

SNWA QL1 LBS 1.2 Checkpoint Report

Detailed USGS National Geospatial Program Lidar Base Specification Version 1.2 Report

Quality level tested: QL1

Report generated on 1/25/2017

This document reports on compliance with the USGS National Geospatial Program Lidar Base Specification Version 1.2. The complete specification, which also contains a list of abbreviations, acronyms, and a glossary of related terms, can be found [here](#).



DPH-11.2 Report on Check Points

The USGS Lidar Base Specification Version 1.2 states: "The Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014) ties the required number of check points for vertical accuracy assessment to the areal extent of the project. Data producers are encouraged to carefully review the new and revised requirements in that document. Check points for NVA assessments shall be surveyed in clear, open areas (which typically produce only single lidar returns), devoid of vegetation and other vertical artifacts (such as boulders, large riser pipes, and vehicles). Ground that has been plowed or otherwise disturbed is not acceptable. The same check points may be used for NVA assessment of the point cloud and DEM. Check points for VVA assessments shall be surveyed in vegetated areas (typically characterized by multiple return lidar). Although the nature of vegetated areas makes absolute definition of a suitable test area difficult, these areas will meet the requirements below. As stated in the National Standards for Spatial Data Accuracy (NSSDA) (Federal Geographic Data Committee, 1998) and reiterated in the ASPRS Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014), it is unrealistic to prescribe detailed requirements for check point locations, as many unpredictable factors will affect field operations and decisions, and the data producer must often have the freedom to use their best professional judgment. The quantity and location of check points shall meet the following requirements, unless alternative criteria are approved by the USGS–NGP in advance:

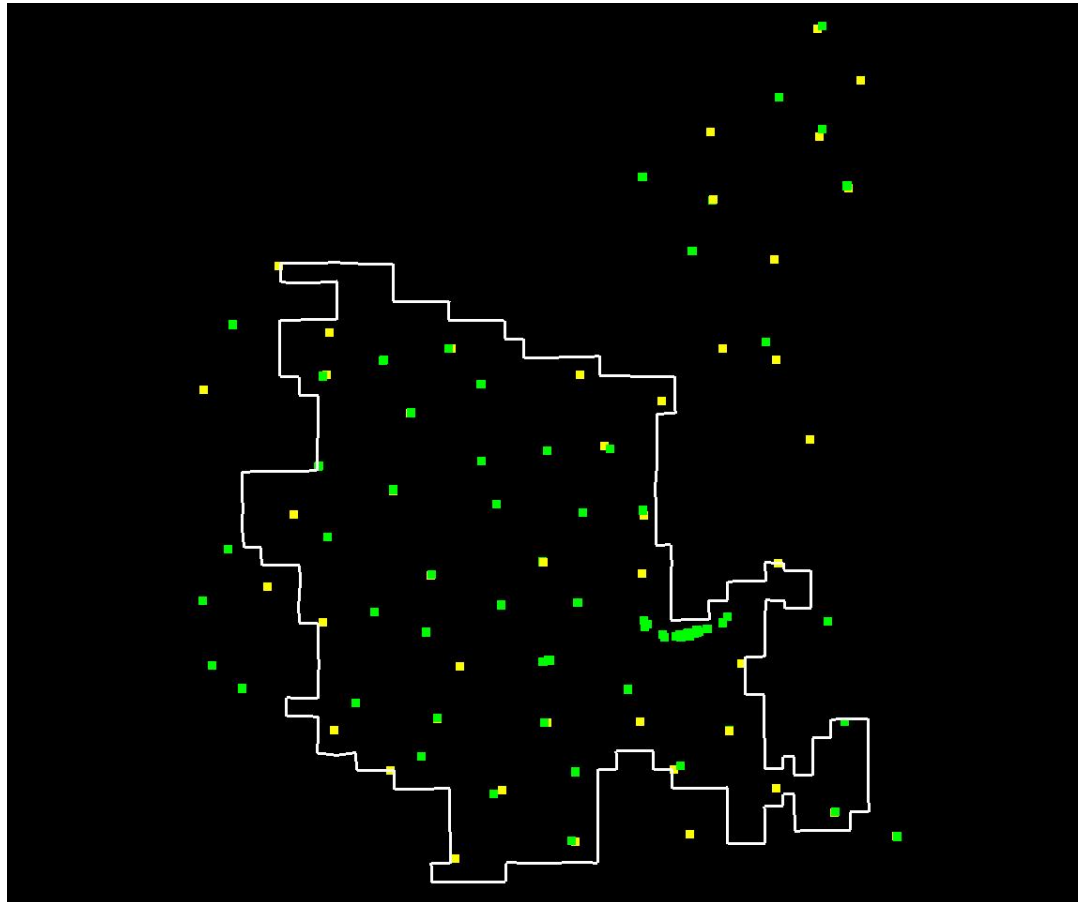
- The ASPRS-recommended total number of check points for a given project size shall be met.
- The ASPRS-recommended distribution of the total number of check points between NVA and VVA assessments shall be met.
- Check points within each assessment type (NVA and VVA) will be well-distributed across the entire project area. See the glossary at the end of this specification for a definition of "well-distributed."
- Within each assessment type, check points will be distributed among all constituent land cover types in approximate proportion to the areas of those land cover types (American Society for Photogrammetry and Remote Sensing, 2014)."

The purpose of this section is to show check points (NVA and VVA).

DPH-11.2 Report on Check Points - continued

[Data Source - Y:\Mapping\Projects\65219059_SNWA_LiDAR_Digital_Elevation_Data\Survey_Control\Laser_Control\Checkpoint_Stuff\GroundPoints_Client_NVAandVVA.csv](#)

[Check Point Path - W:\QL1\Only_Checkpoint_Report\DPH_11_2\CheckPoints.jpg](#)



Yellow points are NVA, green points are VVA.
White polygon is defined project area (DPA) boundary

DPH-11.2 Report on Check Points - continued

Total check points: 266

Total NVA check points: 62

Total VVA check points: 204

Check points in project boundary: 206

Total boundary area: 1570.074 square KM

Number of points per project area: 0.131 points per square KM

TABLE C.1 RECOMMENDED NUMBER OF CHECKPOINTS BASED ON AREA

Project Area (Square Kilometers)	Horizontal Accuracy Testing of Orthoimagery and Planimetrics	Vertical and Horizontal Accuracy Testing of Elevation Data sets		
	Total Number of Static 2D/3D Checkpoints (clearly-defined points)	Number of Static 3D Checkpoints in NVA*	Number of Static 3D Checkpoints in VVA	Total Number of Static 3D Checkpoints
≤500	20	20	5	25
501-750	25	20	10	30
751-1000	30	25	15	40
1001-1250	35	30	20	50
1251-1500	40	35	25	60
1501-1750	45	40	30	70
1751-2000	50	45	35	80
2001-2250	55	50	40	90
2251-2500	60	55	45	100

*Although vertical check points are normally not well defined, where feasible, the horizontal accuracy of lidar data sets should be tested by surveying approximately half of all NVA check points at the ends of point stripes or other point features that are visible and can be measured on lidar intensity returns.

Source: ASPRS Positional Accuracy Standards for Digital Geospatial Data (Edition 1, Version 1.0. - November 2014)

DPH-11.3 Report on Absolute Vertical Accuracy

The USGS Lidar Base Specification Version 1.2 states: "Absolute vertical accuracy of the lidar data and the derived DEM will be assessed and reported in accordance with the ASPRS Positional Accuracy Standards for Digital Geospatial Data (American Society for Photogrammetry and Remote Sensing, 2014). Two broad land cover types shall be assessed: vegetated and nonvegetated. Three absolute accuracy values shall be assessed and reported: NVA for the point cloud, NVA for the DEM, and VVA for the DEM. The minimum NVA and VVA requirements for all data, using the ASPRS methodology, are listed in the tables 'Absolute vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3' (table 4) and 'Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3' (table 5). Both the NVA and VVA required values shall be met. For projects dominated by dense forests, the USGS–NGP may accept higher VVA values."

Table 4. Absolute vertical accuracy for lidar-swath data, Quality Level 0–Quality Level 3.

[RMSE_z, root mean square error in z; cm, centimeter; NVA, nonvegetated vertical accuracy; ≤, less than or equal to]

Quality Level (QL)	RMSE _z (nonvegetated) (cm)	NVA at 95-percent confidence level (cm)
QL0	≤5.0	≤9.8
QL1	≤10.0	≤19.6
QL2	≤10.0	≤19.6
QL3	≤20.0	≤39.2

Table 5. Absolute vertical accuracy for digital elevation models, Quality Level 0–Quality Level 3.

[RMSE_z, root mean square error in z; cm, centimeter; NVA, nonvegetated vertical accuracy; VVA, vegetated vertical accuracy; ≤, less than or equal to]

Quality Level (QL)	RMSE _z (nonvegetated) (cm)	NVA at 95-percent confidence level (cm)	VVA at 95th percentile (cm)
QL0	≤5.0	≤9.8	≤14.7
QL1	≤10.0	≤19.6	≤29.4
QL2	≤10.0	≤19.6	≤29.4
QL3	≤20.0	≤39.2	≤58.8

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

DPH-11.3 Report on Absolute Vertical Accuracy - continued

[Y:\Mapping\Projects\65219059_SNWA LiDAR Digital Elevation Data\Survey_Control\Laser_Control\Checkpoint_Stuff\G_roundPoints_Client_NVAandVVA.csv](Y:\Mapping\Projects\65219059_SNWA_LiDAR_Digital_Elevation_Data\Survey_Control\Laser_Control\Checkpoint_Stuff\G_roundPoints_Client_NVAandVVA.csv)

Units: Meter (/US Survey Feet)

Vertical Accuracy Class tested: 10-cm

Check Points	266
Check Points with Lidar Coverage	208
Check Points with Lidar Coverage (NVA)	42
Check Points with Lidar Coverage (VVA)	166
Average Z Error (NVA)	-0.030/-0.099
Maximum Z Error (NVA)	0.020/0.067
Median Z Error (NVA)	-0.026/-0.087
Minimum Z Error (NVA)	-0.133/-0.437
Standard deviation of Vertical Error (NVA)	0.029/0.096
Skewness of Vertical Error (NVA)	-0.844
Kurtosis of Vertical Error (NVA)	2.099
Non-vegetated Vertical Accuracy (NVA) RMSE(z)	0.042/0.137 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level +/-	0.082/0.269 PASS
FGDC/NSSDA Vertical Accuracy at the 95% Confidence Level +/-	0.082/0.269
Non-vegetated Vertical Accuracy (NVA) RMSE(z) (DEM)	0.042/0.136 PASS
Non-vegetated Vertical Accuracy (NVA) at the 95% Confidence Level (DEM) +/-	0.082/0.267 PASS
Vegetated Vertical Accuracy (VVA) at the 95th Percentile (DEM) +/-	0.270/0.884 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 = 4.179cm, equating to +/- 8.192cm at the 95% confidence level. Actual VVA accuracy was found to be +/- 26.958cm at the 95th percentile.

DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the lidar point cloud swath 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 swath data)

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description
1	803733.3	26743681.57	Yes	1831.84	1831.782	-0.058	1831.753	1831.756	1831.801	1832	1832	1,1,1	NVA
2	718636.87	26839375.53	Yes	2956.01	2956.077	0.067	2956.014	2956.218	2956.278	2956	2956	1,1,1	NVA
3	751171.77	26775355.49	Yes	2419.81	2419.662	-0.148	2419.633	2419.687	2419.691	2420	2420	1,1,1	NVA
4	732311.13	26808495.35	Yes	2959.06	2958.981	-0.079	2958.942	2958.995	2959.019	2959	2959	1,1,1	NVA
5	767887.2	26815838.1	Yes	2337.76	2337.7	-0.060	2337.692	2337.7	2337.702	2338	2338	1,1,1	NVA
6	776211.97	26783976.4	Yes	2170.29	2170.216	-0.074	2170.205	2170.243	2170.256	2170	2170	1,1,1	NVA
7	804377.26	26808444.21	Yes	2147.99	2147.819	-0.171	2147.812	2147.822	2147.836	2148	2148	1,1,1	NVA
8	827588.74	26800920.5	Yes	1983.82	1983.723	-0.097	1983.676	1983.737	1983.764	1984	1984	1,1,1	NVA
9	822534.55	26768595.73	Yes	1990.7	1990.646	-0.054	1990.61	1990.647	1990.647	1991	1991	1,1,1	NVA
10	733155.02	26820495.56	Yes	2902.44	2902.281	-0.159	2902.262	2902.279	2902.29	2902	2902	1,1,1	NVA
11	860631.71	26754875.81	Yes	1396.85	1396.843	-0.007	1396.704	1396.864	1396.893	1397	1397	1,1,1	NVA
13	770303.88	26725511.13	Yes	2309.6	2309.538	-0.062	2309.475	2309.587	2309.647	2310	2310	1,1,1	NVA
14	722890.65	26768680.94	Yes	3421.28	3421.041	-0.239	3421	3421.05	3421.134	3421	3421	1,1,1	NVA
15	731305.43	26738057.6	Yes	2853.81	2853.639	-0.171	2853.615	2853.628	2853.703	2854	2854	1,1,1	NVA
16	850320.16	26726259.36	Yes	1937.31	1937.271	-0.039	1937.267	1937.272	1937.293	1937	1937	1,1,1	NVA
17	821275.56	26709953.39	Yes	2102.18	2102.086	-0.094	2102.026	2102.097	2102.178	2102	2102	1,1,1	NVA
18	831092.06	26696248.06	Yes	2616.86	2616.811	-0.049	2616.639	2616.867	2616.894	2617	2617	1,1,1	NVA
19	782133.21	26690415.03	Yes	2420.78	2420.725	-0.055	2420.714	2420.744	2420.765	2421	2421	1,1,1	NVA
20	803132.26	26675799.34	Yes	3099.96	3099.837	-0.123	3099.748	3099.763	3099.893	3100	3100	1,1,1	NVA
21	768910.13	26670938.14	Yes	2821.59	2821.432	-0.158	2821.41	2821.427	2821.443	2821	2821	1,1,1	NVA
22	734371.11	26707446.63	Yes	2966.79	2966.57	-0.220	2966.547	2966.548	2966.81	2967	2967	1,1,1	NVA
26	876702.2	26684080.69	Yes	2220.24	2220.207	-0.033	2220.18	2220.207	2220.265	2220	2220	1,1,1	NVA
31	821846.56	26752024.38	Yes	1804.49	1804.394	-0.096	1804.38	1804.407	1804.425	1804	1804	1,1,1	NVA
33	750598.76	26696026.78	Yes	2689.55	2689.433	-0.117	2689.347	2689.439	2689.445	2689	2689	1,1,1	NVA
2101	780665.76	26771645.65	Yes	2055.82	2055.781	-0.039	2055.672	2055.793	2055.803	2056	2056	1,1,1	NVA
2111	756191.53	26797674.92	Yes	2329.12	2329.025	-0.095	2329.017	2329.026	2329.055	2329	2329	1,1,1	NVA
2124	730328.18	26782494.33	Yes	2923.52	2923.578	0.058	2923.551	2923.612	2923.615	2924	2924	1,1,1	NVA
2204	776185.95	26805872.25	Yes	2241.73	2241.63	-0.100	2241.608	2241.622	2241.658	2242	2242	1,1,1	NVA
2205	776169.15	26805823.2	Yes	2241.78	2241.728	-0.052	2241.717	2241.724	2241.749	2242	2242	1,1,1	NVA
2208	795058.66	26786889.96	Yes	1911.58	1911.143	-0.437	1911.117	1911.207	1911.211	1911	1911	1,1,1	NVA

Check Points Vertical Accuracy - continued

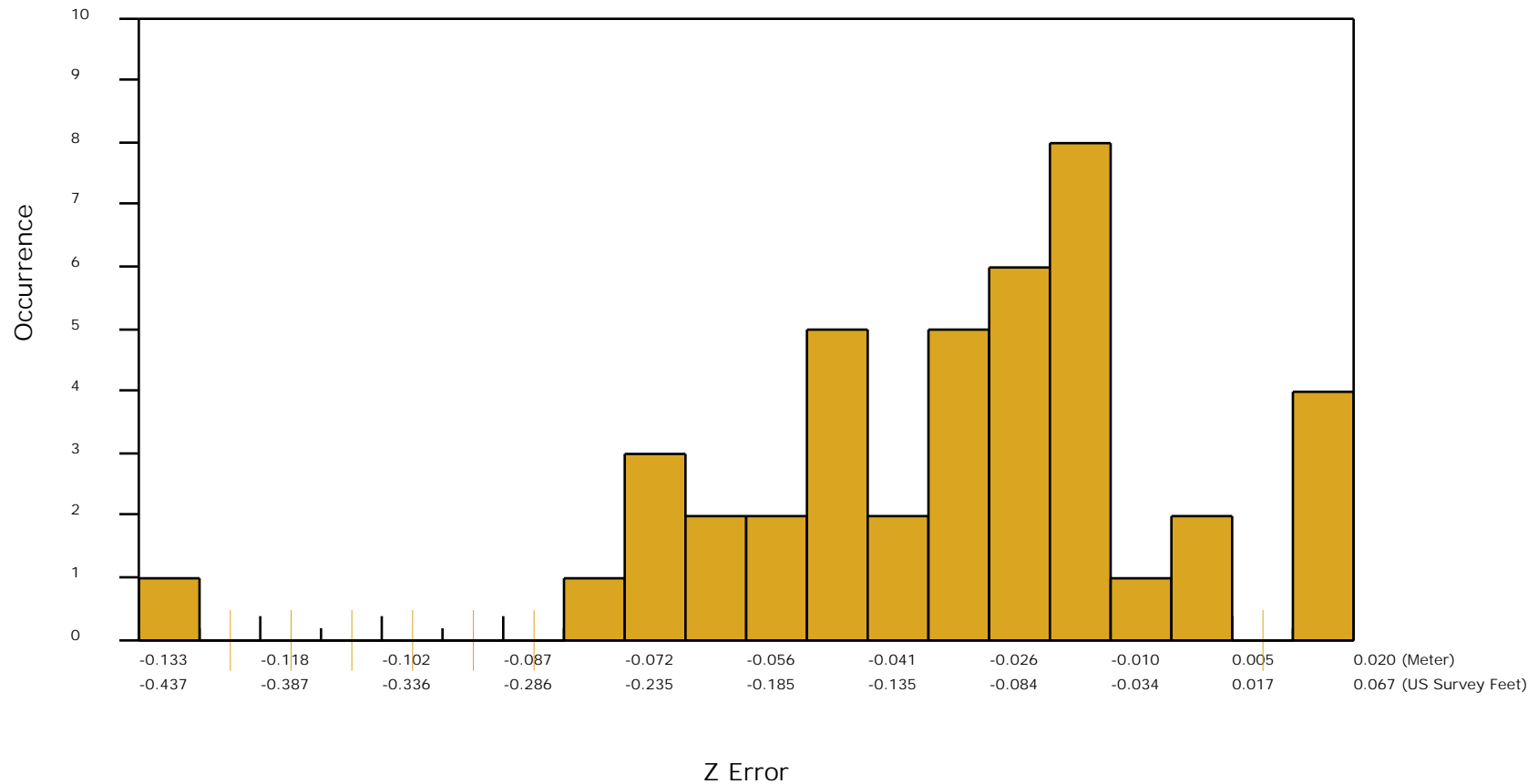
ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Minimum Z	Median Z	Maximum Z	Intensity	Scan Angle Rank	Returns	Description
2213	811148.08	26788244.54	Yes	1865.99	1865.918	-0.072	1865.828	1865.907	1865.928	1866	1866	1,1,1	NVA
3101	715670.09	26748285.19	Yes	3362.47	3362.276	-0.194	3362.232	3362.394	3362.402	3362	3362	1,1,1	NVA
3114	763865.4	26710639.21	Yes	2433.52	2433.525	0.005	2433.517	2433.522	2433.539	2434	2434	1,1,1	NVA
3119	745961.69	26740889.07	Yes	2532.07	2532.131	0.061	2531.939	2532.084	2532.152	2532	2532	1,1,1	NVA
3123	762020.06	26751468.45	Yes	2290.55	2290.501	-0.049	2290.461	2290.539	2290.661	2291	2291	1,1,1	NVA
3206	793951.25	26755068.03	Yes	1877.33	1877.186	-0.144	1877.047	1877.114	1877.298	1877	1877	1,1,1	NVA
3208	781879.17	26742925.64	Yes	2062.69	2062.624	-0.066	2062.552	2062.609	2062.632	2063	2063	1,1,1	NVA
4108	794917.5	26709503.86	Yes	2162.14	2161.914	-0.226	2161.857	2161.883	2161.993	2162	2162	1,1,1	NVA
4112	803120.08	26695479.96	Yes	2555.98	2555.764	-0.216	2555.746	2555.781	2555.788	2556	2556	1,1,1	NVA
4123	879645.33	26709878.94	Yes	1970	1970.065	0.065	1970.007	1970.01	1970.077	1970	1970	1,1,1	NVA
4204	846680.92	26707188.83	Yes	2090.35	2090.194	-0.156	2090.145	2090.219	2090.221	2090	2090	1,1,1	NVA
4217	859982.13	26690873.91	Yes	2341.77	2341.567	-0.203	2341.448	2341.458	2341.605	2342	2342	1,1,1	NVA

DPH-11.3 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\65219059 SNWA LiDAR Digital Elevation Data\Production\LiDAR\01 Boresight\SNWA_QL1](#)

NVA (lidar swath data)



DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the classified (tiled) 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
1	803733.3	26743681.57	Yes	1831.84	1831.773	-0.067	NVA
3	751171.77	26775355.49	Yes	2419.81	2419.675	-0.135	NVA
4	732311.13	26808495.35	Yes	2959.06	2959.003	-0.057	NVA
5	767887.2	26815838.1	Yes	2337.76	2337.696	-0.064	NVA
6	776211.97	26783976.4	Yes	2170.29	2170.244	-0.046	NVA
7	804377.26	26808444.21	Yes	2147.99	2147.822	-0.168	NVA
8	827588.74	26800920.5	Yes	1983.82	1983.734	-0.086	NVA
9	822534.55	26768595.73	Yes	1990.7	1990.642	-0.058	NVA
10	733155.02	26820495.56	Yes	2902.44	2902.270	-0.170	NVA
11	860631.71	26754875.81	Yes	1396.85	1396.910	0.060	NVA
13	770303.88	26725511.13	Yes	2309.6	2309.483	-0.117	NVA
14	722890.65	26768680.94	Yes	3421.28	3421.130	-0.150	NVA
15	731305.43	26738057.6	Yes	2853.81	2853.640	-0.170	NVA
16	850320.16	26726259.36	Yes	1937.31	1937.271	-0.039	NVA
17	821275.56	26709953.39	Yes	2102.18	2102.069	-0.111	NVA
18	831092.06	26696248.06	Yes	2616.86	2616.604	-0.256	NVA
19	782133.21	26690415.03	Yes	2420.78	2420.715	-0.065	NVA
20	803132.26	26675799.34	Yes	3099.96	3099.760	-0.200	NVA
21	768910.13	26670938.14	Yes	2821.59	2821.450	-0.140	NVA
22	734371.11	26707446.63	Yes	2966.79	2966.571	-0.219	NVA
26	876702.2	26684080.69	Yes	2220.24	2220.178	-0.062	NVA
31	821846.56	26752024.38	Yes	1804.49	1804.389	-0.101	NVA
33	750598.76	26696026.78	Yes	2689.55	2689.406	-0.144	NVA
2101	780665.76	26771645.65	Yes	2055.82	2055.795	-0.025	NVA
2111	756191.53	26797674.92	Yes	2329.12	2329.029	-0.091	NVA
2124	730328.18	26782494.33	Yes	2923.52	2923.603	0.083	NVA
2204	776185.95	26805872.25	Yes	2241.73	2241.634	-0.096	NVA
2205	776169.15	26805823.2	Yes	2241.78	2241.720	-0.060	NVA
2208	795058.66	26786889.96	Yes	1911.58	1911.209	-0.371	NVA
2213	811148.08	26788244.54	Yes	1865.99	1865.860	-0.130	NVA

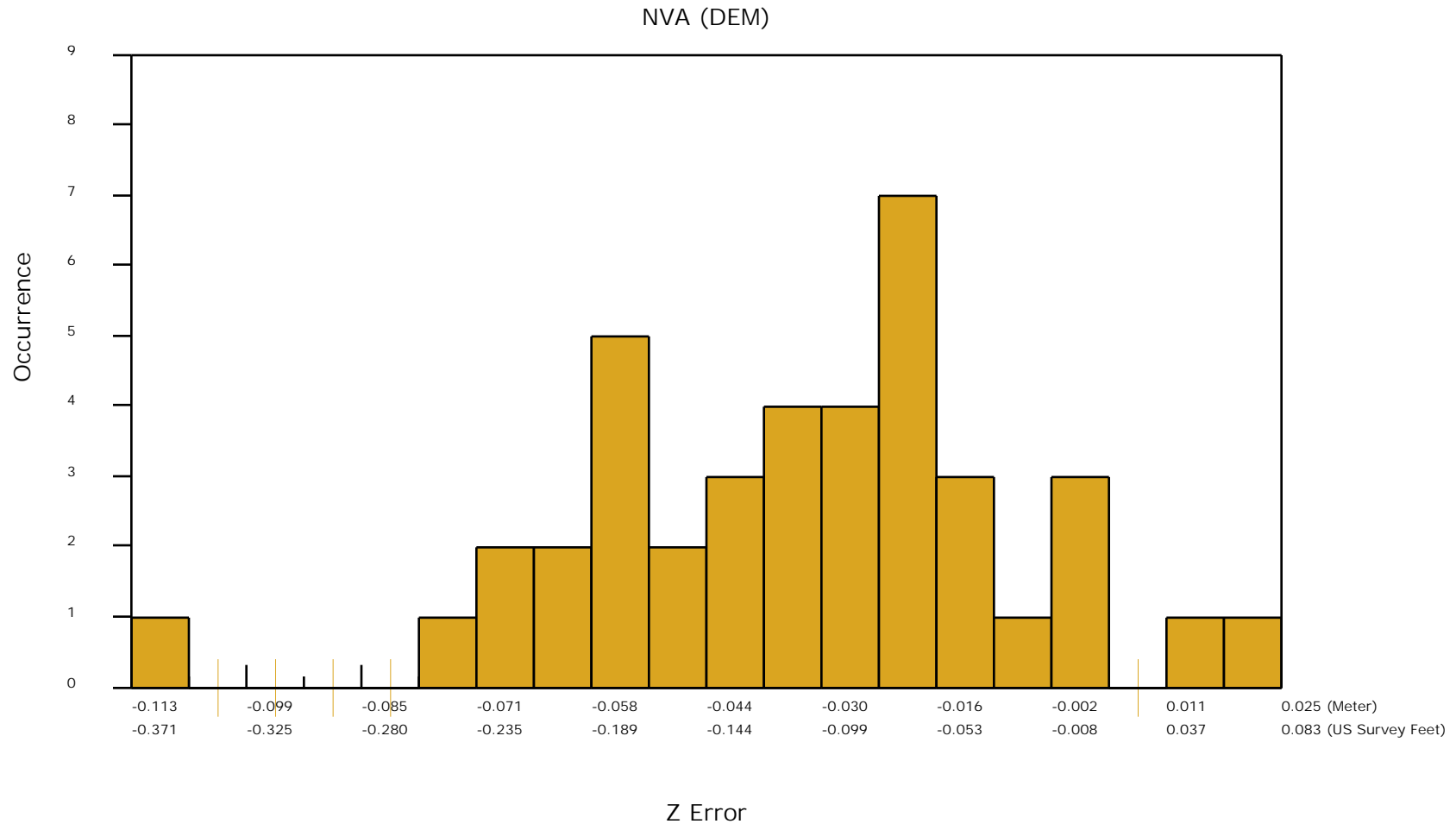
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description
3114	763865.4	26710639.21	Yes	2433.52	2433.519	-0.001	NVA
3119	745961.69	26740889.07	Yes	2532.07	2532.066	-0.004	NVA
3123	762020.06	26751468.45	Yes	2290.55	2290.503	-0.047	NVA
3206	793951.25	26755068.03	Yes	1877.33	1877.134	-0.196	NVA
3208	781879.17	26742925.64	Yes	2062.69	2062.596	-0.094	NVA
4108	794917.5	26709503.86	Yes	2162.14	2162.031	-0.109	NVA
4112	803120.08	26695479.96	Yes	2555.98	2555.808	-0.172	NVA
4123	879645.33	26709878.94	Yes	1970	1970.004	0.004	NVA
4204	846680.92	26707188.83	Yes	2090.35	2090.174	-0.176	NVA
4217	859982.13	26690873.91	Yes	2341.77	2341.558	-0.212	NVA

DPH-11.3 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 - W:\QL1](#)



DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to report the results of measuring the classified (tiled) 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	
1001	822561.31	26738521.31	Yes	1623.31	1623.193	-0.117	VVA	
1002	822537.94	26738499.81	Yes	1623.04	1623.423	0.383	VVA	
1003	822538.7	26738524.88	Yes	1623.04	1623.898	0.858	VVA	
1004	822562.72	26738529.31	Yes	1623.52	1624.130	0.610	VVA	
1005	823329.94	26737613.68	Yes	1604.4	1604.280	-0.120	VVA	
1006	823359.24	26737654.76	Yes	1604.6	1604.445	-0.155	VVA	
1007	823413.48	26737667.64	Yes	1604.78	1604.868	0.088	VVA	
1008	822722.06	26736865.61	Yes	1600.45	1600.356	-0.094	VVA	
1009	822680.54	26736902.59	Yes	1601.23	1601.471	0.241	VVA	
1010	827915.71	26734542.49	Yes	1570.67	1571.559	0.889	VVA	
1011	827929.24	26734532.24	Yes	1570.57	1571.394	0.824	VVA	
1012	827919.58	26734517.53	Yes	1570.64	1571.357	0.717	VVA	
1013	828251.5	26733854.85	Yes	1569.32	1569.922	0.602	VVA	
1014	828237.7	26733848.23	Yes	1569.56	1569.809	0.249	VVA	
1015	828352.64	26733849.55	Yes	1568.61	1569.116	0.506	VVA	
1016	828369.6	26733861.78	Yes	1568.09	1568.421	0.331	VVA	
1017	831481.03	26734030.34	Yes	1545.73	1545.016	-0.714	VVA	
1018	831488.97	26733964.84	Yes	1545.06	1544.918	-0.142	VVA	
1019	831488.86	26734065.67	Yes	1545.56	1545.285	-0.275	VVA	
1020	832973.57	26733862.82	Yes	1534.23	1534.176	-0.054	VVA	
1021	832994.59	26733891.53	Yes	1534.65	1534.955	0.305	VVA	
1022	833008.96	26733901.87	Yes	1534.63	1534.624	-0.006	VVA	
1023	832992.81	26733952.08	Yes	1534.26	1534.130	-0.130	VVA	
1024	833018.18	26733973.73	Yes	1530.62	1530.827	0.207	VVA	
1025	833994.82	26734023.86	Yes	1527.81	1527.666	-0.144	VVA	
1026	833958.22	26734014.66	Yes	1527.69	1527.570	-0.120	VVA	
1027	833827.31	26734084.38	Yes	1529.99	1530.388	0.398	VVA	
1028	833796.77	26734043.88	Yes	1527.29	1527.324	0.034	VVA	
1029	835504.65	26734190.97	Yes	1544.96	1545.113	0.153	VVA	
1030	835364.9	26734175.7	Yes	1532.12	1532.699	0.579	VVA	

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description
1031	835361.18	26734151.31	Yes	1532.89	1533.172	0.282	VVA
1032	836744.45	26734932.96	Yes	1512.17	1512.113	-0.057	VVA
1034	836742.75	26734946.06	Yes	1512.64	1512.606	-0.034	VVA
1036	836969.59	26735107.07	Yes	1510.41	1511.485	1.075	VVA
1037	836746.48	26734901.93	Yes	1513.73	1513.787	0.057	VVA
1038	837589.36	26735354.18	Yes	1510.37	1511.555	1.185	VVA
1039	837570.99	26735287.12	Yes	1509.82	1510.000	0.180	VVA
1040	837548.39	26735285.66	Yes	1510.14	1510.096	-0.044	VVA
1041	837547.87	26735257.24	Yes	1510.1	1510.283	0.183	VVA
1042	837700.54	26735372.23	Yes	1508.01	1507.381	-0.629	VVA
1043	838101.53	26735355.9	Yes	1505.94	1506.365	0.425	VVA
1045	838127.06	26735395.42	Yes	1495.7	1496.380	0.680	VVA
1046	838136	26735367.63	Yes	1503.45	1503.464	0.014	VVA
1047	838163.19	26735452.79	Yes	1494.32	1495.118	0.798	VVA
1048	840470.88	26736259.44	Yes	1485.18	1485.362	0.182	VVA
1049	840460.05	26736265.05	Yes	1485.11	1485.409	0.299	VVA
1050	840462.74	26736273.75	Yes	1485.41	1485.497	0.087	VVA
1051	844913.5	26737887.89	Yes	1473.73	1473.671	-0.059	VVA
1052	844926.59	26737908.29	Yes	1472.01	1472.728	0.718	VVA
1053	844908.53	26737997.38	Yes	1469.21	1470.196	0.986	VVA
1055	846239.81	26739572.76	Yes	1438.54	1439.270	0.730	VVA
1056	846294.73	26739612.91	Yes	1436.99	1437.403	0.413	VVA
1057	846261.77	26739633.64	Yes	1438.12	1438.665	0.545	VVA
1058	846197.88	26739611.17	Yes	1438.36	1438.750	0.390	VVA
1059	837603.92	26735999.81	Yes	1509.53	1510.714	1.184	VVA
1060	837570.35	26736019.67	Yes	1514.18	1515.426	1.246	VVA
1061	837561.75	26736015.26	Yes	1513.98	1514.522	0.542	VVA
1063	834963.41	26735127.9	Yes	1524.3	1524.488	0.188	VVA
1064	834888.33	26735125.27	Yes	1523.13	1523.102	-0.028	VVA
1065	834782.77	26734903.93	Yes	1528.86	1529.042	0.182	VVA
1066	834700.71	26734911.34	Yes	1525.96	1525.855	-0.105	VVA
1067	834664.66	26734928.15	Yes	1522.92	1523.171	0.251	VVA
1068	833729.44	26734712.56	Yes	1529.58	1529.567	-0.013	VVA
1069	833717.96	26734732.58	Yes	1530.6	1530.537	-0.063	VVA
1070	833755.48	26734721.83	Yes	1529.01	1529.018	0.008	VVA

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description
1071	832781.2	26734557.76	Yes	1536.06	1535.982	-0.078	VVA
1072	832756.54	26734547.87	Yes	1536.1	1537.169	1.069	VVA
1073	832732.5	26734533.4	Yes	1536.86	1537.412	0.552	VVA
1074	832612.78	26734457.78	Yes	1537.7	1537.811	0.111	VVA
1075	832587.04	26734437.61	Yes	1538.16	1537.937	-0.223	VVA
1077	832590.06	26734374.11	Yes	1538.18	1539.767	1.587	VVA
2102	780675.15	26771683.07	Yes	2055.54	2057.798	2.258	VVA
2103	780716.17	26771674.53	Yes	2055.28	2055.240	-0.040	VVA
2105	776423.79	26783984.51	Yes	2169.3	2169.527	0.227	VVA
2106	776436.73	26784005.22	Yes	2169	2169.290	0.290	VVA
2109	776423.77	26783984.52	Yes	2169.44	2169.527	0.087	VVA
2110	776436.68	26784005.24	Yes	2169.03	2169.290	0.260	VVA
2112	756240.99	26797673.1	Yes	2329.09	2329.576	0.486	VVA
2113	756264.59	26797737.41	Yes	2328.75	2328.776	0.026	VVA
2114	756309.88	26797686.01	Yes	2327.42	2327.265	-0.155	VVA
2115	748481.51	26812671.83	Yes	2479.2	2479.364	0.164	VVA
2116	748451.15	26812577.82	Yes	2481.19	2480.985	-0.205	VVA
2117	731198.72	26808117.34	Yes	2999.44	2999.208	-0.232	VVA
2118	731212.37	26807982.1	Yes	2998.13	2998.920	0.790	VVA
2119	731250.54	26808001.32	Yes	2996.8	2996.948	0.148	VVA
2125	730158.99	26782521.37	Yes	2929.99	2930.125	0.135	VVA
2126	730116.59	26782527.34	Yes	2930.91	2931.043	0.133	VVA
2127	730075.16	26782439.22	Yes	2935.25	2935.806	0.556	VVA
2128	732663.71	26762273.98	Yes	2976.14	2976.152	0.012	VVA
2129	732669.21	26762278.64	Yes	2976.13	2976.144	0.014	VVA
2130	732641.19	26762388.43	Yes	2975.73	2975.841	0.111	VVA
2132	751206.89	26775809.55	Yes	2410.96	2411.176	0.216	VVA
2133	751213.55	26775814.19	Yes	2410.38	2410.328	-0.052	VVA
2134	751154.51	26775803.55	Yes	2412.4	2412.679	0.279	VVA
2201	766921.06	26815975.93	Yes	2339.48	2339.847	0.367	VVA
2202	766929.67	26815984.76	Yes	2340.08	2340.255	0.175	VVA
2203	766903.16	26815985.7	Yes	2341.08	2341.131	0.051	VVA
2206	776220.01	26805768.44	Yes	2243.41	2243.619	0.209	VVA
2207	776167.05	26805856.78	Yes	2241.89	2241.892	0.002	VVA
2210	795019.14	26786924.79	Yes	1910.83	1910.802	-0.028	VVA

Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description
2211	795003.17	26786942.99	Yes	1910.51	1910.394	-0.116	VVA
2212	795062.97	26786895.71	Yes	1910.68	1910.749	0.069	VVA
2214	812776.56	26787443.39	Yes	1859.78	1860.001	0.221	VVA
2215	812774.16	26787353.56	Yes	1858.85	1859.085	0.235	VVA
2216	805127.32	26769277.43	Yes	1786.73	1786.464	-0.266	VVA
2217	805105.37	26769275.92	Yes	1786.66	1786.764	0.104	VVA
3108	740687.99	26715238.69	Yes	2820.78	2820.811	0.031	VVA
3109	740582.67	26715236.63	Yes	2822.63	2822.702	0.072	VVA
3110	740576.67	26715254.17	Yes	2822.87	2823.057	0.187	VVA
3111	759280.88	26699919.02	Yes	2528.27	2528.123	-0.147	VVA
3112	759270.31	26699922.26	Yes	2529.55	2529.261	-0.289	VVA
3113	759225.72	26699946.72	Yes	2530.83	2530.994	0.164	VVA
3115	763919.81	26710804.12	Yes	2434.16	2434.081	-0.079	VVA
3116	763935.06	26710801.31	Yes	2433.87	2433.864	-0.006	VVA
3117	760656.82	26735240.17	Yes	2341.22	2341.458	0.238	VVA
3118	760650.93	26735393.34	Yes	2340.95	2341.340	0.390	VVA
3120	745889.98	26740933.74	Yes	2535.99	2536.008	0.018	VVA
3121	745876.01	26740942.56	Yes	2536.43	2536.746	0.316	VVA
3122	745867.31	26740926.48	Yes	2533.19	2533.471	0.281	VVA
3124	762182.69	26751616.65	Yes	2287.59	2287.645	0.055	VVA
3125	762148.38	26751615.87	Yes	2288.21	2288.221	0.011	VVA
3126	762115.44	26751618.57	Yes	2288.16	2288.574	0.414	VVA
3127	779729.84	26689279.83	Yes	2458.12	2458.548	0.428	VVA
3128	779741.99	26689266.47	Yes	2458.23	2458.215	-0.015	VVA
3129	779746.88	26689276.2	Yes	2458.08	2458.601	0.521	VVA
3201	822180.06	26769930.52	Yes	1947.56	1947.469	-0.091	VVA
3202	822239.64	26769987.94	Yes	1951.1	1950.903	-0.197	VVA
3203	822104.32	26769727.25	Yes	1947.97	1947.640	-0.330	VVA
3204	793727.13	26755196.96	Yes	1881.5	1881.540	0.040	VVA
3205	793672.56	26755400.6	Yes	1883.84	1883.953	0.113	VVA
3209	781896.98	26742939.24	Yes	2062.66	2062.443	-0.217	VVA
3210	781887.67	26743066.78	Yes	2061.97	2061.903	-0.067	VVA
3211	781927.05	26742897.79	Yes	2063.03	2063.246	0.216	VVA
3212	793819.11	26726906.39	Yes	2024.17	2023.981	-0.189	VVA
3213	793579.96	26726978.36	Yes	2026.59	2026.622	0.032	VVA

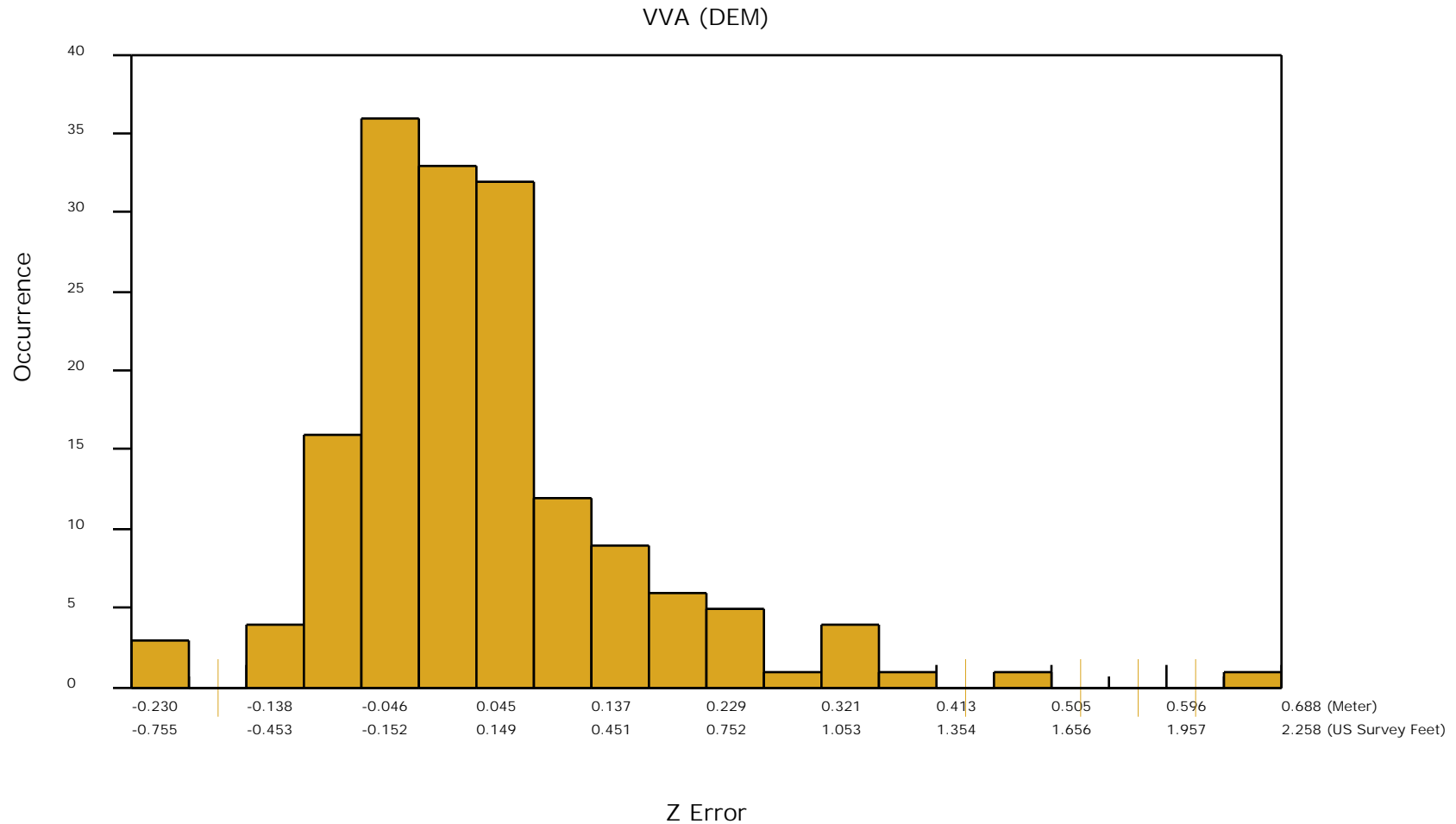
Check Points Vertical Accuracy - continued

ID	X	Y	Coverage	Z	Z From Lidar	Z Error	Description
3214	793562.7	26726921.19	Yes	2028.61	2027.855	-0.755	VVA
3215	795193.3	26727348.18	Yes	2006.73	2006.708	-0.022	VVA
3216	795310.65	26727336	Yes	2005.04	2004.960	-0.080	VVA
3217	795251.89	26727389.61	Yes	2006.28	2006.312	0.032	VVA
3218	795666.28	26727304.88	Yes	2001.31	2001.476	0.166	VVA
3219	795745.78	26727328.99	Yes	2000.36	2000.489	0.129	VVA
3220	795713.89	26727247.1	Yes	2002.11	2001.988	-0.122	VVA
3221	817868.86	26718952.37	Yes	1817.05	1816.609	-0.441	VVA
3222	817943.79	26718965.17	Yes	1814.78	1814.618	-0.162	VVA
3223	817965.67	26719028.24	Yes	1813.57	1813.460	-0.110	VVA
3224	803650.47	26743764.85	Yes	1829.45	1829.656	0.206	VVA
3225	803813.71	26743735.61	Yes	1826.85	1826.618	-0.232	VVA
4109	794171.77	26709456.35	Yes	2160.67	2160.804	0.134	VVA
4110	794193.99	26709459.39	Yes	2161.1	2160.730	-0.370	VVA
4111	794133.86	26709451.55	Yes	2160.86	2160.429	-0.431	VVA
4113	803001.67	26695595.73	Yes	2555.92	2555.759	-0.161	VVA
4114	803030.78	26695577.62	Yes	2557.48	2557.609	0.129	VVA
4115	802936.59	26695488.34	Yes	2552.09	2552.077	-0.013	VVA
4116	802934.91	26695531.18	Yes	2553.06	2552.833	-0.227	VVA
4117	801963.65	26676063.03	Yes	3046.31	3046.330	0.020	VVA
4118	801934.64	26676071.6	Yes	3044.19	3044.198	0.008	VVA
4119	801929.48	26676031.2	Yes	3047.38	3047.679	0.299	VVA
4124	879625.51	26709824.81	Yes	1972.4	1972.619	0.219	VVA
4125	879611.89	26709843.85	Yes	1973.25	1973.241	-0.009	VVA
4201	846723.05	26707311.82	Yes	2092.29	2092.219	-0.071	VVA
4202	846642.84	26707345.48	Yes	2092	2092.529	0.529	VVA
4205	832873.42	26697379.59	Yes	2524.55	2524.749	0.199	VVA
4206	832869.93	26697412.68	Yes	2523.56	2523.293	-0.267	VVA
4212	876759.18	26684149.17	Yes	2222.76	2222.675	-0.085	VVA

DPH-11.3 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 - W:\QL1](#)

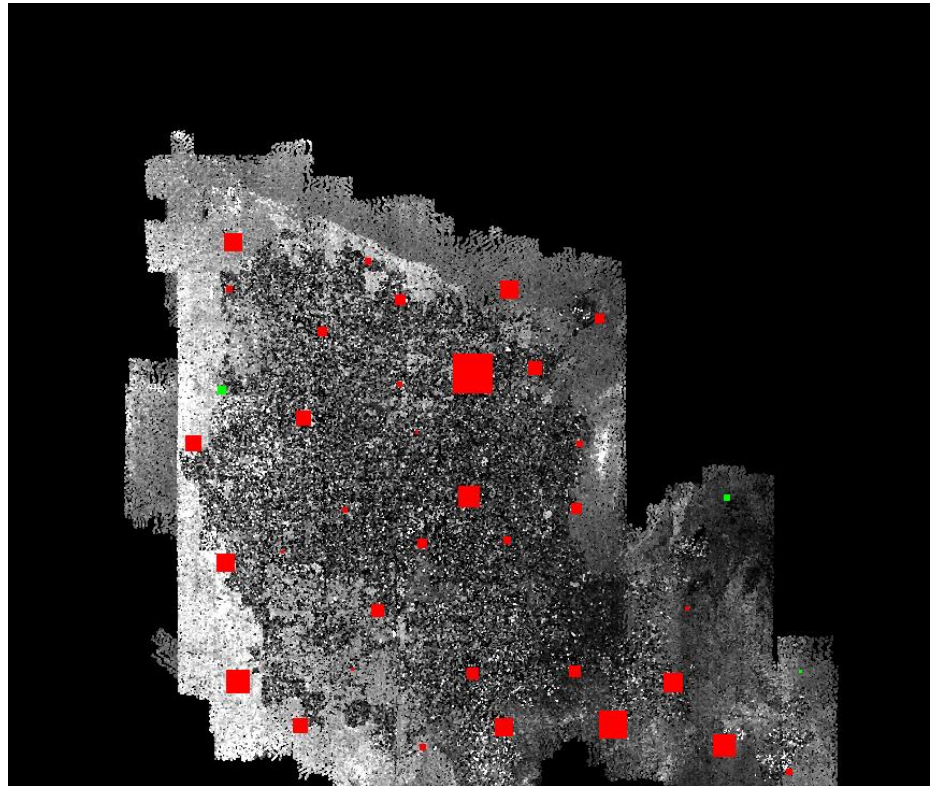



DPH-11.3 Report on Absolute Vertical Accuracy - continued

The purpose of this section is to show a graphic of lidar swath 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\65219059_SNWA_LiDAR_Digital_Elevation_Data\Production\LiDAR\01_Boresight\SNWA_QL1](Y:\Mapping\Projects\65219059_SNWA_LiDAR_Digital_Elevation_Data\Production\LiDAR\01_Boresight\SNWA_QL1)

[Result Path - W:\QL1\Only_Checkpoint_Report\DPH_11_3\ColorByIntensity_ControlPoints_NVA.jpg](W:\QL1\Only_Checkpoint_Report\DPH_11_3\ColorByIntensity_ControlPoints_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-11.3 Report on Absolute Vertical Accuracy - continued


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

[Data Source - W:\QL1](#)

[Result Path - W:\QL1\Only_Checkpoint_Report\DPH_11_3\ColorByIntensity_ControlPoints_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.

Skipped Tests

C-1 Report on Collection Area
C-2 Report on Returns
C-3 Report on Intensity
C-4 Report on Point Density and NPS per Flight Line
C-5 Report on Data Void
C-6 Overview of Spatial Distribution Verification
C-7 Report on Collection Conditions
DPH-1 Report on LAS Format
DPH-2 Report on Waveform Data
DPH-3 Report on GPS Time Type
DPH-4 Report on Datums
DPH-5 Report on Projections
DPH-6 Report on Units
DPH-7 Report on File Source ID
DPH-8 Report on Point Families
DPH-9 Report on LAS File Size
DPH-10 Flight Line Coverage
DPH-11.1.1 Smooth Surface Repeatability
DPH-11.1.2 Overlap consistency (interswath)
DPH-12 Use of the LAS Withheld Flag
DPH-13 Use of the LAS Overlap Flag
DPH-14 Point Classification
DPH-15/DPH-16 Reports on Classification Accuracy and Consistency
DPH-17 Report on Tiles

USGS LBS 1.2 QC Module Input Requirements Matrix

Test number	Boresighted LAS (Swath Data)	Classified LAS (Tiled Data)	Tile Scheme Shapefile	Project Boundary Shapefile	LiDAR Check Points
C-1	X	X		X	
C-2	X	X			
C-3	X	X			
C-4	X			O	
C-5	X			O	
C-6	X			O	
C-7	X	X			
DPH-1	X	X			
DPH-2	X	X			
DPH-3	X	X			
DPH-4	X	X			
DPH-5	X	X			
DPH-6	X	X			
DPH-7	X				
DPH-8	X				
DPH-9	X				
DPH-10	X			X	
DPH-11.1.1	X				
DPH-11.1.2	X			X	
DPH-11.2				X	X
DPH-11.3	X	X			X
DPH-12	X	X			
DPH-13	X	X			
DPH-14		X			
DPH-15		X			
DPH-16		X			
DPH-17		X	X		

X = Required

X = Will use Boresighted (Swath) LAS if available, else Classified LAS

O = Optional

O = Optional for single-area density reporting, but required for multi-area (multiple boundary) reporting of individual and aggregate areas