Urban stormwater microplastic size distribution and impact of subsampling on polymer diversity

Authors Swaraj Parmar,[1] Georgia Arbuckle-Keil,[1]* George Kumi,[1] N.L. Fahrenfeld[2]*
[1]Department of Chemistry, Rutgers Camden, 315 Penn St., Camden, NJ 08102, 856-225-6333,
arbuckle@camden.rutgers.edu,
[2]Civil & Environmental Engineering, Rutgers, The State University of New Jersey, 500 Bartholomew Rd,
Piscataway, NJ 08854, 848-445-8416, nfahrenf@rutgers.edu
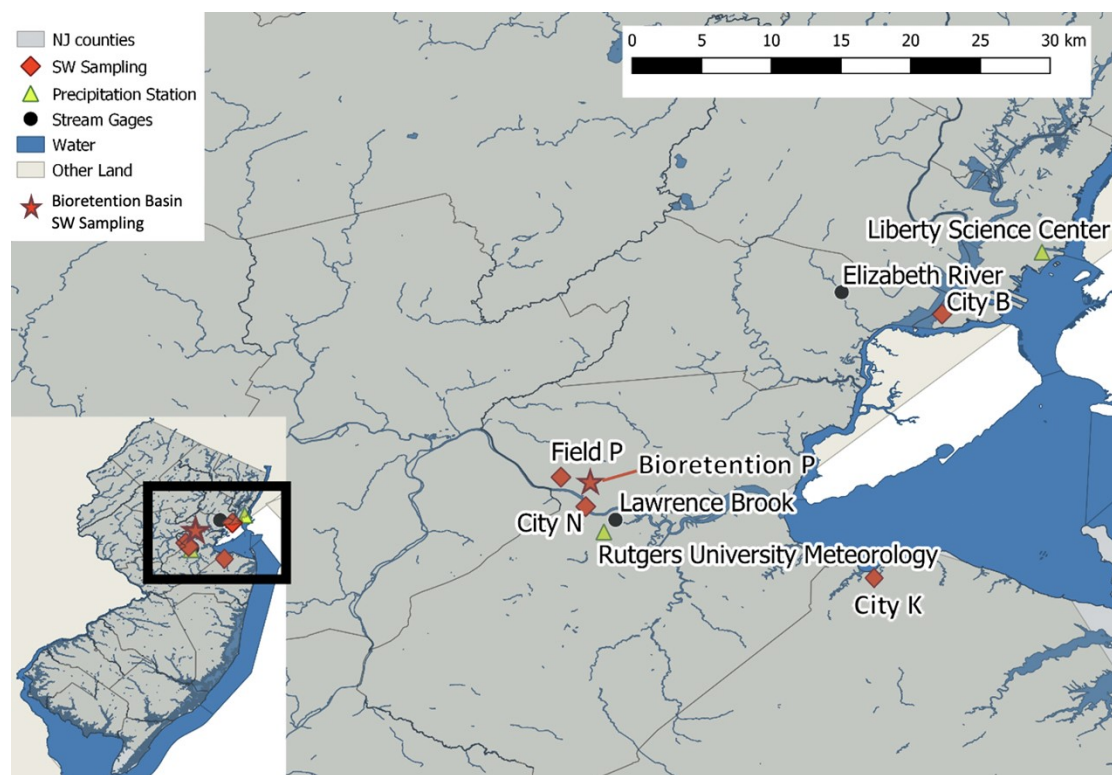
Supplementary Information

Fig. S1 Map of the area of study in New Jersey, USA. Stormwater sampling sites were in New Brunswick (City N), Piscataway (Field P and Bioretention P), and North Jersey (City B and City K). Locations of rain and stream gages are also shown.
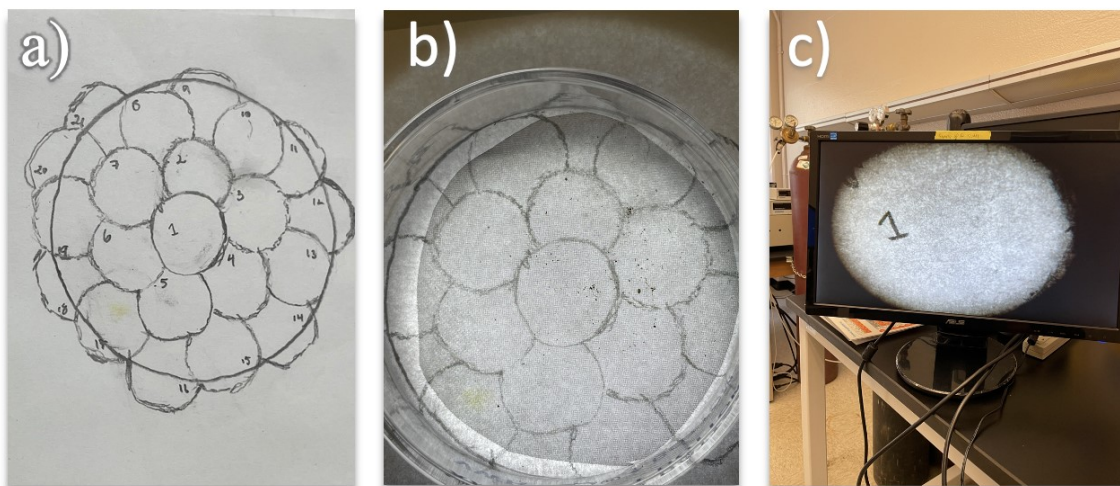
Fig. S2 Particle count pattern under the light microscope (a) the circle was the size of the boundary of the Moticam microscope camera screen, each segment was numbered, and visual images of each segment were taken for each sample set, (b) Petri dish was placed onto the particle count pattern, which was divided into segments, (c) Visual feed of segment 1 on computer monitor of the microscope camera.
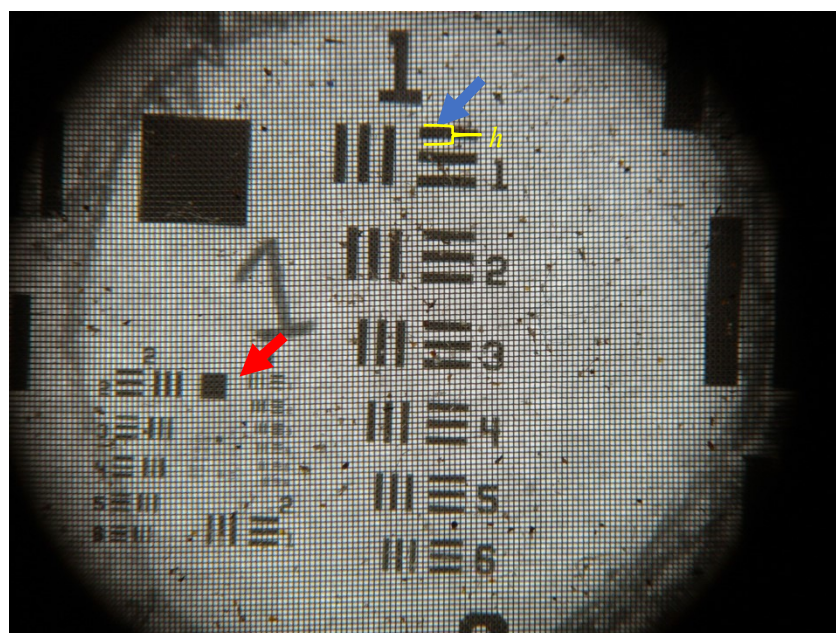

Fig. S3 Image of USAF resolution test chart under the sample petri dish, red arrow represents group 3 element 1 (G3-E1) equivalent to 62.50 μm in height and blue arrow represents group 1 element 1 (G1-E1) equivalent to 250μm in height and the dimension representing the measurement (h) is given in yellow. Particles smaller than the height (h) of G3-E1 (red arrow) were not included in the total particle count.
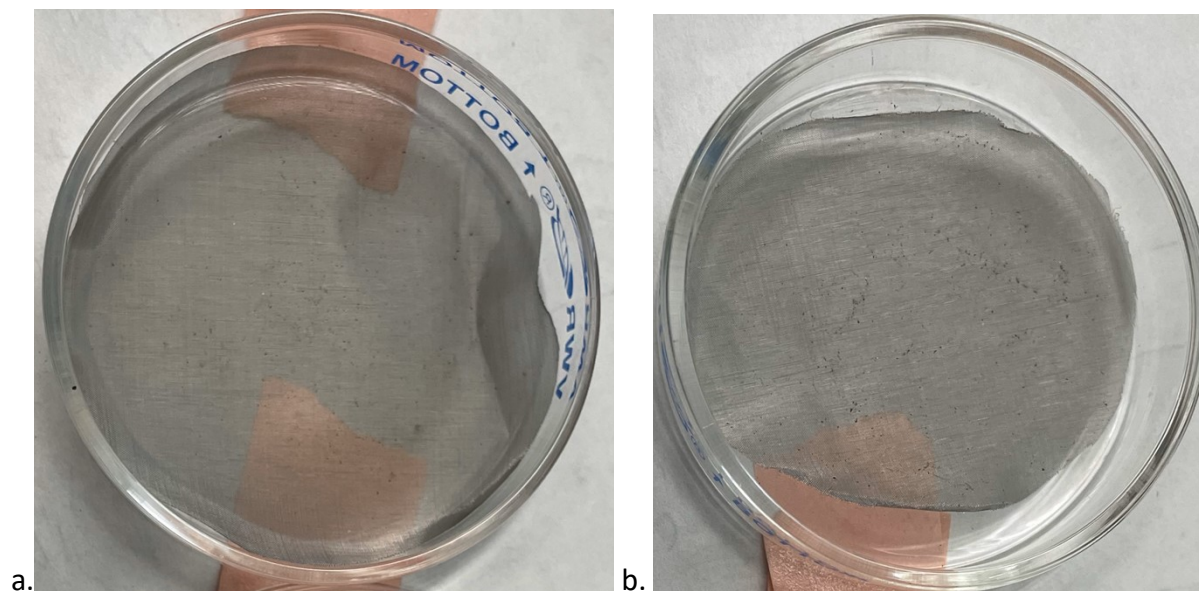
Fig. S4 Example images of filters (63 μm mesh, 47 mm diameter) in glass petri dishes diameter) from (a) Field P 8/4/2020 and (b) City N 10/25/2020 demonstrating particle distribution across the filter area.
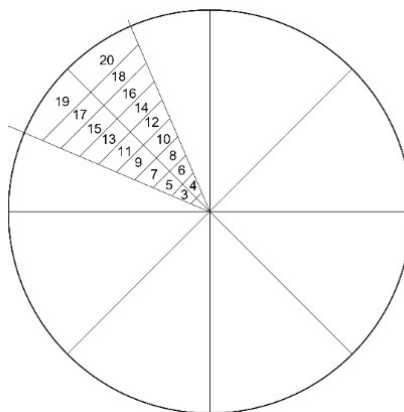

Fig. S5 Subsampling pattern for random particle selection. The pie slice segment numbered 1-20 is where particles of interest were taken from and relocated to the IR substrate for FTIR analysis.
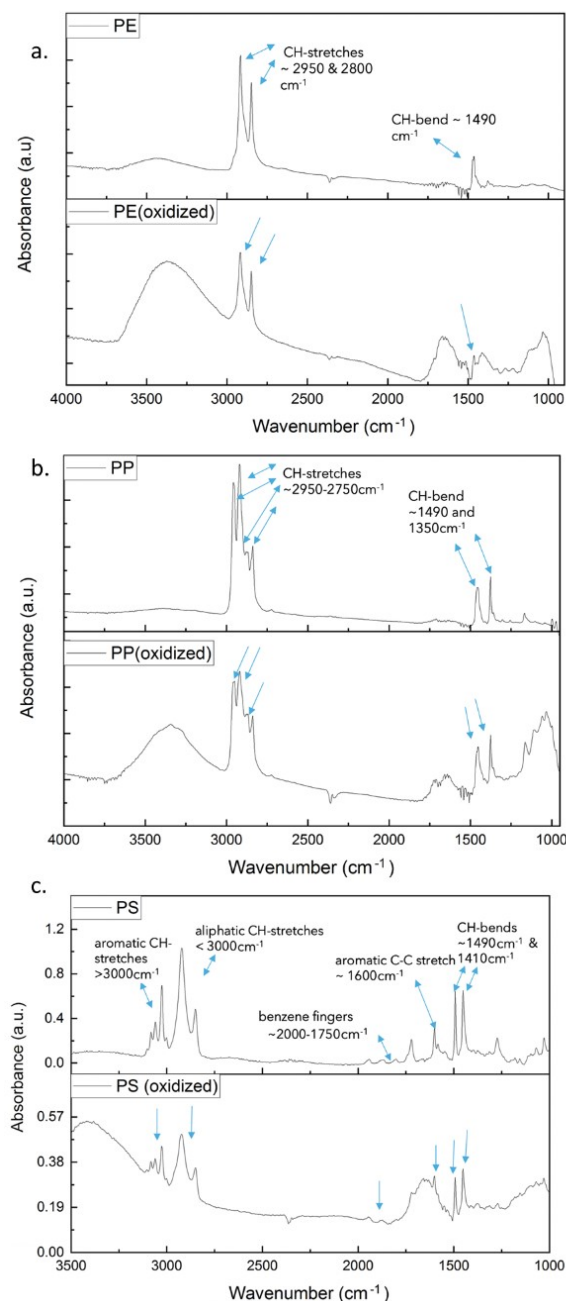
Fig. S6 Stormwater MP Transmission FTIR spectra of **a**. polyethylene (PE): sample with minimal surface oxidation (top) and another sample with higher degree of oxidation (bottom). Characteristic bands for PE: CH stretches ~2900-2800 cm^{-1}, & CH bend ~1490 cm^{-1} which are difficult to note due to the higher amount of oxidation in the spectrum (bottom). **b**. polypropylene (PP): sample with minimal surface oxidation (top) and another sample with higher degree of oxidation (bottom). Characteristic bands for PP: CH stretches ~2900-2750 cm^{-1}, & CH bend ~1490 and 1350 cm^{-1}. **c**. polystyrene (PS): sample with no surface oxidation (top) and one with higher degree of oxidation (bottom). Characteristic bands for PS: aromatic CH stretches above 3000 cm^{-1} aliphatic CH stretches below 3000 cm^{1}, benzene finger bands ~2000-1750 cm^{-1}, aromatic C-C stretch ~ 1600 cm^{-1} and CH bends ~1490 cm^{-1}and 1410 cm^{-1}.
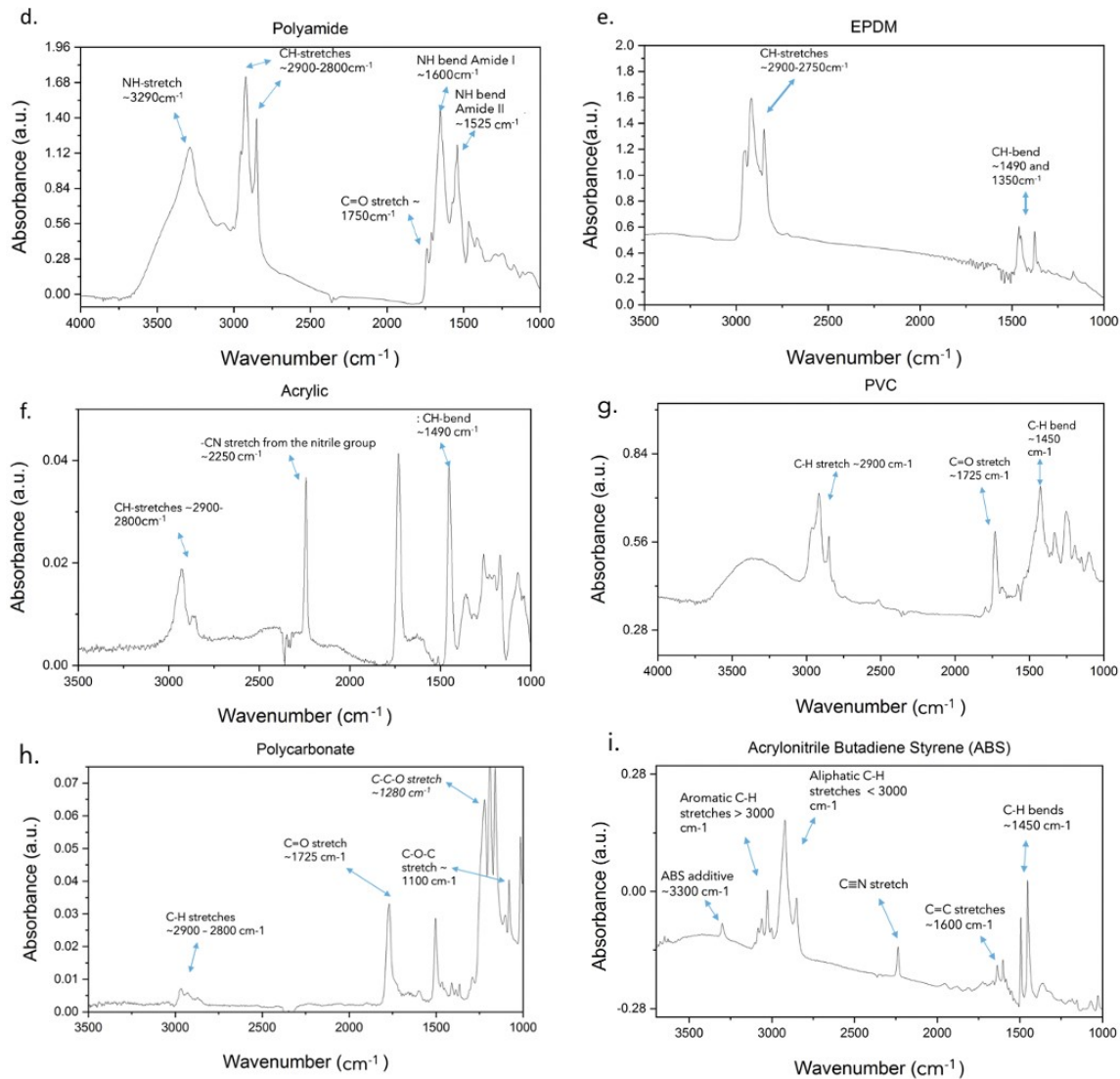
Fig. S6 (continued) Stormwater MP Transmission FTIR spectra of **d.** polyamide (PA), **e.** ethylene-propylene diene monomer (EPDM), **f.** polyacrylonitrile (PAN) 'acrylic', **g**. oxidized polyvinyl chloride (PVC), **h**. a polycarbonate (PC), and **i.** acrylonitrile butadiene styrene (ABS) MP identified in stormwater.
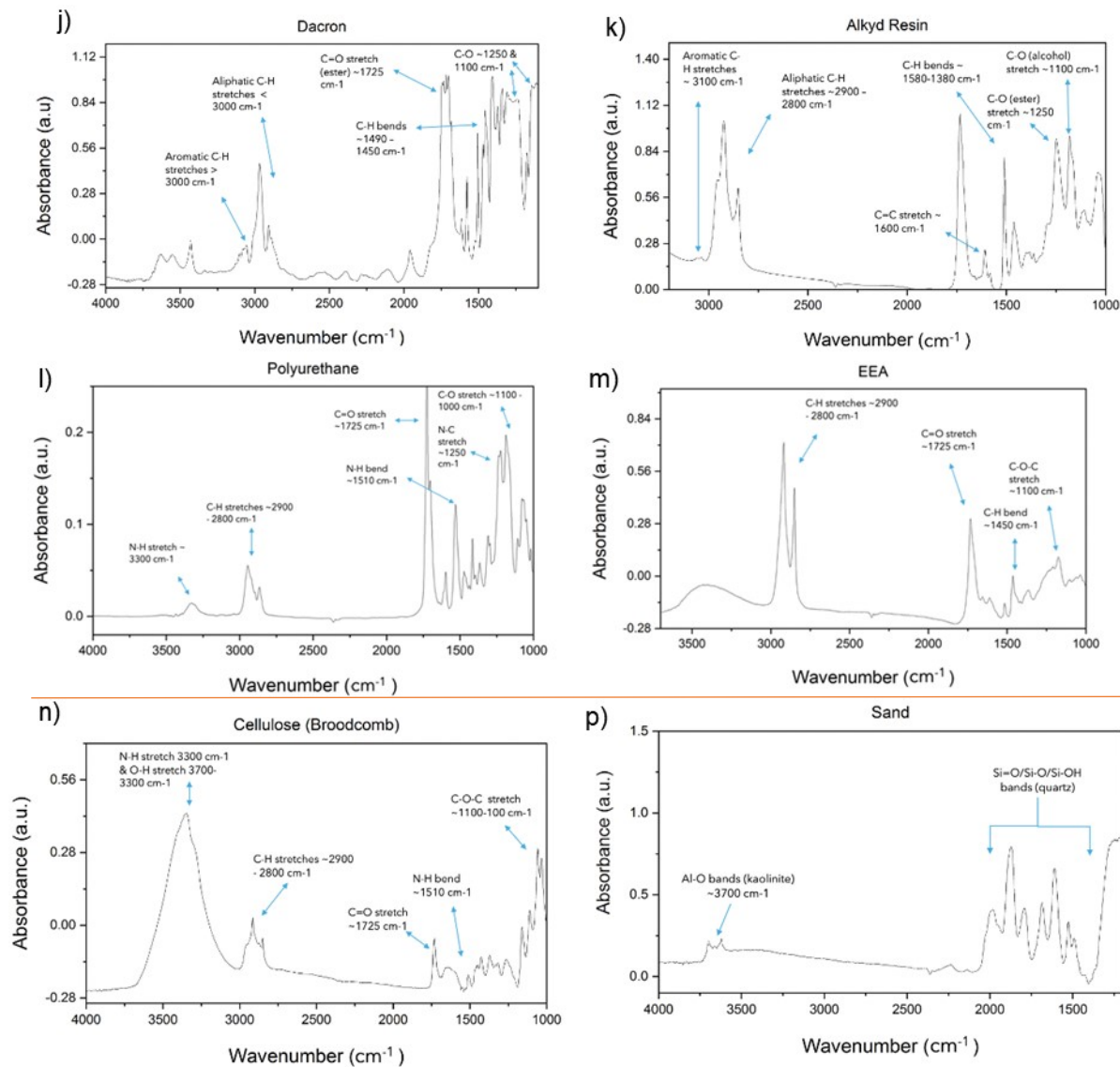
Fig. S6 (continued) Stormwater MP Transmission FTIR spectra for **j.** polyester (Dacron) from Field P, **k.** alkyd resin from Field P, **l.** polyurethane from Bioretention P, and **m.** ethylene ethyl acrylate copolymer (EEA) from Bioretention P. Two spectra for are also shown as example non-microplastic particles with **n)** an example cellulose spectrum with a spectral library match from OpenSpecy as broodcomb and **p)** sand.
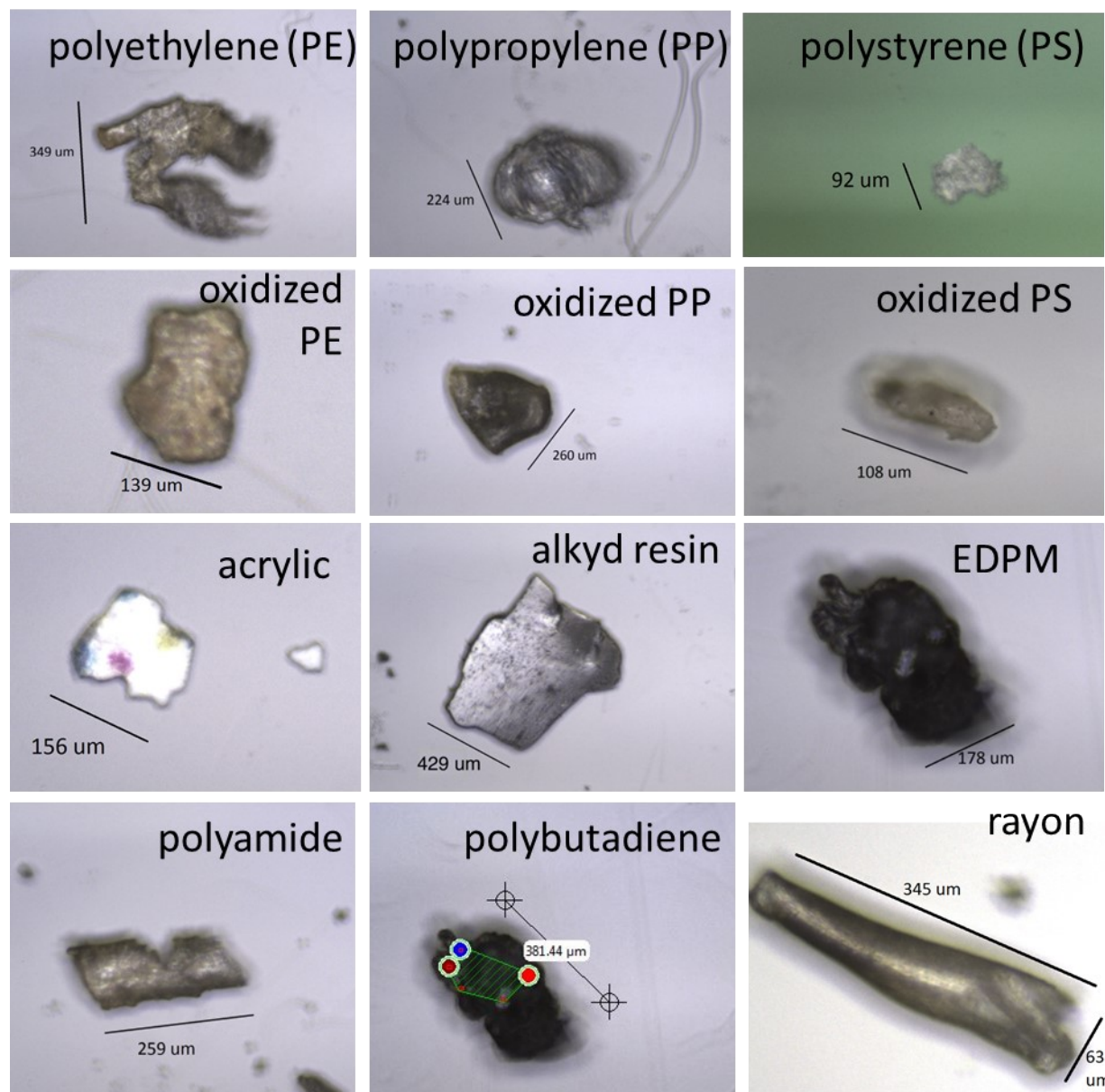
Fig. S7 Example visual images of polymer particles observed in stormwater samples. Note scale bar on each image. EPDM = Ethylene propylene diene monomer. All images taken with LUMOS microscope camera on CaF_2 IR substrate except the PS image was captured with the particle on a MirrIR slide. Polybutadiene image shows blue and red circles where the FTIR spectra were captured.