



Original thinking... applied

E-Flows

Edge of Field Waterbody
Safety Assessment Facility

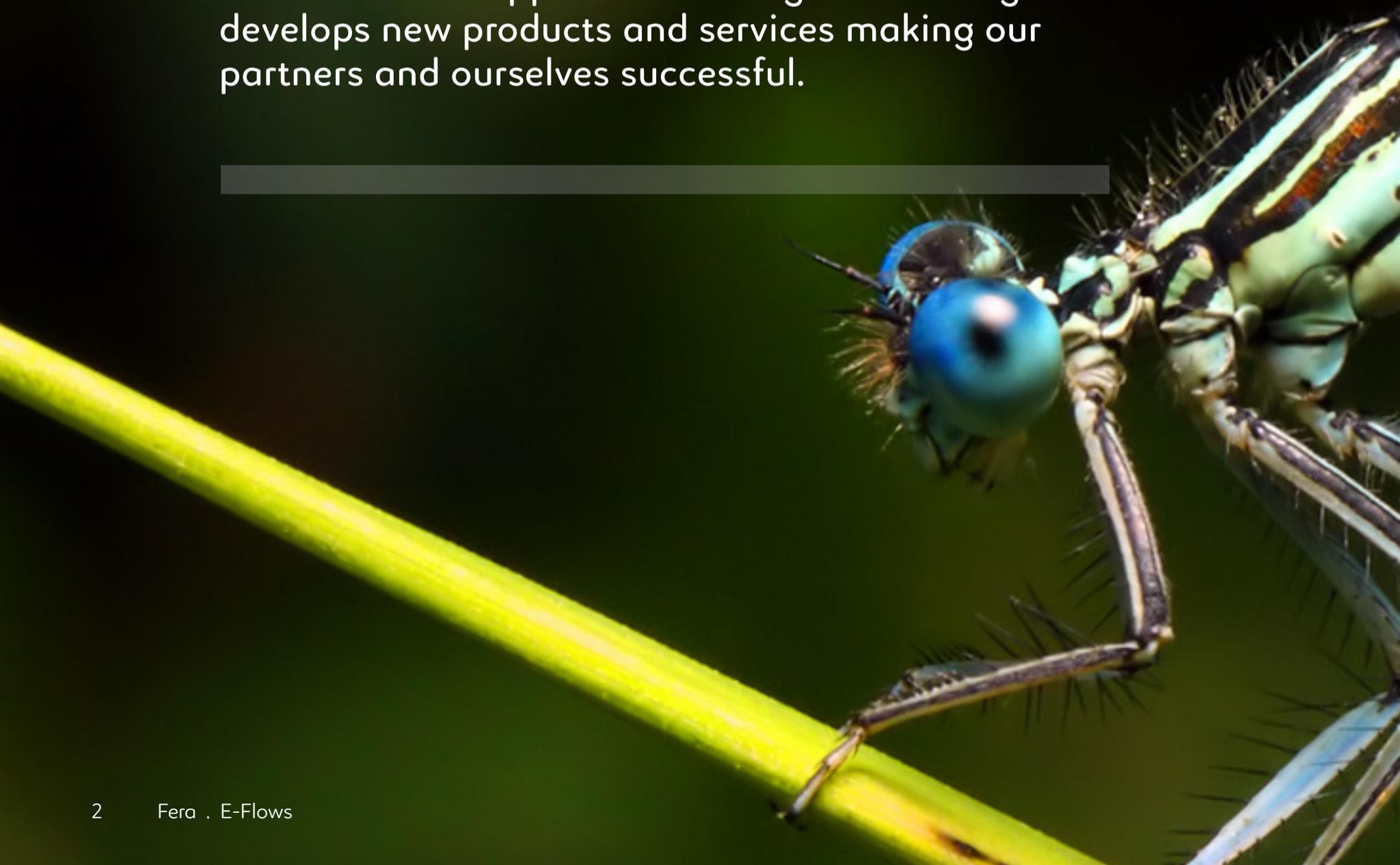


We work with
Innovate UK

As Plant Protection Products are developed and registered, there is a need to ensure that they are safe for the aquatic environment. The new E-Flows mesocosm provides a unique test-bed to provide robust data to demonstrate safety.

The E-Flows mesocosm is a ground-breaking project by the Centre for Crop Health and Protection (CHAP), supported by Innovate UK and developed, designed, managed & operated by Fera. The project will deliver a facility that is a realistic, but closely controlled, facsimile of edge-of-field waterbodies that can be exposed to plant protection products in real-world scenarios to ensure the safety of our aquatic habitats. This unique facility represents a leap forward in the support of Aquatic Higher Tier Risk Assessments.

Our innovative approach and original thinking develops new products and services making our partners and ourselves successful.



Common problems encountered in mesocosm studies

Individual mesocosm units are relatively small and often cannot support the abundance and diversity of biota required to deliver robust data in support of regulatory requirements.

This is essentially due to the small systems having insufficient biological resources available for whole communities to survive and thrive.

The system stresses that occur due to resource limitations (competition, grazing pressure, predation etc) drives multiple small systems to diversify between themselves rather than within themselves.

This means that each individual mesocosm unit can deliver a very different biological outcome to that of its neighbours, even in reference condition.

High variability of biological outcome can lead to the data having insufficient statistical power to satisfy regulatory requirements for data robustness.

For example, the criteria for the number of species with abundances that meet the criteria for Minimum Detectable Differences (MDD) may not be met.

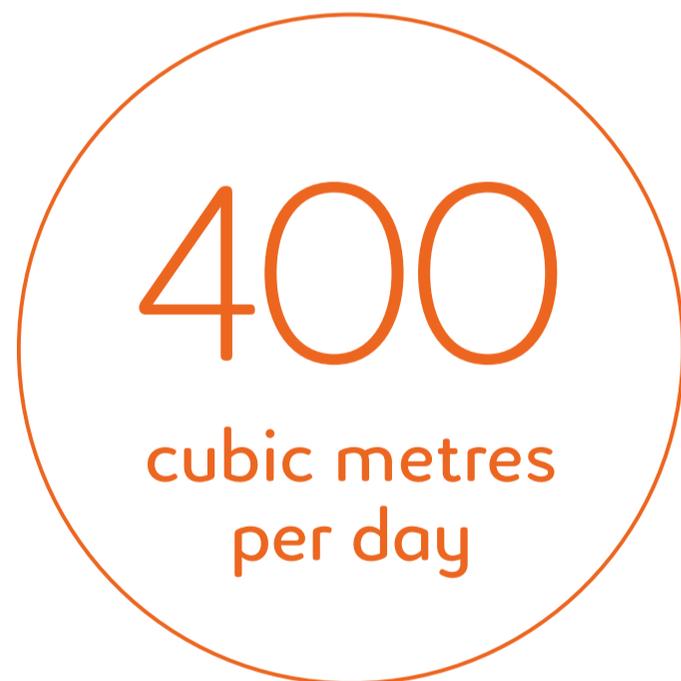
Introducing the FIRST Fully Flow-through Field Scale Mesocosm Exposure Facility in Europe

Large mesocosm units are better able to support diverse aquatic communities, providing organisms with the resources that are needed to establish large populations.

These populations can be sampled using a variety of methods to provide large datasets that better reflect community status in realistic scenarios – statistically much better than the limited presence/absence of a few key species. Large datasets provide confidence in the results and clearer outcomes for regulatory interpretation.

To this aim, the E-flows mesocosm provides a test-bed of 60 realistic streams, each up to two metres wide and ten metres long, each having a continuous matched supply of aged fresh water, and all being independent of each other. This provides a facility that is a realistic, but closely controlled, facsimile of edge-of-field surface waters that can be exposed to plant protection products in a real-world scenario to ensure the safety of our aquatic habitats.

Each 10m experimental unit has a base volume of up to 4000 litres, and for the first time, can be supplied with non-recirculated, fully flow through freshwater at any rate up to five litres per minute per unit if the whole system is utilised. This means that the E-flows facility as a whole can handle over 400 cubic metres of water per day – that’s over an Olympic sized swimming pool every week!



400
cubic metres
per day



The flow in each stream unit can be varied independently so that they can be slow flowing, like ditches, or even almost still, like ponds. On an individual basis, each experimental unit can flow as slowly as 0.2 litres per minute, or as fast as 15 litres per minute. The biota established in each unit will be in accordance with the type of habitat being simulated. The appropriate flow will minimise the stress to the organisms that can occur in artificial habitats. All waste water can be treated through a purpose built tertiary treatment prior to release.

Also, the variable retention time that is controlled by the flow regime, means that exposures can be made as pulses. This stimulates the way that models predict exposures will occur in real edge-of-field waterbodies after rainfall events. With retention times manageable to 0.1 days or less (> 10 volume changes per day) exposures can be short spikes, or can be held (re-circulated) or gradually reduced with no physical shocks to the biota that can occur with manual manipulations. Fera can also provide near to real-time chemical analysis with on-site state-of-the-art analytical suites, allowing rapid adjustments to be made to dosing regimes.

The E-Flows mesocosm will be available for higher tier regulatory risk assessment projects, or any other research projects involving impacts or effects on lowland aquatic habitats from Spring 2018 onwards.

Experimental area 1.2 Hectares
Total area 2.7 hectares



Water is supplied via a borehole from a Grade A sandstone aquifer.

Sixty independent, 10m long, fully flow through stream mesocosm experimental units with variable flow rates up to 5 litres per unit per minute.

Variable streams that can be shortened by adjusting the weir point or joined creating 20m streams.

Depth can be up to 40 cm, width up to 2m and base volume up to 4000 litres.

Five lagoons receive the borehole water and allow it to age and naturalise for 5 days before entering the mesocosm.

Streams at ground level, configured with 1:2.5 slope, and lined with supporting mesh and substrate to allow effective biota colonisation.

Each stream flows into its own capture pond/lagoon before water is discharged from the system.

They can be also be used as an additional pond environment and for capture of drift or for water sampling.

Water treatment centre with activated carbon filters that remove any residual chemicals prior to discharge.

Unshaded site is buffered by terrestrial vegetation, free from flooding and set into created wetland to provide stocks for re-colonisation.

Trees felled to prevent overshadowing and an area set out to stock ponds and natural pools to increase wetland diversity.

- Large, field scale habitat supports biota establishment and maintains diversity, allowing access to a wide range of species for assessment.
- Flowing system supports diversity by stabilising water quality, temperature and oxygen status reducing between replicate variability.
- Continuous variable flow and controlled dosing methodology supports pulsed exposure scenarios to mimic exposures predicted by FOCUS.



Serving the Agrichemical Industry:

- Optimising and standardising higher tier risk assessments
- Providing our partners with high quality regulatory evidence helping novel plant protection products receive and maintain registration.
- Supporting the development of novel crop protection that are safe for our aquatic environment

Ultimately meaning more choice and increased yields for our food and farming industries.

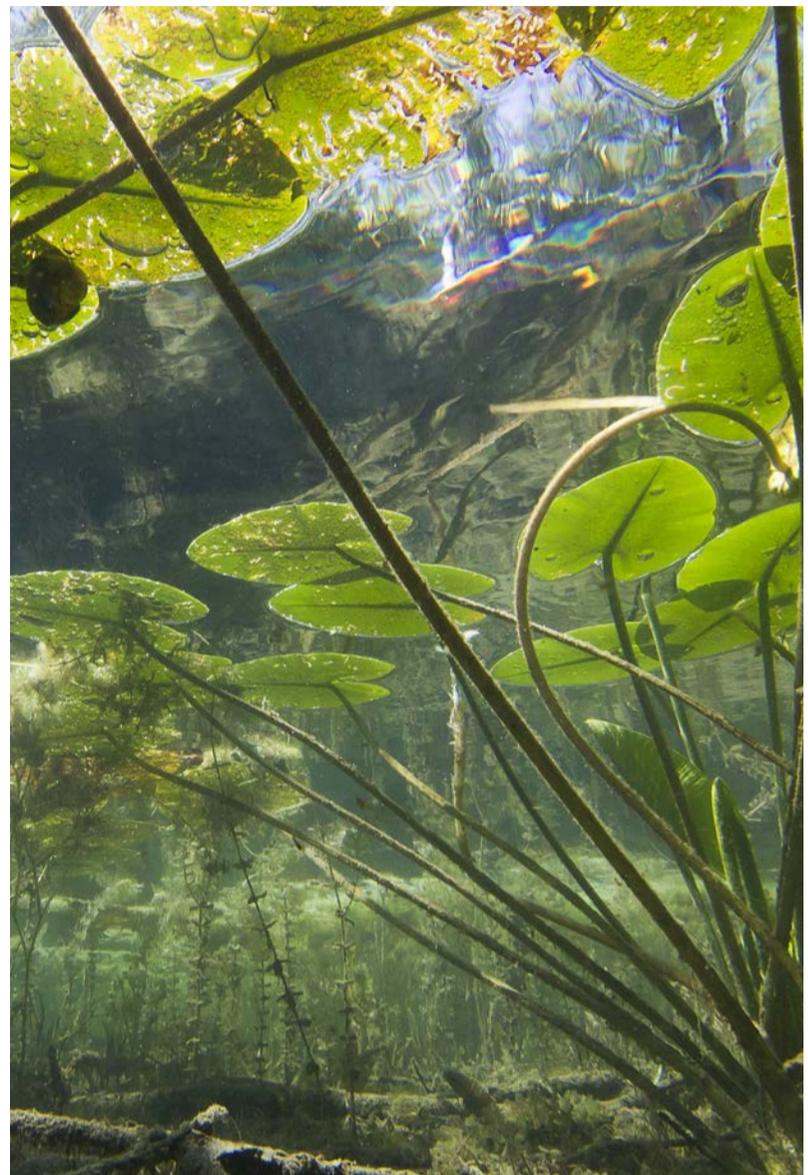


The first fully flow-through field scale mesocosm exposure facility in Europe will help to support the Industry by:

- **Replication capability designed to meet the requirement for Level 1 Reliability Index (Ri1) graded experiments.**
Reducing variation and producing reportable data against minimum detectable differences for statistical robustness.
- **Designed, built and managed to EFSA 2013 Guidance***

Standardising the approach and data output and assisting in ease of data interpretation.

*Guidance on Tiered Risk Assessment for Plant Protection Products for Aquatic Organisms in Edge-of-Field Surface Waters (EFSA, 2013)



How can agri-chemical companies commission studies using E-Flows?

If you have a crop-protection product that requires a more refined aquatic risk assessment, please contact us to enquire about the benefits of mesocosm tests using E-flows. Together we can help to give farmers more options in the fight against pests and diseases.

Contact us about our E-Flows services at: sales@fera.co.uk



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