

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\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block1_Surdex\point_cloud\Swaths](Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block1_Surdex\point_cloud\Swaths)

Quality level tested: QL2

File	Number of First Returns	Area	Point Density	NPS
00014.las	219,461,506	79,204,341	2.771/0.257	0.601/1.972
00015.las	28,329,769	8,836,205	3.206/0.298	0.558/1.831
00018.las	244,825,062	79,142,671	3.093/0.287	0.569/1.867
00021.las	237,177,006	76,624,512	3.095/0.288	0.568/1.864
00022.las	233,199,023	75,739,542	3.079/0.286	0.570/1.870

C-4.1 Report on Nominal Pulse Spacing (NPS) - continued

File	Number of First Returns	Area	Point Density	NPS
00024.las	242,818,002	78,580,685	3.090/0.287	0.569/1.867
00031.las	253,075,760	77,732,902	3.256/0.302	0.554/1.818
00032.las	56,296,332	17,366,849	3.242/0.301	0.555/1.821
00041.las	224,893,646	78,164,723	2.877/0.267	0.590/1.936
00043.las	232,233,807	76,361,739	3.041/0.283	0.573/1.880
00049.las	239,224,771	79,171,284	3.022/0.281	0.575/1.886
00051.las	52,849,929	14,582,380	3.624/0.337	0.525/1.722
00064.las	243,577,998	78,764,844	3.092/0.287	0.569/1.867
00065.las	215,066,639	80,245,839	2.680/0.249	0.611/2.005
00072.las	221,470,230	71,805,967	3.084/0.287	0.569/1.867
00075.las	255,342,996	79,602,797	3.208/0.298	0.558/1.831
00082.las	191,119,753	73,208,232	2.611/0.243	0.619/2.031
00099.las	216,160,590	77,402,037	2.793/0.259	0.598/1.962
00101.las	205,587,902	77,674,258	2.647/0.246	0.615/2.018
00107.las	204,429,343	78,142,594	2.616/0.243	0.618/2.028
00110.las	290,975,538	78,580,830	3.703/0.344	0.520/1.706
00113.las	197,030,452	75,426,960	2.612/0.243	0.619/2.031
00114.las	230,291,937	76,575,607	3.007/0.279	0.577/1.893
00117.las	240,641,070	79,047,681	3.044/0.283	0.573/1.880
00120.las	221,131,009	79,434,679	2.784/0.259	0.599/1.965
00124.las	236,017,074	78,662,505	3.000/0.279	0.577/1.893
00125.las	239,983,303	70,459,456	3.406/0.316	0.542/1.778
00144.las	224,390,220	77,432,558	2.898/0.269	0.587/1.926
00146.las	285,584,134	79,591,449	3.588/0.333	0.528/1.732
00151.las	225,227,558	78,942,819	2.853/0.265	0.592/1.942
00156.las	263,747,692	79,453,344	3.320/0.308	0.549/1.801
00158.las	202,250,816	78,295,747	2.583/0.240	0.622/2.041
00161.las	259,974,926	78,457,792	3.314/0.308	0.549/1.801
00164.las	239,059,254	77,166,735	3.098/0.288	0.568/1.864
00166.las	219,086,593	77,981,410	2.809/0.261	0.597/1.959
00169.las	229,561,061	79,436,364	2.890/0.268	0.588/1.929
00171.las	241,411,498	76,920,346	3.138/0.292	0.564/1.850
00172.las	278,848,518	77,981,364	3.576/0.332	0.529/1.736

C-4.1 Report on Nominal Pulse Spacing (NPS) - continued

File	Number of First Returns	Area	Point Density	NPS
00173.las	237,412,063	77,081,774	3.080/0.286	0.570/1.870
00177.las	218,188,550	78,074,595	2.795/0.260	0.598/1.962
00179.las	238,919,047	77,036,014	3.101/0.288	0.568/1.864
00185.las	231,862,487	76,254,737	3.041/0.283	0.573/1.880
00186.las	215,933,236	79,720,651	2.709/0.252	0.608/1.995
00187.las	243,473,863	79,372,519	3.067/0.285	0.571/1.873
00188.las	226,851,038	76,069,762	2.982/0.277	0.579/1.900
00189.las	212,032,445	80,223,972	2.643/0.246	0.615/2.018
00192.las	220,593,268	68,012,211	3.243/0.301	0.555/1.821
00196.las	233,333,873	76,559,621	3.048/0.283	0.573/1.880
00198.las	114,251,991	47,713,819	2.395/0.223	0.646/2.119
00203.las	165,393,060	68,726,620	2.407/0.224	0.645/2.116
00210.las	227,320,226	78,523,838	2.895/0.269	0.588/1.929
00216.las	215,917,535	77,092,729	2.801/0.260	0.598/1.962
00219.las	224,230,330	74,064,114	3.028/0.281	0.575/1.886
00225.las	231,456,699	79,353,733	2.917/0.271	0.586/1.923
00229.las	208,638,676	77,499,311	2.692/0.250	0.609/1.998
00233.las	245,406,184	79,690,288	3.079/0.286	0.570/1.870
00235.las	222,674,340	76,594,058	2.907/0.270	0.586/1.923
00238.las	205,115,577	76,084,205	2.696/0.250	0.609/1.998
Average			2.968/0.276	0.580/1.903
			pp Square Meter/ pp Square US Survey Foot	Meter/ US Survey Feet
1274.1237732	12,680,267,561	3,299,965,423	3.843/0.357	0.510/1.673
Aggregate	12,680,267,561	3,299,965,423	3.843/0.357	0.510/1.673
			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.