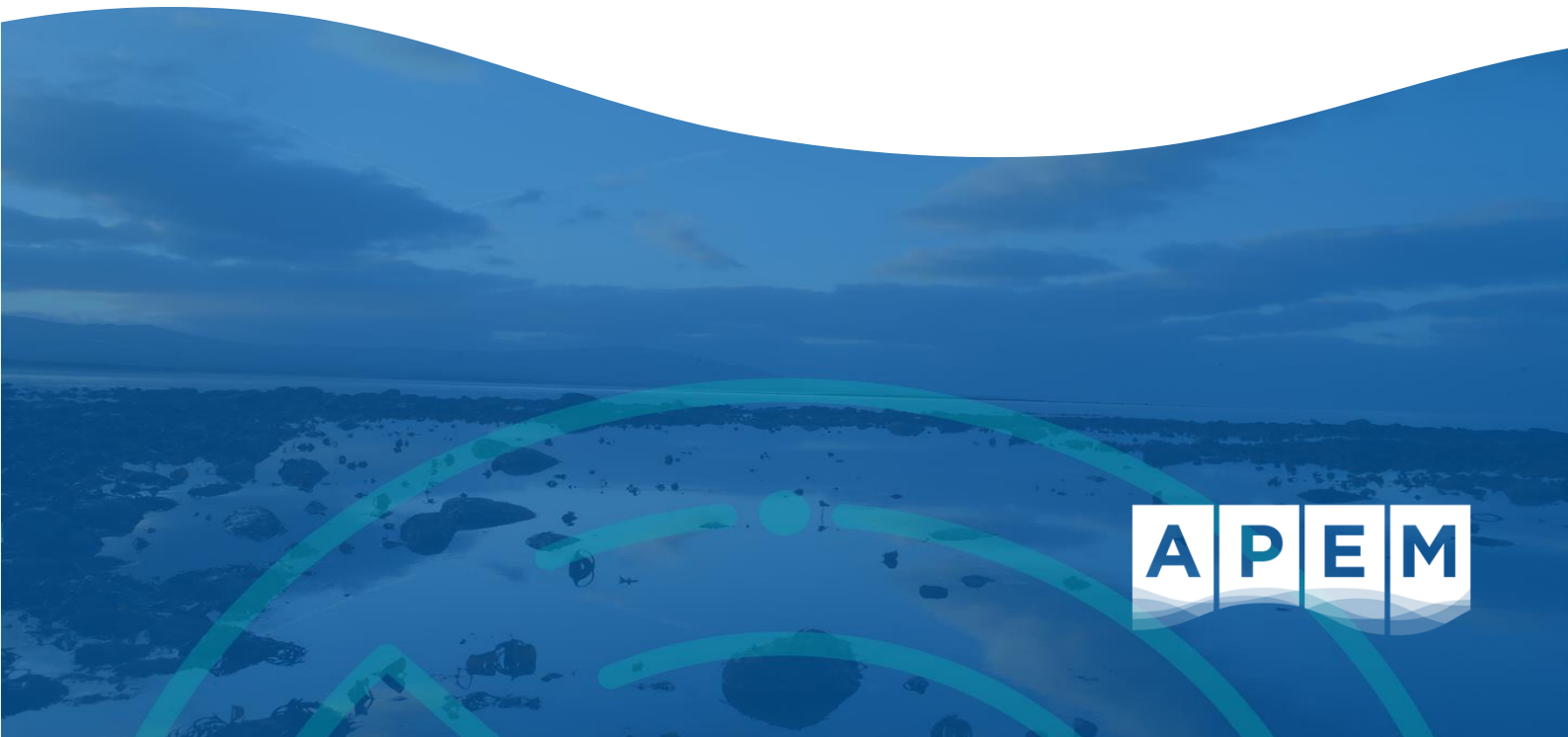
NMBAQC

NE Atlantic Marine Biological Analytical Quality Control Scheme

NMBAQC Scheme 2023/24

PS89 Report

Lydia McIntyre-Brown



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McIntyre-Brown, L. & Hall, D., 2024. National Marine Biological Analytical Quality Control Scheme. Particle Size Results: PS89 Report to the NMBAQC Scheme participants. Apem Report NMBAQCps89, 19pp, July 2024.

Revision and Amendment Register

Version Number	Date	Section(s)	Page(s)	Summary of Changes	Approved by
1.0	09/02/2024	All	All	Creation of Document	LMB
1.1	13/02/2024	All	All	Review of Document	DH
1.2	08/04/2024	2 & appendices	9 - 18	Update PSA_3015 data	LMB

At the time of issue no data had been received from participants PSA_3009, PSA_3013 and PSA_30014.

Contents

List of Figures

List of Tables

Abbreviations

n/p – Not participating at the current time.

n/r – no response from participant/ no data submitted.

"-" – no data submitted.

1. BENCHMARK DATA

Table 1 Summary data for the Benchmark replicates distributed as PS89.

Sample	Method	% Gravel	% Sand	% Mud	Sediment Description
PSA_3036 BM REP 1	NMBAQC	46.37	49.66	3.97	Sandy Gravel
PSA_3037 BM REP2	NMBAQC	46.18	50.67	3.15	Sandy Gravel
PSA_3038 BM REP 3	NMBAQC	45.64	50.73	3.63	Sandy Gravel
PSA_3039 BM REP 4	NMBAQC	45.68	51.19	3.13	Sandy Gravel
PSA_3040 BM REP 5	NMBAQC	46.34	50.70	2.96	Sandy Gravel
BM Rep Average	NMBAQC	46.04	50.59	3.37	Sandy Gravel

Table 2 Summary of the sieve data the Benchmark replicates distributed as PS89.

Phi Interval; microns		PSA_3036 BM REP 1	PSA_3037 BM REP2	PSA_3038 BM REP 3	PSA_3039 BM REP 4	PSA_3040 BM REP 5	BM Rep Average
-6.50 to -6.00; 63 mm		0.00	0.00	0.00	0.00	0.00	0.00
-6.00 to -5.50; 45 mm		0.00	0.00	0.00	0.00	0.00	0.00
-5.50 to -5.00; 31.5 mm		0.00	0.00	0.00	0.00	0.00	0.00
-5.00 to -4.50; 22.4 mm		0.00	0.00	0.00	0.00	0.00	0.00
-4.50 to -4.00; 16 mm		0.00	0.00	0.00	0.00	0.00	0.00
-4.00 to -3.50; 11.2 mm		0.00	0.00	0.00	0.00	0.00	0.00
-3.50 to -3.00; 8 mm		0.00	0.00	0.00	0.00	0.00	0.00
-3.00 to -2.50; 5.6 mm		4.22	7.55	4.51	1.89	2.27	4.09
-2.50 to -2.00; 4 mm		117.19	110.87	129.20	118.17	110.79	117.24
-2.00 to -1.50; 2.8 mm		153.55	154.99	139.99	151.63	159.09	151.85
-1.50 to -1.00; 2 mm		3.88	5.09	3.55	3.68	3.22	3.88
-1.00 to -0.50; 1.4 mm		23.44	27.53	23.89	24.75	24.42	24.81
-0.50 to 0.00; 1.0 mm		43.92	42.82	43.86	44.03	41.66	43.26
>1.0mm		346.20	348.85	345.00	344.15	341.45	345.13
<1.0mm	Base Pan	8.62	7.31	14.03	10.87	8.88	9.94
	Oven dried	246.53	246.89	248.50	247.79	243.95	246.73
Total Weight		601.35	603.05	607.53	602.81	594.28	601.80

Table 3 Summary of the final laser data for the Benchmark replicates distributed as PS89.

Phi Interval; microns	PSA_3036 BM REP 1	PSA_3037 BM REP2	PSA_3038 BM REP 3	PSA_3039 BM REP 4	PSA_3040 BM REP 5	BM Rep Average
0.00 to 0.50; (707 µm)	4.94	4.19	4.97	4.96	4.85	4.78
0.50 to 1.00; (500 µm)	11.81	12.62	11.99	12.70	12.53	12.33
1.00 to 1.50; (353.6 µm)	29.48	31.28	30.09	30.73	30.89	30.49
1.50 to 2.00; (250 µm)	28.09	28.90	28.30	28.44	28.81	28.51
2.00 to 2.50; (176.8 µm)	11.57	11.41	11.61	11.50	11.72	11.56
2.50 to 3.00; (125 µm)	3.41	3.13	3.30	3.28	3.08	3.24
3.00 to 3.50; (88.39 µm)	0.85	0.70	0.86	0.79	0.84	0.81
3.50 to 4.00; (62.5 µm)	0.47	0.30	0.49	0.30	0.32	0.38
4.00 to 4.50; (44.19 µm)	0.37	0.28	0.33	0.22	0.29	0.30
4.50 to 5.00; (31.25 µm)	0.46	0.34	0.42	0.35	0.29	0.37
5.00 to 5.50; (22.097 µm)	0.40	0.31	0.35	0.28	0.28	0.32
5.50 to 6.00; (15.625 µm)	0.23	0.18	0.27	0.20	0.20	0.21
6.00 to 6.50; (11.049 µm)	0.51	0.39	0.49	0.39	0.36	0.43
6.50 to 7.00; (7.813 µm)	0.37	0.31	0.39	0.35	0.27	0.34
7.00 to 7.50; (5.524 µm)	0.57	0.43	0.55	0.48	0.40	0.49
7.50 to 8.00; (3.906 µm)	0.82	0.59	0.72	0.61	0.54	0.66
8.00 to 8.50; (2.762 µm)	0.65	0.49	0.58	0.52	0.45	0.54
8.50 to 9.00; (1.953 µm)	0.66	0.51	0.57	0.50	0.46	0.54
9.00 to 9.50; (1.381 µm)	0.86	0.65	0.70	0.62	0.61	0.69
9.50 to 10.00; (0.977 µm)	0.77	0.62	0.64	0.59	0.59	0.64
10.00 to 10.50; (0.691 µm)	0.53	0.47	0.47	0.46	0.45	0.47
10.50 to 11.00; (0.488 µm)	0.45	0.40	0.40	0.38	0.38	0.40
11.00 to 11.50; (0.345 µm)	0.50	0.42	0.42	0.37	0.39	0.42
11.50 to 12.00; (0.244 µm)	0.50	0.40	0.42	0.35	0.38	0.41
12.00 to 12.50; (0.173 µm)	0.36	0.31	0.32	0.27	0.29	0.31
12.50 to 13.00; (0.122 µm)	0.22	0.20	0.21	0.19	0.19	0.20
13.00 to 13.50; (0.086 µm)	0.10	0.11	0.11	0.12	0.10	0.11
13.50 to 14.00; (0.061 µm)	0.03	0.04	0.04	0.05	0.04	0.04
14.00 to 14.50; (0.043 µm)	0.00	0.01	0.01	0.01	0.01	0.01
>14.50; (0.01 µm)	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00
Mean	318.44	329.31	323.44	331.84	332.20	327.03
Sorting	2.97	2.67	2.79	2.66	2.59	2.74
Skewness	-0.45	-0.44	-0.44	-0.42	-0.42	-0.44
Kurtosis	3.68	3.51	3.54	3.39	3.33	3.53
Mode	Unimodal	Unimodal	Unimodal	Unimodal	Unimodal	Unimodal
Primary Mode	426.8	426.8	426.8	426.8	426.8	426.8

Table 4 Summary of Coefficient of Variation for Benchmark laser replicates for PS89.

		PSA_3036 BM REP 1	PSA_3037 BM REP2	PSA_3038 BM REP 3	PSA_3039 BM REP 4	PSA_3040 BM REP 5	BM Rep Average
D_{10}	Sub-sample 1	3.13	0.98	1.03	0.51	1.57	3.13
	Sub-sample 2	15.32	2.45	0.71	0.86	0.68	15.32
	Sub-sample 3	3.40	1.40	1.50	1.49	0.80	3.40
D_{50}	Sub-sample 1	0.36	0.18	0.25	0.31	0.32	0.36
	Sub-sample 2	0.41	0.31	0.25	0.24	0.26	0.41
	Sub-sample 3	0.66	0.66	0.02	0.40	0.11	0.66
D_{90}	Sub-sample 1	1.12	0.76	1.24	0.71	1.05	1.12
	Sub-sample 2	1.22	0.96	0.73	1.15	0.99	1.22
	Sub-sample 3	1.49	0.49	0.67	0.40	0.78	1.49

$$COV = \left(\frac{StDev}{Mean}\right) * 100$$

ISO 133020 defines good reproducibility when: COV is <3% for D50

COV is <5% for D10 and D90

All limits double when the D50 is <10microns.

In reality 3% and 5% are low and greater variability is expected for natural sediment samples therefore a maximum of 20% (based on three replicates being measured) will be used as a guide.
The Benchmark replicates show good reproducibility.

Table 5 Laser Metadata for the Benchmark replicates for PS89.

	Benchmark Lab
Laser used: Dispersion Unit:	Beckman Coulter LS 13320 Universal Liquid Module
Analysis model: Dispersion Used Particle Refractive Index Particle Absorption Index: Fines extension	Mie Water (RI – 1.33) 1.55 0.1 PIDS system
Obscuration	10%
Pump Speed (% or rpm) Stirrer speed (% or rpm) Ultrasonic duration Ultrasonic level	80% n/a 20 2

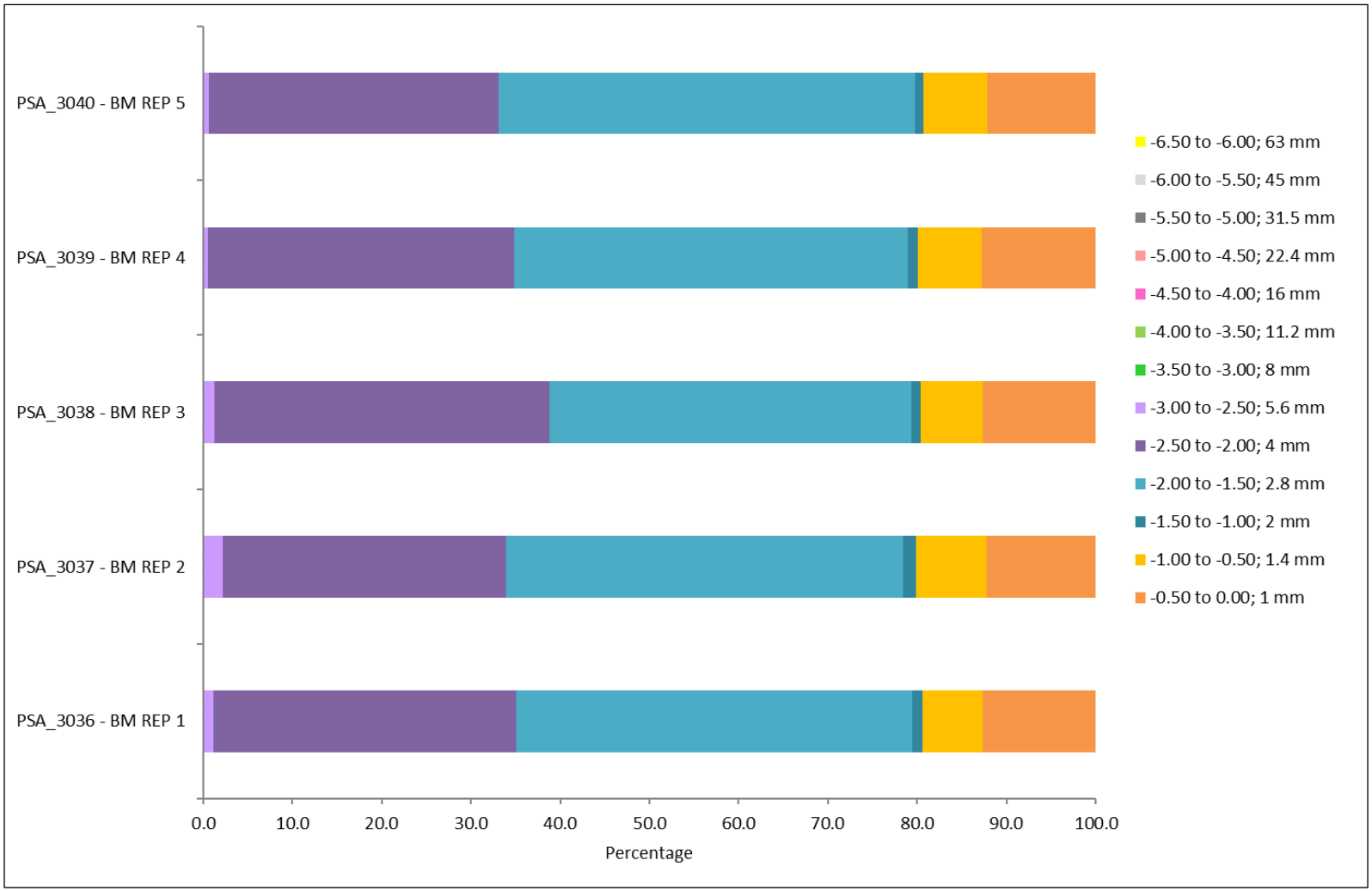

Figure 1 Bar chart showing the Benchmark sieve data with percentage of sediment in each size category for sediment distributed as PS89**.**

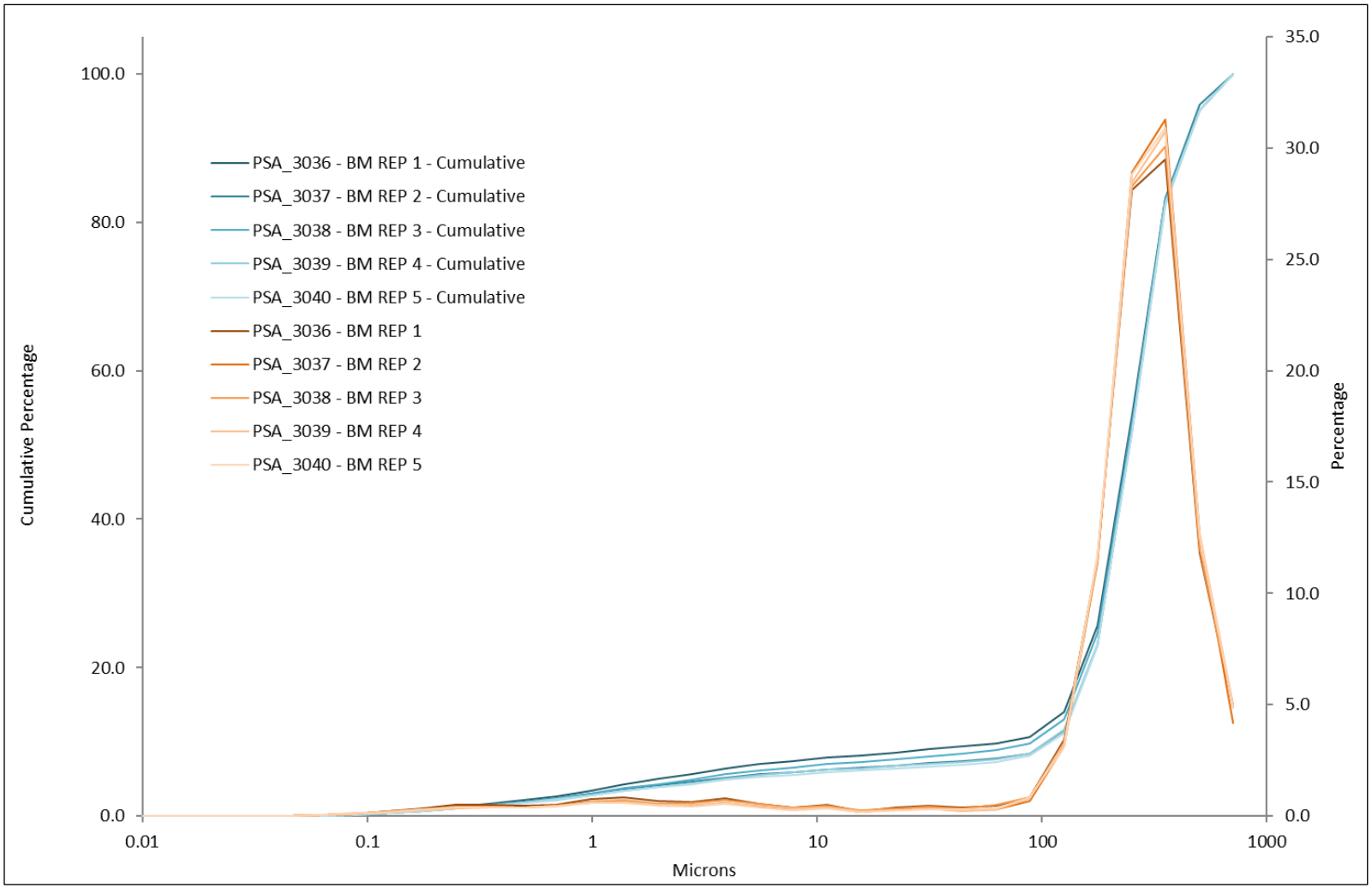

Figure 2 Particle size distribution curves resulting from final laser analysis of 5 replicate samples of sediment distributed as PS89 (Benchmark Data).

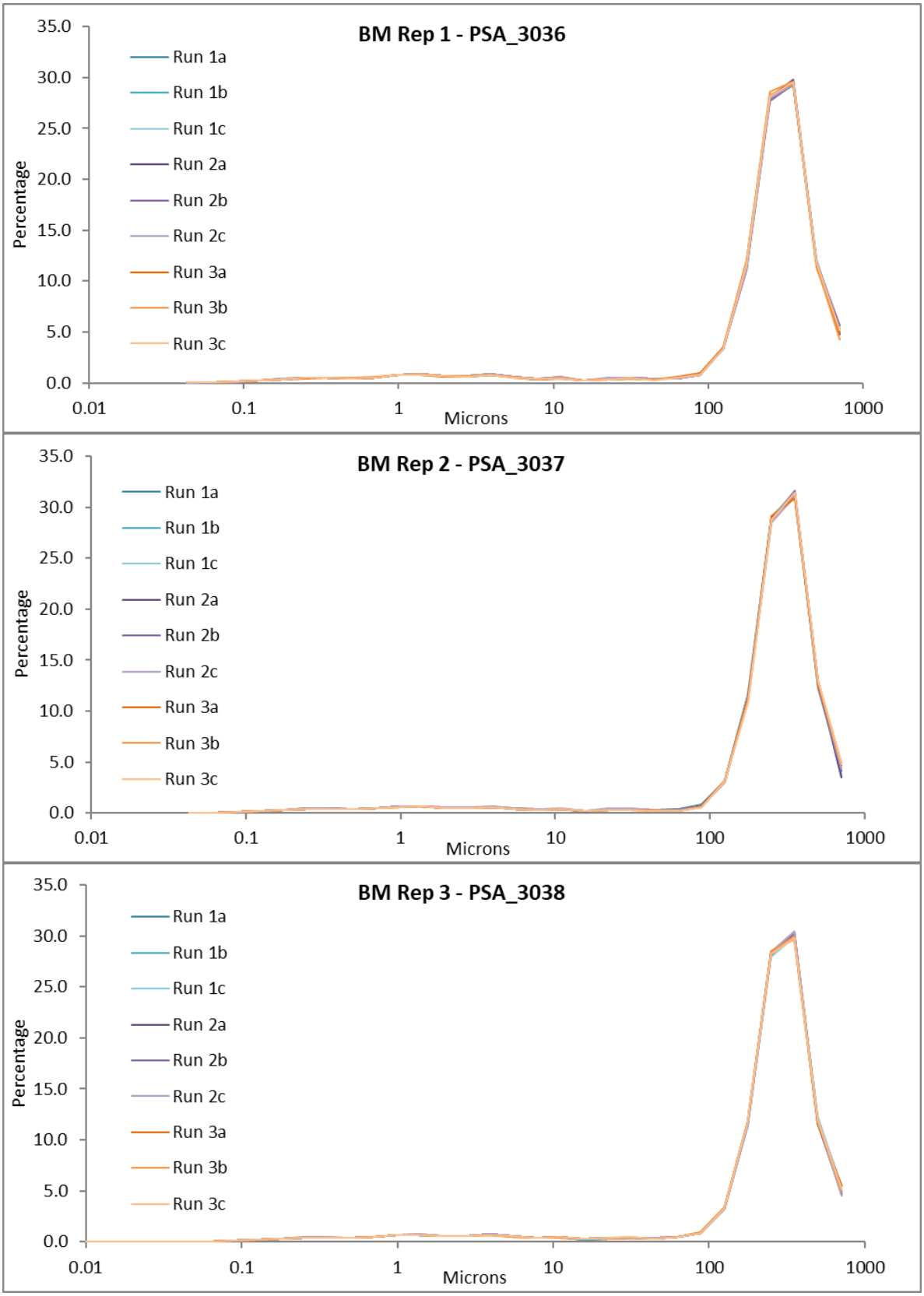

Figure 3 Particle size distribution curves resulting from laser analysis of five replicate samples of sediment distributed as PS89.

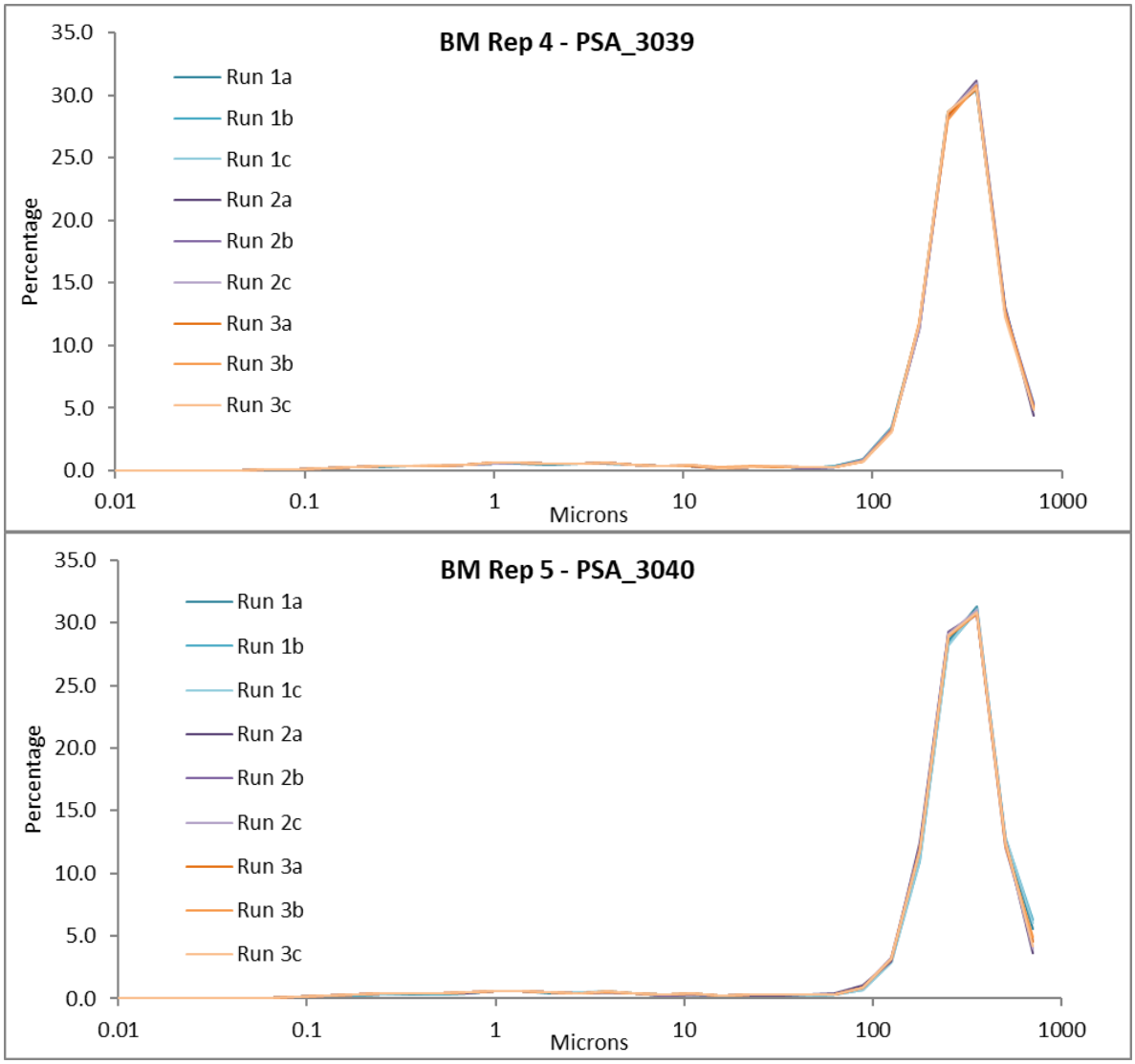

Figure 3 Particle size distribution curves resulting from laser analysis of five replicate samples of sediment distributed as PS89.

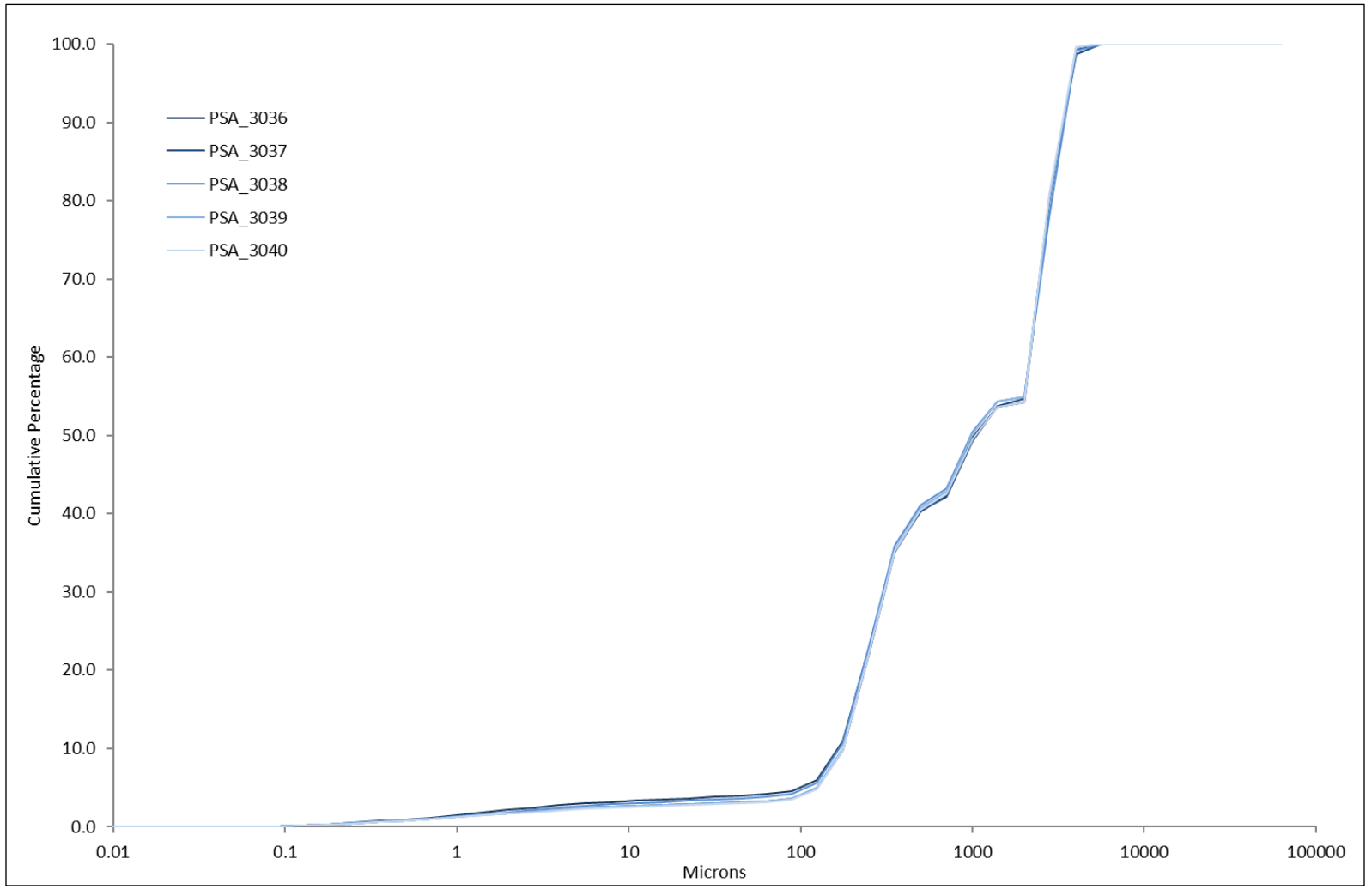

Figure 4 Particle size distribution curves resulting from analysis of 5 replicate samples of sediment distributed as PS89 (Benchmark Data).

2. PARTICIPANT DATA

Table 6 Summary of equipment and methods used by participants and sample summary data provided by participants for sediment distributed as PS89.

Lab	Equipment Used		Method Used	Chemical Dispersant	Peroxide pre-treatment	Summary Data			Sediment Description	
	Sieves	Laser				% Gravel	% Sand	% Mud	(post analysis)	Gradistat Textural Group
BM Average	Yes	Yes	NMBAQC	No	No	46.04	50.59	3.37	Sandy Gravel	Sandy Gravel
PSA_3001_a	Yes	Yes	NMBAQC	No	No	49.39	48.46	2.15	Sandy Gravel	Sandy Gravel
PSA_3001_b	Yes	Yes	NMBAQC	No	No	49.39	49.59	1.02	Sandy Gravel	Sandy Gravel
PSA_3001_c	Yes	Yes	NMBAQC	No	No	49.39	48.18	2.43	Sandy Gravel	Sandy Gravel
PSA_3002	Yes	Yes	OTHER	No	No	47.09	49.16	3.75	Sandy Gravel	Sandy Gravel
PSA_3003	Yes	Yes	NMBAQC	No	No	46.22	53.33	0.45	Sandy Gravel	Sandy Gravel
PSA_3004	Yes	Yes	NMBAQC	No	No	46.1	51.6	2.3	Sandy Gravel	Sandy Gravel
PSA_3005	Yes	Yes	NMBAQC	No	No	46.5	50.5	3.0	Sandy Gravel	Sandy Gravel
PSA_3006	Yes	Yes	NMBAQC	No	No	45.72	51.27	3.01	Sandy Gravel	Sandy Gravel
PSA_3007	Yes	Yes	OTHER	No	No	49.28	49.58	1.14	Sandy Gravel	Sandy Gravel
PSA_3008	Yes	Yes	NMBAQC	No	No	45.64	54.30	0.06	Sandy Gravel	Sandy Gravel
PSA_3009	n/p	n/p	n/p	n/p	n/p	n/p	n/p	n/p	n/p	n/p
PSA_3010	Yes	Yes	NMBAQC	No	No	46.17	52.25	1.58	Sandy Gravel	Sandy Gravel
PSA_3011	Yes	Yes	NMBAQC	No	No	46.20	51.70	2.11	Sandy Gravel	Sandy Gravel
PSA_3012	Yes	Yes	NMBAQC	No	No	45.17	51.16	3.67	Sandy Gravel	Sandy Gravel
PSA_3013	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r	n/r
PSA_3014	n/p	n/p	n/p	n/p	n/p	n/p	n/p	n/p	n/p	n/p
PSA_3015	Yes	Yes	NMBAQC	No	No	47.36	32.68	19.96	Muddy Sandy Gravel	Muddy Sandy Gravel

Table 7 Summary of the sieve data provided by participants for sediment distributed as PS89.

Phi interval (explicit); Sieve mesh (mm)		Benchmark Average	PSA_3001_a	PSA_3002	PSA_3003	PSA_3004	PSA_3005	PSA_3006	PSA_3007
Sieves Used		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
-6.50 to -6.00; 63 mm		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-6.00 to -5.50; 45 mm		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-5.50 to -5.00; 31.5		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-5.00 to -4.50; 22.4		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-4.50 to -4.00; 16 mm		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-4.00 to -3.50; 11.2		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-3.50 to -3.00; 8 mm		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
-3.00 to -2.50; 5.6 mm		4.09	2.62	3.97	2.31	2.54	2.12	3.66	0.00
-2.50 to -2.00; 4 mm		117.24	102.90	99.47	94.02	94.75	110.64	111.77	0.00
-2.00 to -1.50; 2.8 mm		151.85	137.63	194.47	170.38	156.15	179.74	152.56	0.00
-1.50 to -1.00; 2 mm		3.88	4.67	2.23	4.81	10.88	8.60	2.06	318.99
-1.00 to -0.50; 1.4 mm		24.81	22.48	29.77	23.39	23.67	27.82	24.88	0.00
-0.50 to 0.00; 1 mm		43.26	39.77	45.20	40.99	43.63	49.82	43.55	66.53
Total		345.13	310.06	375.10	335.90	331.62	378.72	338.48	385.52
Summary Data									
>1 mm		345.13	310.06	375.10	335.90	348.30	378.72	338.48	385.52
<1 mm	Base pan	9.94	8.49	-	13.64	16.68	9.04	7.68	-
	Oven dried	246.73	183.19	262.27	237.91	225.16	259.48	244.51	-
Total Sample Weight		601.80	501.74	637.37	587.45	573.46	647.25	590.67	385.52

Table 7 Summary of the sieve data provided by participants for sediment distributed as PS89**.**

Phi interval (explicit); Sieve mesh (mm)		Benchmark Average	PSA_3008	PSA_3009	PSA_3010	PSA_3011	PSA_3012	PSA_3013	PSA_3014	PSA_3015
Sieves Used		Yes	Yes	n/p	Yes	Yes	Yes	n/r	n/p	Yes
-6.50 to -6.00; 63 mm		0.00	0.00	n/p	0.00	0.00	0.00	n/r	n/p	0.00
-6.00 to -5.50; 45 mm		0.00	0.00	n/p	0.00	0.00	0.00	n/r	n/p	0.00
-5.50 to -5.00; 31.5		0.00	0.00	n/p	0.00	0.00	0.00	n/r	n/p	0.00
-5.00 to -4.50; 22.4		0.00	0.00	n/p	0.00	0.00	0.00	n/r	n/p	0.00
-4.50 to -4.00; 16 mm		0.00	0.00	n/p	0.00	0.00	0.00	n/r	n/p	0.00
-4.00 to -3.50; 11.2		0.00	0.00	n/p	0.00	0.00	0.00	n/r	n/p	0.00
-3.50 to -3.00; 8 mm		0.00	0.00	n/p	0.00	0.00	0.00	n/r	n/p	0.00
-3.00 to -2.50; 5.6 mm		4.09	0.54	n/p	4.92	7.67	16.52	n/r	n/p	8.52
-2.50 to -2.00; 4 mm		117.24	78.88	n/p	116.77	105.75	82.93	n/r	n/p	102.94
-2.00 to -1.50; 2.8 mm		151.85	141.65	n/p	165.54	161.35	124.40	n/r	n/p	151.35
-1.50 to -1.00; 2 mm		3.88	4.44	n/p	12.42	5.28	2.89	n/r	n/p	3.27
-1.00 to -0.50; 1.4 mm		24.81	20.51	n/p	27.48	27.01	21.92	n/r	n/p	24.91
-0.50 to 0.00; 1 mm		43.26	34.32	n/p	48.82	45.12	38.28	n/r	n/p	41.65
Total		345.13	280.34	n/p	375.95	352.18	286.93	n/r	n/p	332.64
Summary Data										
>1 mm		345.13	280.34	n/p	375.95	352.18	286.94	n/r	n/p	332.64
<1 mm	Base pan	9.94	14.36	n/p	6.13	38.78	4.28	n/r	n/p	9.51
	Oven dried	246.73	199.37	n/p	267.05	215.26	210.72	n/r	n/p	219.71
Total Sample Weight		601.80	494.07	n/p	649.13	606.23	501.94	n/r	n/p	561.86

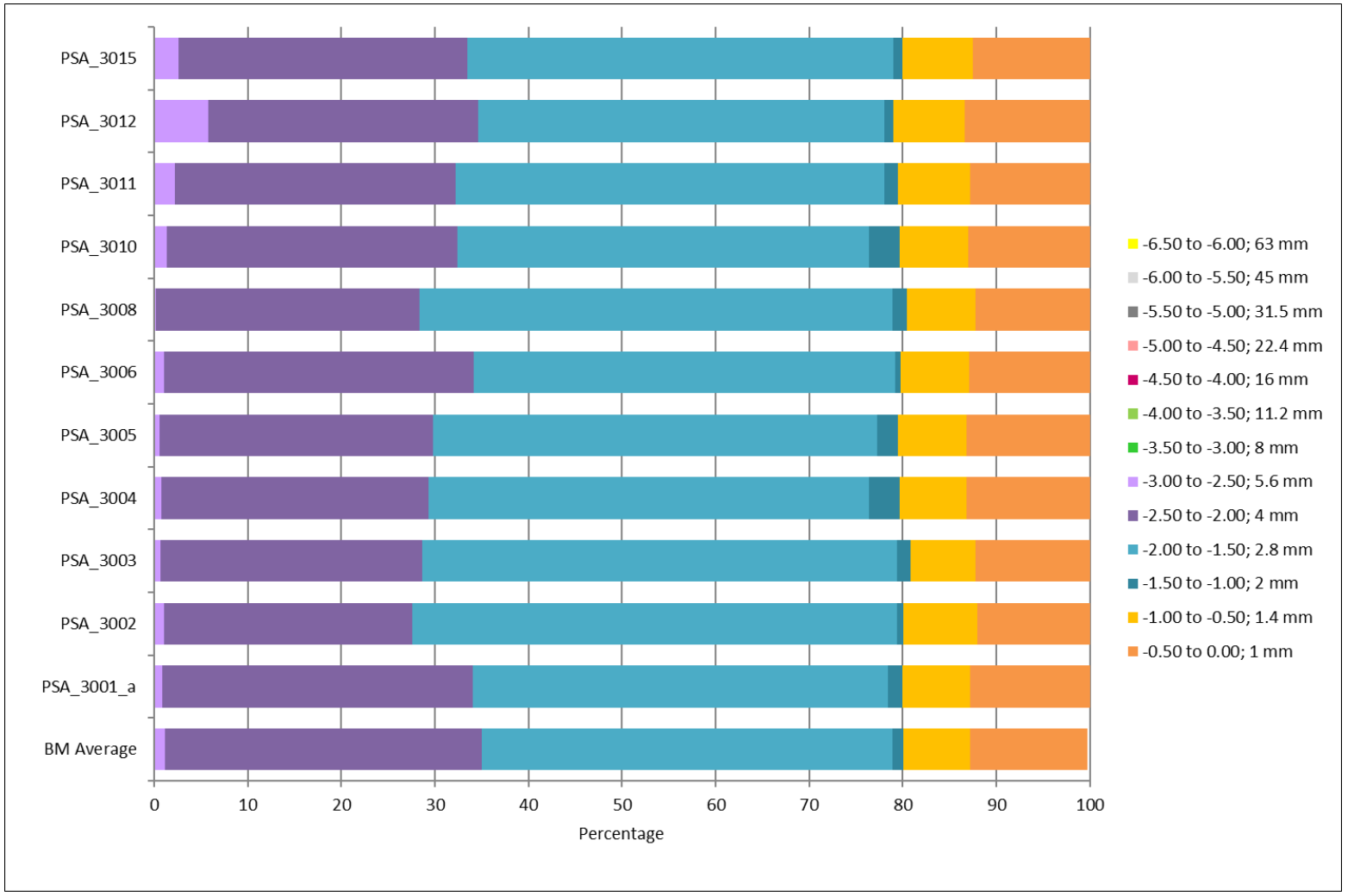

Figure 5 Final sieve data (in percentages) provided by each participant for sediment distributed as PS89.

Table 8 Summary of final laser data for the participants for sediment distributed as PS89 with Gradistat output.

Microns	Benchmark Average	PSA_3001_a	PSA_3001_b	PSA_3001_c	PSA_3002	PSA_3003	PSA_3004
707	4.78	1.16	3.21	1.78	1.98	13.31	1.52
500	12.33	11.03	16.48	11.98	13.99	13.09	13.31
353.6	30.49	27.61	29.88	27.26	27.52	28.52	28.43
250	28.51	31.54	29.13	30.25	27.97	26.27	30.48
176.8	11.56	18.26	15.39	17.55	15.35	11.17	16.85
125	3.24	4.57	3.26	4.53	3.78	3.49	4.07
88.39	0.81	0.15	0.00	0.16	0.12	1.90	0.11
62.5	0.38	0.05	0.00	0.12	0.18	1.21	0.10
44.19	0.30	0.39	0.00	0.44	0.51	0.32	0.37
31.25	0.37	0.40	0.00	0.43	0.45	0.04	0.34
22.097	0.32	0.23	0.00	0.26	0.30	0.03	0.18
15.625	0.21	0.14	0.00	0.20	0.30	0.06	0.13
11.049	0.43	0.23	0.02	0.26	0.40	0.02	0.23
7.813	0.34	0.31	0.22	0.34	0.54	0.03	0.35
5.524	0.49	0.40	0.27	0.43	0.67	0.04	0.44
3.906	0.66	0.50	0.30	0.54	0.81	0.05	0.52
2.762	0.54	0.60	0.35	0.66	0.94	0.04	0.61
1.953	0.54	0.61	0.39	0.68	0.95	0.05	0.52
1.381	0.69	0.50	0.39	0.55	0.77	0.06	0.40
0.977	0.64	0.45	0.34	0.50	0.72	0.06	0.35
0.691	0.47	0.55	0.26	0.65	0.98	0.04	0.45
0.488	0.40	0.31	0.13	0.40	0.71	0.05	0.23
0.345	0.42	0.00	0.00	0.02	0.06	0.05	0.00
0.244	0.41	0.00	0.00	0.00	0.00	0.05	0.00
0.173	0.31	0.00	0.00	0.00	0.00	0.03	0.00
0.122	0.20	0.00	0.00	0.00	0.00	0.02	0.00
0.086	0.11	0.00	0.00	0.00	0.00	0.01	0.00
0.061	0.04	0.00	0.00	0.00	0.00	0.00	0.00
0.043	0.01	0.00	0.00	0.00	0.00	0.00	0.00
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Gradistat Outputs							
MEAN:	327.03	309.44	348.03	311.25	313.14	383.99	319.75
SORTING:	2.74	1.92	1.56	2.22	2.79	1.73	1.81
SKEWNESS:	-0.44	-0.30	-0.06	-0.35	-0.43	-0.01	-0.26
KURTOSIS:	3.53	1.94	1.01	2.47	3.21	1.18	1.69
MODE:	Unimodal	Unimodal	Unimodal	Unimodal	Unimodal	Unimodal	Unimodal
Primary	426.8	301.80	426.80	301.80	301.80	426.80	301.80

Table 8 Summary of final laser data for the participants for sediment distributed as PS89 with Gradistat output.

Microns	Benchmark Average	PSA_3005	PSA_3006	PSA_3007	PSA_3008	PSA_3009	PSA_3010
707	4.78	1.11	5.75	4.71	2.60	n/p	3.73
500	12.33	12.83	12.52	18.06	16.21	n/p	16.10
353.6	30.49	29.47	30.70	29.90	36.07	n/p	30.02
250	28.51	31.12	28.51	27.88	31.39	n/p	29.22
176.8	11.56	15.61	11.39	14.01	10.57	n/p	14.49
125	3.24	2.72	3.02	2.63	2.04	n/p	2.67
88.39	0.81	0.00	0.78	0.00	0.81	n/p	0.00
62.5	0.38	0.00	0.28	0.00	0.18	n/p	0.00
44.19	0.30	0.68	0.28	0.00	0.08	n/p	0.59
31.25	0.37	0.76	0.33	0.00	0.05	n/p	0.68
22.097	0.32	0.35	0.30	0.00	0.00	n/p	0.35
15.625	0.21	0.17	0.22	0.00	0.00	n/p	0.22
11.049	0.43	0.27	0.40	0.27	0.00	n/p	0.29
7.813	0.34	0.41	0.32	0.41	0.00	n/p	0.35
5.524	0.49	0.50	0.44	0.43	0.00	n/p	0.32
3.906	0.66	0.56	0.58	0.40	0.00	n/p	0.26
2.762	0.54	0.62	0.47	0.36	0.00	n/p	0.23
1.953	0.54	0.65	0.47	0.32	0.00	n/p	0.22
1.381	0.69	0.62	0.59	0.28	0.00	n/p	0.20
0.977	0.64	0.55	0.55	0.22	0.00	n/p	0.05
0.691	0.47	0.47	0.41	0.11	0.00	n/p	0.00
0.488	0.40	0.35	0.35	0.00	0.00	n/p	0.00
0.345	0.42	0.18	0.36	0.00	0.00	n/p	0.00
0.244	0.41	0.00	0.35	0.00	0.00	n/p	0.00
0.173	0.31	0.00	0.27	0.00	0.00	n/p	0.00
0.122	0.20	0.00	0.18	0.00	0.00	n/p	0.00
0.086	0.11	0.00	0.10	0.00	0.00	n/p	0.00
0.061	0.04	0.00	0.04	0.00	0.00	n/p	0.00
0.043	0.01	0.00	0.01	0.00	0.00	n/p	0.00
0.01	0.00	0.00	0.00	0.00	0.00	n/p	0.00
Total	100.00	100.00	100.00	100.00	100.00	n/p	100.00
Gradistat Outputs							
MEAN:	327.03	319.08	336.59	362.60	369.48	n/p	349.23
SORTING:	2.74	2.26	2.59	1.56	1.46	n/p	1.58
SKEWNESS:	-0.44	-0.38	-0.40	-0.05	-0.04	n/p	-0.09
KURTOSIS:	3.53	2.81	3.28	0.98	1.03	n/p	1.08
MODE:	Unimodal	Unimodal	Unimodal	Unimodal	Unimodal	n/p	Unimodal
Primary	426.8	301.8	426.8	426.8	426.8	n/p	426.8

Table 8 Summary of final laser data for the participants for sediment distributed as PS89 with Gradistat output.

Microns	Benchmark Average	PSA_3011	PSA_3012	PSA_3013	PSA_3014	PSA_3015
707	4.78	2.83	0.68	n/r	n/p	0.14
500	12.33	13.12	11.68	n/r	n/p	7.85
353.6	30.49	31.15	27.57	n/r	n/p	23.15
250	28.51	31.10	30.51	n/r	n/p	16.33
176.8	11.56	12.49	16.82	n/r	n/p	3.50
125	3.24	3.54	3.90	n/r	n/p	0.10
88.39	0.81	0.72	0.10	n/r	n/p	0.00
62.5	0.38	0.03	0.18	n/r	n/p	0.00
44.19	0.30	0.00	0.55	n/r	n/p	0.00
31.25	0.37	0.05	0.53	n/r	n/p	0.02
22.097	0.32	0.10	0.37	n/r	n/p	0.57
15.625	0.21	0.25	0.33	n/r	n/p	2.31
11.049	0.43	0.42	0.40	n/r	n/p	2.92
7.813	0.34	0.28	0.47	n/r	n/p	4.65
5.524	0.49	0.39	0.56	n/r	n/p	4.58
3.906	0.66	0.53	0.68	n/r	n/p	4.26
2.762	0.54	0.42	0.83	n/r	n/p	4.04
1.953	0.54	0.38	0.89	n/r	n/p	3.90
1.381	0.69	0.47	0.75	n/r	n/p	3.79
0.977	0.64	0.47	0.70	n/r	n/p	3.63
0.691	0.47	0.35	0.86	n/r	n/p	2.59
0.488	0.40	0.24	0.58	n/r	n/p	3.24
0.345	0.42	0.18	0.05	n/r	n/p	2.91
0.244	0.41	0.16	0.00	n/r	n/p	2.41
0.173	0.31	0.13	0.00	n/r	n/p	1.78
0.122	0.20	0.11	0.00	n/r	n/p	1.02
0.086	0.11	0.07	0.00	n/r	n/p	0.29
0.061	0.04	0.04	0.00	n/r	n/p	0.00
0.043	0.01	0.01	0.00	n/r	n/p	0.00
0.01	0.00	0.00	0.00	n/r	n/p	0.00
Total	100.00	100.00	100.00	n/r	n/p	100.00
Gradistat Outputs						
MEAN:	327.03	331.43	305.39	n/r	n/p	46.36
SORTING:	2.74	1.93	2.65	n/r	n/p	13.76
SKEWNESS:	-0.44	-0.33	-0.41	n/r	n/p	-0.72
KURTOSIS:	3.53	2.16	3.19	n/r	n/p	0.61
MODE:	Unimodal	Unimodal	Unimodal	n/r	n/p	Bimodal
Primary Mode	426.8	426.8	301.8	n/r	n/p	426.80
Secondary Mode	-	-	-	-	-	9.43

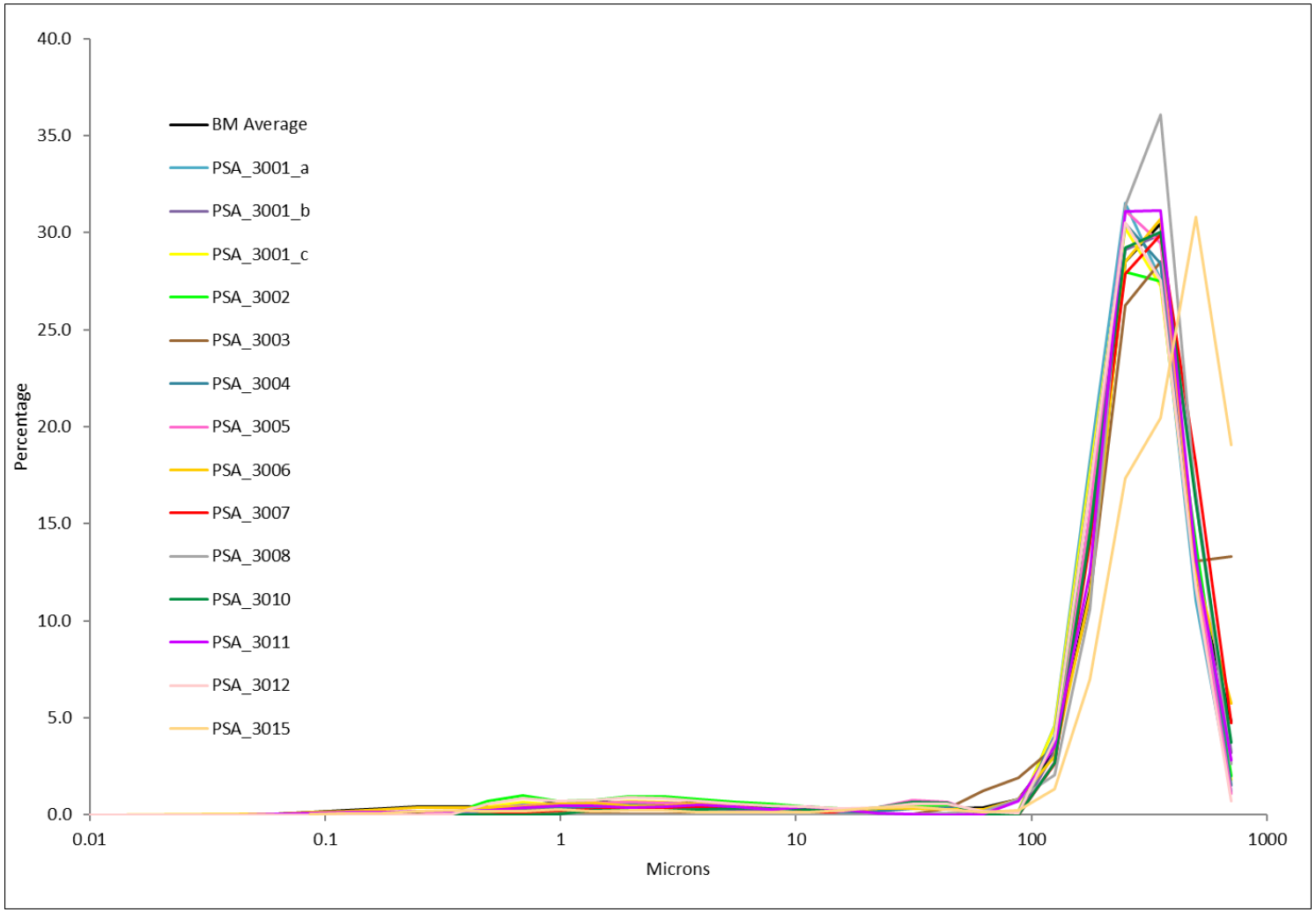

Figure 6 Final laser data (in percentages) provided by each participant and the Benchmark average for sediment distributed as PS89**.**

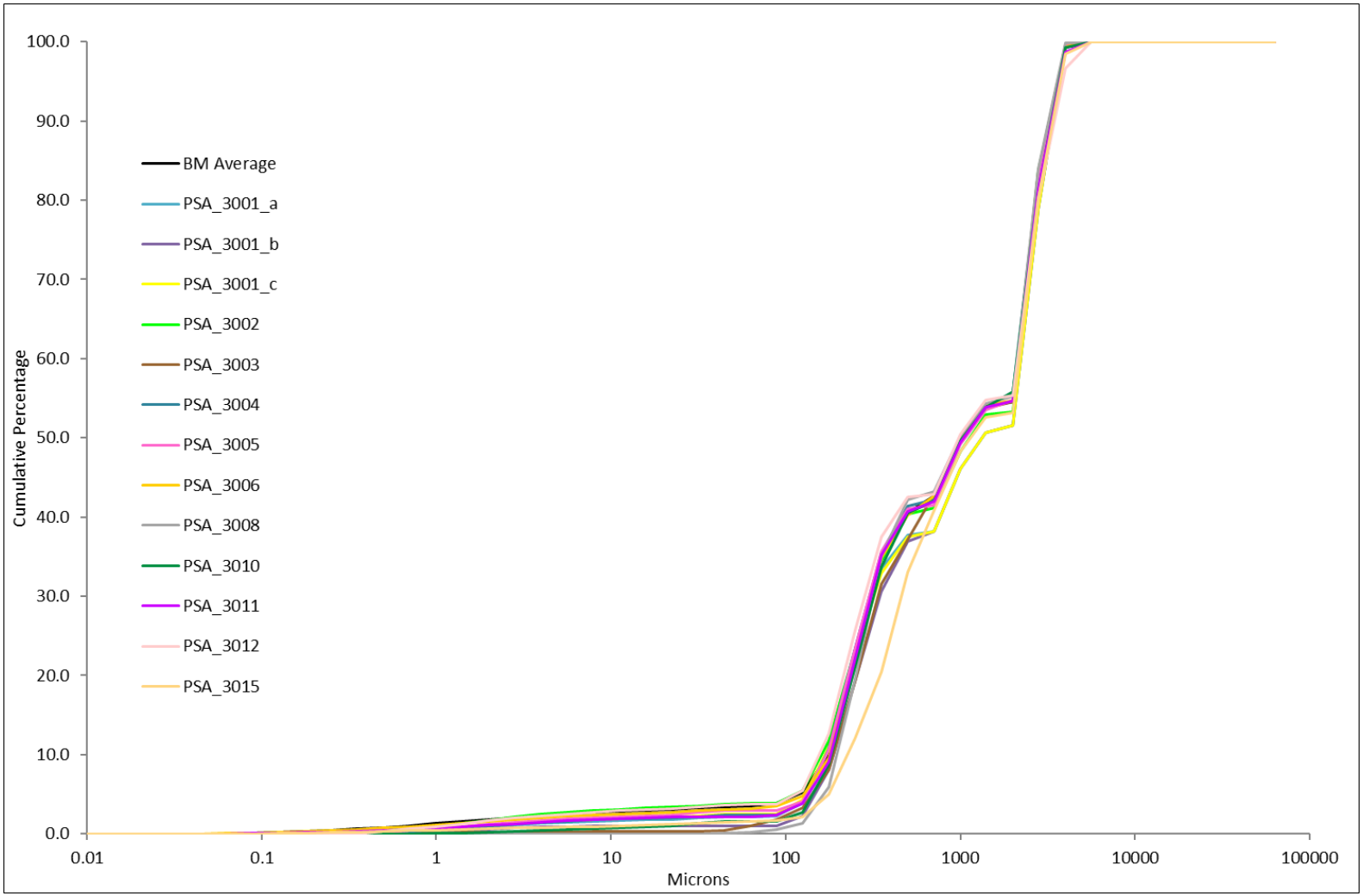

Figure 7 Particle size distribution curves from all participating laboratories and the Benchmark average for sediment distributed as PS89**.**

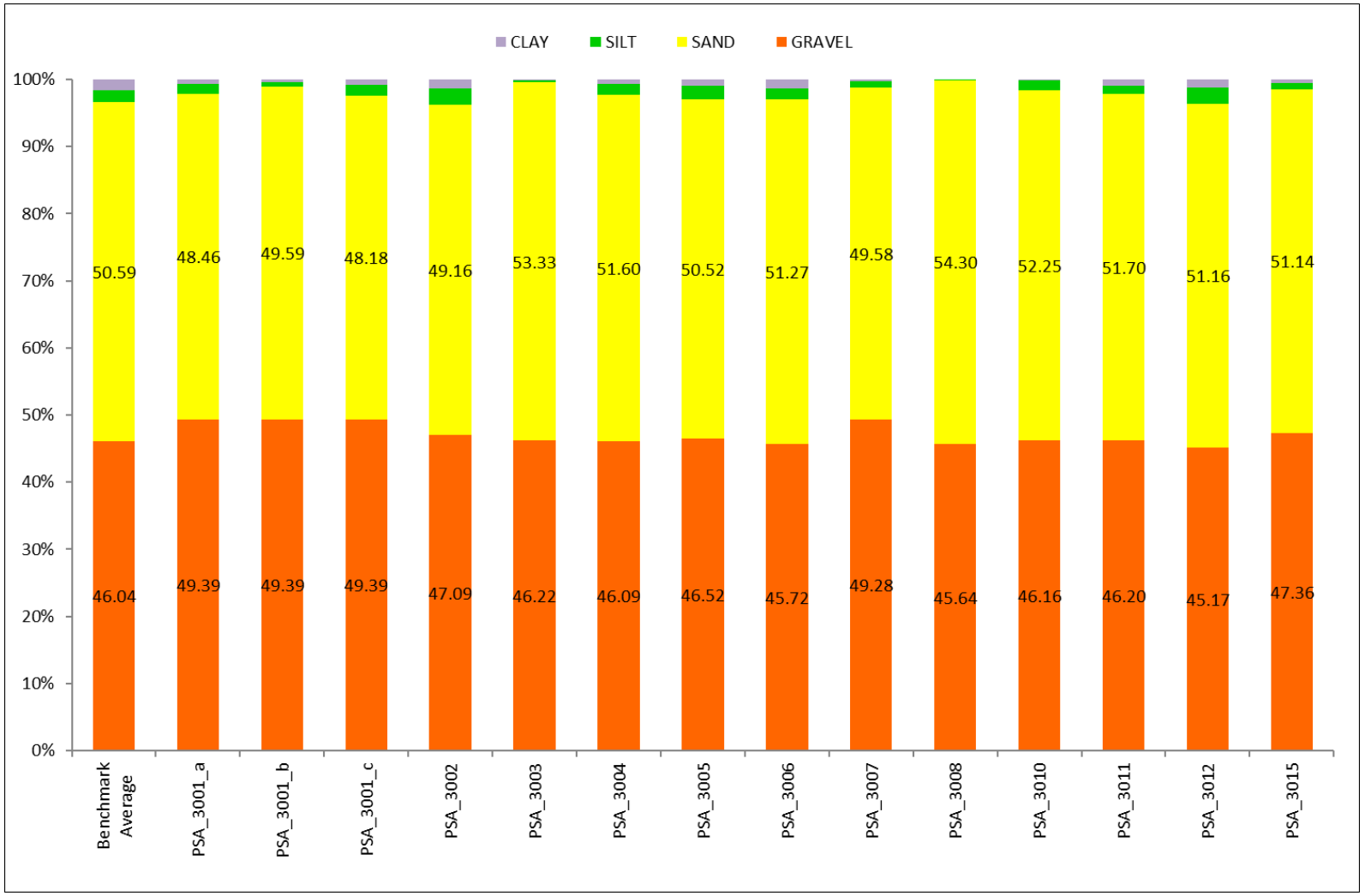

Figure 8 Bar charts showing the percentage gravel, sand, silt and clay recorded by each participating laboratory and the Benchmark average for PS89.

All appendices are MS Excel files embedded within this PDF Report.

Appendix 1 – Benchmark and Participant laser replicate data for sediment distributed as PS89.

Appendix 2 - Gradistat output of size categories based on final merged data provided by each participant and the Benchmark Average for sediment distributed as PS89.

Appendix 3 – Benchmark Lab and Participant Final Merged Data for sediment distributed as PS89.

Appendix 4 – Individual comparison of participant and Benchmark sieve data for sediment distributed as PS89.