



Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Development of a GIS-based Tool for Prioritisation of Potential PFAS Sites

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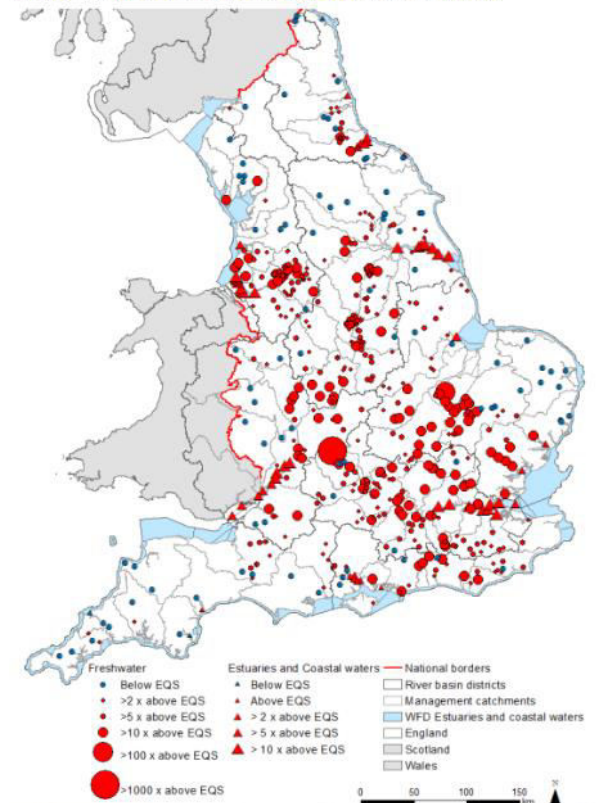
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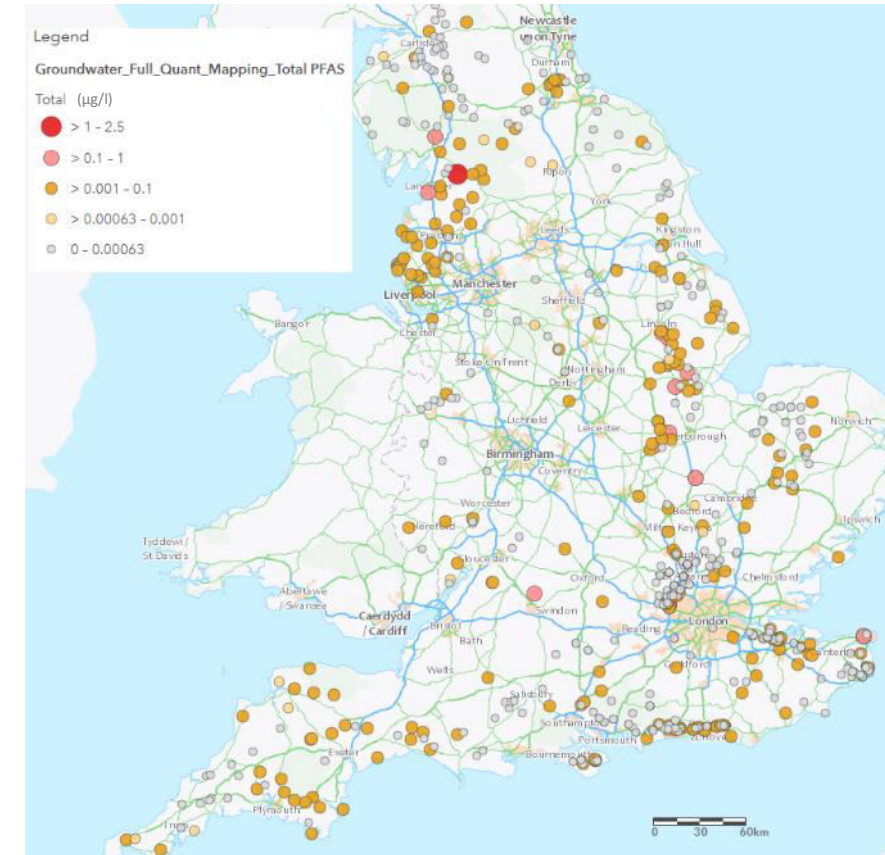
Background: Surveillance monitoring shows widespread PFAS occurrence

- Surveillance monitoring shows the **ubiquitous presence** of PFOS in surface water, often above EQS.
- PFAS also widespread in groundwater mainly at low levels; locally present in raw waters that drinking water supplies are taken from.
- Identified need for further research and investigative work to evaluate the **sources** contributing to widespread PFAS in the environment.
- A better understanding of the sources of PFAS and pathways to surface waters and groundwater will help ensure **effective actions** can be implemented.

Figure 3. Sampling locations and mean measured PFOS concentrations from Environment Agency monitoring compared with the water AA EQS in England, 2016 to 2018



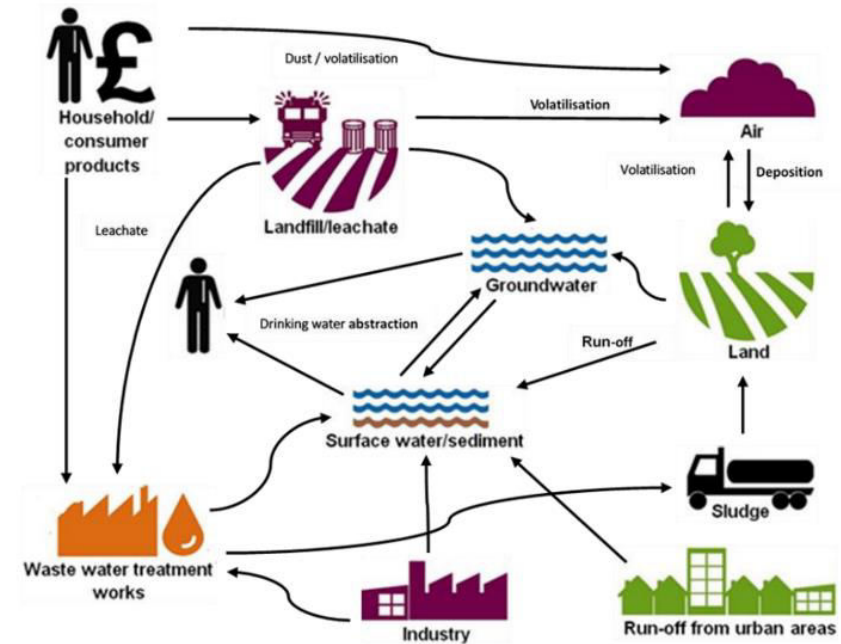
Surface Water



Groundwater

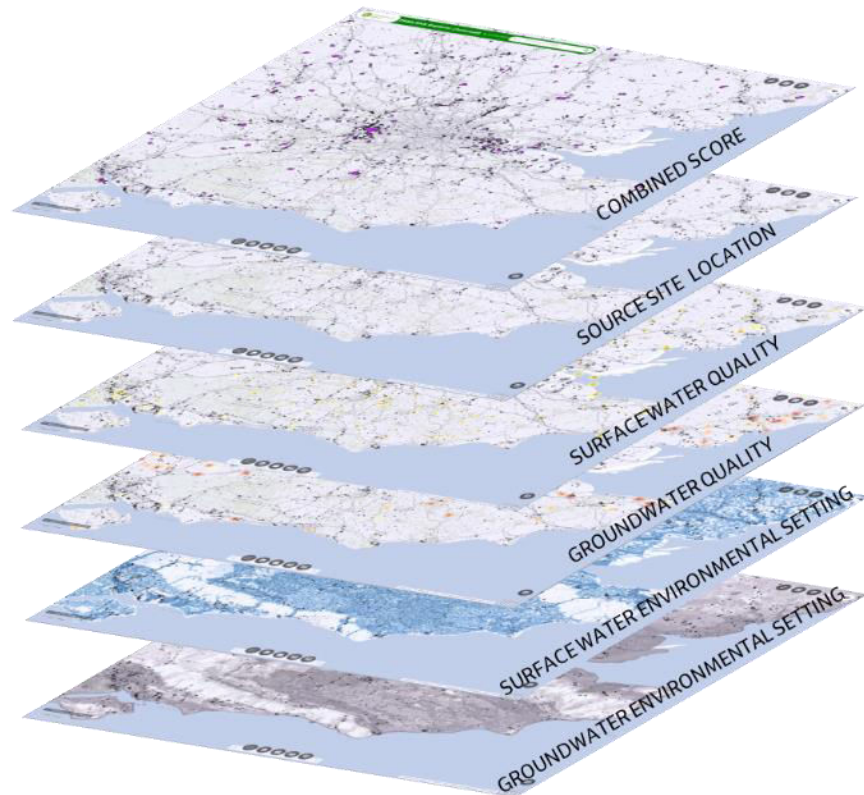
The problem: How to prioritise the large number of potential PFAS source sites

- PFAS have applications in a wide variety of consumer products and industrial applications because of their unique chemical and physical properties
- They have been in use since the 1950s
- There are thousands of potential source sites where PFAS may have been lost to the environment
 - Where PFAS-containing Aqueous Fire Fighting Foam has been used in firefighting training, and fire protection and prevention
 - Industrial applications of PFAS e.g. mist suppression, specialist coatings
 - Disposal of materials containing PFAS – waste water effluent, landfill, run-off
- How do you prioritise these sites for further assessment and effective regulation in a consistent and systematic manner, rather than simply focusing on the known and high-profile sites ?



From Environment Agency
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1012230/Poly- and perfluoroalkyl substances -sources pathways and environmental data - report.pdf

Approach : The PFAS Risk Prioritisation Project



GIS based Multicriteria Analysis

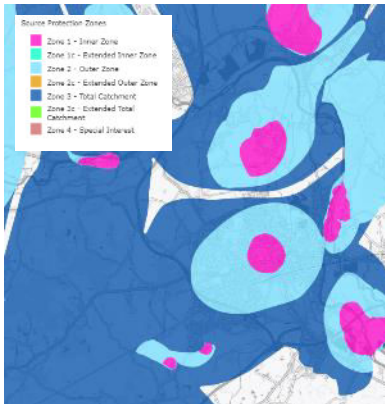
- Objective: to develop a methodology to identify higher risk potential source sites and enable **prioritisation of effort** on the sites that can make the most difference
- A national GIS-based tool to map and prioritise sites, and then to build a robust evidence base to justify further risk management action
- Output - the **PFAS Risk Explorer** which gives access to GIS web apps, analysis tools and reports
- Uses a Geographical Information Systems (GIS) approach utilising ESRI ArcGIS Professional with automated models
- Uses Multicriteria Analysis to rank source sites based on environmental setting from **national datasets**, water quality data and site types
- Presumptive source mapping helps rapid and systematic identification of potential exposure sources

Presumptive Mapping of Potential Source Sites

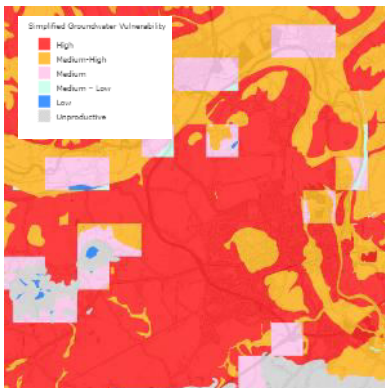
- National scale mapping of selected potential PFAS source sites
- Data sources include:
 - Use of existing datasets
 - Web scouring to build datasets
 - Data held by regulators
 - Data purchased from suppliers e.g. Groundsure
- Mixture of co-ordinate points, addresses and polygons

Site Type	Number
'Air transport sites' – airports, airfields, current and former military sites	672
Current and former fire station sites and training grounds	2668
Landfills –'historical', permitted and current	20900
Wastewater treatment sites	4565
Current and former 'Control of Major Accident Hazard Sites'	2286
*Selected current 'regulated industry sites'	755
*includes selected target industries such as textiles, metals, paper, chemicals, refineries requiring a Part A(1) Environmental Permit under EPR 2016	

Building the Environmental Setting Heatmaps



Source Protection Zones



Groundwater Vulnerability



Combined Groundwater Environmental Setting Heatmap

Input

- National mapping representative of groundwater environmental setting

Process

- Combine using weighted scores

Output

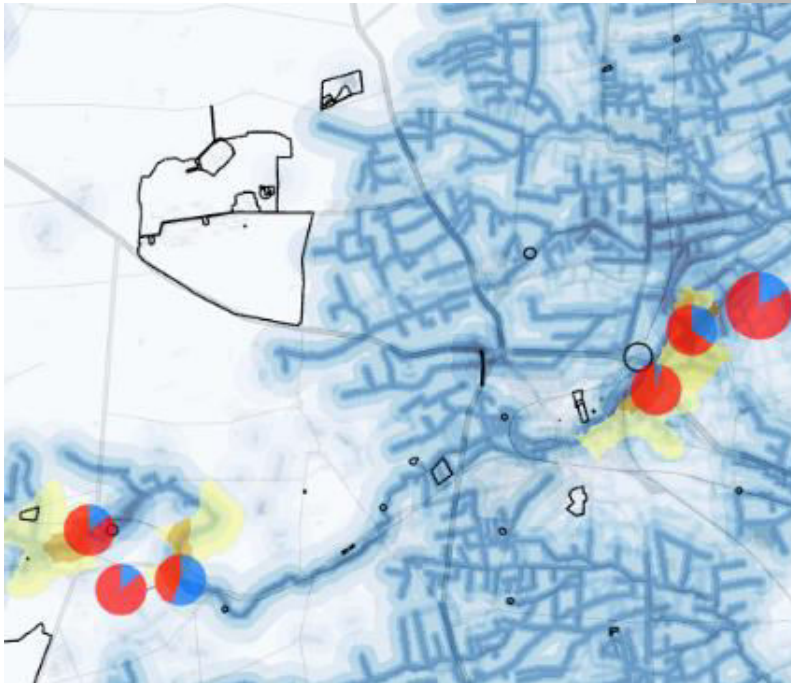
- 'Heatmap' representative of overall groundwater environmental setting

Outcome

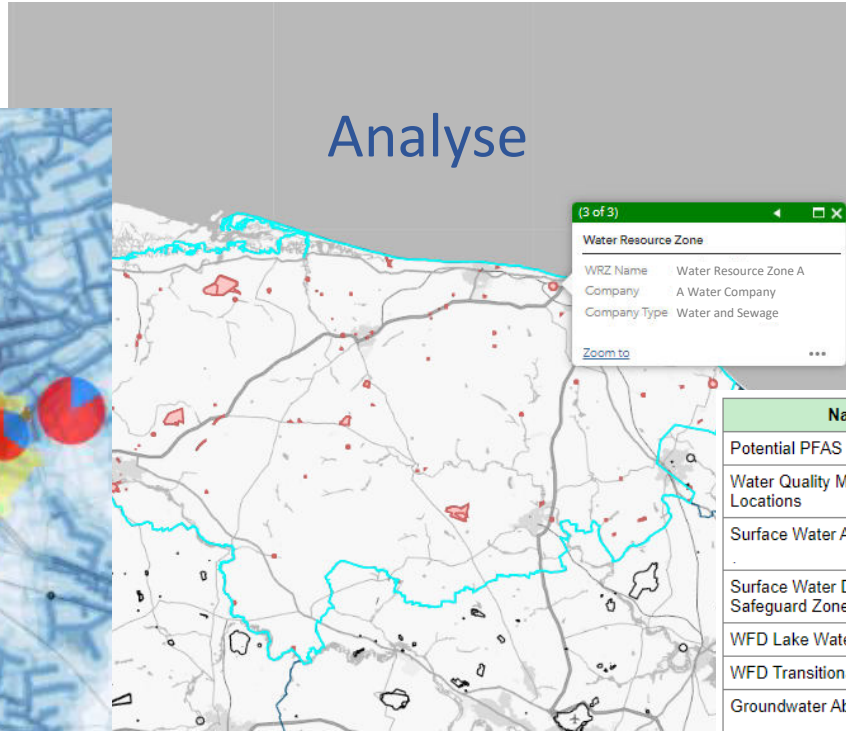
- Individual site scores weighted by environmental risk factors

GIS Portal and Capabilities

Visualise



Analyse



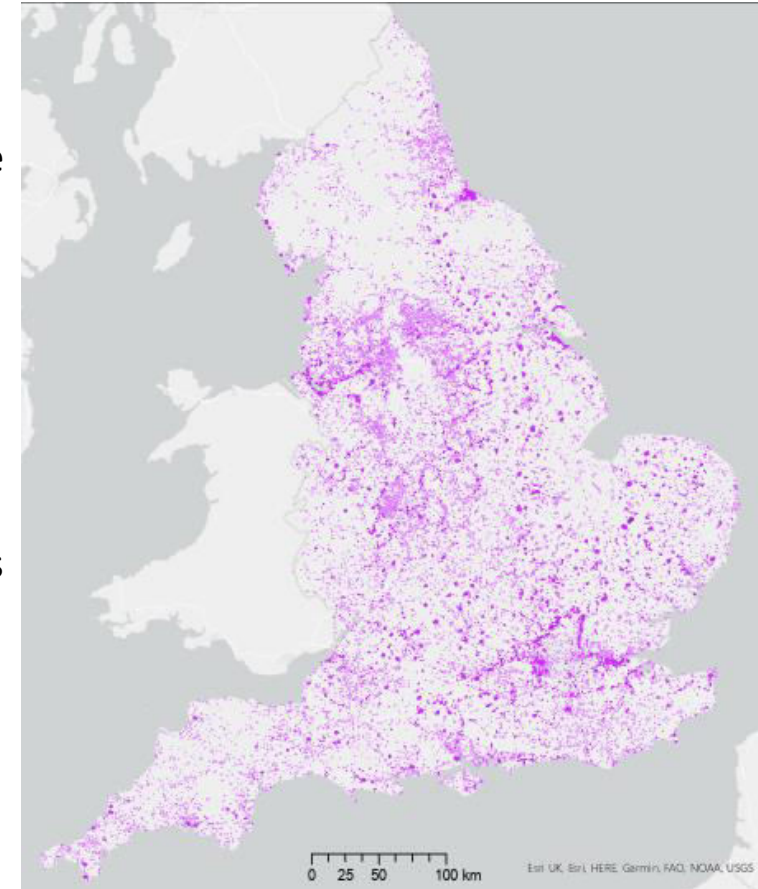
Water Resource Zone	
WRZ Name	Water Resource Zone A
Company	A Water Company
Company Type	Water and Sewage
Zoom to	

Report

Name	Count	Area(km ²)
Potential PFAS Source Sites	42	2.67
Water Quality Monitoring Locations	7	N/A
Surface Water Abstractions	3	N/A
Surface Water Drinking Water Safeguard Zones	0	0
WFD Lake Waterbodies	0	0
WFD Transitional Waterbodies	0	0
Groundwater Abstractions	14	N/A
Source Protection Zones	5	59.72
Soluble Rock / Karst	0	0
Principal Bedrock Aquifer	261	61.87
Simplified Groundwater Vulnerability	358	78.52

Outcome

- We have mapped > 30,000 sites which are potential PFAS sources; this is presumptive mapping NOT known sources.
- More than half these sites have scores indicating high risk scores because they are situated in sensitive locations vulnerable to contamination due to proximity to surface water or groundwater.
- This model can't be used to identify if sites present unacceptable risks.
- But it can be used by regulators and stakeholders as the first step in identifying and prioritising sites for further desk based or site investigation.
- The study demonstrates the magnitude of the challenge facing regulators and stakeholders associated with identifying and managing PFAS sources
- Next steps include model enhancement and refinement:
 - Improved user interface to enable operational uptake
 - Further case studies and sensitivity testing
 - Refined source site differentiation



Acknowledgements

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