

C-2 Report on Multiple Discrete Returns

The USGS Lidar Base Specification Version 2.1 states: "Deriving and delivering multiple discrete returns are required in all conventional lidar data collection efforts. Data collection shall be capable of at least three returns per pulse. Full waveform collection is acceptable and is promoted; however, full waveform data are regarded as supplemental information."

The purpose of this section is to report on the presence and quantities of lidar returns in the LAS data. Empty return columns can indicate a collection or processing problem dealing with lidar return attribute information.

[Data Source - Y:\Mapping\Projects\65220595_CO_SanLuisJuanMiguel\Production\Final_Client_Deliverables\Block5\point_cloud\Swaths_New](#)

File	First return	Second return	Third return	Other returns	Total points
00010.las	261,009,006	19,366,878	3,776,717	368,300	284,520,901
00011.las	121,555,568	1,149,881	11,069	290	122,716,808
00012.las	270,399,783	23,948,726	7,491,632	1,888,789	303,728,930
00014.las	142,108,849	31,050,679	6,481,480	744,194	180,385,202
00015.las	19,375,823	6,020,826	1,223,286	82,046	26,701,981
00016.las	7,688,893	1,123,770	115,633	4,232	8,932,528
00017.las	27,698,650	10,858,325	2,960,556	500,965	42,018,496
00018.las	154,757,046	39,269,900	15,232,613	4,654,822	213,914,381
00020.las	442,679,797	8,839,048	1,268,909	134,710	452,922,464
00021.las	164,381,341	173,855	9,805	928	164,565,929
00022.las	176,874,639	59,913	5,655	540	176,940,747
00024.las	216,315,397	3,688,123	499,636	46,398	220,549,554
00025.las	446,018,864	7,656,612	670,019	56,091	454,401,586
00028.las	72,661,643	25,842,906	5,891,079	697,537	105,093,165
00029.las	397,712,878	71,852,758	23,136,425	5,942,466	498,644,527
00030.las	94,166,121	27,641,084	6,106,499	673,284	128,586,988
00031.las	91,522,469	10,480,419	1,756,115	166,149	103,925,152
00032.las	369,258,873	7,956,578	776,873	73,607	378,065,931
00033.las	165,832,828	22,068,811	7,119,019	1,694,627	196,715,285
00034.las	271,407,131	28,263,632	10,885,147	3,400,102	313,956,012
00035.las	319,227,111	3,834,601	393,746	53,131	323,508,589
00036.las	163,724,517	188,882	9,201	370	163,922,970
00037.las	11,632,385	847,775	100,812	6,024	12,586,996
00038.las	70,359,907	11,770,907	1,980,188	163,097	84,274,099
00041.las	211,649,861	1,993,953	175,192	13,966	213,832,972

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File	First return	Second return	Third return	Other returns	Total points
00043.las	153,164,770	29,532,094	5,975,421	620,751	189,293,036
00044.las	409,253,001	28,315,085	5,466,797	540,223	443,575,106
00045.las	420,940,434	7,166,444	675,970	60,630	428,843,478
00046.las	124,409,233	33,784,203	7,525,854	889,718	166,609,008
00049.las	219,977,535	1,828,937	163,525	13,751	221,983,748
00050.las	74,991,734	18,454,495	3,944,053	462,989	97,853,271
00052.las	86,142,955	31,123,805	6,940,219	754,788	124,961,767
00053.las	325,980,883	25,219,893	5,692,406	705,760	357,598,942
00054.las	420,086,805	77,363,635	28,261,793	6,924,141	532,636,374
00056.las	11,584,166	5,271,688	1,435,896	187,185	18,478,935
00057.las	172,543,558	48,655,488	13,605,517	2,280,141	237,084,704
00058.las	166,042,924	57,826,306	16,253,044	2,699,805	242,822,079
00059.las	161,885,708	17,359,202	4,946,941	962,167	185,154,018
00060.las	307,855,467	27,755,803	6,732,469	945,693	343,289,432
00061.las	199,959,234	50,379,599	15,617,625	3,021,149	268,977,607
00063.las	84,510,252	32,211,827	9,465,233	1,711,084	127,898,396
00064.las	168,648,677	8,993,425	1,286,076	76,944	179,005,122
00065.las	73,344,024	10,789,171	1,814,658	184,114	86,131,967
00066.las	311,749,128	2,123,375	130,459	6,459	314,009,421
00067.las	450,678,631	69,198,859	19,756,054	3,112,779	542,746,323
00068.las	366,494,749	75,487,648	22,980,756	4,996,483	469,959,636
00069.las	118,605,841	1,133,197	32,666	1,226	119,772,930
00071.las	138,659,033	13,667,918	3,566,841	551,597	156,445,389
00072.las	134,815,269	26,432,887	4,550,425	298,765	166,097,346
00073.las	465,725,171	8,987,187	858,816	80,939	475,652,113
00074.las	271,093,874	24,143,747	4,499,383	456,149	300,193,153
00075.las	91,833,978	7,772,957	1,135,426	53,103	100,795,464
00076.las	446,366,667	8,686,407	894,289	83,290	456,030,653
00077.las	350,945,894	4,944,000	513,514	50,669	356,454,077
00078.las	28,068,604	131,929	5,778	400	28,206,711
00079.las	127,050,699	38,287,954	8,596,596	1,067,278	175,002,527
00080.las	178,728,564	21,335,672	5,714,844	1,272,936	207,052,016
00081.las	346,867,599	6,243,586	970,111	121,010	354,202,306
00082.las	119,866,701	23,846,461	4,375,032	342,804	148,430,998

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File	First return	Second return	Third return	Other returns	Total points
00094.las	367,542,294	8,506,020	2,221,205	513,431	378,782,950
00096.las	470,107,310	83,231,220	30,225,860	7,398,601	590,962,991
00097.las	121,722,377	97,012	217	01	121,819,607
00099.las	156,867,999	489,681	26,226	2,787	157,386,693
00100.las	272,010,097	9,971,312	1,431,075	77,102	283,489,586
00101.las	77,463,707	8,708,877	1,711,783	217,925	88,102,292
00102.las	428,929,600	18,915,008	4,609,876	766,597	453,221,081
00103.las	45,362,235	19,600,741	5,414,958	819,582	71,197,516
00104.las	483,064,521	9,431,684	969,100	71,495	493,536,800
00105.las	447,736,417	7,950,664	1,038,808	78,766	456,804,655
00106.las	139,164,062	43,311,670	9,966,543	1,360,803	193,803,078
00107.las	74,131,364	7,823,154	1,180,747	66,505	83,201,770
00108.las	451,797,139	47,901,334	10,495,701	1,339,389	511,533,563
00109.las	46,466,573	247,300	23,058	2,707	46,739,638
00110.las	204,698,274	34,557,747	8,071,997	1,000,137	248,328,155
00112.las	63,902,012	14,456,449	2,447,144	193,995	80,999,600
00113.las	134,704,847	27,898,167	6,381,571	801,589	169,786,174
00114.las	210,065,286	1,194,527	25,589	2,112	211,287,514
00115.las	38,229,438	10,201,758	1,874,791	176,154	50,482,141
00117.las	217,114,245	2,317,636	267,376	22,533	219,721,790
00119.las	85,079,561	14,677,752	3,543,679	312,451	103,613,443
00120.las	127,260,532	34,428,667	12,108,356	3,599,330	177,396,885
00124.las	219,097,792	2,670,354	387,291	32,072	222,187,509
00125.las	142,992,392	25,657,095	5,131,288	435,185	174,215,960
00126.las	408,264,639	86,199,375	26,780,904	5,943,956	527,188,874
00129.las	87,084,017	26,075,862	6,332,250	848,342	120,340,471
00130.las	389,293,198	38,726,897	8,343,288	886,629	437,250,012
00141.las	48,260,325	13,458,153	2,295,588	174,786	64,188,852
00144.las	163,946,021	640,079	27,912	3,365	164,617,377
00146.las	90,464,002	14,166,860	2,357,566	292,482	107,280,910
00150.las	381,097,341	60,458,606	21,926,045	5,612,074	469,094,066
00151.las	203,151,935	2,597,951	357,962	28,564	206,136,412
00154.las	114,627,164	31,653,711	4,558,767	352,081	151,191,723
00155.las	207,229,515	24,014,041	7,019,759	1,471,530	239,734,845

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File	First return	Second return	Third return	Other returns	Total points
00156.las	162,754,036	42,384,316	12,120,181	2,269,138	219,527,671
00158.las	75,648,748	13,169,888	2,618,242	469,617	91,906,495
00161.las	169,134,959	36,721,659	7,264,136	677,886	213,798,640
00164.las	87,892,678	13,841,930	2,451,383	307,000	104,492,991
00166.las	184,818,393	4,368,482	913,655	1,206,388	191,306,918
00169.las	204,831,101	1,604,218	140,440	13,090	206,588,849
00170.las	489,527,545	82,137,506	28,678,329	6,530,176	606,873,556
00171.las	167,361,955	264,368	27,346	3,012	167,656,681
00172.las	200,605,020	402,703	58,386	6,790	201,072,899
00173.las	165,123,612	276,579	18,427	1,908	165,420,526
00174.las	448,395,728	87,173,365	27,474,709	5,635,708	568,679,510
00175.las	446,063,666	73,282,481	20,185,331	3,596,180	543,127,658
00177.las	206,719,789	2,622,680	338,220	31,835	209,712,524
00178.las	173,887,767	26,147,921	6,175,576	1,041,081	207,252,345
00179.las	229,133,246	2,005,348	131,906	12,859	231,283,359
00181.las	435,341,106	9,094,752	1,058,647	75,777	445,570,282
00182.las	91,381,001	21,684,418	5,614,503	736,401	119,416,323
00183.las	189,003,028	31,818,356	9,504,371	1,745,637	232,071,392
00184.las	376,207,617	61,412,889	20,255,268	4,630,999	462,506,773
00185.las	173,222,146	79,479	1,524	62	173,303,211
00186.las	136,106,468	34,427,686	12,171,052	2,871,532	185,576,738
00187.las	141,879,589	44,464,275	17,228,447	5,947,038	209,519,349
00188.las	165,783,108	39,936	972	81	165,824,097
00189.las	75,627,102	3,372,886	454,756	14,763	79,469,507
00190.las	95,522,980	35,740,387	14,515,081	4,082,751	149,861,199
00191.las	436,364,535	24,196,048	5,068,847	621,353	466,250,783
00192.las	82,497,201	14,815,721	3,240,475	312,080	100,865,477
00193.las	142,235,850	29,937,478	5,586,090	528,091	178,287,509
00194.las	138,272,210	14,277,210	3,828,525	738,187	157,116,132
00195.las	135,147,807	39,115,854	12,185,108	2,701,177	189,149,946
00196.las	165,073,216	104,832	3,001	241	165,181,290
00197.las	6,103,407	2,122,715	442,984	87,956	8,757,062
00198.las	33,467,124	7,825,134	1,594,484	149,367	43,036,109
00199.las	340,585,717	4,702,772	648,863	93,490	346,030,842

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File	First return	Second return	Third return	Other returns	Total points
00200.las	373,543,589	7,543,487	1,737,449	341,963	383,166,488
00201.las	331,628,817	4,067,531	573,713	84,732	336,354,793
00202.las	373,580,252	69,351,856	25,138,818	6,246,944	474,317,870
00203.las	94,650,686	14,354,737	2,649,682	209,348	111,864,453
00204.las	46,466,298	13,747,466	2,925,323	311,029	63,450,116
00205.las	112,909,996	563,842	13,724	997	113,488,559
00206.las	341,254,077	31,319,937	10,005,492	2,130,714	384,710,220
00208.las	364,999,179	31,205,839	9,121,231	1,645,732	406,971,981
00209.las	190,491,703	25,956,295	8,053,971	1,897,104	226,399,073
00210.las	205,087,721	2,449,464	293,571	25,565	207,856,321
00211.las	434,027,456	11,687,900	2,266,422	259,210	448,240,988
00212.las	441,623,377	9,754,787	779,127	73,500	452,230,791
00213.las	385,912,740	19,629,734	4,836,867	821,877	411,201,218
00214.las	291,562,582	27,703,190	9,319,660	2,174,122	330,759,554
00215.las	84,613,500	25,810,602	5,450,411	484,998	116,359,511
00216.las	201,274,410	2,911,224	161,013	13,830	204,360,477
00217.las	78,027,849	14,006,021	2,087,021	229,000	94,349,891
00218.las	416,791,372	12,977,787	3,471,796	822,325	434,063,280
00219.las	146,518,775	30,828,709	6,857,624	789,074	184,994,182
00220.las	120,990,521	39,830,677	10,070,826	1,712,752	172,604,776
00221.las	311,592,368	3,485,615	138,589	3,353	315,219,925
00222.las	444,474,875	25,659,522	5,047,687	569,947	475,752,031
00223.las	183,700,566	39,254,198	10,763,780	2,100,623	235,819,167
00224.las	54,400,638	7,614,231	1,012,549	58,958	63,086,376
00225.las	213,339,988	3,315,394	461,494	44,419	217,161,295
00226.las	53,337,971	11,935,110	2,093,702	206,157	67,572,940
00227.las	277,017,596	3,278,443	237,628	3,388	280,537,055
00228.las	188,881,407	26,638,077	8,384,002	2,043,413	225,946,899
00229.las	79,263,629	9,638,966	1,891,064	268,482	91,062,141
00231.las	286,394,300	2,189,737	137,695	7,024	288,728,756
00232.las	29,788,489	12,038,985	2,762,653	360,758	44,950,885
00233.las	85,386,893	10,288,615	1,691,113	185,155	97,551,776
00234.las	249,372,910	24,264,919	7,121,249	1,389,338	282,148,416
00235.las	208,792,095	1,413,496	69,262	7,020	210,281,873

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<u>File</u>	<u>First return</u>	<u>Second return</u>	<u>Third return</u>	<u>Other returns</u>	<u>Total points</u>
00236.las	36,166,998	10,963,954	2,109,522	260,838	49,501,312
00237.las	448,004,066	10,437,932	2,057,762	281,478	460,781,238
00238.las	198,590,291	902,053	15,412	1,248	199,509,004
00240.las	116,423,542	155,435	347	10	116,579,334
00373.las	76,676,189	40,686,433	16,318,979	4,156,469	137,838,070
00379.las	93,147,011	52,044,455	20,906,317	5,172,444	171,270,227
00384.las	96,214,906	46,880,222	19,286,584	5,515,484	167,897,196
00389.las	177,699,039	30,972,600	11,035,736	2,831,369	222,538,744
00399.las	203,152,141	14,583,351	4,042,342	1,005,851	222,783,685
00410.las	172,667,287	34,719,766	13,751,368	4,037,881	225,176,302
00416.las	50,443	38,455	17,778	3,818	110,494
00423.las	109,639,943	21,759,621	6,536,265	1,409,324	139,345,153
00424.las	87,450,372	22,675,830	6,877,849	1,321,380	118,325,431
00439.las	1,793,887	475,310	167,891	36,344	2,473,432
<u>Total</u>	<u>35,628,913,568</u>	<u>3,572,289,172</u>	<u>974,765,698</u>	<u>192,505,083</u>	<u>40,368,473,521</u>