	Notes (Final)
Name of Meeting:	Isle of Wight Council (IWC) Environment & Sustainability Forum: Occurrence and distribution of microplastics in the mudflat sediments of the Medina Estuary, Isle of Wight
Date and Time:	14th November 2024, 18:00 – 19:30
Chair:	Katy Hurd – Climate Change and Biosphere Coordinator (Apologies from Alaster Sims)
Attendees:	Liberty Turrell – Speaker; Katy Hurd (note taker and chair); Seb Taylor; Cllr. Jenny Hicks, Cllr. Robert Packham; Ian Boyd; Fiona Fitz-Herbert; Paul Ofei-Manu; Cllr. Penny Acton
Notes:	Introduction to Katy Hurd • Katy Hurd introduced herself as the new Climate Change and Biosphere Coordinator of Council. • Katy is currently planning the E&S Forum meetings for 2025 and is looking for suggestions for topics to be considered. Please email sustainability@iow.gov.uk if you have any suggestions. **Liberty Turrell – Presented on her research on the occurrence and distribution of microplastics in the mudflat sediments of the Medina Estuary, Isle of Wight**. Liberty has kindly provided the full research document and her PowerPoint presentation which will be emailed out to those who attended. The key points of which were: **Abstract** • **Objective**: To understand the fate of microplastics in estuarine environments, focusing on the Medina Estuary. • **Methodology**: Sediment samples were collected from mudflats during low tide, analysed through wet sieving, density separation, and then hot needle test (which if a plastic will mean that the sample will respond by curling / melting). • **Findings**: Microplastics were found in all samples, with synthetic fibres being the most common. Concentrations varied significantly, influenced by tidal dynamics and wind patterns. **Introduction** • **Plastic Pollution**: Plastics are pervasive in aquatic environments, with microplastics (<5mm) being a major concern due to their ability to enter food chains. Studies have shown microplastics in all five of the major ocean species currently studied. • **Estuaries**: Serve as critical zones for microplastic exchange between rivers and oceans, acting as sediment and pollutant sinks due to their lower energy. **Study Site** • **Medina Estuary**: Located on the Isle of Wight, affected by effluent discharge from combined sewer overflows (CSOs) with high spill rates. • **Water Quality**: Monitored by the Environment Agency, with concerns over high phosphate and nitrate levels from pollution sources. **Methodology**

- **Field Sampling**: Conducted at low tide across 16 sites along the estuary's mudflats.
- **Laboratory Analysis**: Included removal of organic matter, wet sieving, density separation, filtration. microplastic extraction and identification, hot needle test and microplastic quantification.

Results

- **Microplastic Occurrence**: Found in all samples, with concentrations ranging from 277 to over 20,000 items per kg of dry sediment.
- **Spatial Distribution**: Significant variation observed, with hotspots far from pollution sources, indicating strong influence of tidal and wind dynamics.
- **Microplastic Morphology**: Predominantly synthetic fibres, with minimal presence of fragments and beads.

Discussion

- **Contamination Issue**: The estuary is severely contaminated, with microplastic concentrations higher than many other global estuaries. The dominance of primary microplastics (microfibres / microbeads) is indicative of the wastewater system as a major source.
- **Sources and Transport**: CSOs are major contributors, but tidal and wind patterns also play crucial roles in microplastic distribution.
- **Residence Times**: Microplastics exhibit varying residence times in sediments, influenced by tidal action and shoreline morphology.

Conclusion

- **Severe Contamination**: The Medina Estuary is heavily polluted with microplastics, primarily synthetic fibres from wastewater discharge (98%).
- **Research Implications**: Highlights the need for further research on microplastic fate in estuaries and improved wastewater management to mitigate pollution.

Future Research

- **Extended Sampling**: Longer-term studies to better understand temporal variations in microplastic distribution.
- **Improved Identification Methods**: Combining techniques like FTIR spectroscopy with the hot needle test for more accurate microplastic identification.

The presentation was followed by a Q&A.

FFH - Noted the reference to glitter and asked if there a large impact from glitter due to the festival?
A: Not a large amount of glitter found, but those washing will mean that it goes down the sink. KH said she would discuss communication with the waste team to see what they already have in agreement with the festival organisers. Maybe there is an opportunity for a comms campaign.

There was a general discussion about the source of the additional microfibre and the potential of affect from tourist industry and over washing of clothes. KH suggested maybe a campaign would be a good idea to try and reduce the number of washes domestically. In addition, it was stated that Council sponsors the Student Union to provide free access to an award winning toolkit designed to support sustainable practices in organisations. Sign up to Green

	Impact will start again in March 2025 – it could help those in the Tourist industry consider options to reduce their washing output. Green Impact | Students Organising for Sustainability | Green Impact is SOS-UK's sustainability engagement programme for teams FFH asked if there are any plans to respond to the findings? A: Liberty is working with the EA and SW to see what can be done. It is noted that the infrastructure is outdated but there is a lot of work being done to reduce blue water from entering the system in the first place by SW. IB: discussed the multi-designated status of the estuary and how sad he found the findings and stressed the urgent need for action to clean up the estuary. PO-M: Asked if Liberty's methodology was comparable with the other research noted in the presentation? A: Liberty answered that the laboratory analysis methodology she used is widely employed for microplastic research. All other global studies which the Medina was compared to investigated intertidal sediments, but did not explicitly state that these environments were affected by wastewater discharges. ST: What is the policy status to deal with microplastics? A: There is policy for sewage with relation to public health, but not for microplastics which are not currently routinely monitored by EA. ST: How and where can we apply pressure for change? A: (IB) LNRS – Within the Environment Act 2021 there is also an enhanced duty for biodiversity that every LA have to have regard for. Both are a helpful mix of tools. KH: Did it appear that the microplastic could have been trapped by the algae? A: It was considered that this would be something that would have to have further tests to prove. The Forum offered a special thankyou to Liberty for attending and presenting her findings.
PSQ:	• Would the attendees be interested in attending in person rather than online? ○ Unanimous answer from those in the meeting was no
AOB:	• None
Next Meeting	• The next Meeting will be in January where we will focus on the LNRS (Decembers meeting has been postponed). It will be delivered as a Webinar which will require people to register via a link that will be sent out soon.

Occurrence and Distribution of Microplastics in the Mudflat Sediments of the Medina Estuary, Isle of Wight

Presented by: Liberty Turrell

November 14th, 2024

The Global Plastic Problem

Washing clothes

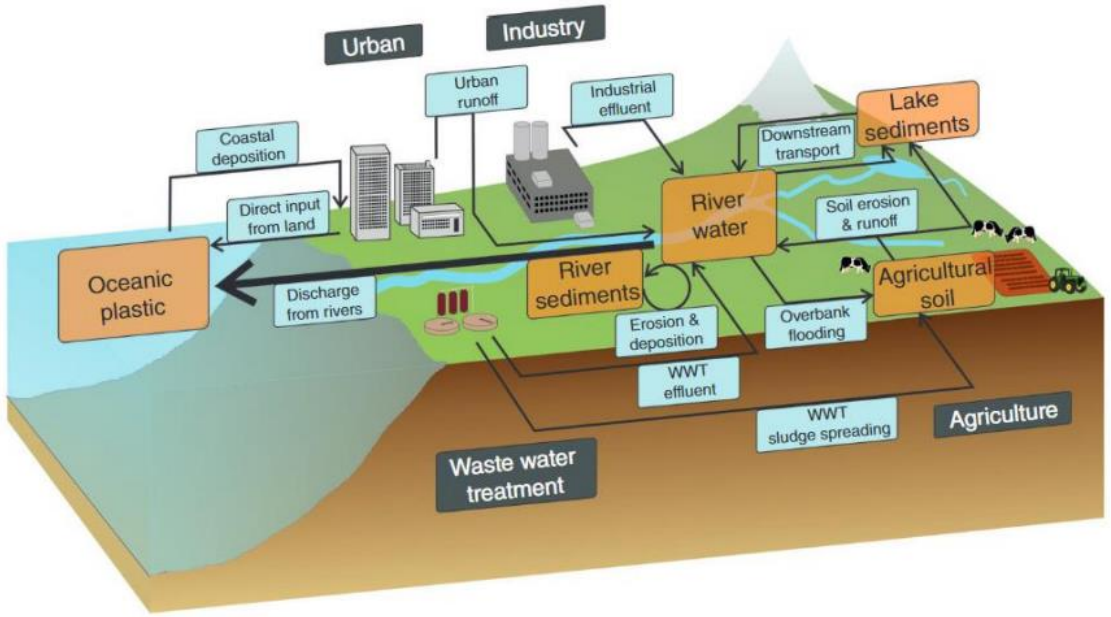
Abrasion of vehicle tyres

Road markings

City dust

Marine protective coatings

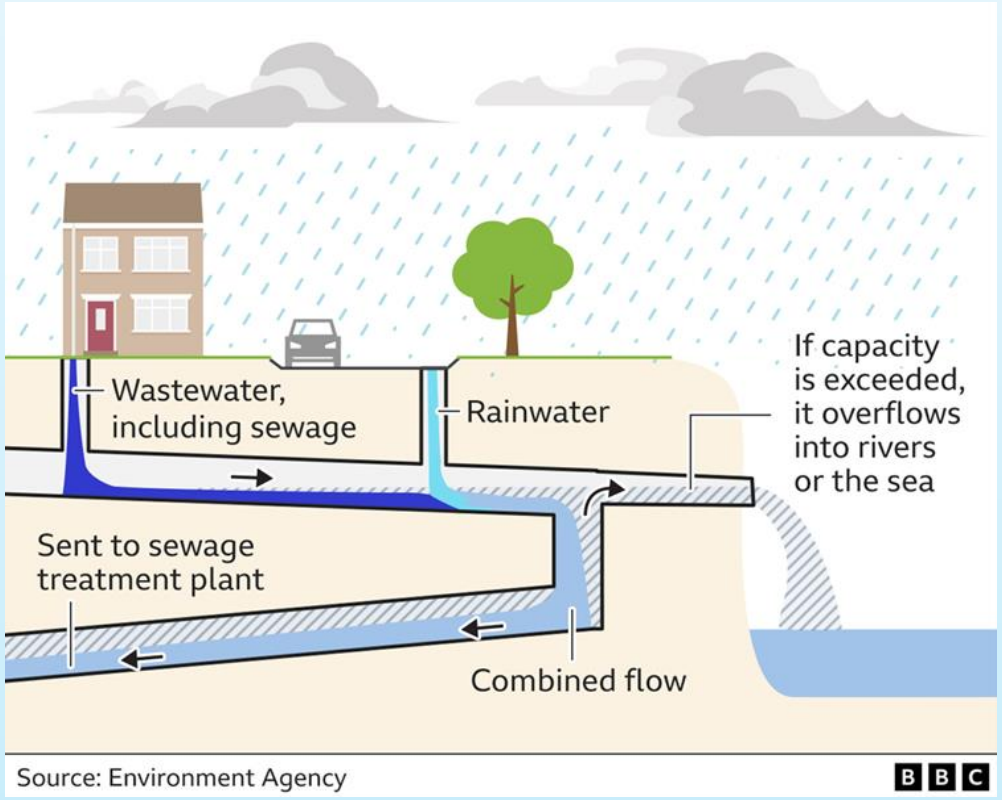
Sources of Microplastics (Boucher and Friot, 2017)



Source: Horton and Dixon (2017)

Sewer Overflows as a Source of Microplastics

"Combined sewer overflows are a necessary part of the existing sewerage system, developed as overflow valves to reduce the risk of sewage backing up during heavy rainfall" (Environment Agency, 2024).



There were **464,056** monitored 'spill' events into waterways by water companies in England during 2023, which is a **54%** increase from 2022 (Environment Agency, 2024).

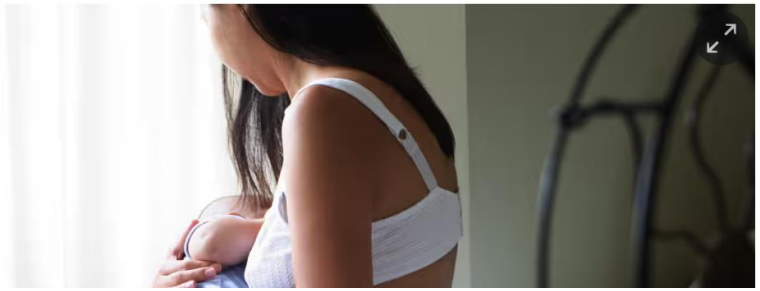
Consequences of Microplastic Pollution

Potential health effects:

- Impacting reproductive capability (Li et al., 2021)
- Induced oxidative stress causing cell damage (Barboza et al., 2019)
- Reduced feeding activity affecting growth (Wright et al., 2013)

Microplastics found in human breast milk for the first time

Exclusive: Researchers concerned over potential health impacts of chemical contaminants on babies



Home > Animal Facts > Marine Animals > Scientists Just Collected 11 Petri Dishes Of Dolphin Breath – And F

Scientists just collected 11 petri dishes of dolphin breath – and found something very worrying

The exhaled air – collected from wild bottlenose dolphins in Florida and Louisiana – contained harmful microplastics, say the researchers.

Article | Open access | Published: 31 January 2019

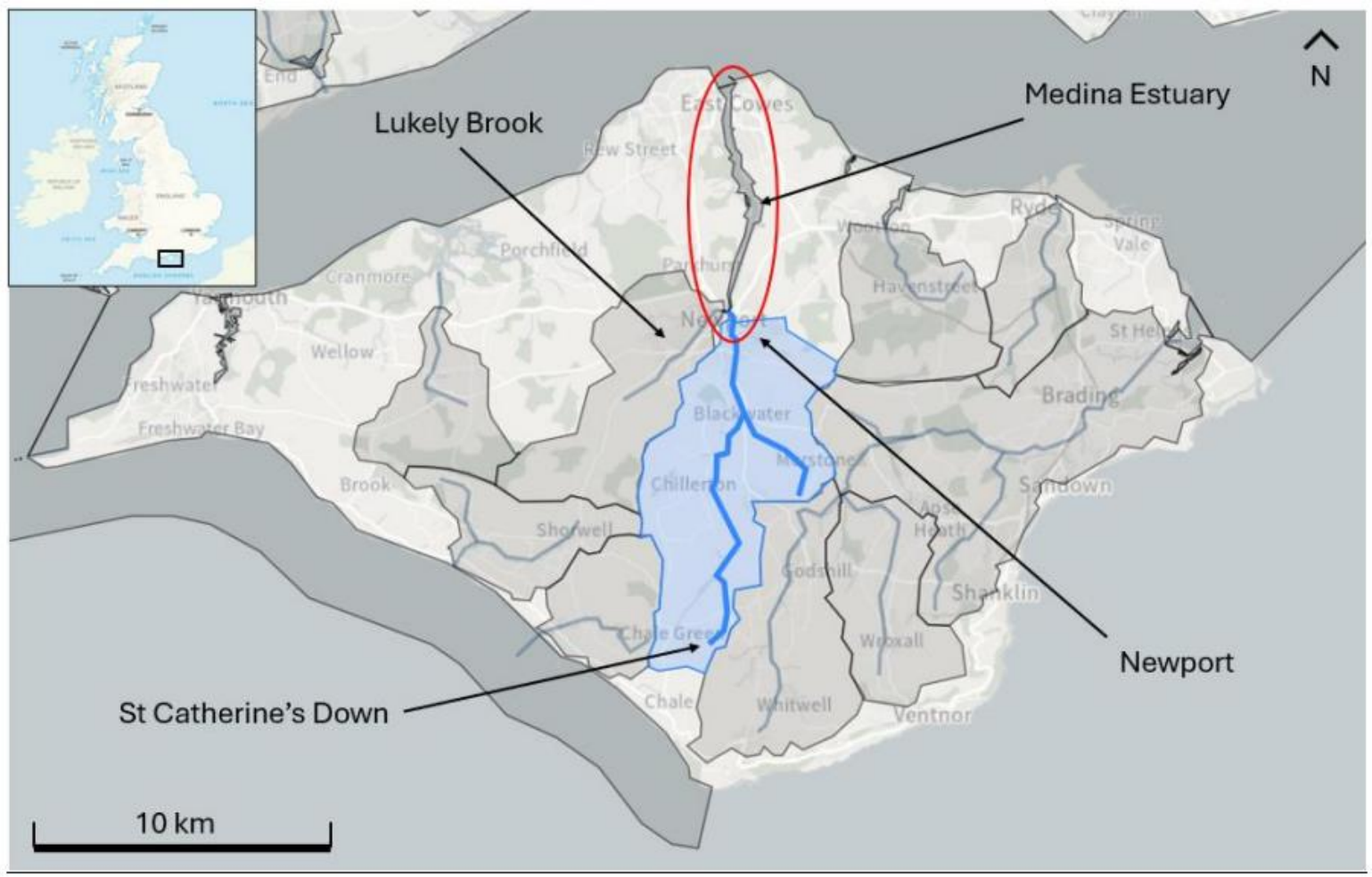
Microplastics in marine mammals stranded around the British coast: ubiquitous but transitory?

S. E. Nelms, J. Barnett, A. Brownlow, N. J. Davison, R. Deaville, T. S. Galloway, P. K. Lindeque, D. Santillo & B. J. Godley

Scientific Reports **9**, Article number: 1075 (2019) | Cite this article

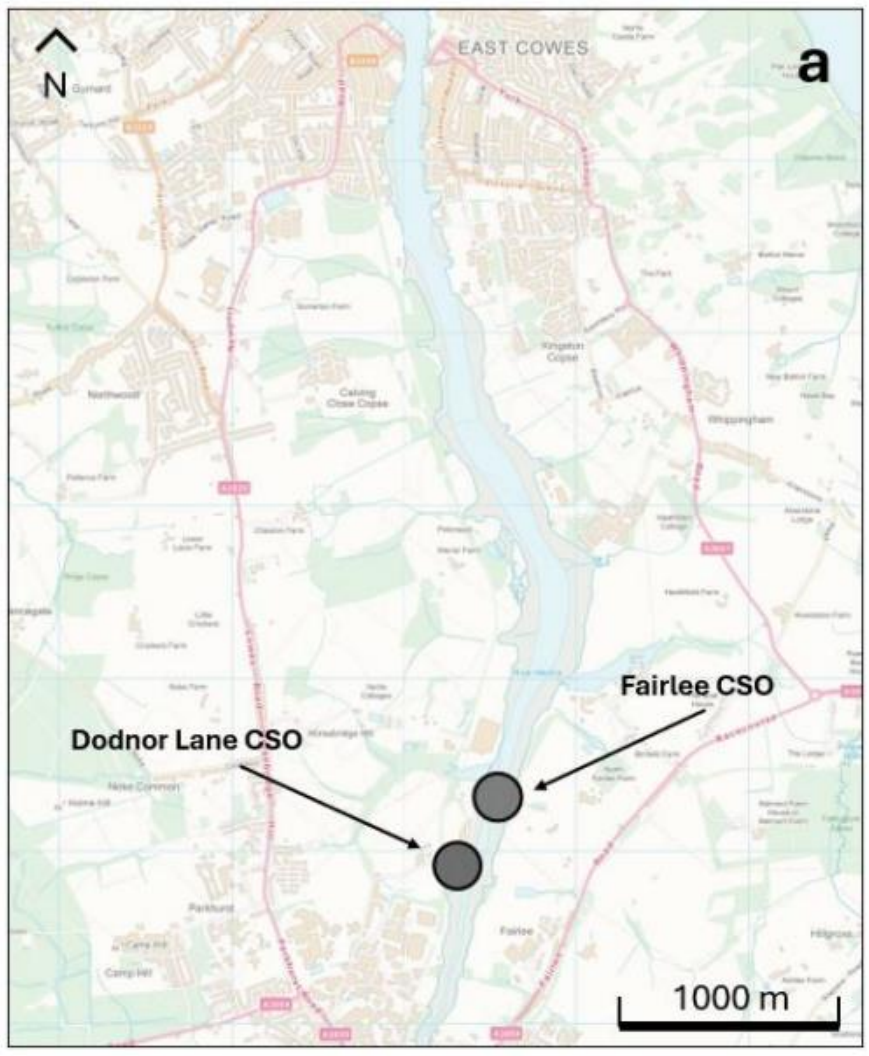
38k Accesses | **260** Citations | **1254** Altmetric | Metrics

The Medina Estuary



River Medina Catchment *(Source: Digimap, 2023; Environment Agency, 2023)*

Water quality of the Medina Estuary



Source: The Author

	Dodnor Lane Pumping Station CSO & EO			Fairlee CSO		
	2021	**2022**	**2023**	**2021**	**2022**	**2023**
Total duration (hrs) all spills	483.06	535.22	998.59	957.81	757.32	1,933.72
Counted spills	77	75	108	73	63	117

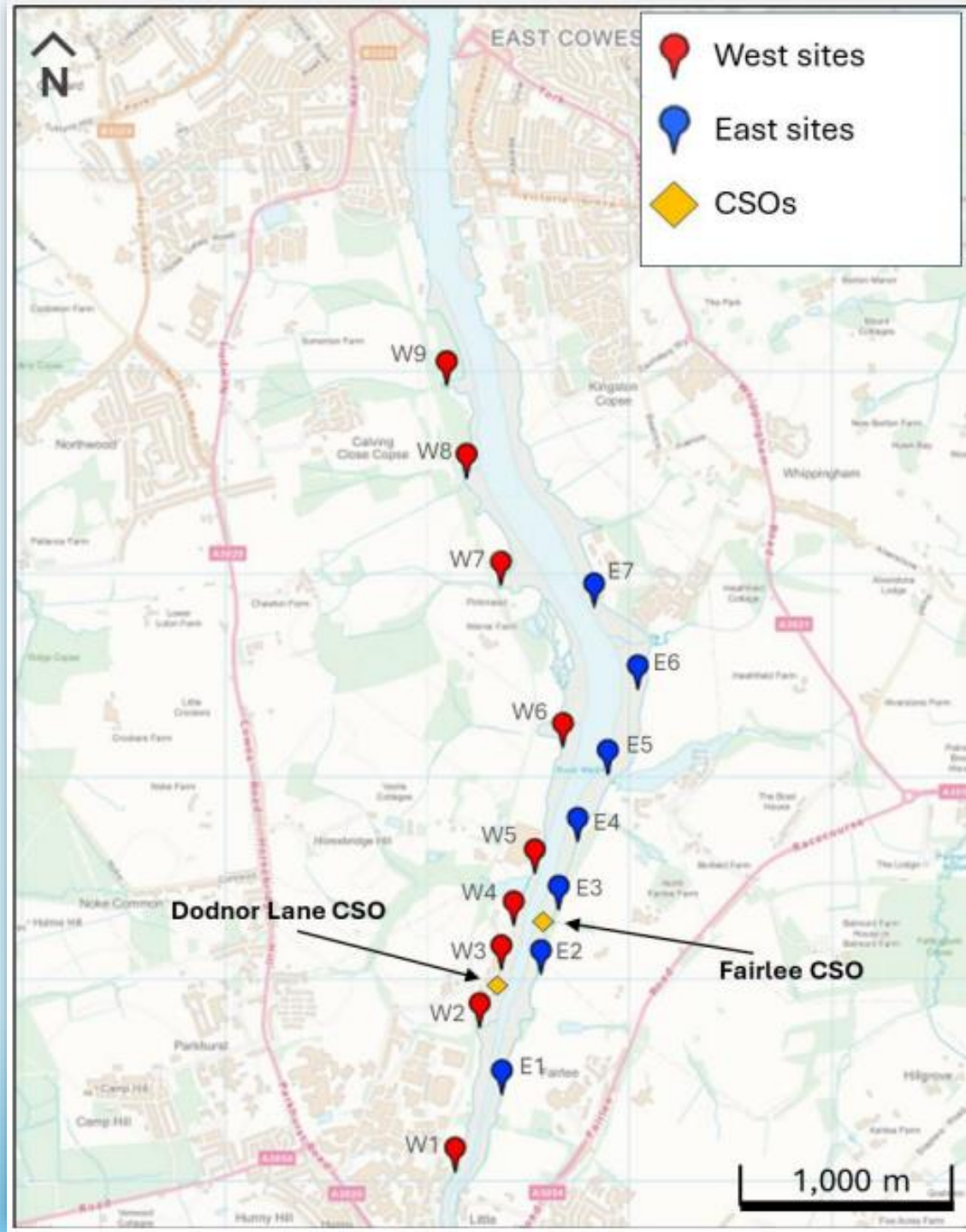
Source: Environment Agency (2024)

In 2022, the overall ecological status of the Medina catchment was assessed as 'moderate' by the Environment Agency, which ranks mid in the 5 possible classes (Environment Agency, 2023)

Methods

Field Sampling Strategy

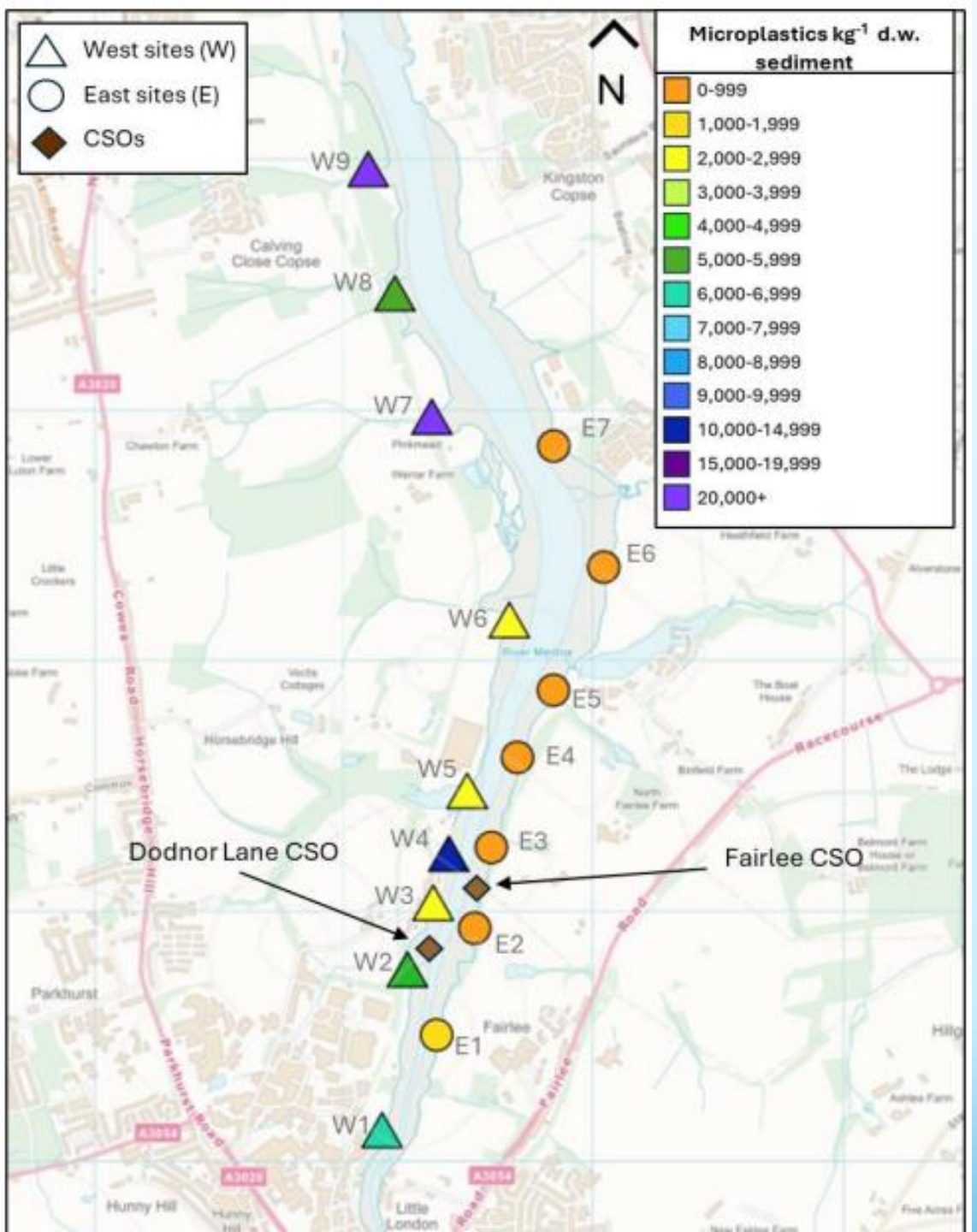
- 16 sites
- 500m intervals (systematic)
- Eastern and western mudflats
- Increased sampling upstream and downstream of CSOs
- Samples taken from high tide mark
- Representative sample captured
- Top 2cm of sediment was sampled



Methods

Lab analysis procedure

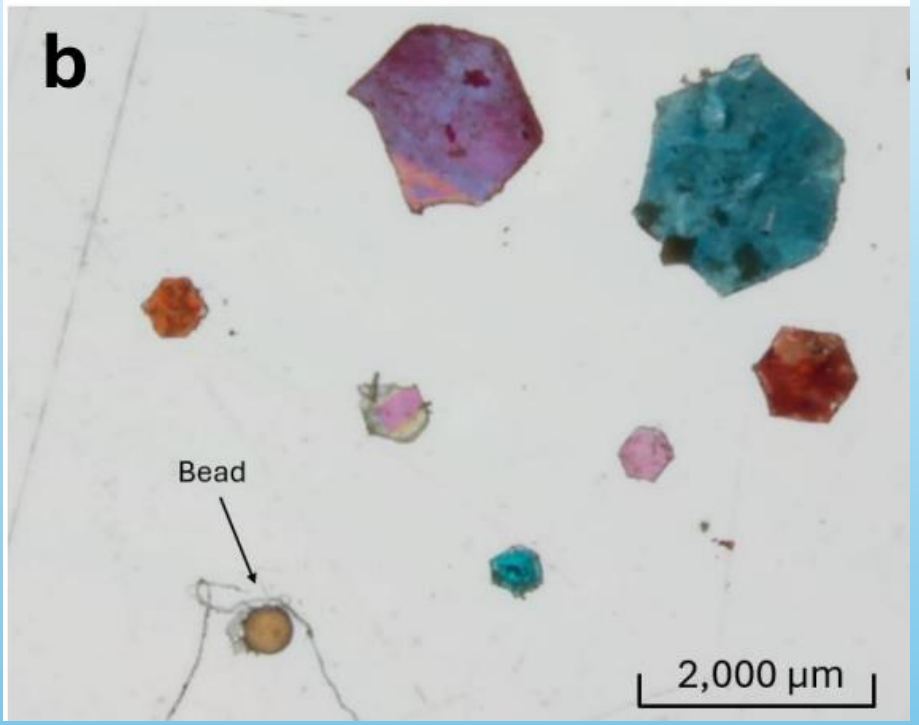
1. Removal of organic matter
2. Wet sieving
3. Density separation
4. Filtration
5. Microplastic extraction and identification
6. Hot needle test



Results: Occurrence and Distribution

- Microplastic concentrations range from **277 items** kg-1 d.w. sediment at site E6 to **~132,000 items** kg-1 sediment at site W7
- Average value of **2,147 items** kg-1 d.w. sediment
- Sites W7 and W9 are the most contaminated, **>20 items** per gram of mudflat sediment.

Results: Microplastic Assemblage



Microplastic assemblage at site W7

a) The immense quantity of microfibres estimated at **~130,000 items** kg-1 d.w. mudflat sediment.

b) Microfragments and microbead.

Discussion: Microplastic Pollution of Estuarine Sediments

Estuary	Location	Microplastics kg^{-1} d.w. sediment	Dominant microplastic shape	Citation
Kayamkulam Estuary	India	433	Fibre	(Radhakrishnan et al., 2021)
Fuhe River Estuary	China	558 ± 233	Fragment, fibre	(Zhou et al., 2021)
Changjiang Estuary	China	121± 9	Fibre	(Peng et al., 2017)
Haihe Estuary	China	216 ± 92	Fibre	(Wu et al., 2019)
Pearl River Estuary	China	851 ± 177	Fibre	(Zuo et al., 2020)
Carrick Roads Estuary	Falmouth, UK	827 ± 162	Fragment, fibre	(Nel et al., 2020)
Ebro Estuary	Spain	2,052 ± 746	Fibre	(Simon-Sánchez et al., 2019)
Guanabara Bay Estuary	Brazil	528 ±30	Fibre	(Alves and Figueiredo, 2019)
Tampa Bay Estuary	USA	280 ±290	Fibre	(McEachern et al., 2019)
17 estuaries in Caspian Sea	Iran	351 ± 233	Fibre	(Ghayebzadeh et al., 2021)
Jagir Estuary	Indonesia	217	Fibre	(Firdaus et al., 2020)
Medina Estuary	Isle of Wight, UK	2,147	Fibre	Present study

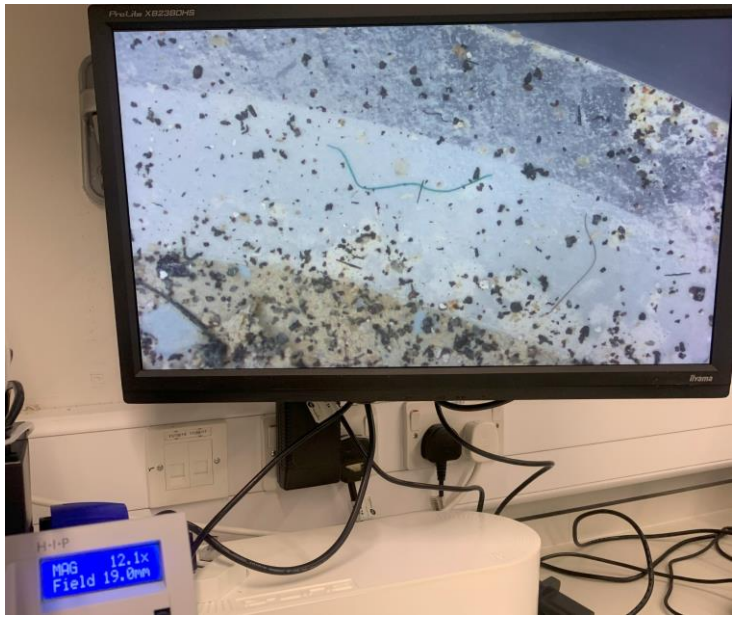
Discussion: Spatial Heterogeneity of Microplastic Concentrations

Site W9

Site W7

Site E4

Discussion: Wastewater as a Source of Microplastics



Conclusions

- Estuaries have been largely overlooked in research concerning the fate of microplastics in the aquatic environment.
- The prevalence and abundance of microplastics found in the intertidal mudflat sediments has highlighted a severe contamination issue of the Medina Estuary
- Primary microplastics, especially microfibres, dominate the microplastic assemblage which is indicative of the wastewater system as responsible for the release of these pollutants
- Whilst the spatial pattern of microplastic concentrations observed is partly influenced by the CSOs, these particles exhibit great distributional heterogeneity throughout the estuary
- Intertidal mudflats serve as temporary sinks for microplastics prior to their expulsion from the estuary.

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