Microplastics, sediments and the Taff Bargoed

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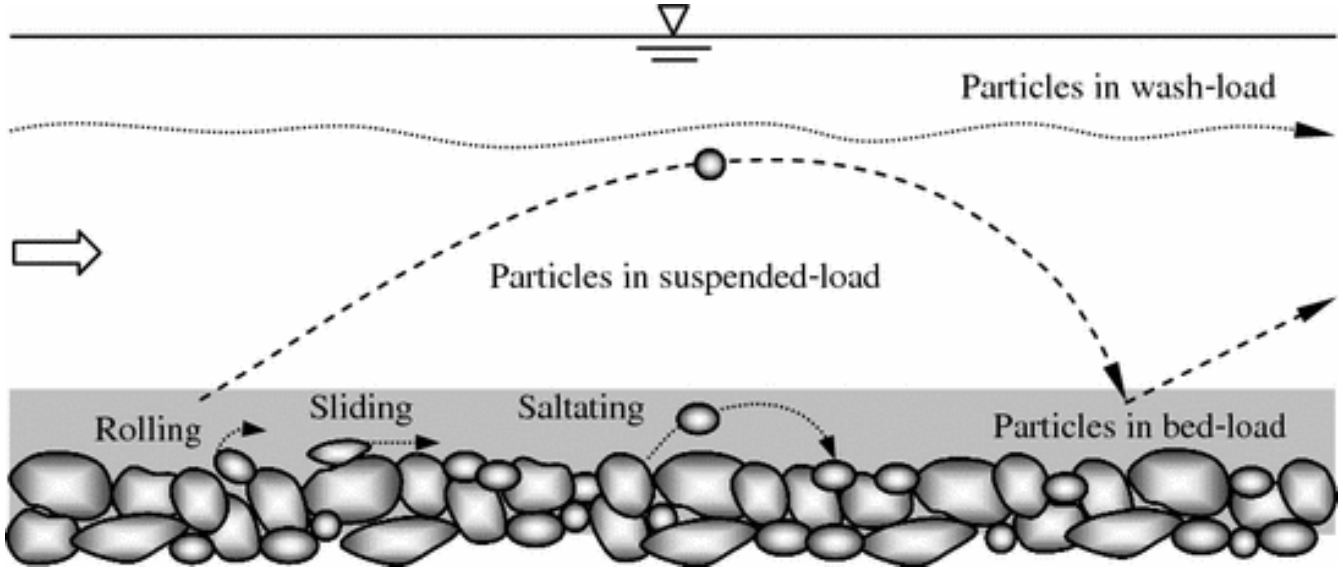
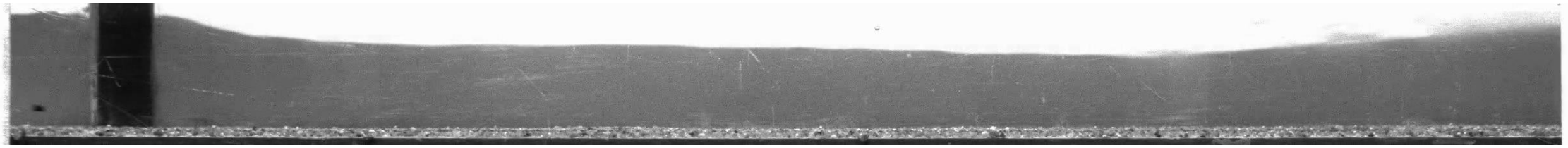
Introduction: Microplastics and sediment

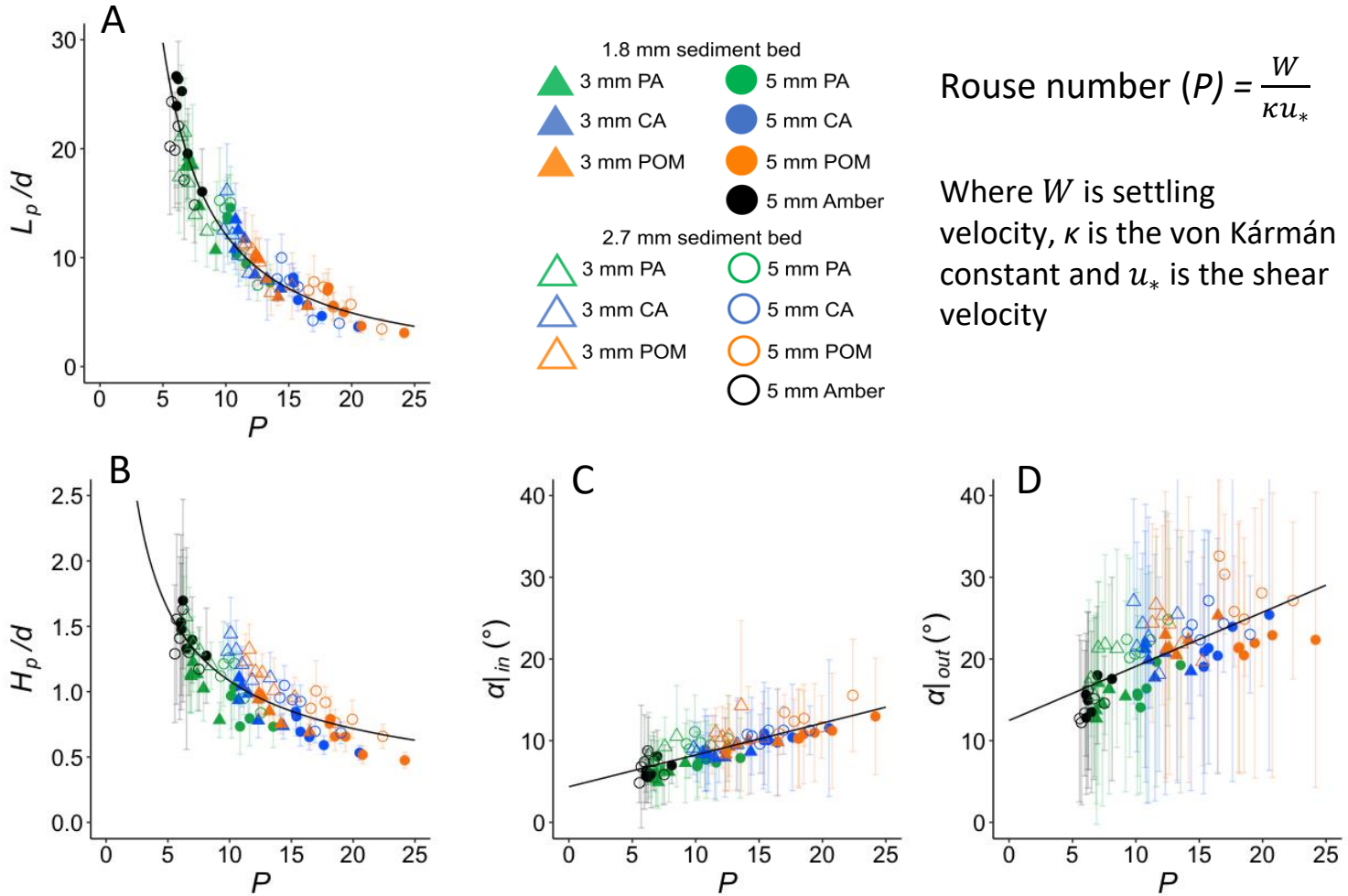
Similarities	Differences
- Size	- Shape
- Distribution	- Density
	- Elasticity

How will the transport of microplastics differ when compared to natural sediment?



Previous work – Microplastic and sediment transport mechanics





Rouse number $(P) = \frac{W}{\kappa u_*}$

Where W is settling velocity, κ is the von Kármán constant and u_* is the shear velocity

Method

- 3 types of spherical microplastic compared to spherical natural sediment (amber)

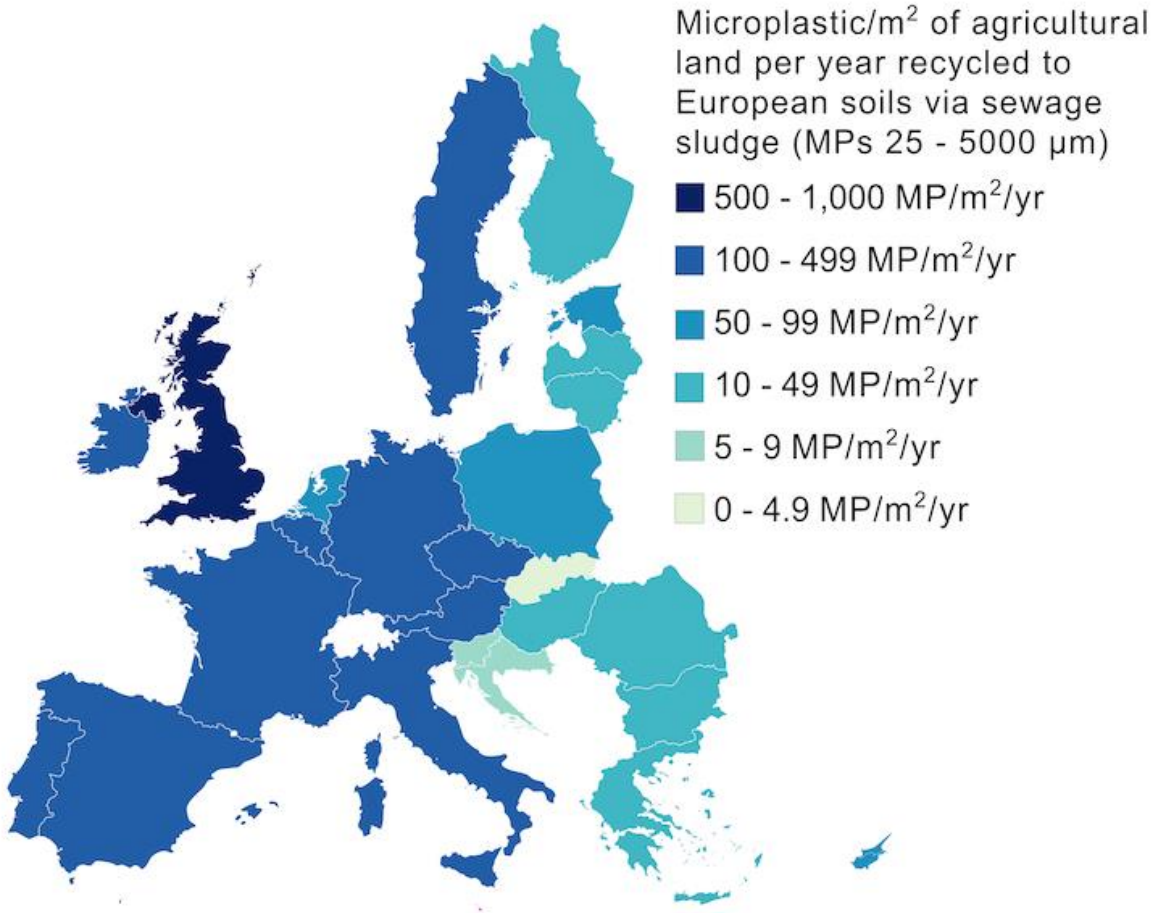
Conclusions

- Spherical microplastics behave analogously to natural sediments in flows
- The Rouse number can be used to characterise saltation, regardless of material
- Sediment transport theory can be used as a foundation for microplastic transport

Lofty, J., Valero, D., Wilson, C. A. M. E., Franca, M. J., & Ouro, P. (2023). *Microplastic and natural sediment in bed load saltation: material does not dictate the fate*. (PrePrint) https://arxiv.org/abs/2303.14990v1

Previous work: Sources of microplastic in rivers – land run off

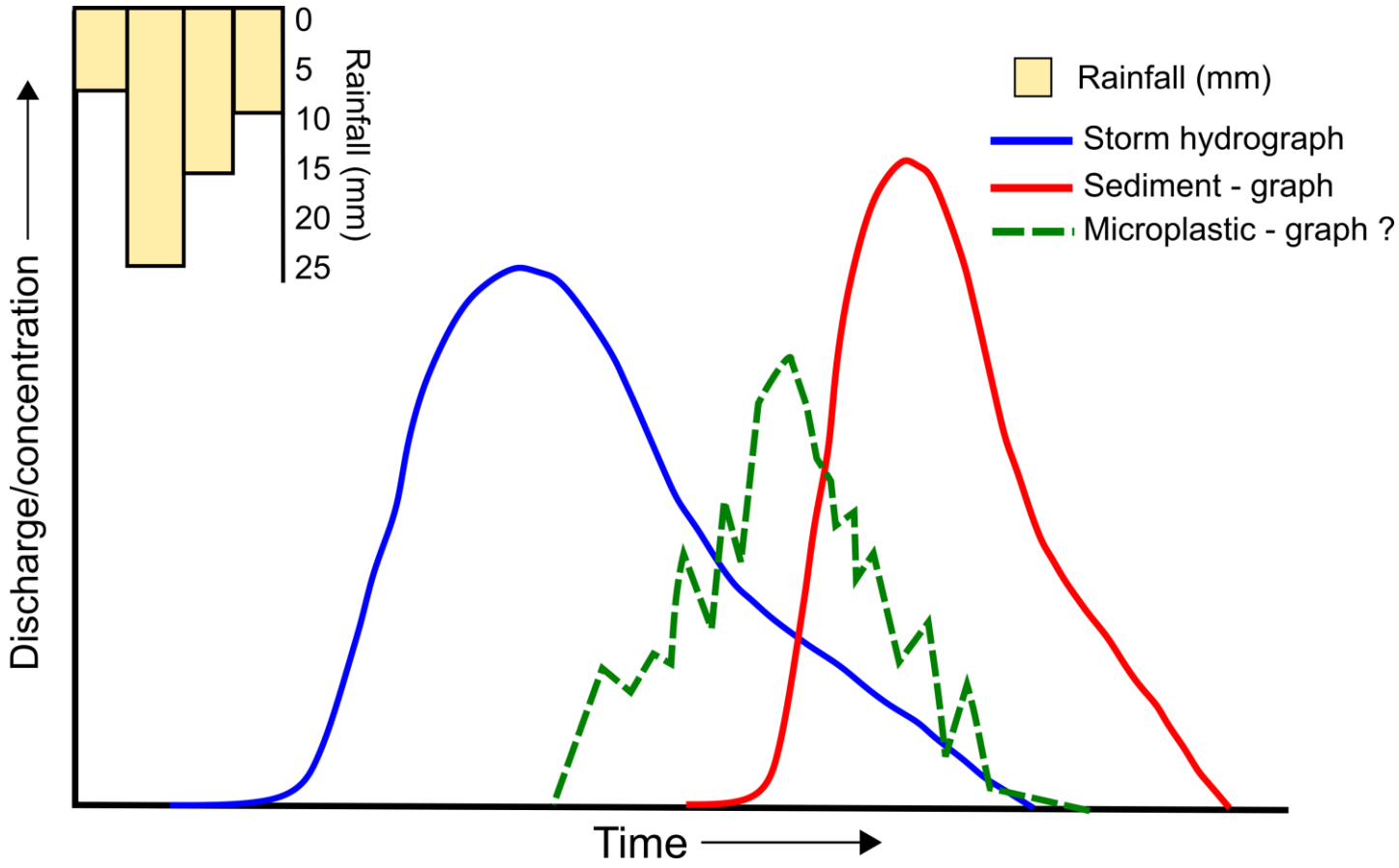
- Focus on land run off as a source of microplastics
  - Fertiliser generated at Nash WwTP (Newport, Wales) contained up to 24 microplastics/g, equal to 1% of the sewage sludge weight
  - Between 31 - 42,000 tonnes of microplastic are applied to European soils annually from fertiliser generated from WwTPs
  - 99% of microplastics are transported away from the originally applied soils, likely into rivers



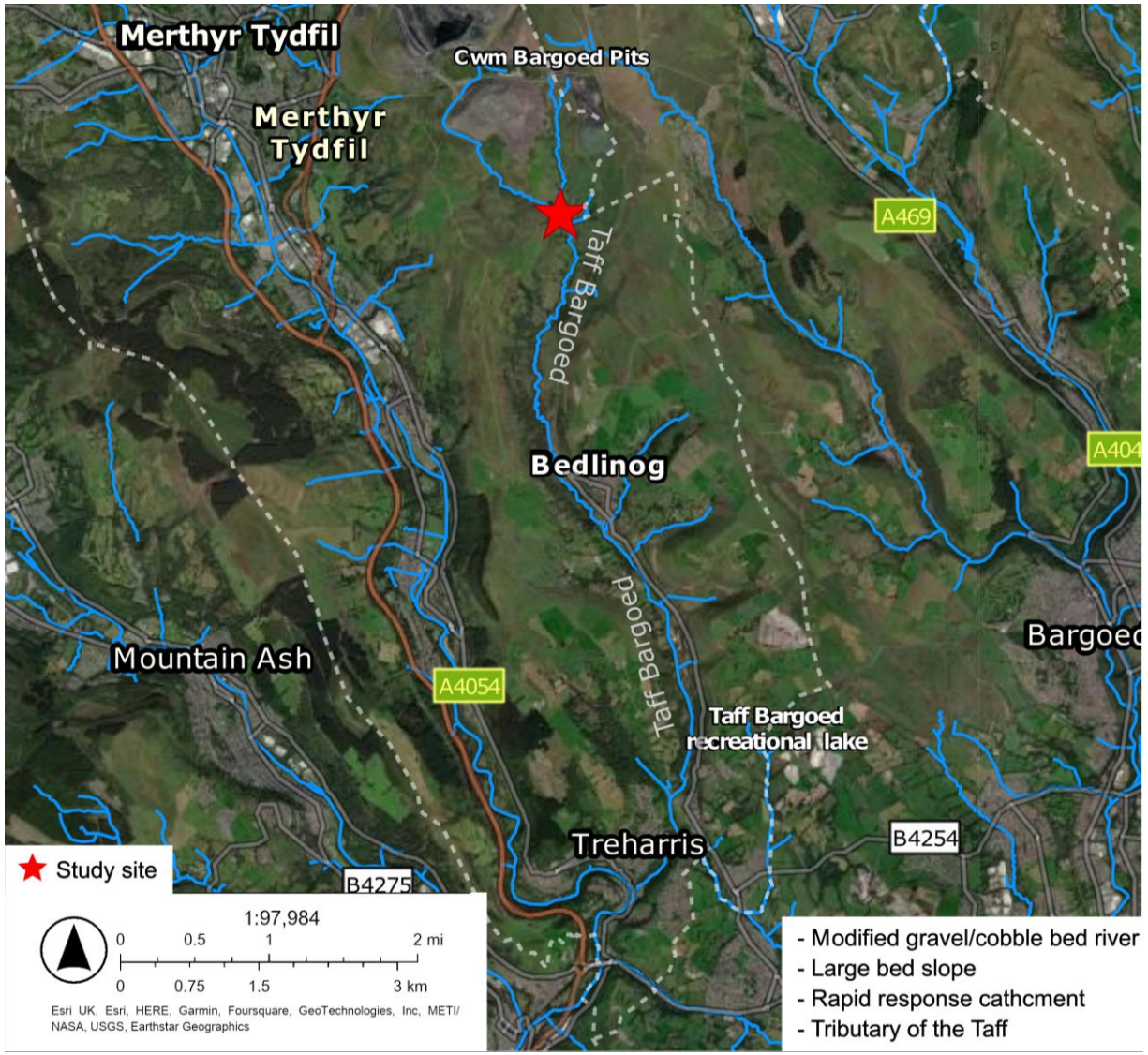
Lofty, J., Muhawenimana, V., Wilson, C.A.M.E., Ouro, P., 2022. Microplastics removal from a primary settler tank in a wastewater treatment plant and estimations of contamination onto european agricultural land via sewage sludge recycling. Environ. Pollut. 304, 119198. https://doi.org/10.1016/j.envpol.2022.119198.

Project aims – Catchment response of sediment and microplastic to climate changes

- Can we use the response of sediment to rainfall as a proxy for predicting the quantity of microplastic entering the river?
- What is the trigger for the mobilisation and transport of the sediment and the microplastic particles from land into rivers?



Study site - The Taff Bargoed



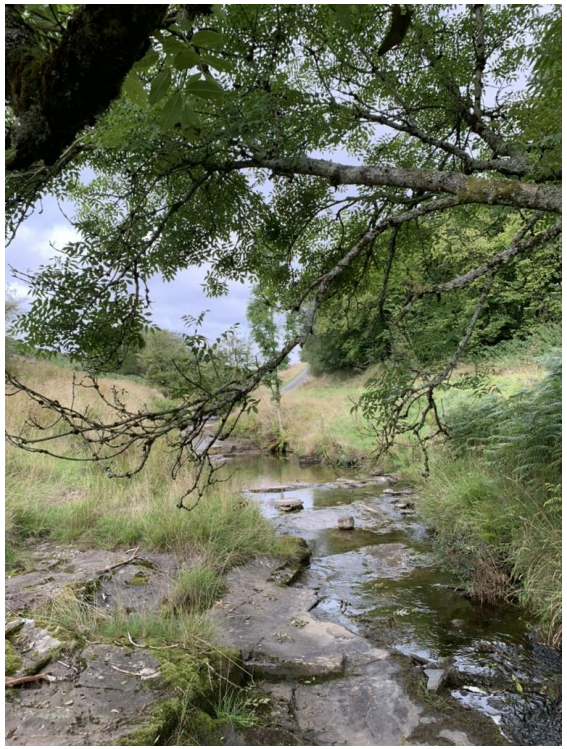
Study site:
- Upper reach of the Taff Bargoed
- Cwm Bargoed coal pits at the source of Taff Bargoed

At the site:
- Multiparameter sonde (since Oct 22):
  - pH
  - Conductivity
  - Turbidity (proxy for suspended solids)
- Rain Gauge (since Jan 23)
- 3 water depth sensors (since Jan 23)
- Continuous water velocity sensor (since May 23)

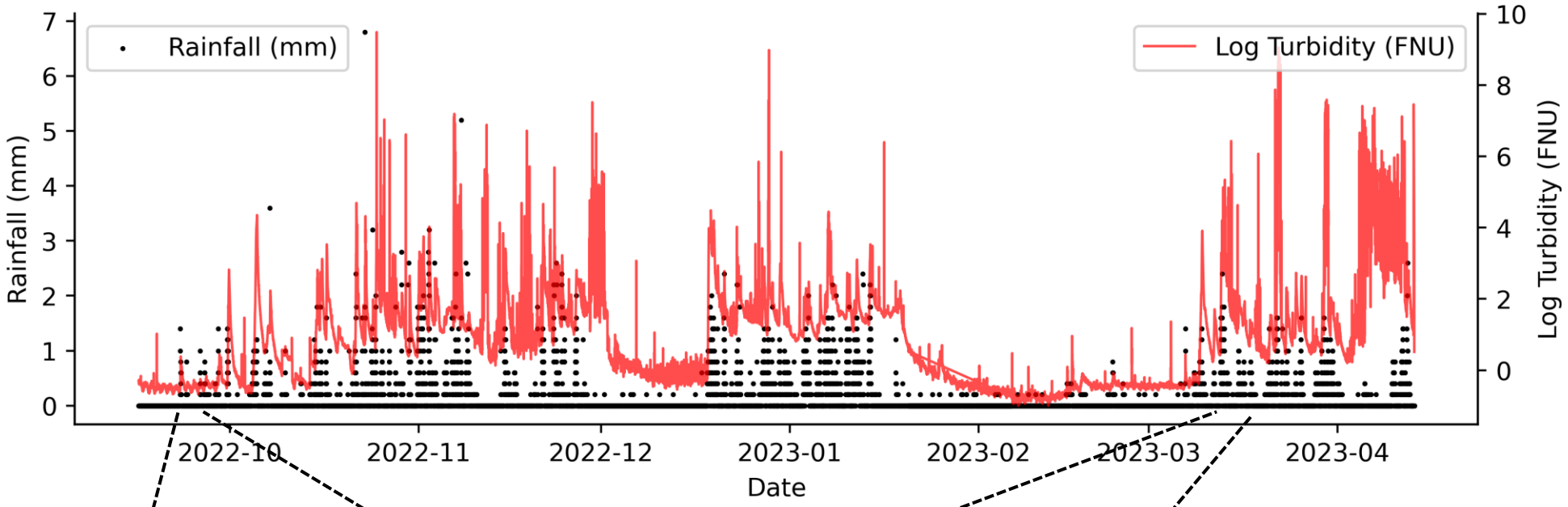
All the ingredients to have high temporal:
- Water quality measurements
- Catchment response
- River flow characterisation.

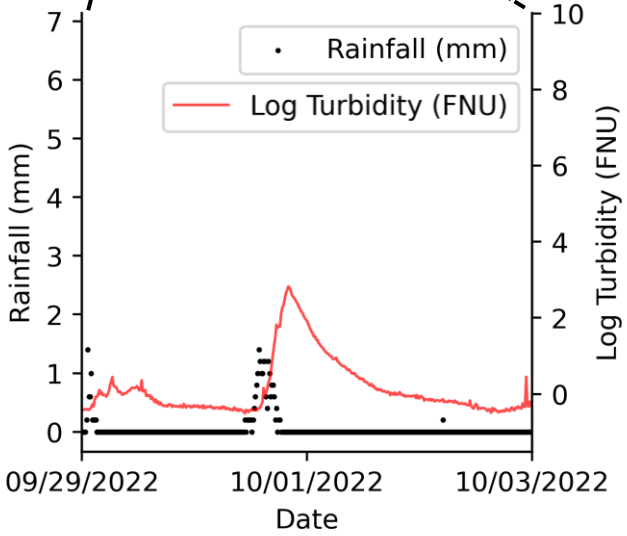
Study site - The Taff Bargoed

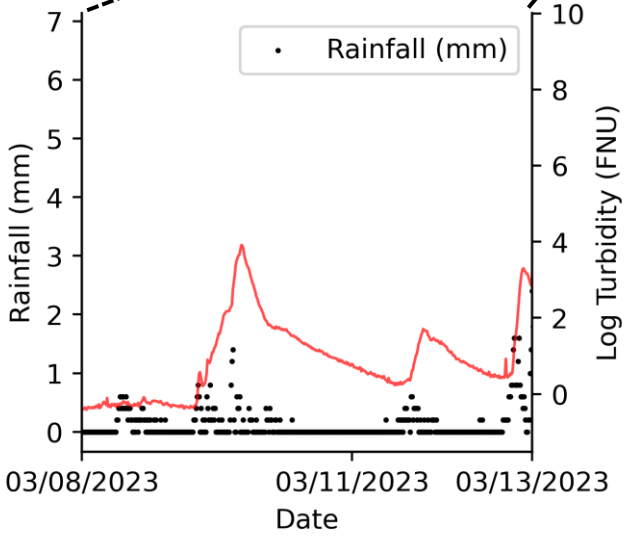





Monitoring so far..







Next coming months

- Water discharge data
- Water depth data
- Microplastic concentrations

Open access dataset:
https://jameslofty.shinyapps.io/taff_sondedata/

Thank you for listening!
Any questions or suggestions

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