

## 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\65220751\\_NE\\_Southwest\Production\Final\\_Client\\_Deliverables\Projectwide\UTM13\point\\_cloud\Swath](#)

File	First return	Second return	Third return	Other returns	Total points
CS_00108.las	799,726,979	753,756	61,588	2,005	800,544,328
CS_00115.las	326,625,253	513,907	43,093	1,656	327,183,909
CS_00128.las	653,683,348	599,296	48,779	2,074	654,333,497
CS_00129.las	453,631,492	361,910	28,270	991	454,022,663
CS_01003.las	6,417,013	321	01	00	6,417,335
CS_01004.las	32,662,023	104,235	10,546	405	32,777,209
CS_01005.las	35,625,595	248,429	33,841	1,577	35,909,442
CS_01006.las	44,224,170	197,265	26,464	1,051	44,448,950
CS_01007.las	43,528,147	191,817	24,608	1,027	43,745,599
CS_01008.las	65,314,396	317,977	45,991	2,086	65,680,450
CS_01009.las	73,349,590	286,281	40,934	2,010	73,678,815
CS_01010.las	103,769,128	338,081	52,600	3,165	104,162,974
CS_01011.las	109,518,840	583,596	86,711	4,814	110,193,961
CS_01012.las	154,443,060	1,136,077	163,496	7,909	155,750,542
CS_01013.las	409,478,368	1,558,129	198,113	10,074	411,244,684
CS_01014.las	366,637,404	2,162,196	411,807	34,495	369,245,902
CS_01015.las	368,529,552	1,209,704	163,123	10,206	369,912,585
CS_01016.las	355,917,938	755,699	97,642	5,973	356,777,252
CS_01017.las	362,089,257	577,341	71,567	4,704	362,742,869
CS_01018.las	358,874,772	416,910	41,347	2,282	359,335,311
CS_01019.las	378,776,998	384,070	44,064	3,112	379,208,244
CS_01020.las	383,217,795	650,934	68,115	4,200	383,941,044
CS_01021.las	718,061,703	3,076,780	423,655	23,860	721,585,998
CS_01022.las	643,279,337	2,667,707	266,566	10,020	646,223,630
CS_01023.las	666,014,097	3,077,421	364,065	18,691	669,474,274

## *C-2 Report on Multiple Discrete Returns - continued*

File	First return	Second return	Third return	Other returns	Total points
CS_01024.las	641,265,530	4,224,997	529,301	29,378	646,049,206
CS_01025.las	637,478,625	4,078,032	493,046	25,861	642,075,564
CS_01026.las	644,421,316	3,386,942	480,071	31,511	648,319,840
CS_01027.las	659,723,855	3,769,698	534,331	35,062	664,062,946
CS_01028.las	643,371,465	3,993,432	595,346	44,947	648,005,190
CS_01029.las	682,041,661	4,468,848	573,314	40,684	687,124,507
CS_01030.las	650,588,830	5,688,472	709,671	49,168	657,036,141
CS_01031.las	699,873,938	6,581,811	968,629	75,036	707,499,414
CS_01032.las	494,632,657	2,030,243	279,524	14,049	496,956,473
CS_01033.las	382,542,592	1,237,113	159,118	8,106	383,946,929
CS_01034.las	238,462,872	72,954	8,882	595	238,545,303
CS_01035.las	240,874,546	138,335	17,729	1,131	241,031,741
CS_01036.las	175,410,472	71,835	10,964	792	175,494,063
CS_01037.las	2,449,885	1,148	04	00	2,451,037
CS_01038.las	506,249,119	2,662,663	454,251	28,616	509,394,649
CS_01039.las	508,562,707	3,131,431	509,255	30,372	512,233,765
CS_01040.las	515,113,098	2,875,908	451,874	26,949	518,467,829
CS_01041.las	17,256,745	16,464	2,395	158	17,275,762
CS_01042.las	27,962,061	895,214	2,064	74	28,859,413
CS_01043.las	29,333,974	1,839,323	7,314	357	31,180,968
CS_01044.las	28,685,081	1,418,339	8,497	431	30,112,348
CS_01045.las	31,713,178	562,625	23,883	734	32,300,420
CS_01046.las	30,665,919	500,572	49,981	1,753	31,218,225
CS_01047.las	30,476,540	62,929	9,209	622	30,549,300
CS_01048.las	29,652,061	85,681	8,945	474	29,747,161
CS_01049.las	31,587,943	95,873	10,597	660	31,695,073
CS_01050.las	29,798,350	49,458	6,212	650	29,854,670
CS_01051.las	29,960,157	19,355	2,553	237	29,982,302
CS_01052.las	29,738,205	34,068	6,436	692	29,779,401
CS_01053.las	30,514,827	47,467	10,029	856	30,573,179
CS_01054.las	30,203,786	22,271	3,941	353	30,230,351
CS_01056.las	29,824,542	32,229	5,507	587	29,862,865
CS_01057.las	31,629,348	60,921	12,991	1,825	31,705,085
CS_01058.las	40,129,614	231,315	42,807	4,546	40,408,282

## *C-2 Report on Multiple Discrete Returns - continued*

File	First return	Second return	Third return	Other returns	Total points
CS_01059.las	41,330,003	520,070	93,068	8,514	41,951,655
CS_01060.las	42,209,061	702,550	154,768	16,041	43,082,420
CS_01061.las	41,868,794	651,211	118,047	8,975	42,647,027
CS_01062.las	42,688,460	1,545,829	201,264	18,734	44,454,287
CS_01063.las	39,663,959	1,340,668	90,196	4,894	41,099,717
CS_01064.las	43,622,072	1,017,694	157,924	11,664	44,809,354
CS_01065.las	40,387,313	585,706	106,160	8,154	41,087,333
CS_01066.las	42,913,736	267,636	45,547	3,330	43,230,249
CS_01067.las	40,323,998	33,233	3,392	231	40,360,854
CS_01068.las	42,156,605	30,392	3,211	131	42,190,339
CS_01069.las	46,615,366	63,367	10,525	900	46,690,158
CS_01070.las	43,054,056	19,787	2,279	171	43,076,293
CS_01071.las	503,145,066	2,655,974	320,410	11,485	506,132,935
CS_01072.las	546,239,796	3,793,839	577,019	29,413	550,640,067
CS_01073.las	508,629,441	3,130,461	469,475	25,052	512,254,429
CS_01074.las	552,704,892	2,351,368	353,445	20,016	555,429,721
CS_01075.las	503,155,341	1,094,502	139,386	8,697	504,397,926
CS_01076.las	546,572,115	921,408	98,358	4,695	547,596,576
CS_01077.las	504,998,871	981,242	112,494	5,827	506,098,434
CS_01078.las	541,759,413	998,937	119,454	7,106	542,884,910
CS_01079.las	509,377,296	966,549	130,270	8,878	510,482,993
CS_01080.las	517,307,710	1,432,066	230,354	15,749	518,985,879
CS_01081.las	513,985,097	2,040,249	306,713	23,592	516,355,651
CS_01082.las	502,287,512	2,557,269	430,130	33,364	505,308,275
CS_01083.las	508,705,026	2,674,817	461,989	34,190	511,876,022
CS_01084.las	483,639,577	2,488,533	429,667	32,817	486,590,594
CS_01085.las	476,896,154	2,211,067	406,017	33,887	479,547,125
CS_01086.las	480,085,770	2,222,423	373,787	28,653	482,710,633
CS_01087.las	494,779,254	1,714,816	273,207	20,643	496,787,920
CS_01088.las	494,905,782	1,023,171	147,887	9,379	496,086,219
CS_01089.las	505,580,228	732,116	85,010	5,406	506,402,760
CS_01090.las	492,211,656	871,185	76,986	5,507	493,165,334
CS_01091.las	504,300,249	1,003,198	54,153	3,609	505,361,209
CS_01092.las	521,056,266	1,171,778	103,099	5,617	522,336,760

## *C-2 Report on Multiple Discrete Returns - continued*

<u>File</u>	<u>First return</u>	<u>Second return</u>	<u>Third return</u>	<u>Other returns</u>	<u>Total points</u>
CS_01093.las	508,235,762	973,186	112,223	5,990	509,327,161
CS_01094.las	510,389,063	802,418	105,610	6,805	511,303,896
CS_01095.las	479,016,582	779,859	90,921	6,069	479,893,431
CS_01096.las	206,492,993	420,691	73,673	5,686	206,993,043
CS_01097.las	334,670,871	2,049,003	435,672	35,928	337,191,474
CS_01098.las	337,216,829	3,762,973	894,926	84,004	341,958,732
CS_01099.las	643,559,908	5,596,675	719,017	48,256	649,923,856
CS_01100.las	651,756,516	6,267,018	857,168	63,630	658,944,332
CS_01101.las	649,058,681	3,823,511	554,064	41,870	653,478,126
CS_01102.las	640,874,035	5,127,878	980,197	96,876	647,078,986
CS_01103.las	650,441,635	9,161,545	2,155,144	262,984	662,021,308
CS_01104.las	634,829,600	14,919,451	4,055,622	579,512	654,384,185
CS_01105.las	649,994,403	14,529,407	4,018,369	567,285	669,109,464
CS_01106.las	634,539,684	18,775,495	5,154,350	693,412	659,162,941
CS_01107.las	637,380,386	18,756,367	5,050,594	655,977	661,843,324
CS_01108.las	632,372,614	18,327,311	5,010,506	668,430	656,378,861
CS_01109.las	646,006,616	19,727,516	4,783,375	500,186	671,017,693
CS_01110.las	665,776,813	18,017,988	4,651,003	547,726	688,993,530
CS_01111.las	638,035,830	13,916,971	3,405,025	400,337	655,758,163
CS_01112.las	672,492,718	10,660,293	2,365,588	248,732	685,767,331
CS_01113.las	638,655,659	7,056,651	1,386,737	135,130	647,234,177
CS_01114.las	676,567,231	5,317,318	954,159	86,915	682,925,623
CS_01115.las	640,525,273	3,465,530	489,363	34,139	644,514,305
CS_01116.las	676,636,022	4,576,703	664,647	46,095	681,923,467
CS_01117.las	636,306,986	2,469,056	366,322	25,972	639,168,336
CS_01118.las	686,132,202	3,410,182	528,623	40,500	690,111,507
CS_01119.las	503,538,739	6,856,313	1,599,572	130,106	512,124,730
CS_01120.las	689,909,090	12,740,208	3,113,269	272,288	706,034,855
CS_01121.las	645,062,459	15,324,138	4,076,743	390,766	664,854,106
CS_01122.las	688,725,645	14,037,801	3,688,740	363,813	706,815,999
CS_01123.las	645,295,169	14,167,690	3,886,920	421,244	663,771,023
CS_01124.las	685,229,016	20,568,668	5,744,794	688,159	712,230,637
CS_01125.las	649,783,428	19,941,826	5,499,781	694,708	675,919,743
CS_01126.las	665,308,626	18,455,260	4,945,835	630,636	689,340,357

*C-2 Report on Multiple Discrete Returns - continued*

<u>File</u>	<u>First return</u>	<u>Second return</u>	<u>Third return</u>	<u>Other returns</u>	<u>Total points</u>
CS_01127.las	656,882,502	7,334,012	1,382,785	143,174	665,742,473
Total	49,672,447,275	464,489,828	100,292,685	10,694,314	50,247,924,102