

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.

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[Data Source - Y:\Mapping\Projects\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\vertical_accuracy\checkpoints\NE_Southwest_162NVA_115VVA_utm14.shp](Y:\Mapping\Projects\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\vertical_accuracy\checkpoints\NE_Southwest_162NVA_115VVA_utm14.shp)

Units: Meter (/Feet)

Vertical Accuracy Class tested: 10-cm

Check Points in defined project area (DPA):	277
Check Points with Lidar Coverage	277
Check Points with Lidar Coverage (NVA)	162
Check Points with Lidar Coverage (VVA)	115
Average Z Error (NVA)	0.014/0.045
Maximum Z Error (NVA)	0.229/0.751
Median Z Error (NVA)	0.016/0.052
Minimum Z Error (NVA)	-0.262/-0.861
Standard deviation of Vertical Error (NVA)	0.066/0.215
Skewness of Vertical Error (NVA)	-0.932
Kurtosis of Vertical Error (NVA)	3.938
Non-vegetated Vertical Accuracy (NVA) RMSE(z) ¹	0.067/0.219 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/- ¹	0.131/0.429 PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-	0.131/0.429
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM) ²	0.067/0.220 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level (DEM) +/- ²	0.131/0.431 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (TIN) +/- ¹	0.248/0.813 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (DEM) +/- ²	0.249/0.818 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 = 6.7cm, equating to +/- 13.1cm at the 95% confidence level. Actual VVA accuracy was found to be +/- 24.9cm 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
1002	302735.572	4536940.413	Yes	991.979	992.155	0.176	992.124	992.141	992.184	8749	2782	1,1,1		
1003	344249.867	4468157.659	Yes	875.196	875.22	0.024	875.214	875.23	875.238	20005	-261	1,1,1		
1004	277618.137	4498847.693	Yes	987.76	987.775	0.015	987.764	987.773	987.779	18950	-131	1,1,1		
1005	319807.206	4449449.41	Yes	873.72	873.699	-0.021	873.684	873.706	873.723	18211	1940	1,1,1		
1005A	314989.199	4447320.42	Yes	847.959	848.093	0.134	848.082	848.091	848.12	18550	-2621	1,1,1		
1012	348098.969	4431407.232	Yes	885.236	885.234	-0.002	885.23	885.231	885.25	6928	935	1,1,1		
1014	324411.2	4440744.181	Yes	869.617	869.63	0.013	869.585	869.62	869.64	19123	-1821	1,1,1		
1015	294021.738	4555776.77	Yes	949.386	949.411	0.025	949.405	949.413	949.415	4799	884	1,1,1		
1016	253638.8	4499615.799	Yes	1057.319	1057.319	0.000	1057.313	1057.319	1057.321	23969	-1418	1,1,1		
1017	265294.959	4434835.321	Yes	953.637	953.638	0.001	953.591	953.639	953.641	10469	1870	1,1,1		
1025	282553.49	4573079.099	Yes	1028.624	1028.619	-0.005	1028.604	1028.614	1028.642	6314	-1947	1,1,1		
1025A	282372.973	4566204.07	Yes	946.24	946.215	-0.025	946.213	946.215	946.217	5632	-1466	1,1,1		
1026	310452.133	4521318.498	Yes	987.192	987.187	-0.005	987.141	987.206	987.221	14741	-1799	1,1,1		
1026A	304094.572	4521727.588	Yes	1009.722	1009.673	-0.049	1009.648	1009.688	1009.697	12420	-2626	1,1,1		
1027	297648.692	4464504.217	Yes	989.171	989.259	0.088	989.243	989.272	989.275	17069	1712	1,1,1		
1028	271286.888	4547607.275	Yes	1043.022	1042.894	-0.128	1042.894	1042.894	1042.898	4022	-1287	1,1,1		
1029	350300.358	4456980.403	Yes	804.067	804.093	0.026	804.064	804.079	804.1	21984	-1307	1,1,1		
1029A	348890.507	4460929.743	Yes	818.309	818.311	0.002	818.309	818.31	818.321	20886	-2	1,1,1		
1030	251931.841	4443286.556	Yes	1028.508	1028.552	0.044	1028.546	1028.548	1028.554	24133	-1211	1,1,1		
1031	327628.118	4577246.752	Yes	940.075	940.103	0.028	940.098	940.105	940.107	17481	-170	1,1,1		
1032	339755.865	4482858.095	Yes	902.626	902.67	0.044	902.64	902.654	902.674	21375	854	1,1,1		
1035	301575.875	4562245.454	Yes	932.227	932.301	0.074	932.281	932.298	932.311	6833	-413	1,1,1		
1036	305945.032	4570373.468	Yes	982.87	982.888	0.018	982.871	982.874	982.91	7368	1676	1,1,1		
1036A	301838.843	4572485.668	Yes	1019.701	1019.715	0.014	1019.711	1019.716	1019.732	7472	-3233	1,1,1		
1037	328235.406	4481455.955	Yes	909.947	910.176	0.229	910.162	910.175	910.191	14973	-2670	1,1,1		
1038	292165.163	4503300.405	Yes	983.897	983.919	0.022	983.91	983.923	983.943	23194	1116	1,1,1		
1039	284694.784	4456953.338	Yes	987.327	987.339	0.012	987.312	987.337	987.356	6863	1606	1,1,1		
1041	318410.678	4517102.403	Yes	946.688	946.728	0.040	946.718	946.726	946.737	12976	2801	1,1,1		
1041A	316732.298	4515613.187	Yes	964.494	964.387	-0.107	964.375	964.387	964.436	19728	-2310	1,1,1		
1043	275929.756	4433454.762	Yes	934.574	934.552	-0.022	934.503	934.53	934.575	10700	-884	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
1044	284709.961	4485812.403	Yes	984.563	984.617	0.054	984.615	984.618	984.624	11767	-1149	1,1,1		
1048	332935.332	4521851.065	Yes	970.047	970.033	-0.014	970.006	970.043	970.062	11441	1316	1,1,1		
1051	396732.124	4514292.358	Yes	846.163	846.188	0.025	846.147	846.188	846.2	13874	-3441	1,1,1		
1052	257102.365	4452803.927	Yes	1051.228	1051.199	-0.029	1051.18	1051.196	1051.206	22968	909	1,1,1		
1053	354194.151	4513236.564	Yes	873.506	873.467	-0.039	873.447	873.452	873.479	12051	2518	1,1,1		
1053A	353974.21	4514838.405	Yes	883.202	883.286	0.084	883.269	883.272	883.292	20877	-2674	1,1,1		
1055	271021.474	4490959.079	Yes	1013.895	1013.897	0.002	1013.837	1013.889	1013.921	16266	329	1,1,1		
1057	324312.914	4504087.89	Yes	984.495	984.414	-0.081	984.407	984.413	984.43	11065	1493	1,1,1		
1059	352467.845	4542227.889	Yes	917.804	917.739	-0.065	917.708	917.737	917.74	12867	-63	1,1,1		
1059A	346311.078	4546928.794	Yes	920.085	920.083	-0.002	920.075	920.08	920.101	19474	270	1,1,1		
1060	380334.575	4530593.306	Yes	846.613	846.563	-0.050	846.554	846.587	846.612	14569	500	1,1,1		
1061	274370.412	4570994.165	Yes	1009.277	1009.015	-0.262	1009.011	1009.019	1009.024	6535	960	1,1,1		
1062	318863.99	4534927.024	Yes	971.482	971.505	0.023	971.481	971.514	971.516	13546	32	1,1,1		
1064	331664.991	4539481.061	Yes	956.401	956.474	0.073	956.468	956.479	956.495	18538	-396	1,1,1		
1064A	325019.958	4534827.302	Yes	966.429	966.3	-0.129	966.296	966.301	966.304	20602	138	1,1,1		
1065	293626.412	4435673.562	Yes	973.282	973.253	-0.029	973.243	973.26	973.264	15997	1683	1,1,1		
1068	373933.447	4540153.558	Yes	835.677	835.726	0.049	835.718	835.729	835.752	16568	603	1,1,1		
1069	270320.038	4534596.709	Yes	1044.707	1044.866	0.159	1044.853	1044.861	1044.887	15421	-1603	1,1,1		
1070	303095.114	4491781.981	Yes	983.592	983.577	-0.015	983.549	983.577	983.588	20114	-1848	1,1,1		
1071	309615.401	4446578.343	Yes	853.495	853.51	0.015	853.498	853.51	853.513	17949	1070	1,1,1		
1073	362621.114	4562886.199	Yes	889.822	889.86	0.038	889.851	889.856	889.862	26161	-1586	1,1,1		
1076	394878.736	4565616.142	Yes	918.197	918.232	0.035	918.187	918.246	918.266	21093	-1876	1,1,1		
1077	271785.211	4583439.857	Yes	1073.218	1073.249	0.031	1073.24	1073.251	1073.251	3619	339	1,1,1		
1078	285143.574	4475843.014	Yes	1008.693	1008.737	0.044	1008.728	1008.734	1008.74	9713	1443	1,1,1		
1079	249918.518	4483588.585	Yes	1059.109	1059.1	-0.009	1059.088	1059.114	1059.119	24092	1789	1,1,1		
1080	312794.492	4494790.819	Yes	973.617	973.632	0.015	973.617	973.631	973.651	19712	-2583	1,1,1		
1081	356573.589	4579108.28	Yes	950.408	950.321	-0.087	950.302	950.324	950.327	21601	2499	1,1,1		
1083	302309.073	4555243.451	Yes	933.48	933.505	0.025	933.493	933.505	933.511	2449	2653	1,1,1		
1086	306802.862	4577161.576	Yes	996.734	996.719	-0.015	996.712	996.713	996.721	8050	1824	1,1,1		
1088	247830.308	4533761.092	Yes	1093.311	1093.282	-0.029	1093.279	1093.295	1093.313	15435	1698	1,1,1		
1089	361663.675	4569982.287	Yes	905.55	905.579	0.029	905.571	905.575	905.589	21690	850	1,1,1		
1090	340850.685	4522360.369	Yes	898.34	898.35	0.010	898.31	898.343	898.358	11136	-913	1,1,1		
1091	254354.031	4521014.78	Yes	1072.648	1072.677	0.029	1072.674	1072.68	1072.687	21420	-1308	1,1,1		
1091A	249116.094	4520856.655	Yes	1081.398	1081.409	0.011	1081.332	1081.407	1081.419	18621	-2316	1,1,1		
1192	345259.054	4572952.959	Yes	914.996	915.042	0.046	915.017	915.045	915.066	12151	2489	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
1092	263079.093	4563784.864	Yes	1113.653	1113.742	0.089	1113.714	1113.733	1113.755	5854	-2116	1,1,1		
1093	315456.148	4471069.849	Yes	857.353	857.422	0.069	857.402	857.441	857.446	10055	-2694	1,1,1		
1094	342953.535	4584043.869	Yes	948.712	948.746	0.034	948.74	948.749	948.783	5440	-2435	1,1,1		
1097	328447.611	4458573.093	Yes	892.188	892.255	0.067	892.233	892.251	892.272	12229	-117	1,1,1		
1098	278327.929	4532771.656	Yes	1021.559	1021.641	0.082	1021.633	1021.672	1021.672	18008	727	1,1,1		
1100	385764.898	4555979.501	Yes	861.447	861.492	0.045	861.489	861.534	861.549	23020	-804	1,1,1		
1101	382925.633	4509578.15	Yes	881.1	881.101	0.001	881.088	881.107	881.114	18890	2453	1,1,1		
1104	360134.413	4521171.122	Yes	894.757	894.857	0.100	894.841	894.864	894.867	20835	1917	1,1,1		
1108	277962.666	4512459.436	Yes	1023.301	1023.397	0.096	1023.391	1023.404	1023.455	18543	-53	1,1,1		
1112	351720.51	4551885.435	Yes	854.238	854.245	0.007	854.233	854.252	854.266	14488	813	1,1,1		
1114	365934.738	4529367.897	Yes	947.918	947.968	0.050	947.95	947.962	947.981	26352	-348	1,1,1		
1115	304828.212	4430544.714	Yes	977.211	977.233	0.022	977.218	977.221	977.242	17157	-2596	1,1,1		
1116	318941.252	4549483.13	Yes	965.98	965.973	-0.007	965.969	965.969	965.994	10960	1184	1,1,1		
1116A	336813.454	4558653.883	Yes	877.591	877.553	-0.038	877.533	877.592	877.596	13483	1611	1,1,1		
1117	265622.757	4470262.448	Yes	1034.516	1034.499	-0.017	1034.484	1034.504	1034.507	25933	-423	1,1,1		
1117A	265711.929	4475029.233	Yes	1029.121	1028.882	-0.239	1028.875	1028.884	1028.885	25000	-682	1,1,1		
1119	372468.642	4518619.386	Yes	890.009	889.998	-0.011	889.917	889.985	889.999	23610	-632	1,1,1		
1121	344169.734	4543993.171	Yes	934.379	934.411	0.032	934.397	934.413	934.416	21242	-227	1,1,1		
1122	263429.429	4509120.178	Yes	1047.099	1047.116	0.017	1047.094	1047.106	1047.146	21136	-1236	1,1,1		
1123	263818.551	4524211.07	Yes	1055.104	1055.191	0.087	1055.141	1055.194	1055.217	20238	-1463	1,1,1		
1124	277784.338	4505500.543	Yes	1014.406	1014.432	0.026	1014.401	1014.406	1014.441	14198	-73	1,1,1		
1125	352085.569	4521045.515	Yes	932.651	932.622	-0.029	932.614	932.619	932.625	11887	2789	1,1,1		
1128	312556.171	4485106.425	Yes	933.241	933.292	0.051	933.268	933.299	933.313	20570	-2584	1,1,1		
1130	302686.37	4469256.589	Yes	973.746	973.745	-0.001	973.739	973.744	973.748	17824	-2751	1,1,1		
1130A	299375.449	4469437.079	Yes	952.8	952.923	0.123	952.919	952.922	952.949	18652	-1787	1,1,1		
1131	338464.214	4560224.178	Yes	875.806	875.865	0.059	875.845	875.859	875.87	10871	-1732	1,1,1		
1132	289851.9	4533986.26	Yes	1024.196	1024.191	-0.005	1024.176	1024.195	1024.198	16676	1348	1,1,1		
1135	309790.733	4436835.273	Yes	926.936	926.904	-0.032	926.889	926.892	926.918	19524	2388	1,1,1		
1136	292974.26	4524922.928	Yes	1006.398	1006.361	-0.037	1006.348	1006.394	1006.405	10085	2184	1,1,1		
1137	257337.096	4553096.751	Yes	1002.688	1002.703	0.015	1002.701	1002.705	1002.705	4673	2870	1,1,1		
1144	297359.496	4454946.027	Yes	974.125	974.156	0.031	974.153	974.156	974.157	15678	1747	1,1,1		
1145	335541.871	4459093.426	Yes	809.464	809.496	0.032	809.48	809.486	809.512	12637	2408	1,1,1		
1146	372094.982	4556907.326	Yes	890.673	890.709	0.036	890.677	890.7	890.712	11762	-2178	1,1,1		
1149	283202.521	4583549.681	Yes	1073.969	1074.026	0.057	1074.002	1074.031	1074.041	5286	1902	1,1,1		
1150	266243.989	4459589.413	Yes	1031.235	1031.268	0.033	1031.247	1031.266	1031.29	21944	2629	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
1151	346250.199	4502205.42	Yes	926.692	926.687	-0.005	926.683	926.684	926.694	20978	993	1,1,1		
1152	357669.084	4555163.603	Yes	847.442	847.451	0.009	847.416	847.454	847.468	9765	1587	1,1,1		
1152A	358750.675	4559346.733	Yes	874.923	875.035	0.112	875.02	875.041	875.041	26062	-88	1,1,1		
1153	250250.182	4606498.99	Yes	1130.935	1130.903	-0.032	1130.888	1130.91	1130.91	6183	1554	1,1,1		
1154	283587.998	4552368.085	Yes	989.916	989.96	0.044	989.959	989.96	989.96	6062	2657	1,1,1		
1155	284931.332	4468124.653	Yes	1025.312	1025.104	-0.208	1025.082	1025.117	1025.123	13090	1337	1,1,1		
1156	365717.3	4532981.006	Yes	882.049	882.065	0.016	882.061	882.063	882.089	19606	1122	1,1,1		
1157	394471.303	4552235.719	Yes	866.114	866.117	0.003	866.05	866.126	866.138	18478	1091	1,1,1		
1159	384718.139	4542422.562	Yes	808.955	809.017	0.062	809.014	809.015	809.029	4978	2663	1,1,1		
1160	271520.319	4447644.815	Yes	1010.125	1010.163	0.038	1010.145	1010.166	1010.173	20895	388	1,1,1		
1162	313598.524	4457693.56	Yes	936.575	936.623	0.048	936.613	936.63	936.643	20049	2796	1,1,1		
1164	394993.098	4581537.643	Yes	860.523	860.587	0.064	860.561	860.583	860.59	19753	2340	1,1,1		
1165	345266.918	4442005.26	Yes	822.959	822.963	0.004	822.949	822.951	822.99	18043	721	1,1,1		
1166	292140.786	4484930.163	Yes	1002.192	1002.185	-0.007	1002.177	1002.177	1002.201	8804	2732	1,1,1		
1168	297488.348	4512817.741	Yes	980.075	980.079	0.004	980.072	980.094	980.143	17954	-2452	1,1,1		
1169	246560.426	4453149.52	Yes	1069.542	1069.491	-0.051	1069.483	1069.493	1069.504	25699	-813	1,1,1		
1170	262610.345	4479923.433	Yes	1035.217	1035.143	-0.074	1035.138	1035.138	1035.152	21316	-886	1,1,1		
1171	277092.755	4563461.307	Yes	1035.396	1035.386	-0.010	1035.382	1035.39	1035.392	3634	-2709	1,1,1		
1172	331990.529	4556281.53	Yes	885.472	885.547	0.075	885.518	885.541	885.554	14314	1538	1,1,1		
1176	312417.233	4477882.745	Yes	868.604	868.695	0.091	868.662	868.667	868.722	24759	-2622	1,1,1		
1177	373818.479	4507376.881	Yes	857.336	857.28	-0.056	857.261	857.276	857.29	20988	195	1,1,1		
1178	306474.889	4501259.964	Yes	963.03	963.045	0.015	963.039	963.046	963.048	17297	-1885	1,1,1		
1179	251167.858	4576543.393	Yes	1012.153	1012.198	0.045	1012.185	1012.205	1012.225	5441	-1539	1,1,1		
1180	345266.158	4448699.05	Yes	848.601	848.59	-0.011	848.561	848.577	848.602	12520	1114	1,1,1		
1181	302790.214	4546675.174	Yes	996.357	996.363	0.006	996.334	996.369	996.38	1678	-982	1,1,1		
1182	352299.371	4530963.778	Yes	920.947	920.847	-0.100	920.831	920.836	920.87	14592	1126	1,1,1		
1183	248595.571	4491605.75	Yes	1068.064	1068.07	0.006	1068.044	1068.053	1068.087	20395	-1486	1,1,1		
1186	338288.586	4491367.822	Yes	863.976	863.786	-0.190	863.754	863.782	863.815	21296	-1086	1,1,1		
1187	371021.498	4582460.875	Yes	922.53	922.548	0.018	922.546	922.549	922.55	13639	503	1,1,1		
1188	259691.762	4491282.548	Yes	1038.184	1038.205	0.021	1038.198	1038.199	1038.209	18074	-1348	1,1,1		
1191	247747.3	4433715.192	Yes	1000.794	1000.878	0.084	1000.875	1000.876	1000.889	13684	1691	1,1,1		
1193	322487.818	4564429.479	Yes	895.453	895.339	-0.114	895.319	895.323	895.346	10839	-1125	1,1,1		
1194	356624.808	4507665.182	Yes	909.617	909.57	-0.047	909.559	909.567	909.573	18860	254	1,1,1		
1195	275162.212	4521713.59	Yes	1036.325	1036.394	0.069	1036.383	1036.388	1036.42	17543	-140	1,1,1		
1195A	269401.473	4528337.426	Yes	1042.739	1042.838	0.099	1042.829	1042.833	1042.852	15064	-997	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
1196	351833.041	4563051.478	Yes	871.049	871.05	0.001	871.03	871.061	871.089	21603	-1521	1,1,1		
1197	284260.761	4442489.721	Yes	963.432	963.532	0.100	963.518	963.522	963.55	12376	1496	1,1,1		
1197A	284340.678	4444900.497	Yes	962.396	962.423	0.027	962.417	962.421	962.439	12237	1529	1,1,1		
1200	366400.722	4577264.388	Yes	919.296	919.307	0.011	919.298	919.304	919.336	11669	-2695	1,1,1		
1201	300424.911	4578273.558	Yes	1018.246	1018.25	0.004	1018.247	1018.248	1018.261	7175	-1489	1,1,1		
1202	256445.113	4464092.225	Yes	1053.215	1053.35	0.135	1053.344	1053.354	1053.361	24176	1273	1,1,1		
1204	246052.154	4462997.443	Yes	1079.193	1079.162	-0.031	1079.148	1079.165	1079.183	22820	1731	1,1,1		
1205	282239.425	4561781.003	Yes	1029.179	1029.259	0.080	1029.246	1029.253	1029.268	5743	2856	1,1,1		
1206	329673.481	4468595.652	Yes	883.545	883.599	0.054	883.585	883.596	883.611	8091	1997	1,1,1		
1209	263721.284	4517187.553	Yes	1051.079	1051.088	0.009	1051.082	1051.09	1051.1	21779	-1095	1,1,1		
1212	284481.77	4448961.128	Yes	965.367	965.41	0.043	965.384	965.412	965.412	17853	1641	1,1,1		
1214	298571.222	4478328.472	Yes	928.023	928.095	0.072	928.068	928.108	928.11	12894	1514	1,1,1		
1216	395389.308	4535217.609	Yes	794.807	794.845	0.038	794.818	794.843	794.855	13664	-554	1,1,1		
1217	373567.418	4547959.189	Yes	824.414	824.472	0.058	824.453	824.469	824.487	15092	-640	1,1,1		
1217A	371957.594	4552395.404	Yes	850.899	850.923	0.024	850.91	850.922	850.924	9928	1576	1,1,1		
1218	277069.685	4479309.676	Yes	966.413	966.499	0.086	966.476	966.496	966.537	24589	-128	1,1,1		
1221	380266.41	4522969.421	Yes	892.905	892.885	-0.020	892.864	892.886	892.898	22627	-90	1,1,1		
1223	318212.128	4584073.828	Yes	973.662	973.662	0.000	973.637	973.648	973.667	10712	-1439	1,1,1		
1224	318311.155	4509083.089	Yes	977.127	977.113	-0.014	977.083	977.1	977.12	11370	-1781	1,1,1		
1227	324121.018	4430054.012	Yes	913.8	913.787	-0.013	913.759	913.779	913.79	11152	-1934	1,1,1		
1229	249264.966	4595007.192	Yes	1119.453	1119.474	0.021	1119.468	1119.488	1119.49	6711	-580	1,1,1		
1231	328502.568	4492987.035	Yes	941.342	941.294	-0.048	941.279	941.302	941.309	12590	-2592	1,1,1		
1232	295185.346	4563282.8	Yes	951.908	951.929	0.021	951.925	951.935	951.951	7252	-2054	1,1,1		
1233	378816.871	4570540.303	Yes	898.154	898.212	0.058	898.192	898.218	898.229	22538	-2065	1,1,1		
1234	326498.946	4521908.694	Yes	953.254	953.256	0.002	953.255	953.258	953.258	10962	1610	1,1,1		
1236	332979.464	4452644.166	Yes	845.668	845.692	0.024	845.682	845.697	845.698	11282	389	1,1,1		
1237	339273.081	4429705.237	Yes	902.459	902.451	-0.008	902.438	902.453	902.467	18107	-1091	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
2002	302771.148	4536915.624	Yes	990.134	990.278	0.144	990.247	990.28	990.285	20168	2881	1,1,1		
2003	342821.682	4468183.787	Yes	849.756	849.87	0.114	849.84	849.869	849.885	28532	-337	1,1,1		
2004	277583.722	4498844.316	Yes	987.76	987.831	0.071	987.806	987.864	987.869	20166	-38	1,1,1		
2005	319411.278	4449439.351	Yes	866.277	866.315	0.038	866.211	866.287	866.326	20496	2086	1,1,1		
2005A	314968.214	4447329.372	Yes	848.045	848.328	0.283	848.303	848.327	848.341	17378	-2254	1,1,1		
2012	348082.701	4431386.136	Yes	882.407	882.469	0.062	882.45	882.481	882.49	21052	998	1,1,1		
2014	324424.064	4440215.143	Yes	891.443	891.47	0.027	891.462	891.478	891.489	22421	-1719	1,1,1		
2015	294907.953	4555641.81	Yes	945.791	945.986	0.195	945.931	945.985	945.992	6681	1248	1,1,1		
2016	253648.035	4499558.802	Yes	1055.44	1055.519	0.079	1055.519	1055.52	1055.524	20977	-1363	1,1,1		
2017	265459.926	4435342.165	Yes	949.656	949.708	0.052	949.695	949.707	949.724	26576	2505	1,1,1		
2025	282589.09	4574528.547	Yes	1025.175	1025.27	0.095	1025.241	1025.271	1025.28	6906	2447	1,1,1		
2025A	282235.21	4561802.096	Yes	1029.17	1029.271	0.101	1029.226	1029.259	1029.277	8558	2815	1,1,1		
2026	310631.272	4521407.604	Yes	982.222	982.247	0.025	982.24	982.248	982.254	28793	-1646	1,1,1		
2026A	318439.774	4517094.158	Yes	946.654	946.687	0.033	946.685	946.688	946.702	23551	-1393	1,1,1		
2026AA	297482.313	4512961.722	Yes	980.555	980.658	0.103	980.616	980.693	980.701	17675	-2420	1,1,1		
2027	298281.672	4464496.764	Yes	985.762	985.867	0.105	985.846	985.877	985.903	21644	1334	1,1,1		
2028	271347.061	4547673.282	Yes	1041.695	1041.762	0.067	1041.732	1041.738	1041.776	5310	-1538	2,3,1		
2029	350339.3	4457388.33	Yes	803.414	803.454	0.040	803.449	803.465	803.479	23203	-1191	1,1,1		
2029A	348906.38	4460926.942	Yes	818.166	818.201	0.035	818.173	818.203	818.22	15212	-66	2,2,1		
2030	251968.252	4443295.303	Yes	1028.732	1028.854	0.122	1028.843	1028.845	1028.865	22893	-1088	1,1,1		
2031	327632.553	4577253.679	Yes	939.861	939.918	0.057	939.888	939.925	939.98	20379	-187	1,1,1		
2032	340505.469	4482868.318	Yes	902.165	902.065	-0.100	902.011	902.033	902.084	20473	-1646	1,1,1		
2035	301714.091	4562163.332	Yes	932.847	932.972	0.125	932.937	932.99	932.993	6834	-163	1,1,1		
2036	305952.306	4570373.968	Yes	983.437	983.538	0.101	983.416	983.42	983.578	7422	1687	1,1,1		
2036A	301162.842	4572524.915	Yes	1016.156	1016.362	0.206	1016.336	1016.393	1016.398	6160	-2806	1,1,1		
2037	328248.625	4482266.643	Yes	913.519	913.894	0.375	913.886	913.9	913.909	19091	-2677	1,1,1		
2038	292398.123	4503298.927	Yes	978.658	978.667	0.009	978.641	978.672	978.672	24848	1895	1,1,1		
2039	284711.942	4456988.838	Yes	986.561	986.667	0.106	986.657	986.671	986.672	19918	1659	1,1,1		
2043	275910.811	4433402.106	Yes	934.423	934.453	0.030	934.421	934.461	934.48	17765	-838	1,1,1		
2044	285113.171	4485562.641	Yes	982.785	982.821	0.036	982.818	982.821	982.822	21935	305	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
2048	332978.067	4521825.053	Yes	969.776	969.846	0.070	969.845	969.851	969.87	24128	1424	1,1,1		
2051	396676.026	4514220.932	Yes	843.012	843.13	0.118	843.064	843.109	843.138	16995	-3532	1,1,1		
2052	257084.04	4451977.07	Yes	1044.166	1044.125	-0.041	1044.075	1044.095	1044.125	22443	808	1,1,1		
2053	354103.648	4513225.424	Yes	873.199	873.327	0.128	873.325	873.327	873.378	18333	2435	1,1,1		
2053A	353992.996	4514840.145	Yes	883.661	883.798	0.137	883.79	883.792	883.828	22124	-2575	1,1,1		
2055	269399.638	4491066.276	Yes	1017.129	1017.201	0.072	1017.196	1017.201	1017.206	19146	-497	1,1,1		
2057	324660.104	4503762.312	Yes	969.58	969.538	-0.042	969.53	969.538	969.545	20966	264	1,1,1		
2059	352489.933	4542302.295	Yes	918.584	918.606	0.022	918.595	918.599	918.633	24988	220	1,1,1		
2059A	347033.16	4546546.851	Yes	921.059	921.059	0.000	921.027	921.07	921.08	20734	1562	1,2,2		
2060	380665.51	4530777.102	Yes	849.829	849.892	0.063	849.867	849.938	849.939	21404	-172	1,1,1		
2061	274188.819	4571156.213	Yes	1014.046	1013.683	-0.363	1013.662	1013.687	1013.699	7655	1485	1,1,1		
2062	318847.762	4534948.03	Yes	972.547	972.653	0.106	972.643	972.648	972.737	18525	-47	1,1,1		
2064	331408.208	4539484.04	Yes	959.224	959.298	0.074	959.295	959.296	959.305	22465	-394	1,1,1		
2064A	324509.924	4534830.035	Yes	963.77	963.7	-0.070	963.684	963.687	963.718	22035	107	1,1,1		
2065	293639.676	4435669.984	Yes	973.968	974.075	0.107	974.063	974.098	974.157	19232	1703	1,1,1		
2065A	284531.101	4442466.444	Yes	964.092	964.156	0.064	964.154	964.156	964.262	21176	2385	1,1,1		
2068	373946.801	4540152.744	Yes	835.905	836.053	0.148	836.046	836.052	836.074	27757	610	1,1,1		
2068A	373314.582	4548031.11	Yes	823.641	824.041	0.400	823.995	824.041	824.078	22856	-404	1,1,1		
2069	270319.389	4535008.423	Yes	1044.515	1044.687	0.172	1044.672	1044.683	1044.689	19978	-1671	1,1,1		
2070	303112.64	4491797.161	Yes	982.569	982.573	0.004	982.536	982.57	982.595	29501	-1885	1,1,1		
2071	309642.511	4446630.31	Yes	852.892	852.944	0.052	852.935	852.948	852.955	32693	1131	1,1,1		
2073	363242.328	4562870.289	Yes	880.751	880.828	0.077	880.797	880.826	880.861	23256	-1518	1,2,1		
2076	394861.019	4565353.863	Yes	915.809	915.888	0.079	915.882	915.89	915.89	23324	-1011	1,1,1		
2077	271797.12	4583445.527	Yes	1073.416	1073.49	0.074	1073.487	1073.494	1073.505	7721	358	1,1,1		
2078	284757.116	4477318.552	Yes	982.487	982.409	-0.078	982.386	982.402	982.425	24205	-26	1,1,1		
2079	249265.593	4483626.872	Yes	1058.582	1058.65	0.068	1058.647	1058.648	1058.662	21669	1451	1,1,1		
2080	312930.263	4494799.219	Yes	977.538	977.501	-0.037	977.448	977.469	977.569	21520	-2132	1,1,1		
2081	356556.669	4578785.098	Yes	934	934.132	0.132	934.109	934.113	934.205	13073	2142	1,1,1		
2083	302681.767	4555359.825	Yes	935.897	935.951	0.054	935.949	935.977	935.98	9274	1543	1,1,1		
2086	306793.942	4577174.794	Yes	996.109	996.144	0.035	996.136	996.138	996.156	7615	1777	1,1,1		
2088	247447.988	4533784.057	Yes	1093.033	1093.032	-0.001	1093.017	1093.027	1093.047	16576	422	1,1,1		
2089	361685.437	4569983.199	Yes	905.391	905.359	-0.032	905.351	905.368	905.373	14087	843	2,1,1		
2090	341424.288	4522223.384	Yes	893.712	893.776	0.064	893.764	893.777	893.803	21168	-510	1,1,1		
2091	254006.816	4521648.069	Yes	1072.966	1073.074	0.108	1073.058	1073.074	1073.076	20390	2029	1,1,1		
2091A	249123.808	4520371.922	Yes	1079.485	1079.728	0.243	1079.675	1079.726	1079.728	21866	-2895	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
2092	263336.686	4563683.783	Yes	1114.321	1114.438	0.117	1114.425	1114.436	1114.446	5415	-1801	1,3,3		
2093	316248.952	4470641.826	Yes	859.238	859.33	0.092	859.328	859.328	859.337	26212	278	1,1,1		
2094	342871.629	4583614.744	Yes	952.67	952.95	0.280	952.928	952.938	952.971	22180	-1650	1,1,1		
2097	328381.011	4458203.426	Yes	884.636	884.742	0.106	884.728	884.738	884.767	27394	-331	1,1,1		
2098	278151.519	4532762.409	Yes	1024.054	1024.235	0.181	1024.202	1024.224	1024.257	22546	1315	1,1,1		
2100	386015.664	4555976.346	Yes	862.384	862.419	0.035	862.389	862.425	862.447	24508	-777	1,1,1		
2101	382934.303	4509572.461	Yes	881.208	881.217	0.009	881.211	881.212	881.222	23968	2425	1,1,1		
2104	360152.876	4521421.427	Yes	895.16	895.278	0.118	895.249	895.253	895.292	24161	1085	1,1,1		
2108	278006.524	4512510.672	Yes	1021.364	1021.471	0.107	1021.466	1021.476	1021.483	20460	-201	1,1,1		
2108A	275148.571	4522733.954	Yes	1038.615	1038.784	0.169	1038.782	1038.783	1038.788	23367	-3	1,1,1		
2112	352012.15	4552253.624	Yes	852.583	852.587	0.004	852.586	852.59	852.594	23897	3078	1,1,1		
2114	365199.058	4528984.608	Yes	884.178	884.178	0.000	884.139	884.182	884.199	23667	-1787	1,1,1		
2115	304821.418	4430786.558	Yes	976.586	976.577	-0.009	976.549	976.588	976.598	21288	-2788	1,1,1		
2116	319264.78	4549464.39	Yes	961.617	961.735	0.118	961.701	961.743	961.746	25805	1151	1,1,1		
2116A	336001.072	4558683.506	Yes	878.581	878.66	0.079	878.644	878.661	878.684	22823	1655	1,1,2		
2117	265608.264	4470265.271	Yes	1034.588	1034.675	0.087	1034.675	1034.676	1034.687	22658	-483	1,1,1		
2117A	265685.39	4475061.446	Yes	1028.936	1028.714	-0.222	1028.705	1028.717	1028.726	23172	-790	1,1,1		
2119	372381.357	4518759.095	Yes	883.217	883.23	0.013	883.222	883.225	883.234	27722	-1104	1,1,1		
2121	344402.217	4544004.722	Yes	930.46	930.562	0.102	930.534	930.571	930.579	15342	-280	1,1,1		
2122	263426.156	4509708.591	Yes	1049.27	1049.274	0.004	1049.234	1049.263	1049.291	22742	-1287	1,1,1		
2123	263836.172	4524217.795	Yes	1054.711	1054.759	0.048	1054.735	1054.745	1054.765	23993	-1399	1,1,1		
2124	277787.289	4505711.66	Yes	1014.2	1014.271	0.071	1014.262	1014.272	1014.291	24176	-49	1,1,1		
2125	352078.326	4521192.323	Yes	938.001	938.261	0.260	938.242	938.258	938.267	16218	2558	1,1,1		
2128	313385.14	4485064.98	Yes	931.621	931.653	0.032	931.647	931.654	931.663	26223	135	1,1,1		
2130	302662.856	4469250.252	Yes	973.359	973.424	0.065	973.41	973.446	973.477	26820	-2430	1,1,1		
2130A	299385.482	4469431.831	Yes	952.371	952.555	0.184	952.513	952.558	952.566	22902	-1814	1,1,1		
2131	338897.165	4560188.42	Yes	874.175	874.019	-0.156	874.012	874.016	874.024	27267	-1611	1,1,1		
2132	289300.57	4534021.431	Yes	1021.805	1021.817	0.012	1021.81	1021.814	1021.861	19168	-628	1,1,1		
2135	309793.267	4436131.943	Yes	930.222	930.313	0.091	930.306	930.32	930.328	20914	2478	1,2,1		
2136	293365.056	4524945.892	Yes	1006.995	1007.032	0.037	1007.018	1007.033	1007.037	23062	2234	1,1,1		
2137	257840.615	4553056.006	Yes	1002.298	1002.349	0.051	1002.344	1002.347	1002.351	6793	2798	1,1,1		
2144	296818.169	4454967.232	Yes	947.579	947.739	0.160	947.725	947.74	947.764	19845	-57	1,1,1		
2145	336005.876	4458805.037	Yes	803.893	803.965	0.072	803.952	803.961	803.973	27474	1283	1,1,1		
2146	372088.456	4556704.826	Yes	896.953	897.099	0.146	897.071	897.105	897.114	19951	-2661	1,1,1		
2149	283346.656	4583314.39	Yes	1064.079	1064.185	0.106	1064.179	1064.192	1064.23	6568	1096	1,1,1		

Check Points Vertical Accuracy - continued

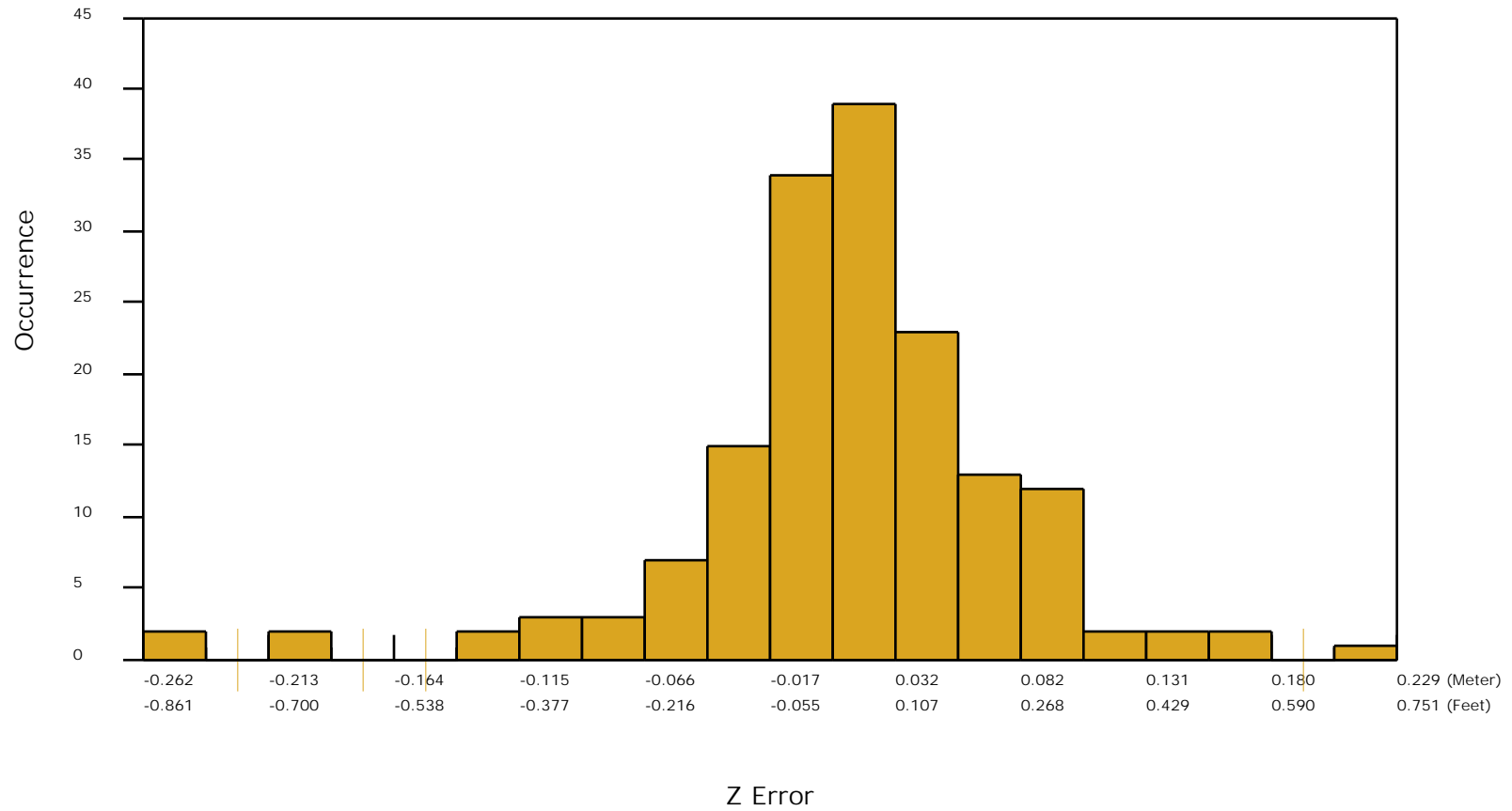
ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description	Comments
2150	266011.582	4459861.706	Yes	1035.192	1035.418	0.226	1035.379	1035.416	1035.455	16296	1956	1,1,1		
2151	347891.546	4502156.735	Yes	935.655	935.558	-0.097	935.541	935.56	935.574	17798	-801	1,1,2		
2152	358424.478	4554947.046	Yes	844.451	844.581	0.130	844.568	844.58	844.59	23730	989	1,1,1		
2152A	358751.4	4559339.08	Yes	875.257	875.444	0.187	875.4	875.447	875.469	20234	-75	1,1,1		
2153	250295.199	4606605.545	Yes	1129.594	1129.645	0.051	1129.633	1129.645	1129.654	8118	1697	1,1,1		
2154	283576.02	4552512.783	Yes	986.436	986.492	0.056	986.476	986.48	986.586	6563	2884	2,2,1		
2155	284915.559	4467814.5	Yes	1025.077	1025.19	0.113	1025.175	1025.183	1025.205	27998	1299	1,1,1		
2156	365738.845	4533039.361	Yes	881.123	881.164	0.041	881.155	881.181	881.184	25097	1308	1,1,1		
2157	395135.116	4552154.929	Yes	904.743	904.876	0.133	904.825	904.902	905.053	19598	1296	1,1,1		
2159	384976.043	4542447.569	Yes	809.16	809.14	-0.020	809.135	809.144	809.169	25041	2391	1,1,1		
2160	272324.45	4447537.206	Yes	1006.678	1006.674	-0.004	1006.672	1006.677	1006.703	21433	2893	1,1,1		
2162	314405.692	4457636.582	Yes	933.536	933.615	0.079	933.599	933.61	933.633	27176	-356	1,1,1		
2164	394815.525	4579968.629	Yes	870.819	870.979	0.160	870.945	870.974	871	22654	-2674	1,1,1		
2165	345271.942	4442019.142	Yes	822.737	822.752	0.015	822.744	822.746	822.765	23822	706	1,1,1		
2166	291803.141	4485307.243	Yes	1003.122	1003.206	0.084	1003.204	1003.21	1003.238	25213	1607	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.

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NVA (lidar data)

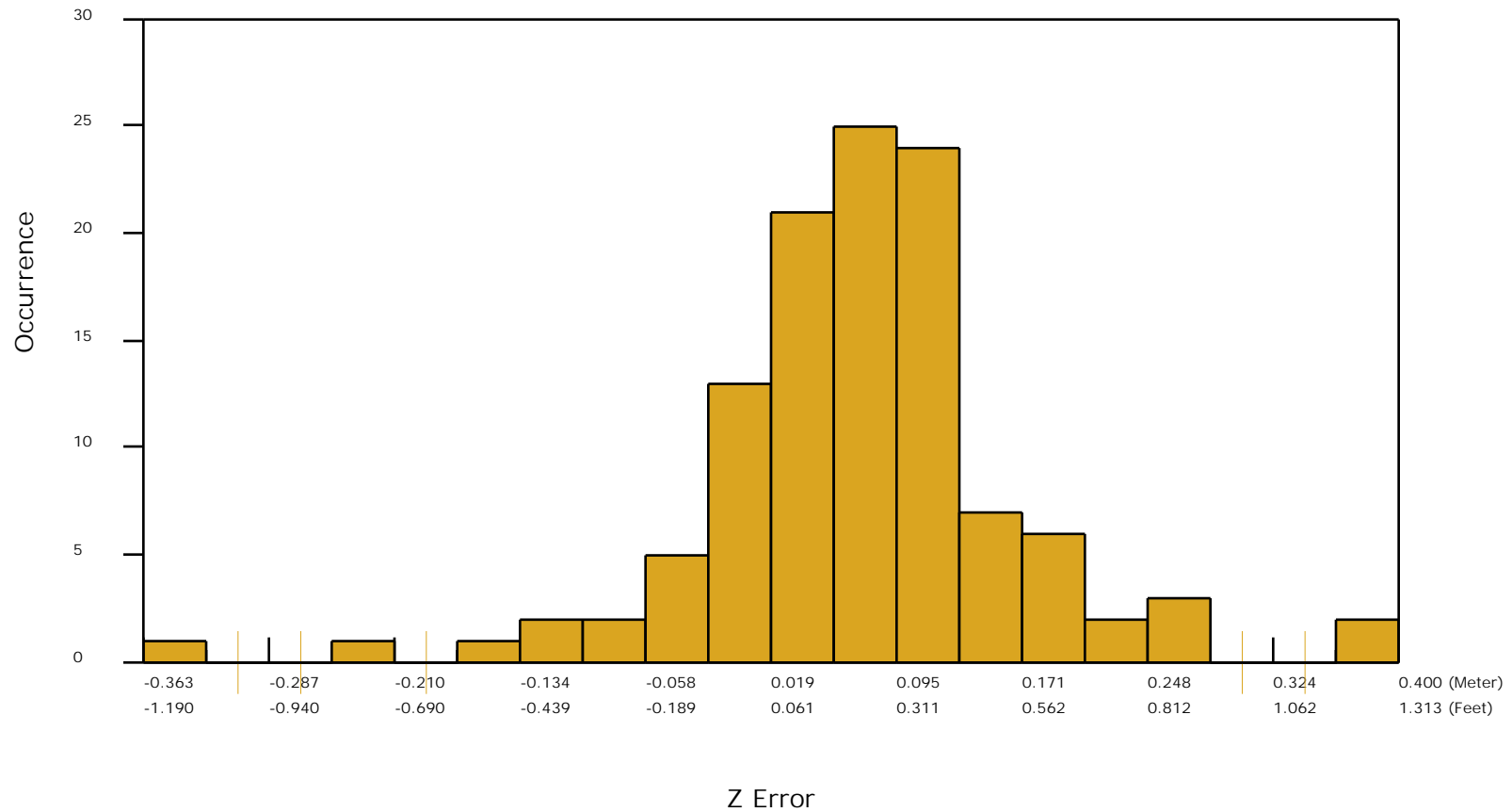


DPH-11 Report on Absolute Vertical Accuracy - continued

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.

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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
1002	302735.572	4536940.413	Yes	991.979	992.154	0.175		
1003	344249.867	4468157.659	Yes	875.196	875.222	0.026		
1004	277618.137	4498847.693	Yes	987.76	987.766	0.006		
1005	319807.206	4449449.41	Yes	873.72	873.716	-0.004		
1005A	314989.199	4447320.42	Yes	847.959	848.091	0.132		
1012	348098.969	4431407.232	Yes	885.236	885.231	-0.005		
1014	324411.2	4440744.181	Yes	869.617	869.626	0.009		
1015	294021.738	4555776.77	Yes	949.386	949.416	0.030		
1016	253638.8	4499615.799	Yes	1057.319	1057.321	0.002		
1017	265294.959	4434835.321	Yes	953.637	953.621	-0.016		
1025	282553.49	4573079.099	Yes	1028.624	1028.623	-0.001		
1025A	282372.973	4566204.07	Yes	946.24	946.219	-0.021		
1026	310452.133	4521318.498	Yes	987.192	987.174	-0.018		
1026A	304094.572	4521727.588	Yes	1009.722	1009.676	-0.046		
1027	297648.692	4464504.217	Yes	989.171	989.250	0.079		
1028	271286.888	4547607.275	Yes	1043.022	1042.893	-0.129		
1029	350300.358	4456980.403	Yes	804.067	804.092	0.025		
1029A	348890.507	4460929.743	Yes	818.309	818.310	0.001		
1030	251931.841	4443286.556	Yes	1028.508	1028.552	0.044		
1031	327628.118	4577246.752	Yes	940.075	940.103	0.028		
1032	339755.865	4482858.095	Yes	902.626	902.666	0.040		
1035	301575.875	4562245.454	Yes	932.227	932.311	0.084		
1036	305945.032	4570373.468	Yes	982.87	982.877	0.007		
1036A	301838.843	4572485.668	Yes	1019.701	1019.731	0.030		
1037	328235.406	4481455.955	Yes	909.947	910.166	0.219		
1038	292165.163	4503300.405	Yes	983.897	983.913	0.016		
1039	284694.784	4456953.338	Yes	987.327	987.322	-0.005		
1041	318410.678	4517102.403	Yes	946.688	946.729	0.041		
1041A	316732.298	4515613.187	Yes	964.494	964.387	-0.107		
1043	275929.756	4433454.762	Yes	934.574	934.574	0.000		

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
1044	284709.961	4485812.403	Yes	984.563	984.599	0.036		
1048	332935.332	4521851.065	Yes	970.047	970.000	-0.047		
1051	396732.124	4514292.358	Yes	846.163	846.208	0.045		
1052	257102.365	4452803.927	Yes	1051.228	1051.186	-0.042		
1053	354194.151	4513236.564	Yes	873.506	873.479	-0.027		
1053A	353974.21	4514838.405	Yes	883.202	883.287	0.085		
1055	271021.474	4490959.079	Yes	1013.895	1013.852	-0.043		
1057	324312.914	4504087.89	Yes	984.495	984.447	-0.048		
1059	352467.845	4542227.889	Yes	917.804	917.768	-0.036		
1059A	346311.078	4546928.794	Yes	920.085	920.095	0.010		
1060	380334.575	4530593.306	Yes	846.613	846.550	-0.063		
1061	274370.412	4570994.165	Yes	1009.277	1009.020	-0.257		
1062	318863.99	4534927.024	Yes	971.482	971.523	0.041		
1064	331664.991	4539481.061	Yes	956.401	956.459	0.058		
1064A	325019.958	4534827.302	Yes	966.429	966.303	-0.126		
1065	293626.412	4435673.562	Yes	973.282	973.249	-0.033		
1068	373933.447	4540153.558	Yes	835.677	835.729	0.052		
1069	270320.038	4534596.709	Yes	1044.707	1044.883	0.176		
1070	303095.114	4491781.981	Yes	983.592	983.565	-0.027		
1071	309615.401	4446578.343	Yes	853.495	853.503	0.008		
1073	362621.114	4562886.199	Yes	889.822	889.848	0.026		
1076	394878.736	4565616.142	Yes	918.197	918.230	0.033		
1077	271785.211	4583439.857	Yes	1073.218	1073.255	0.037		
1078	285143.574	4475843.014	Yes	1008.693	1008.723	0.030		
1079	249918.518	4483588.585	Yes	1059.109	1059.101	-0.008		
1080	312794.492	4494790.819	Yes	973.617	973.617	0.000		
1081	356573.589	4579108.28	Yes	950.408	950.316	-0.092		
1083	302309.073	4555243.451	Yes	933.48	933.511	0.031		
1086	306802.862	4577161.576	Yes	996.734	996.718	-0.016		
1088	247830.308	4533761.092	Yes	1093.311	1093.303	-0.008		
1089	361663.675	4569982.287	Yes	905.55	905.572	0.022		
1090	340850.685	4522360.369	Yes	898.34	898.348	0.008		
1091	254354.031	4521014.78	Yes	1072.648	1072.686	0.038		
1091A	249116.094	4520856.655	Yes	1081.398	1081.426	0.028		
1192	345259.054	4572952.959	Yes	914.996	915.018	0.022		

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
1092	263079.093	4563784.864	Yes	1113.653	1113.730	0.077		
1093	315456.148	4471069.849	Yes	857.353	857.426	0.073		
1094	342953.535	4584043.869	Yes	948.712	948.766	0.054		
1097	328447.611	4458573.093	Yes	892.188	892.277	0.089		
1098	278327.929	4532771.656	Yes	1021.559	1021.657	0.098		
1100	385764.898	4555979.501	Yes	861.447	861.506	0.059		
1101	382925.633	4509578.15	Yes	881.1	881.108	0.008		
1104	360134.413	4521171.122	Yes	894.757	894.864	0.107		
1108	277962.666	4512459.436	Yes	1023.301	1023.407	0.106		
1112	351720.51	4551885.435	Yes	854.238	854.248	0.010		
1114	365934.738	4529367.897	Yes	947.918	947.977	0.059		
1115	304828.212	4430544.714	Yes	977.211	977.239	0.028		
1116	318941.252	4549483.13	Yes	965.98	965.968	-0.012		
1116A	336813.454	4558653.883	Yes	877.591	877.593	0.002		
1117	265622.757	4470262.448	Yes	1034.516	1034.501	-0.015		
1117A	265711.929	4475029.233	Yes	1029.121	1028.878	-0.243		
1119	372468.642	4518619.386	Yes	890.009	889.984	-0.025		
1121	344169.734	4543993.171	Yes	934.379	934.416	0.037		
1122	263429.429	4509120.178	Yes	1047.099	1047.084	-0.015		
1123	263818.551	4524211.07	Yes	1055.104	1055.143	0.039		
1124	277784.338	4505500.543	Yes	1014.406	1014.440	0.034		
1125	352085.569	4521045.515	Yes	932.651	932.616	-0.035		
1128	312556.171	4485106.425	Yes	933.241	933.277	0.036		
1130	302686.37	4469256.589	Yes	973.746	973.743	-0.003		
1130A	299375.449	4469437.079	Yes	952.8	952.915	0.115		
1131	338464.214	4560224.178	Yes	875.806	875.849	0.043		
1132	289851.9	4533986.26	Yes	1024.196	1024.189	-0.007		
1135	309790.733	4436835.273	Yes	926.936	926.897	-0.039		
1136	292974.26	4524922.928	Yes	1006.398	1006.352	-0.046		
1137	257337.096	4553096.751	Yes	1002.688	1002.702	0.014		
1144	297359.496	4454946.027	Yes	974.125	974.164	0.039		
1145	335541.871	4459093.426	Yes	809.464	809.511	0.047		
1146	372094.982	4556907.326	Yes	890.673	890.692	0.019		
1149	283202.521	4583549.681	Yes	1073.969	1074.024	0.055		
1150	266243.989	4459589.413	Yes	1031.235	1031.262	0.027		

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
1151	346250.199	4502205.42	Yes	926.692	926.693	0.001		
1152	357669.084	4555163.603	Yes	847.442	847.447	0.005		
1152A	358750.675	4559346.733	Yes	874.923	875.040	0.117		
1153	250250.182	4606498.99	Yes	1130.935	1130.890	-0.045		
1154	283587.998	4552368.085	Yes	989.916	989.953	0.037		
1155	284931.332	4468124.653	Yes	1025.312	1025.100	-0.212		
1156	365717.3	4532981.006	Yes	882.049	882.031	-0.018		
1157	394471.303	4552235.719	Yes	866.114	866.131	0.017		
1159	384718.139	4542422.562	Yes	808.955	809.036	0.081		
1160	271520.319	4447644.815	Yes	1010.125	1010.178	0.053		
1162	313598.524	4457693.56	Yes	936.575	936.626	0.051		
1164	394993.098	4581537.643	Yes	860.523	860.595	0.072		
1165	345266.918	4442005.26	Yes	822.959	822.943	-0.016		
1166	292140.786	4484930.163	Yes	1002.192	1002.196	0.004		
1168	297488.348	4512817.741	Yes	980.075	980.087	0.012		
1169	246560.426	4453149.52	Yes	1069.542	1069.492	-0.050		
1170	262610.345	4479923.433	Yes	1035.217	1035.144	-0.073		
1171	277092.755	4563461.307	Yes	1035.396	1035.390	-0.006		
1172	331990.529	4556281.53	Yes	885.472	885.546	0.074		
1176	312417.233	4477882.745	Yes	868.604	868.681	0.077		
1177	373818.479	4507376.881	Yes	857.336	857.288	-0.048		
1178	306474.889	4501259.964	Yes	963.03	963.022	-0.008		
1179	251167.858	4576543.393	Yes	1012.153	1012.212	0.059		
1180	345266.158	4448699.05	Yes	848.601	848.557	-0.044		
1181	302790.214	4546675.174	Yes	996.357	996.367	0.010		
1182	352299.371	4530963.778	Yes	920.947	920.855	-0.092		
1183	248595.571	4491605.75	Yes	1068.064	1068.067	0.003		
1186	338288.586	4491367.822	Yes	863.976	863.813	-0.163		
1187	371021.498	4582460.875	Yes	922.53	922.547	0.017		
1188	259691.762	4491282.548	Yes	1038.184	1038.201	0.017		
1191	247747.3	4433715.192	Yes	1000.794	1000.880	0.086		
1193	322487.818	4564429.479	Yes	895.453	895.339	-0.114		
1194	356624.808	4507665.182	Yes	909.617	909.568	-0.049		
1195	275162.212	4521713.59	Yes	1036.325	1036.412	0.087		
1195A	269401.473	4528337.426	Yes	1042.739	1042.835	0.096		

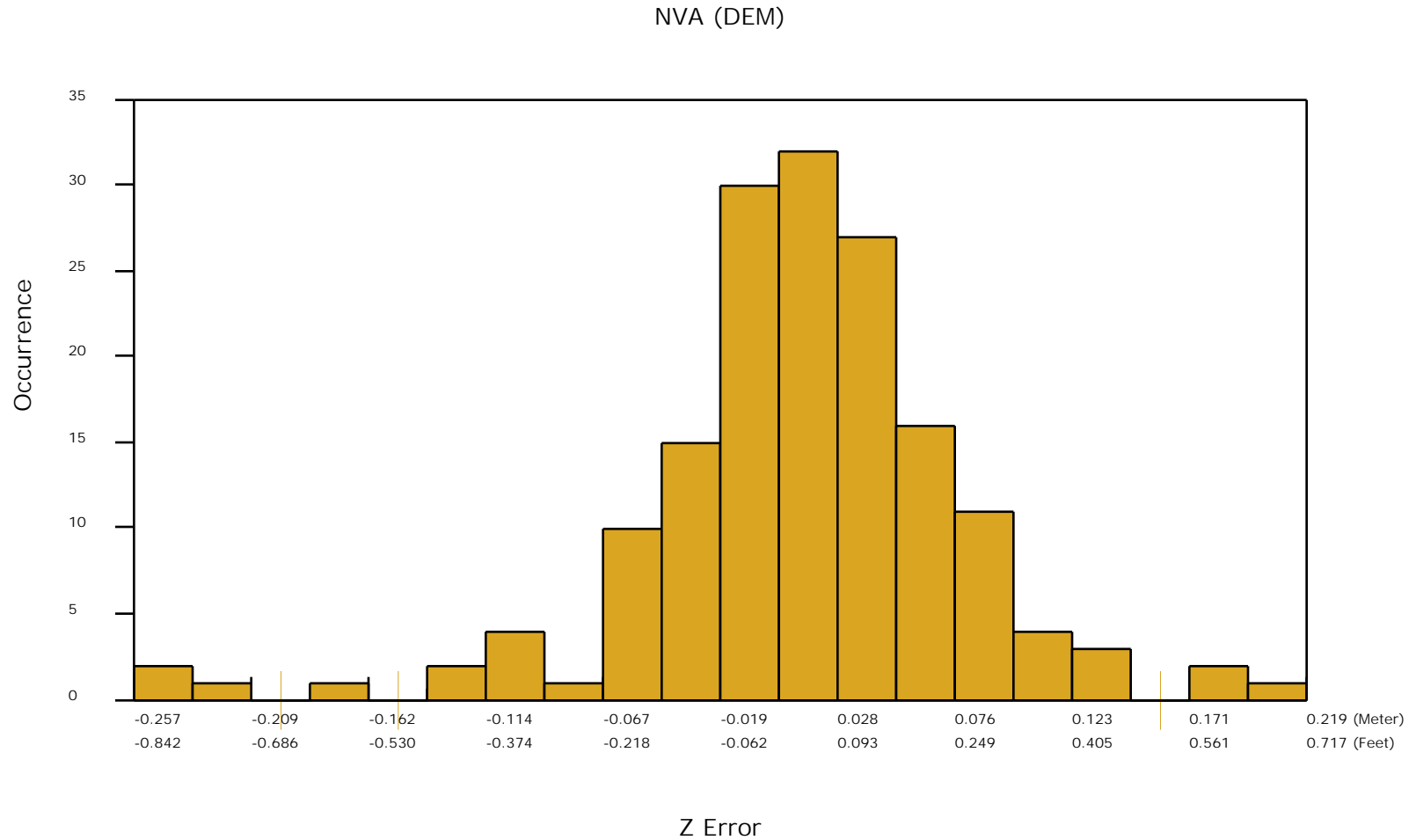
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
1196	351833.041	4563051.478	Yes	871.049	871.070	0.021		
1197	284260.761	4442489.721	Yes	963.432	963.556	0.124		
1197A	284340.678	4444900.497	Yes	962.396	962.423	0.027		
1200	366400.722	4577264.388	Yes	919.296	919.316	0.020		
1201	300424.911	4578273.558	Yes	1018.246	1018.244	-0.002		
1202	256445.113	4464092.225	Yes	1053.215	1053.360	0.145		
1204	246052.154	4462997.443	Yes	1079.193	1079.152	-0.041		
1205	282239.425	4561781.003	Yes	1029.179	1029.250	0.071		
1206	329673.481	4468595.652	Yes	883.545	883.599	0.054		
1209	263721.284	4517187.553	Yes	1051.079	1051.086	0.007		
1212	284481.77	4448961.128	Yes	965.367	965.411	0.044		
1214	298571.222	4478328.472	Yes	928.023	928.094	0.071		
1216	395389.308	4535217.609	Yes	794.807	794.845	0.038		
1217	373567.418	4547959.189	Yes	824.414	824.469	0.055		
1217A	371957.594	4552395.404	Yes	850.899	850.923	0.024		
1218	277069.685	4479309.676	Yes	966.413	966.485	0.072		
1221	380266.41	4522969.421	Yes	892.905	892.879	-0.026		
1223	318212.128	4584073.828	Yes	973.662	973.644	-0.018		
1224	318311.155	4509083.089	Yes	977.127	977.099	-0.028		
1227	324121.018	4430054.012	Yes	913.8	913.789	-0.011		
1229	249264.966	4595007.192	Yes	1119.453	1119.488	0.035		
1231	328502.568	4492987.035	Yes	941.342	941.300	-0.042		
1232	295185.346	4563282.8	Yes	951.908	951.919	0.011		
1233	378816.871	4570540.303	Yes	898.154	898.206	0.052		
1234	326498.946	4521908.694	Yes	953.254	953.258	0.004		
1236	332979.464	4452644.166	Yes	845.668	845.699	0.031		
1237	339273.081	4429705.237	Yes	902.459	902.436	-0.023		

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\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\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
2002	302771.148	4536915.624	Yes	990.134	990.270	0.136		
2003	342821.682	4468183.787	Yes	849.756	849.865	0.109		
2004	277583.722	4498844.316	Yes	987.76	987.858	0.098		
2005	319411.278	4449439.351	Yes	866.277	866.305	0.028		
2005A	314968.214	4447329.372	Yes	848.045	848.332	0.287		
2012	348082.701	4431386.136	Yes	882.407	882.482	0.075		
2014	324424.064	4440215.143	Yes	891.443	891.433	-0.010		
2015	294907.953	4555641.81	Yes	945.791	945.984	0.193		
2016	253648.035	4499558.802	Yes	1055.44	1055.527	0.087		
2017	265459.926	4435342.165	Yes	949.656	949.682	0.026		
2025	282589.09	4574528.547	Yes	1025.175	1025.251	0.076		
2025A	282235.21	4561802.096	Yes	1029.17	1029.238	0.068		
2026	310631.272	4521407.604	Yes	982.222	982.246	0.024		
2026A	318439.774	4517094.158	Yes	946.654	946.664	0.010		
2026AA	297482.313	4512961.722	Yes	980.555	980.651	0.096		
2027	298281.672	4464496.764	Yes	985.762	985.863	0.101		
2028	271347.061	4547673.282	Yes	1041.695	1041.733	0.038		
2029	350339.3	4457388.33	Yes	803.414	803.461	0.047		
2029A	348906.38	4460926.942	Yes	818.166	818.192	0.026		
2030	251968.252	4443295.303	Yes	1028.732	1028.851	0.119		
2031	327632.553	4577253.679	Yes	939.861	939.933	0.072		
2032	340505.469	4482868.318	Yes	902.165	902.051	-0.114		
2035	301714.091	4562163.332	Yes	932.847	932.937	0.090		
2036	305952.306	4570373.968	Yes	983.437	983.511	0.074		
2036A	301162.842	4572524.915	Yes	1016.156	1016.325	0.169		
2037	328248.625	4482266.643	Yes	913.519	913.900	0.381		
2038	292398.123	4503298.927	Yes	978.658	978.644	-0.014		
2039	284711.942	4456988.838	Yes	986.561	986.665	0.104		
2043	275910.811	4433402.106	Yes	934.423	934.456	0.033		
2044	285113.171	4485562.641	Yes	982.785	982.815	0.030		

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
2048	332978.067	4521825.053	Yes	969.776	969.897	0.121		
2051	396676.026	4514220.932	Yes	843.012	843.126	0.114		
2052	257084.04	4451977.07	Yes	1044.166	1044.083	-0.083		
2053	354103.648	4513225.424	Yes	873.199	873.354	0.155		
2053A	353992.996	4514840.145	Yes	883.661	883.732	0.071		
2055	269399.638	4491066.276	Yes	1017.129	1017.197	0.068		
2057	324660.104	4503762.312	Yes	969.58	969.538	-0.042		
2059	352489.933	4542302.295	Yes	918.584	918.602	0.018		
2059A	347033.16	4546546.851	Yes	921.059	921.062	0.003		
2060	380665.51	4530777.102	Yes	849.829	849.939	0.110		
2061	274188.819	4571156.213	Yes	1014.046	1013.704	-0.342		
2062	318847.762	4534948.03	Yes	972.547	972.707	0.160		
2064	331408.208	4539484.04	Yes	959.224	959.308	0.084		
2064A	324509.924	4534830.035	Yes	963.77	963.624	-0.146		
2065	293639.676	4435669.984	Yes	973.968	974.080	0.112		
2065A	284531.101	4442466.444	Yes	964.092	964.166	0.074		
2068	373946.801	4540152.744	Yes	835.905	836.056	0.151		
2068A	373314.582	4548031.11	Yes	823.641	824.010	0.369		
2069	270319.389	4535008.423	Yes	1044.515	1044.688	0.173		
2070	303112.64	4491797.161	Yes	982.569	982.593	0.024		
2071	309642.511	4446630.31	Yes	852.892	852.945	0.053		
2073	363242.328	4562870.289	Yes	880.751	880.837	0.086		
2076	394861.019	4565353.863	Yes	915.809	915.897	0.088		
2077	271797.12	4583445.527	Yes	1073.416	1073.499	0.083		
2078	284757.116	4477318.552	Yes	982.487	982.431	-0.056		
2079	249265.593	4483626.872	Yes	1058.582	1058.654	0.072		
2080	312930.263	4494799.219	Yes	977.538	977.525	-0.013		
2081	356556.669	4578785.098	Yes	934	934.114	0.114		
2083	302681.767	4555359.825	Yes	935.897	935.952	0.055		
2086	306793.942	4577174.794	Yes	996.109	996.152	0.043		
2088	247447.988	4533784.057	Yes	1093.033	1093.068	0.035		
2089	361685.437	4569983.199	Yes	905.391	905.361	-0.030		
2090	341424.288	4522223.384	Yes	893.712	893.772	0.060		
2091	254006.816	4521648.069	Yes	1072.966	1073.063	0.097		
2091A	249123.808	4520371.922	Yes	1079.485	1079.726	0.241		

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
2092	263336.686	4563683.783	Yes	1114.321	1114.429	0.108		
2093	316248.952	4470641.826	Yes	859.238	859.321	0.083		
2094	342871.629	4583614.744	Yes	952.67	952.967	0.297		
2097	328381.011	4458203.426	Yes	884.636	884.738	0.102		
2098	278151.519	4532762.409	Yes	1024.054	1024.228	0.174		
2100	386015.664	4555976.346	Yes	862.384	862.431	0.047		
2101	382934.303	4509572.461	Yes	881.208	881.280	0.072		
2104	360152.876	4521421.427	Yes	895.16	895.272	0.112		
2108	278006.524	4512510.672	Yes	1021.364	1021.473	0.109		
2108A	275148.571	4522733.954	Yes	1038.615	1038.786	0.171		
2112	352012.15	4552253.624	Yes	852.583	852.589	0.006		
2114	365199.058	4528984.608	Yes	884.178	884.148	-0.030		
2115	304821.418	4430786.558	Yes	976.586	976.564	-0.022		
2116	319264.78	4549464.39	Yes	961.617	961.738	0.121		
2116A	336001.072	4558683.506	Yes	878.581	878.665	0.084		
2117	265608.264	4470265.271	Yes	1034.588	1034.679	0.091		
2117A	265685.39	4475061.446	Yes	1028.936	1028.714	-0.222		
2119	372381.357	4518759.095	Yes	883.217	883.220	0.003		
2121	344402.217	4544004.722	Yes	930.46	930.587	0.127		
2122	263426.156	4509708.591	Yes	1049.27	1049.283	0.013		
2123	263836.172	4524217.795	Yes	1054.711	1054.781	0.070		
2124	277787.289	4505711.66	Yes	1014.2	1014.274	0.074		
2125	352078.326	4521192.323	Yes	938.001	938.270	0.269		
2128	313385.14	4485064.98	Yes	931.621	931.650	0.029		
2130	302662.856	4469250.252	Yes	973.359	973.450	0.091		
2130A	299385.482	4469431.831	Yes	952.371	952.558	0.187		
2131	338897.165	4560188.42	Yes	874.175	874.019	-0.156		
2132	289300.57	4534021.431	Yes	1021.805	1021.813	0.008		
2135	309793.267	4436131.943	Yes	930.222	930.323	0.101		
2136	293365.056	4524945.892	Yes	1006.995	1007.033	0.038		
2137	257840.615	4553056.006	Yes	1002.298	1002.356	0.058		
2144	296818.169	4454967.232	Yes	947.579	947.768	0.189		
2145	336005.876	4458805.037	Yes	803.893	804.012	0.119		
2146	372088.456	4556704.826	Yes	896.953	897.086	0.133		
2149	283346.656	4583314.39	Yes	1064.079	1064.198	0.119		

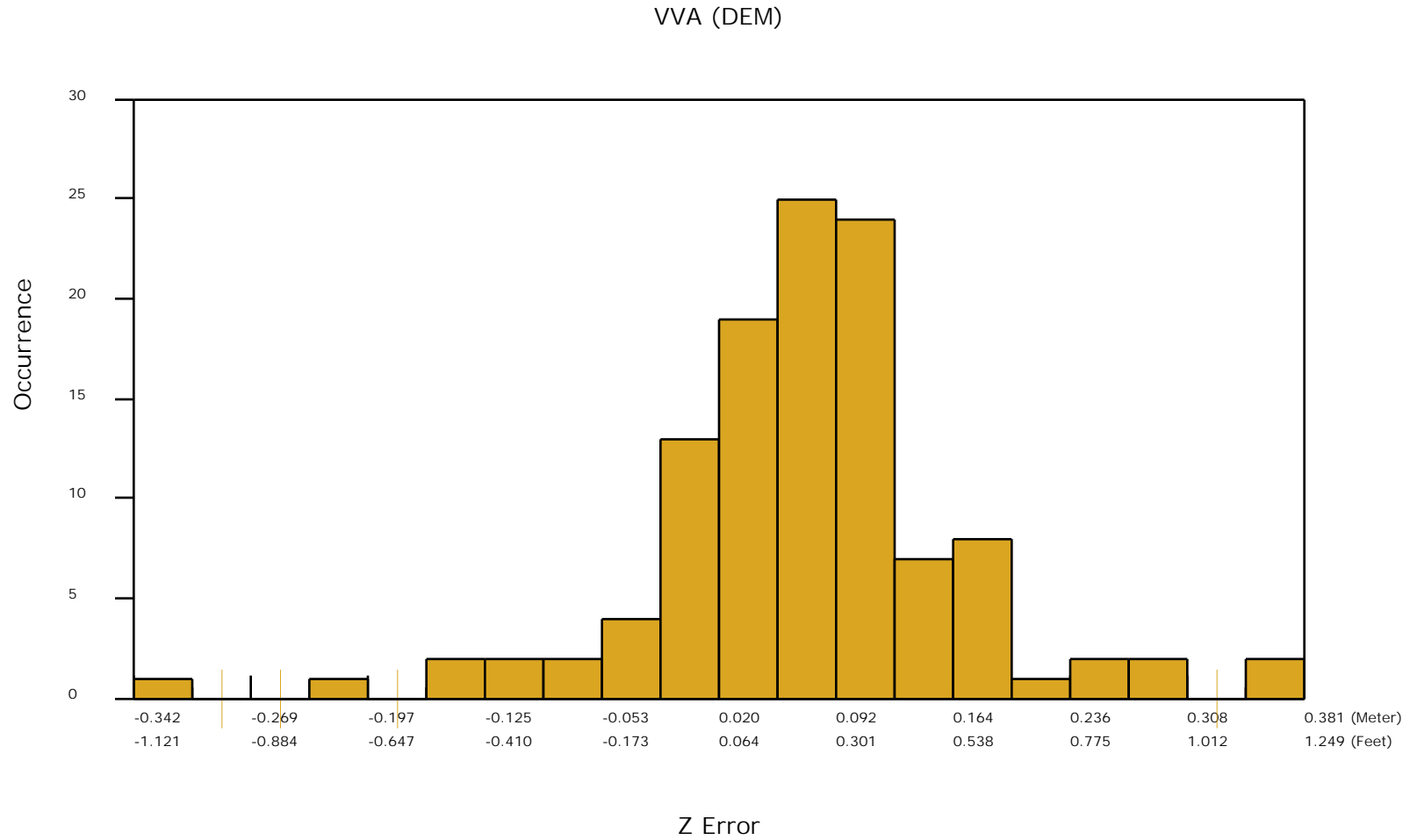
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description	Comments
2150	266011.582	4459861.706	Yes	1035.192	1035.407	0.215		
2151	347891.546	4502156.735	Yes	935.655	935.557	-0.098		
2152	358424.478	4554947.046	Yes	844.451	844.580	0.129		
2152A	358751.4	4559339.08	Yes	875.257	875.433	0.176		
2153	250295.199	4606605.545	Yes	1129.594	1129.636	0.042		
2154	283576.02	4552512.783	Yes	986.436	986.471	0.035		
2155	284915.559	4467814.5	Yes	1025.077	1025.191	0.114		
2156	365738.845	4533039.361	Yes	881.123	881.177	0.054		
2157	395135.116	4552154.929	Yes	904.743	904.850	0.107		
2159	384976.043	4542447.569	Yes	809.16	809.164	0.004		
2160	272324.45	4447537.206	Yes	1006.678	1006.691	0.013		
2162	314405.692	4457636.582	Yes	933.536	933.604	0.068		
2164	394815.525	4579968.629	Yes	870.819	870.966	0.147		
2165	345271.942	4442019.142	Yes	822.737	822.739	0.002		
2166	291803.141	4485307.243	Yes	1003.122	1003.219	0.097		

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\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\point_cloud\tilecls](Y:\Mapping\Projects\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\point_cloud\tilecls)

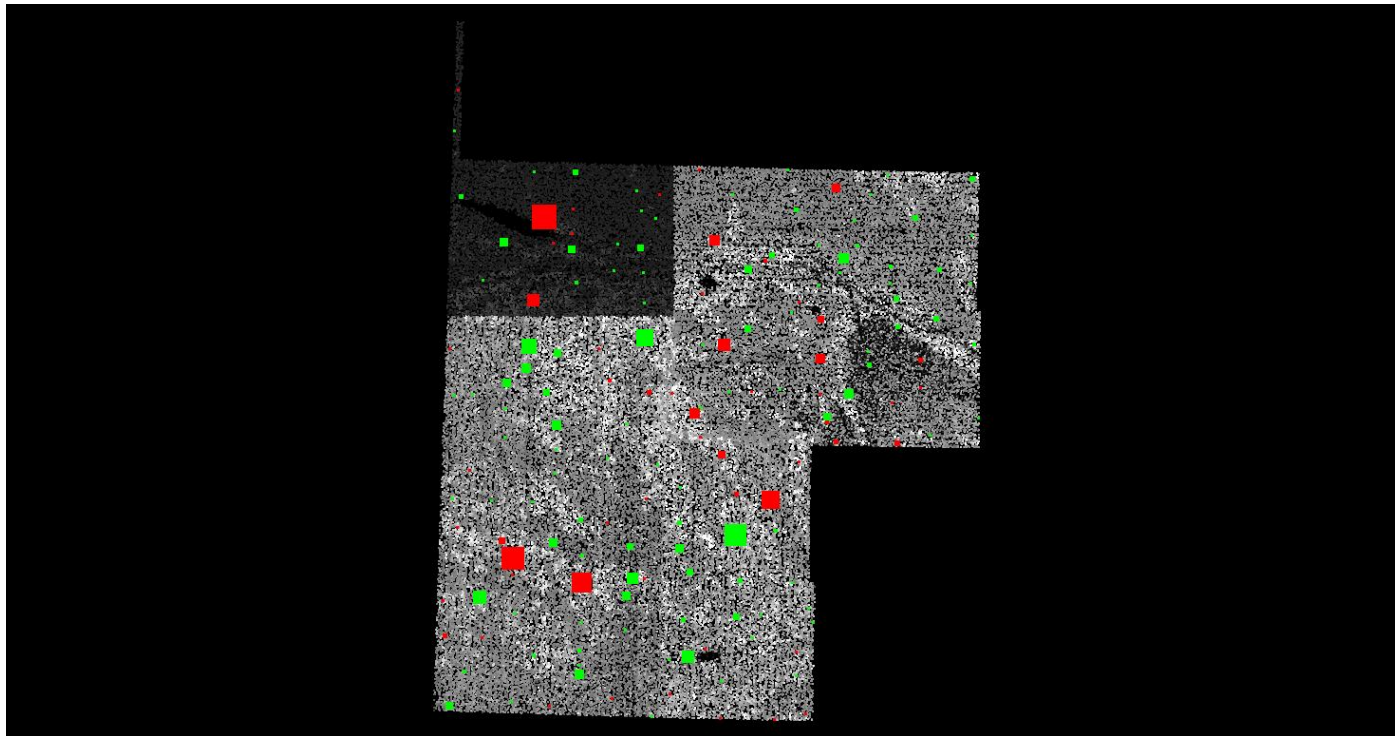


DPH-11 Report on Absolute Vertical Accuracy - continued

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 - Y:\Mapping\Projects\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\point_cloud\tilecls](Y:\Mapping\Projects\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\point_cloud\tilecls)

[Result Path - Y:\Mapping\Projects\65220751_NE_Southwest\Admin\OA_QC\NE_Southwest_UTM14_QC\DPH_11\ColorByIntensity_CheckPoints_NVA.jpg](Y:\Mapping\Projects\65220751_NE_Southwest\Admin\OA_QC\NE_Southwest_UTM14_QC\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).

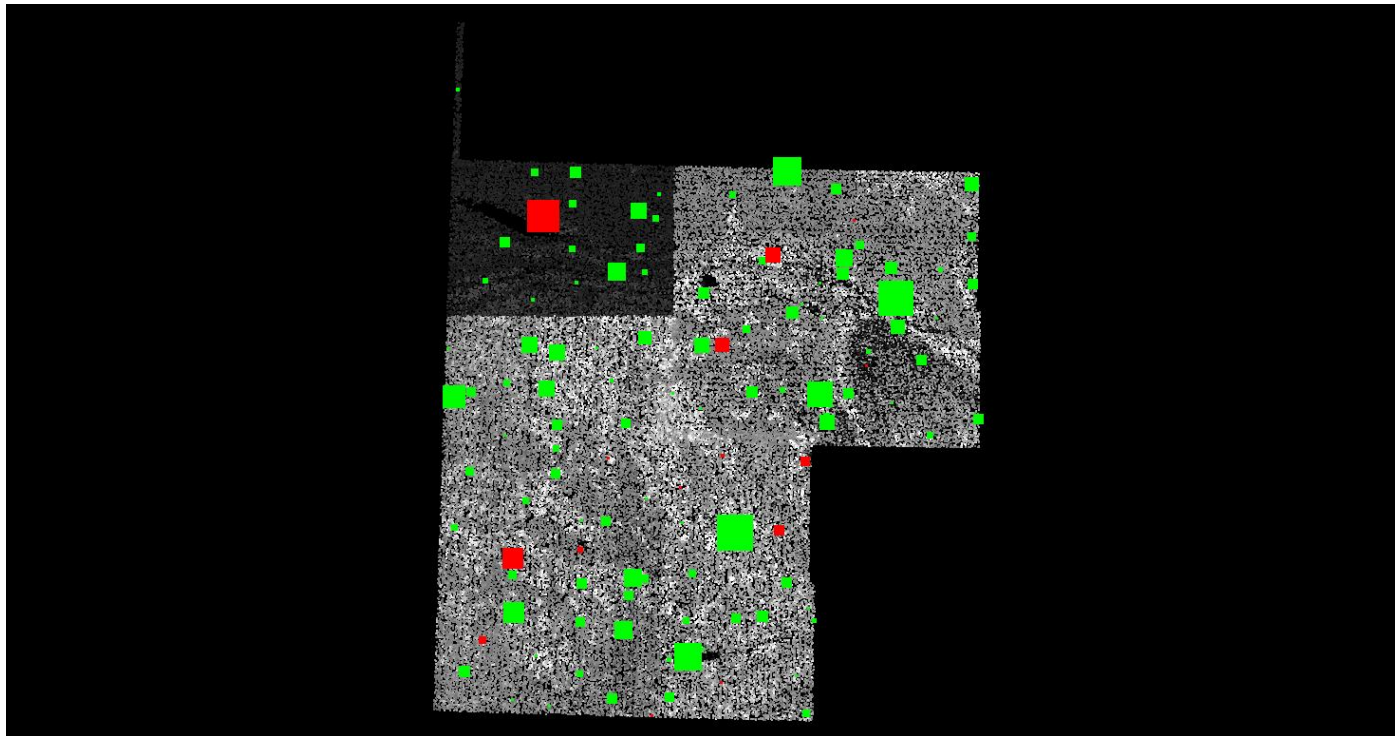
The size of the square symbol represents the absolute value magnitude of error.

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\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\point_cloud\tilecls](Y:\Mapping\Projects\65220751_NE_Southwest\Production\Final_Client_Deliverables\Projectwide\UTM14\point_cloud\tilecls)

[Result Path - Y:\Mapping\Projects\65220751_NE_Southwest\Admin\OA_QC\NE_Southwest_UTM14_QC\DPH_11\ColorByIntensity_CheckPoints_VVA.jpg](Y:\Mapping\Projects\65220751_NE_Southwest\Admin\OA_QC\NE_Southwest_UTM14_QC\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.