

C-4.1 Report on Nominal Pulse Spacing (NPS)

The USGS Lidar Base Specification Version 2.1 states: "The required ANPS and ANPD by QL are listed in table 1. Aggregate Nominal Pulse Density (ANPD) and Aggregate Nominal Pulse Spacing (ANPS) shall meet the requirements of the Quality Level (QL) of the project with a minimum of QL2 for 3DEP collections. Aggregate Nominal Pulse Density (ANPD) shall be no less than 2 points per square meter (QL2); assessment to be made against single swath, first return data located within the geometrically usable center portion (typically ~95%) of each swath. Aggregate Nominal Pulse Spacing (ANPS) shall be no greater than 0.70 meters (QL2); assessment to be made against single swath, first return data located within the geometrically usable center portion (typically ~95%) of each swath. Dependent on the local terrain and land cover conditions in a project, a greater pulse density may be required on specific projects."

Table 1. Aggregate nominal pulse spacing and density.

[QL, quality level; pls/m², pulses per square meter; m, meter; ≤, less than or equal to; ≥, greater than or equal to]

Quality level	Aggregate nominal pulse spacing (m)	Aggregate nominal pulse density (pls/m ²)
QL0	≤0.35	≥8.0
QL1	≤0.35	≥8.0
QL2	≤0.71	≥2.0
QL3	≤1.41	≥0.5

The purpose of this section is to report on the lidar point density and nominal point spacing by LAS file. Averages by files (not including overlap), project boundary polygons (including overlap), and aggregate project boundary polygons (including overlap) are reported.

[Data Source - Y:\Mapping\Projects\6522048201_ISGS_Wabash_and_Embarras\Production\Final_Client_Deliverables\Swath](#)

Quality level tested: QL2

File	Number of First Returns	Area	Point Density	NPS
00108.las	138,913,272	204,435,392	7.309/0.679	0.370/1.213
00110.las	410,714,610	722,445,568	6.125/0.569	0.404/1.326
00111.las	97,786,902	139,687,424	7.535/0.700	0.364/1.195
00112.las	505,453,200	819,078,976	6.641/0.617	0.388/1.273
00113.las	51,461,316	91,030,016	6.082/0.565	0.405/1.330

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File	Number of First Returns	Area	Point Density	NPS
00114.las	635,377,500	1,155,292,736	5.920/0.550	0.411/1.348
00115.las	829,922,652	1,160,839,168	7.696/0.715	0.361/1.183
00116.las	648,120,528	1,169,996,288	5.963/0.554	0.410/1.344
00117.las	862,683,308	1,174,526,848	7.901/0.734	0.356/1.167
00118.las	668,822,695	1,177,600,640	6.114/0.568	0.404/1.327
00119.las	788,669,947	1,171,956,032	7.244/0.673	0.372/1.219
00120.las	675,347,690	1,168,199,360	6.222/0.578	0.401/1.315
00121.las	789,794,715	1,165,354,752	7.298/0.678	0.370/1.215
00122.las	652,246,764	1,160,966,400	6.049/0.562	0.407/1.334
00123.las	793,296,448	1,161,097,216	7.352/0.683	0.369/1.210
00125.las	652,647,365	1,159,394,048	6.060/0.563	0.406/1.333
00126.las	785,847,262	1,162,613,504	7.276/0.676	0.371/1.216
00127.las	661,248,523	1,161,899,008	6.125/0.569	0.404/1.326
00128.las	781,612,782	1,162,663,296	7.233/0.672	0.372/1.220
00129.las	713,345,434	1,161,983,744	6.609/0.614	0.389/1.276
00130.las	59,911,725	94,967,616	6.792/0.631	0.384/1.259
00132.las	738,142,140	1,163,312,704	6.835/0.635	0.383/1.255
00133.las	726,085,127	1,164,081,664	6.717/0.624	0.386/1.266
00134.las	739,111,139	1,161,865,088	6.846/0.636	0.382/1.254
00135.las	735,185,317	1,156,460,416	6.846/0.636	0.382/1.254
00136.las	677,841,185	1,147,128,832	6.361/0.591	0.397/1.301
00137.las	691,545,386	1,159,199,488	6.426/0.597	0.395/1.295
00138.las	683,069,380	1,156,510,784	6.361/0.591	0.397/1.301
00139.las	705,230,263	1,158,823,168	6.555/0.609	0.391/1.282
00140.las	680,933,426	1,159,235,264	6.318/0.587	0.398/1.305
00141.las	696,653,449	1,160,689,792	6.458/0.600	0.393/1.291
00142.las	670,653,065	1,152,892,096	6.265/0.582	0.400/1.311
00143.las	683,099,266	1,151,319,936	6.383/0.593	0.396/1.298
00144.las	369,912,610	639,009,280	6.232/0.579	0.401/1.314
00146.las	643,879,875	1,157,367,104	5.985/0.556	0.409/1.341
00147.las	378,388,578	532,186,944	7.653/0.711	0.361/1.186
00148.las	785,017,941	1,154,758,976	7.319/0.680	0.370/1.213
00149.las	637,988,136	1,156,788,992	5.942/0.552	0.411/1.347

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File	Number of First Returns	Area	Point Density	NPS
00150.las	794,246,624	1,164,345,792	7.341/0.682	0.369/1.211
00151.las	649,780,973	1,163,296,000	6.017/0.559	0.408/1.338
00152.las	779,082,280	1,156,599,744	7.255/0.674	0.371/1.218
00153.las	638,577,536	1,143,278,144	6.017/0.559	0.408/1.338
00154.las	751,753,461	1,148,549,248	7.050/0.655	0.377/1.236
00155.las	648,795,662	1,147,561,856	6.082/0.565	0.405/1.330
00156.las	716,221,269	1,149,322,496	6.706/0.623	0.386/1.267
00158.las	647,701,395	1,124,956,352	6.200/0.576	0.402/1.318
00159.las	790,518,568	1,128,197,696	7.546/0.701	0.364/1.195
00160.las	666,584,685	1,148,944,128	6.243/0.580	0.400/1.313
00161.las	801,226,726	1,147,665,344	7.513/0.698	0.365/1.197
00162.las	674,296,923	1,147,446,848	6.329/0.588	0.397/1.304
00163.las	813,634,745	1,145,032,768	7.653/0.711	0.361/1.186
00165.las	660,790,932	1,156,013,824	6.157/0.572	0.403/1.323
00166.las	690,962,409	1,144,850,176	6.501/0.604	0.392/1.287
00167.las	656,354,005	1,150,041,088	6.146/0.571	0.404/1.324
00168.las	685,583,071	1,140,631,104	6.469/0.601	0.393/1.290
00169.las	663,384,266	1,148,895,808	6.211/0.577	0.401/1.316
00170.las	670,343,839	1,144,290,176	6.308/0.586	0.398/1.307
00171.las	667,499,798	1,149,060,096	6.254/0.581	0.400/1.312
00172.las	652,146,442	1,142,712,384	6.146/0.571	0.404/1.324
00173.las	32,438,885	37,600,000	9.289/0.863	0.328/1.077
00174.las	306,057,593	525,377,024	6.275/0.583	0.399/1.310
00175.las	583,543,181	865,516,864	7.255/0.674	0.371/1.218
00176.las	519,009,996	882,656,960	6.329/0.588	0.397/1.304
00177.las	631,355,067	922,476,352	7.363/0.684	0.369/1.209
00178.las	579,658,965	994,127,296	6.275/0.583	0.399/1.310
00179.las	708,752,777	1,029,240,960	7.416/0.689	0.367/1.205
00180.las	648,075,042	1,106,321,216	6.308/0.586	0.398/1.307
00181.las	757,207,351	1,121,295,936	7.266/0.675	0.371/1.217
00182.las	698,594,129	1,139,935,872	6.598/0.613	0.389/1.277
00183.las	765,736,024	1,171,056,576	7.040/0.654	0.377/1.237
00184.las	735,381,135	1,176,123,648	6.727/0.625	0.386/1.265

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File	Number of First Returns	Area	Point Density	NPS
00185.las	725,568,027	1,186,310,400	6.588/0.612	0.390/1.279
00187.las	815,087,854	1,187,672,064	7.384/0.686	0.368/1.207
00188.las	701,236,383	1,168,991,744	6.458/0.600	0.393/1.291
00189.las	790,505,417	1,145,077,568	7.427/0.690	0.367/1.204
00190.las	676,538,169	1,140,776,192	6.383/0.593	0.396/1.299
00191.las	780,361,198	1,134,817,216	7.406/0.688	0.368/1.206
00192.las	669,731,943	1,140,094,784	6.318/0.587	0.398/1.305
00193.las	768,415,966	1,141,599,040	7.244/0.673	0.372/1.219
00194.las	669,074,582	1,146,560,704	6.286/0.584	0.399/1.309
00195.las	742,949,884	1,142,802,688	6.997/0.650	0.378/1.240
00196.las	315,508,135	547,690,496	6.200/0.576	0.402/1.318
00197.las	693,741,291	1,152,832,000	6.480/0.602	0.393/1.289
00198.las	660,591,613	1,152,475,648	6.168/0.573	0.403/1.321
00199.las	687,897,678	1,139,648,576	6.501/0.604	0.392/1.287
00200.las	649,217,923	1,147,809,856	6.092/0.566	0.405/1.330
00201.las	710,355,396	1,152,786,368	6.631/0.616	0.388/1.274
00202.las	644,563,140	1,139,978,880	6.082/0.565	0.405/1.330
Average			6.641/0.617	0.388/1.273
			pp Square Meter/ pp Square US Survey Foot	Meter/ US Survey Feet
Effingham	56,832,133,108	71,826,079,848	8.514/0.791	0.343/1.124
Aggregate	56,832,133,108	71,826,079,848	8.514/0.791	0.343/1.124
			pp Square Meter/ pp Square US Survey Foot	Meter/ US Survey Feet

* - indicates a swath whose NPS and Point Density were brought up to specifications due to the inclusion of one or more re-flight swaths.