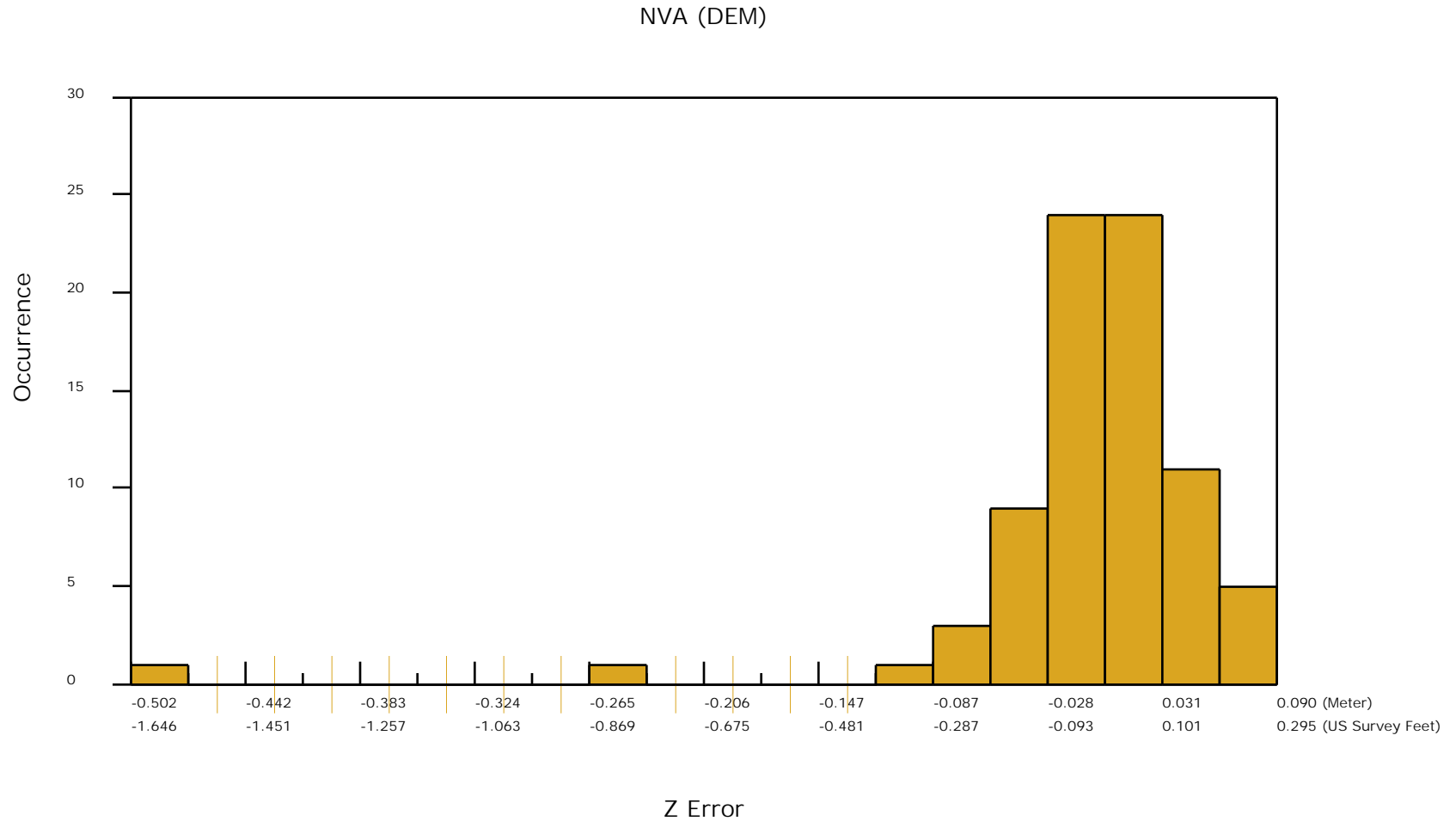
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
5136	2265026.79	1588464.51	Yes	834.79	834.892	0.102		
5137	2289968.63	1391462.18	Yes	686.75	686.625	-0.125		
5141	2230432.84	1479624.62	Yes	650.14	650.295	0.155		
5148	2068374.99	1642265.89	Yes	583.79	583.706	-0.084		
5149	2091349.84	1486512.35	Yes	676.49	676.553	0.063		
5150	2204384.57	1695464.02	Yes	798.13	798.320	0.190		
5155	2298129.2	1554659.71	Yes	601.29	601.346	0.056		
5158	2292310.51	1418018.51	Yes	676.83	676.461	-0.369		
5160	2107872.24	1557758.92	Yes	719.16	719.197	0.037		
5164	2071081.6	1687014.1	Yes	692.34	692.317	-0.023		
5167	2076988.48	1529202.55	Yes	549.41	549.384	-0.026		
5168	2067224.77	1501255.44	Yes	577.06	577.132	0.072		
5169	2232715.21	1617458.61	Yes	785.6	785.723	0.123		
5175	2143103.2	1650658.53	Yes	740.4	740.365	-0.035		

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 - V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls](#)



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
6002	2233278.8	1396225.8	Yes	646.96	647.031	0.071		
6003	2127163.59	1502696.87	Yes	735.51	735.611	0.101		
6007	2244314.57	1295048.3	Yes	670.23	670.292	0.062		
6011	2233228.09	1562033.46	Yes	771.27	771.579	0.309		
6012	2251705.32	1342436.89	Yes	653.86	654.037	0.177		
6015	2099813.73	1650659.88	Yes	685.36	685.490	0.130		
6016	2222851.33	1347622.33	Yes	713.36	713.576	0.216		
6020	2223586.44	1456685.42	Yes	640.07	639.812	-0.258		
6020A	2221644.07	1455054.99	Yes	636.53	636.760	0.230		
6021	2188637.11	1601153.33	Yes	691.61	691.893	0.283		
6022	2297509.28	1621711.07	Yes	761.2	761.136	-0.064		
6025	2136516.33	1581478.64	Yes	616.98	617.461	0.481		
6025A	2131530.94	1593873.2	Yes	584.62	584.579	-0.041		
6027	2135660.39	1655439.11	Yes	720.87	721.146	0.276		
6029	2167726.68	1542903.4	Yes	766.9	767.020	0.120		
6032	2159979.5	1353298.34	Yes	639.73	639.126	-0.604		
6038	2189284.33	1564455.85	Yes	745.49	745.784	0.294		
6039	2045232.51	1462050.44	Yes	547.64	547.737	0.097		
6044	2218928.56	1652373.2	Yes	798.39	798.499	0.109		
6056	2156670.15	1386268.67	Yes	704.97	704.974	0.004		
6058	2175669.16	1675681.52	Yes	784.92	785.095	0.175		
6058A	2182342.19	1651546.16	Yes	792.62	792.716	0.096		
6063	2122109.88	1369351.23	Yes	693.99	694.164	0.174		
6064	2216528.1	1440343.08	Yes	674.21	674.438	0.228		
6065	2264381.22	1546455.71	Yes	773.51	773.593	0.083		
6069	2155856.01	1417499.85	Yes	711.61	711.660	0.050		
6069A	2157296.9	1420228.76	Yes	724.44	724.641	0.201		
6070	2080616.05	1556734.58	Yes	552.37	552.223	-0.147		
6071	2067311.64	1501685.15	Yes	567.61	567.598	-0.012		
6076	2310649.39	1342275.98	Yes	552.23	551.859	-0.371		

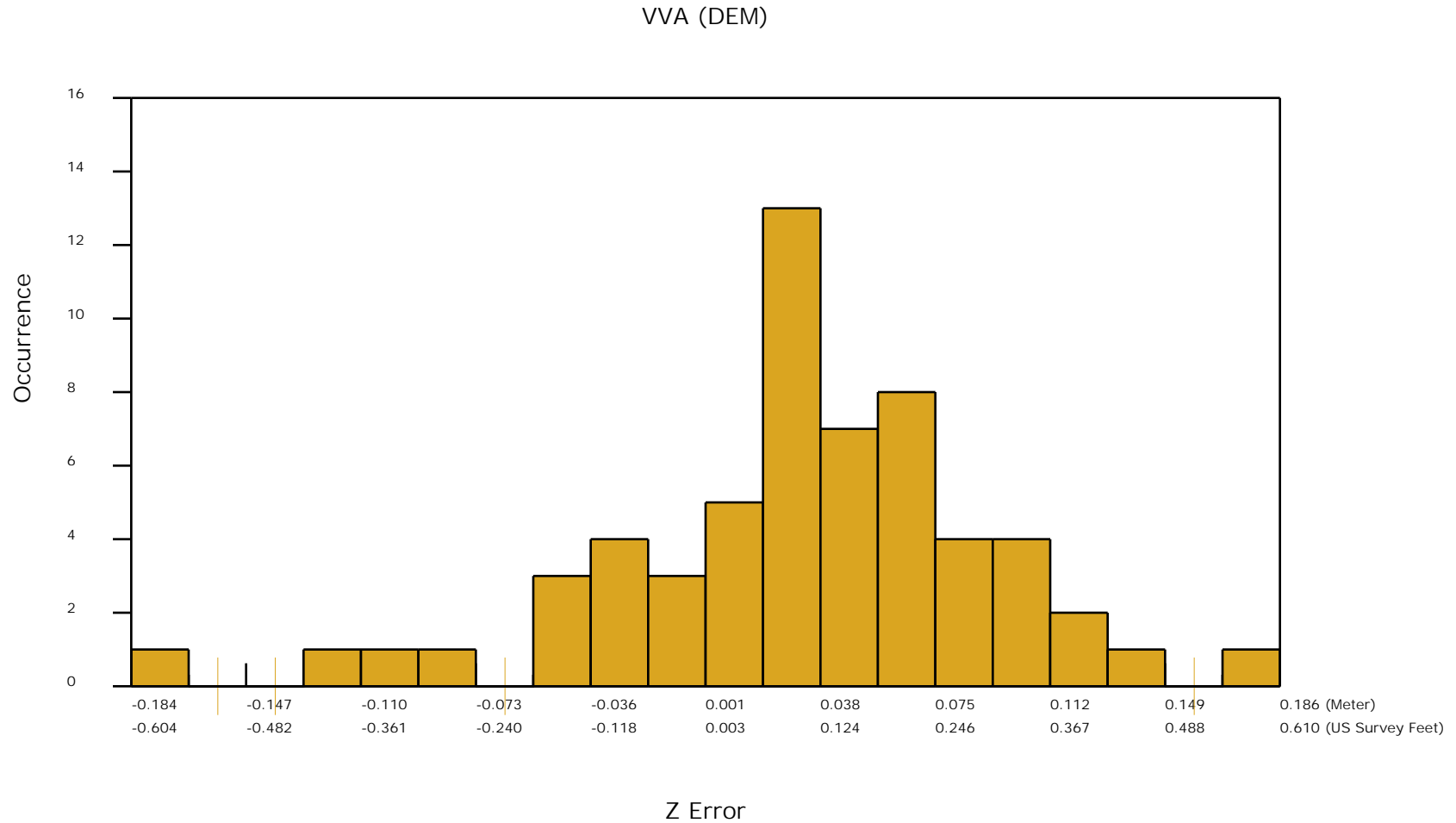
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
6077	2268638.63	1472439.16	Yes	540.56	540.727	0.167		
6081	2233583.07	1574161.44	Yes	776.11	776.268	0.158		
6082	2200095.32	1537323.63	Yes	773.93	774.269	0.339		
6083	2066129.56	1657905.72	Yes	577.26	577.498	0.238		
6084	2131889.06	1340560.6	Yes	636.54	636.797	0.257		
6087	2297112.75	1504265.25	Yes	628.15	628.214	0.064		
6088	2049938.17	1486268.73	Yes	543.4	543.594	0.194		
6088A	2055461	1495697.02	Yes	540.84	540.682	-0.158		
6090	2193801.44	1505538.32	Yes	711.11	711.152	0.042		
6092	2205113.79	1413804.94	Yes	624.64	624.524	-0.116		
6096	2174263.01	1332754.05	Yes	663.73	664.118	0.388		
6096A	2161405.65	1331739.3	Yes	634.86	635.470	0.610		
6100	2101465.33	1415994.78	Yes	718.6	718.261	-0.339		
6101	2300784.51	1361507.95	Yes	588.14	588.010	-0.130		
6102	2076681.01	1528977.27	Yes	549.11	549.203	0.093		
6103	2158898.21	1482767.57	Yes	741.56	741.738	0.178		
6107	2122202.39	1693770.52	Yes	774.59	774.791	0.201		
6108	2114845.94	1467965.27	Yes	756.85	756.916	0.066		
6110	2298499.29	1445773.94	Yes	737.53	737.478	-0.052		
6111	2286833.44	1527579.93	Yes	684.06	684.416	0.356		
6112	2278698.65	1279870.77	Yes	456.51	456.439	-0.071		
6112A	2277794.74	1314105.25	Yes	610.15	610.523	0.373		
6114	2289881.89	1337052.85	Yes	484.5	484.409	-0.091		
6115	2156382.9	1699658.53	Yes	803.1	803.417	0.317		
6116	2089346.19	1615410.13	Yes	572.81	573.004	0.194		
6118	2089319.57	1320959.57	Yes	641.87	641.981	0.111		
6119	2204594.07	1366457.66	Yes	648.65	648.694	0.044		
6124	2201612.17	1694651.97	Yes	788.56	788.635	0.075		
6125	2069422.27	1641109.45	Yes	577.61	577.679	0.069		

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 - V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls](#)

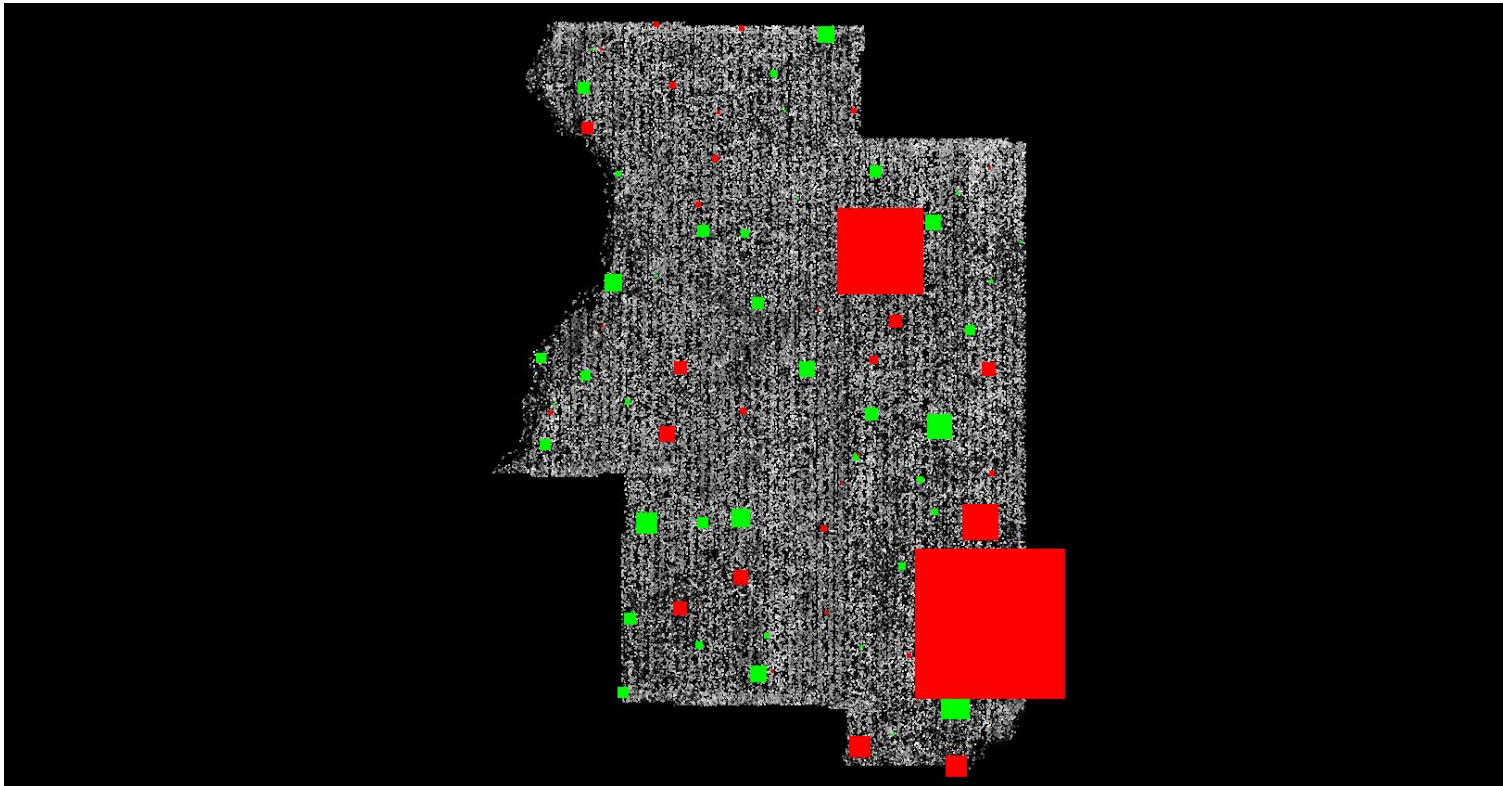


DPH-11 Report on Absolute Vertical Accuracy - continued

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 - V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls](V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls)

[Result Path - D:\00_ISGS\IL_MidNorth_1_D22_229055_OC\DPH_11\ColorByIntensity_CheckPoints_NVA.jpg](D:\00_ISGS\IL_MidNorth_1_D22_229055_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).

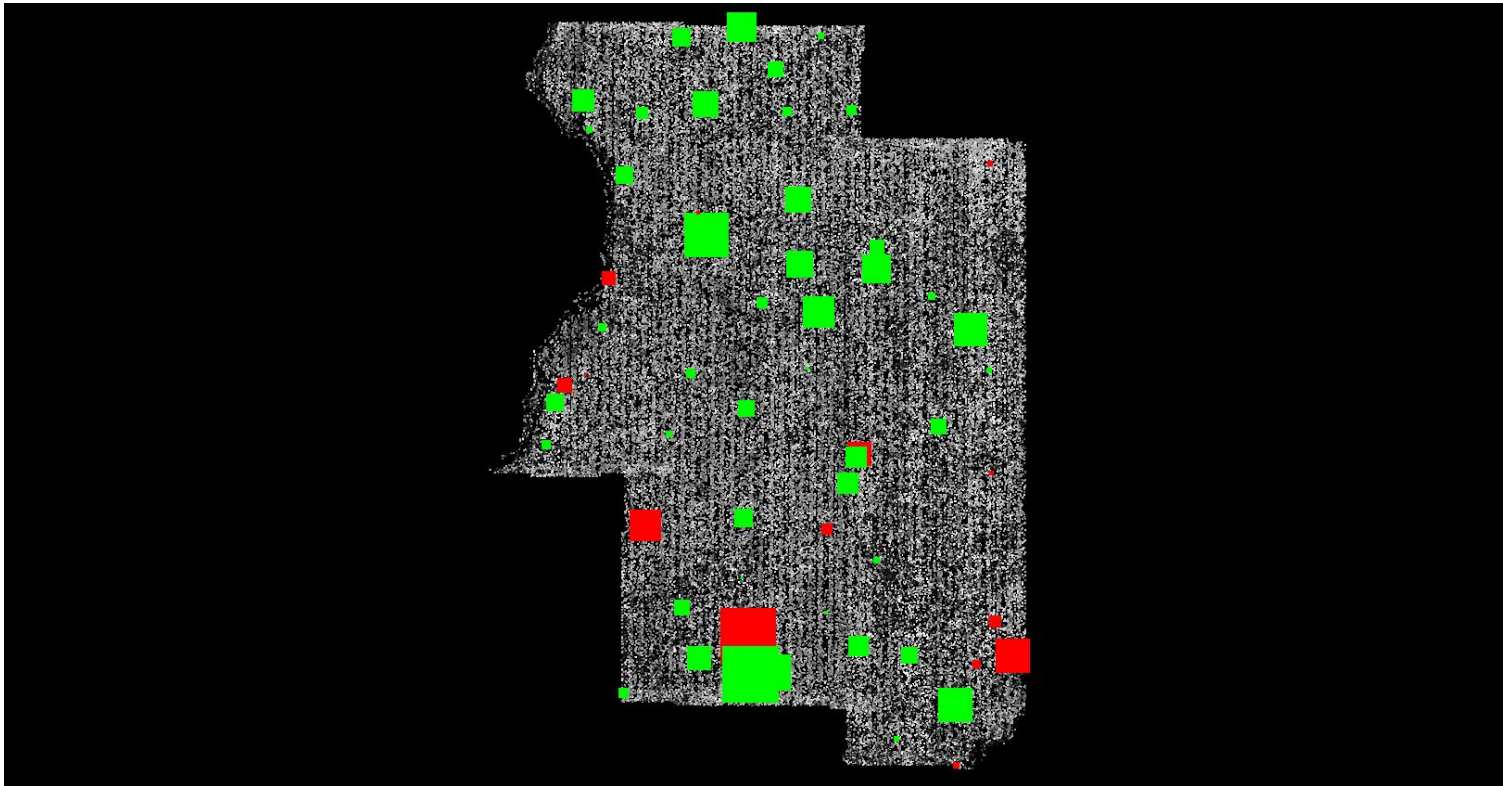
The size of the square symbol represents the absolute value magnitude of error.

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 - V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls](V:\Mapping\Projects\65221205_IL_MidNorth\Production\Final_Client_Deliverables\229058\IL_MidNorth_1_D22_229055\point_cloud\tilecls)

[Result Path - D:\00_ISGS\IL_MidNorth_1_D22_229055_OC\DPH_11\ColorByIntensity_CheckPoints_VVA.jpg](D:\00_ISGS\IL_MidNorth_1_D22_229055_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.