
A plastic storm: The role of stormwater in the microplastic load of an urban river system

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Abstract

Small plastic particles are an omnipresent, persistent and hazardous class of contaminants, making research into their environmental fate a pressing topic. Alongside discharges from wastewater treatment plants, stormwater systems have been shown to be a significant transport vector for ocean-bound microplastics into urban waterways.

Here we present a fine resolution study on the types and quantities of microplastics present in the water column during a storm event. The Kaiwharawhara Stream and its tributaries in Wellington, New Zealand are situated in areas of residential and industrial land use, without input from wastewater treatment plants. During an 18h storm event in August 2021, a total of 11 water samples were collected from the river with an automatic sampler. Each sample consisted of solid material contained in 10L water, collected on a 100 μm stainless steel mesh. To establish a baseline microplastic load, an additional 100L were sampled on dry weather days in February, May, August and October 2021. To isolate the microplastics, all samples were subjected to wet peroxide digestion, followed by density separation with sodium iodide and visual examination under a stereomicroscope. Polymer identification was carried out using Fourier transform infrared spectroscopy (FTIR).

All samples contained microplastic particles. Samples taken during the initial 12h storm period contained 0.3 – 1.1 particles/L, and particle numbers peaked ahead of peak river flow at 2.1 particles/L. The majority of particles isolated were < 1mm in size, with fragments the most abundant morphotype. While lower density polymers such as LDPE were present, high-density PVC represented the polymer type with the highest abundance. When compared to dry-weather samples which contained 0.01 – 0.04 particles/L, our results show a significantly higher load of microplastics in urban waterways during storm events.

Keywords: stormwater, microplastic load, urban waterways, river flow

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