Partnership Meeting

Agenda

Wye Catchment Nutrient Management Board

Date:	**Wednesday 21 January 2026**
Time:	**2.00 pm**
Place:	**Conference Room 1 - Herefordshire Council, Plough Lane Offices, Hereford, HR4 0LE**
Notes:	For any further information please contact: nutrientmanagementboard@herefordshire.gov.uk

If you would like help with this document, or would like it in another format, please email nutrientmanagementboard@herefordshire.gov.uk in advance of the meeting.

Agenda for the meeting of the Wye Catchment Nutrient Management Board

Voting membership

Chairperson	Councillor Elissa Swinglehurst	Herefordshire Council
	Merry Albright	Herefordshire Construction Industry Representative
	Jamie Audsley	Herefordshire Wildlife Trust
	Liz Bickerton	Bannau Brycheiniog National Park Authority
	Louise Bodnar	Voice of the River
	Councillor Jackie Charlton (Vice-Chairperson)	Powys County Council
	Helen Dale	Country Land and Business Association
	Nick Day	The Friends of the Lower Wye
	Simon Evans	The Wye and Usk Foundation
	David Gillam	Save the Wye
	Gordon Green	Wye Salmon Association
	Christine Hugh-Jones	Council for Protection of Rural Wales
	Georgie Hyde	National Farmers Union
	Sarah James	Farm Cymru
	Councillor Catrin Maby	Monmouthshire County Council
	Councillor Andrew McDermid	Forest of Dean District Council
	Andrew McRobb	Council for Protection of Rural England
	Silvia Sivers	Radnorshire Wildlife Trust
	Pat Sterling	Friends of the Upper Wye

Agenda

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1.	**APOLOGIES FOR ABSENCE** To receive apologies for absence and to note any substitutes.	
2.	**NOTES OF THE PREVIOUS MEETING** To receive the notes of the meeting held on 22 October 2025.	7 - 12
3.	**QUESTIONS FROM MEMBERS OF THE PUBLIC** To receive any written questions from members of the public.	13 - 14
4.	**DIFFUSE WATER POLLUTION PLAN (DWPP) UPDATE** The 'Diffuse Water Pollution Plan - River Wye Special Area of Conservation, November 2025' document is attached for ease of reference; this is the same version distributed to board members on 24 November 2025. [Environment Agency]	15 - 180
5.	**WELSH EVIDENCE BASE UPDATE** The 'Phosphorus in the River Wye - Evidence Base for Wales, Evidence base and options appraisal, Issue 4, 8 December 2025' document is attached for ease of reference; this is the same version distributed to board members on 9 January 2026. [Herefordshire Council / Natural Resources Wales / Ricardo]	181 - 344
6.	**NUTRIENT MANAGEMENT PLAN (NMP)** To receive an update on the NMP. [Herefordshire Council]	
7.	**UPDATES FROM THE RIVER WYE STATUTORY OFFICERS' GROUP** To receive the updates report from the Statutory Officers' Group (SOG). [Statutory bodies]	To Follow
8.	**WIDER UPDATES FROM MEMBERS OF THE BOARD** To receive updates on activity from members of the Wye Catchment Nutrient Management Board. [Voting board members and other participants]	
9.	**DATE OF THE NEXT MEETING** It is proposed that the next scheduled meeting be held on Wednesday 22 April 2026, 2.00 pm.	

The Seven Principles of Public Life

(Nolan Principles)

1. Selflessness

Holders of public office should act solely in terms of the public interest.

2. Integrity

Holders of public office must avoid placing themselves under any obligation to people or organisations that might try inappropriately to influence them in their work. They should not act or take decisions in order to gain financial or other material benefits for themselves, their family, or their friends. They must declare and resolve any interests and relationships.

3. Objectivity

Holders of public office must act and take decisions impartially, fairly and on merit, using the best evidence and without discrimination or bias.

4. Accountability

Holders of public office are accountable to the public for their decisions and actions and must submit themselves to the scrutiny necessary to ensure this.

5. Openness

Holders of public office should act and take decisions in an open and transparent manner. Information should not be withheld from the public unless there are clear and lawful reasons for so doing.

6. Honesty

Holders of public office should be truthful.

7. Leadership

Holders of public office should exhibit these principles in their own behaviour and treat others with respect. They should actively promote and robustly support the principles and challenge poor behaviour wherever it occurs.

Notes of the meeting of Wye Catchment Nutrient Management Board held in Conference Room 1 - Herefordshire Council, Plough Lane Offices, Hereford, HR4 0LE on Wednesday 22 October 2025 at 2.00 pm

Chairperson:

Councillor Elissa Swinglehurst	Herefordshire Council

Voting members present in person:

Merry Albright	Herefordshire Construction Industry Representative
Gordon Green / Stuart Smith	Wye Salmon Association
Andrew McRobb	Council for Protection of Rural England

Voting members in attendance remotely:

Liz Bickerton	Bannau Brycheiniog National Park Authority
Louise Bodnar	Voice of the River
Councillor Jackie Charlton	Powys County Council
Nick Day	The Friends of the Lower Wye
Christine Hugh-Jones	Council for Protection of Rural Wales
Sarenta King	Radnorshire Wildlife Trust
Councillor Catrin Maby	Monmouthshire County Council
Councillor Andrew McDermid	Forest of Dean District Council

Other participants present in person:

Gemma Dando	Herefordshire Council
Daniel Humphreys	Dwr Cymru/Welsh Water
Claire Minett	Natural England
Martin Quine	Environment Agency
Bradley Willson	Herefordshire Council

Other participants in attendance remotely:

Emma Guy	Bannau Brycheiniog National Park Authority
Ethan Hamer	Powys County Council
Craig O'Connor	Monmouthshire County Council
Alicia Parker	National Farmers Union
Ann Weedy	Natural Resources Wales
Martin Williams	Farm Herefordshire

Support officers:

Ben Baugh	Herefordshire Council
Donna Thornton	Herefordshire Council

13. APOLOGIES FOR ABSENCE

Apologies for absence were recorded from: Jamie Audsley, Herefordshire Wildlife Trust; Helen Dale, Country Land and Business Association; and David Gillam, Save the Wye, with Ian Hague in attendance online as a substitute.

14. NOTES OF THE PREVIOUS MEETING

The notes of the previous meeting held on 16 July 2025 were agreed.

As a matter arising, there was a brief discussion about the appropriateness and ability of local authorities to monitor manure management plans, particularly once manure left premises. It was commented that the issue had been raised with Welsh Government. It was also commented that applicants could be required to provide evidence which could then be assessed by planning authorities using external expertise. The Chairperson requested that the board be informed as discussions progressed.

15. UPDATES FROM LOCAL PLANNING AUTHORITIES ON CUMULATIVE IMPACTS

Further to a question received for the 30 July 2025 meeting about how planning authorities record and assess the cumulative impacts from intensive livestock farming developments across the catchment, it was noted that responses from the planning authorities were awaited; once received, responses will be published in (post-meeting) Supplement B (link).

16. QUESTIONS FROM MEMBERS OF THE PUBLIC

A document containing questions received for the meeting from Dr Christine Hugh-Jones was included in Supplement 1 (link). In addition to the statutory agencies and planning authorities identified in the question document, it was requested that the Environment Agency also provide a written response; once received, responses will be published in (post-meeting) Supplement B (link).

A board member commented on the need for more information and guidance given potential 'grey areas' around permitting, approvals, management, and monitoring.

A board member commented on the submission of complex questions shortly before meetings and the difficulties for the relevant bodies to respond in a timely manner. The Chairperson suggested that substantial issues should be notified to the Chairperson sufficiently in advance of each meeting, so that consideration could be given to the inclusion of an item of business on the agenda. It was noted that as much notice as possible would be beneficial to statutory agencies, as input may be required from national technical teams.

17. UPDATE FROM THE RIVER WYE STATUTORY OFFICERS' GROUP

The River Wye Statutory Officers' Group (SOG) Update slide deck was provided in the agenda.

The Chairperson drew attention to the SOG Meeting Summary of 24 September 2024 (agenda page 18) and expressed concern that the limited text did not provide the Nutrient Management Board (NMB) with sufficient information to undertake its agreed role to both advise and 'challenge decision makers on their proposals, plans and decisions/actions', nor did it demonstrate the SOG operating principle of working 'openly and collaboratively with the NMB, seeking and taking into account the NMBs views in its decision making'; River Wye governance, October 2023: SOG terms of reference (link).

Other board members commented on the need: to understand who was participating in SOG meetings; to provide keys to graphs and photographs included in the update; to identify definitive actions / outcomes; and for open collaboration, with the SOG being explicit about the support that the NMB could provide to the responsible bodies in their work to protect and restore the River Wye.

Dan Humphries commented on delays in the Diffuse Water Pollution Plan and Welsh Evidence Base. Martin Quine acknowledged the potential to review the governance arrangements but emphasised the need to manage expectations, particularly in terms of progress between quarterly meetings. Ann Weedy commented that the delays in the key documents limited the scope of the recent SOG meeting.

There was a discussion about the contents of the SOG Update going forward, with comments made about: the potential for benchmarks; the need for detailed SOG meeting minutes; and the need for additional narrative to aid understanding for non-professionals.

Noting a reference in the Natural England slides, 'Ongoing advice to the planning department regarding the need to demonstrate that growth proposed in the new local plan and related plans can be accommodated without causing nutrient targets on the River Lugg and the River Wye to be exceeded', the Chairperson commented on the need to take account of the Cardiff University report on the role of phosphate and other nutrients on water quality in the River Wye.

The Chairperson provided a brief overview of the Welsh Government Water Summit (25 September 2025), chaired by the Deputy First Minister with responsibility for Climate Change and Rural Affairs, and commented on the positive input from the agricultural sector and the clear sightedness about the challenges.

18. DIFFUSE WATER POLLUTION PLAN (DWPP)

Further to minute 6 of the 16 July 2025 meeting, Diffuse Water Pollution Plan progress report (link), Martin Quine advised that the Diffuse Water Pollution Plan (DWPP) was nearing finalisation. It was reported that the DWPP had been delayed due to a peer review process and the need to share it with the claimant in a judicial review; no further details of the implications of the latter could be provided in the meeting. It was anticipated that the DWPP would be available by the time that the contractor was appointed for the catchment management plan. The board was advised that there would not be a public consultation, but the DWPP would be publicly available. It was suggested that a separate session to explore the contents of the DWPP could be arranged.

With comments made by board members about the background to the DWPP, assurance was sought about the timeframe; the potential to write to the Parliamentary Under-Secretary of State for Water and Flooding was briefly explored. Martin Quine expected that the DWPP could be shared in the next few weeks.

The Chairperson noted the position of the Environment Agency but commented on the potential benefits of sharing draft documents openly and collaboratively with key stakeholders.

19. UPDATE ON THE WELSH EVIDENCE BASE

Gemma Dando reported that the Welsh Evidence Base document had been circulated for peer review with the statutory agencies and local authorities, with responses due back by the end of the week. A further iteration would then be circulated to board members.

20. NUTRIENT MANAGEMENT PLAN (NMP) DELIVERY

The Chairperson noted that the River Wye Statutory Officers' Group was responsible for producing a publicly available Nutrient Management Plan but considered that a degree of collaboration through the draft stages would be beneficial.

Martin Quine said that, once the Diffuse Water Pollution Plan and the Welsh Evidence Base were finalised, work could be progressed on a bridging document. The Chairperson highlighted the importance of identifying and tracking actions.

There was discussion about the gap between the outputs of the measures and mechanisms modelled and the target. Martin Quine acknowledged that the agencies did not have all the answers currently, referenced the Welsh and UK government joint research initiative, and emphasised that there was a significant volume of work being undertaken in the catchment.

A board member commented on the significant roles of regulatory bodies and the farming community in the delivery of meaningful outcomes. A remote attendee commented on the need to consider emerging issues, including the ramifications of the Planning and Infrastructure Bill.

21. PROJECT TARA

Martin Quine advised that there were resourcing challenges with project TARA (Testing Approaches to Regulation of Agriculture) but the Environment Agency was still committed to producing it; it was anticipated that a summary of findings would be available towards the end of 2025 or in early 2026.

There was a brief discussion about the value of data sharing with stakeholders in a timely and effective manner, supporting transparency and accountability in the spending of public money.

22. LEGACY PHOSPHORUS (P) STUDY

Martin Quine reported that this study had been commissioned by the Environment Agency national team, working closely with Lancaster University, and an update on its publication would be shared with the board in due course.

23. WELSH AND UK GOVERNMENT JOINT RESEARCH INITIATIVE

Garreth Dunstall and Mark Richardson from the Department of Environment, Food and Rural Affairs (Defra) attended remotely for this item only. Garreth Dunstall provided a brief update on the joint research initiative, the principal points included:

i. The project remained a top priority for both UK and Welsh Governments.

ii. Steps were being taken to accelerate research on both sides of the border, including the procurement of third party services; the contractors would help to define the scope of the research and undertake a gap analysis / literature review.

iii. There was a need to avoid duplication and build on existing research and stakeholder contributions, with a strong data and evidence led approach.

iv. The importance of involving stakeholders in the process was emphasised, with a workshop being planned for early 2026.

v. It was noted that prioritisation would be given to an on farm, living labs approach.

In response to questions from board members, Garreth Dunstall advised that:

- the approach sought to ensure that learning and evidence gathered could be used in a practical way;

- the stakeholder list had not been confirmed but it would include a broad range, such as farming interests, environmental groups, and citizen scientists;

- it would be sensible to look at good practice and learning from across the UK;

- the need to cover the robustness of agriculture statistics, including livestock figures, was recognised; and

- the piece of work would prioritise value for money and impactful interventions.

The Chairperson welcomed the update and suggested the circulation of information around timelines.

24. RIVER WYE LAND USE MODELLING PROJECT USING FARMSCOPER

The formal publication of the 'River Wye Land Use Modelling Project using Farmscoper - Version 2' (link)' by Natural England on 17 July 2025 was noted.

A board member commented on some of the limitations of modelling and considered that differentiation between pig and poultry farms would be helpful.

There was a brief discussion about the length of time that it took for final reports to materialise from some agencies. It was noted that resourcing challenges within small teams could affect project delivery.

25. CORRESPONDENCE WITH WATER COMPANIES ABOUT BIOSOLIDS

The Chairperson reported that, arising from recent media coverage of the extent of leachate spreading on English farms, correspondence had been sent to the principal water companies to gain an understanding of biosolids coming into the catchment. It was noted that a response from Dŵr Cymru Welsh Water was included in Supplement 1 (link).

The Chairperson commented that it would be helpful to share appropriate data arising from the soil sampling being undertaken with appropriate bodies, anonymised as necessary and in compliance with General Data Protection Regulation; a response from Dŵr Cymru Welsh Water was published after the meeting in (post-meeting) Supplement A (link).

It was reported that United Utilities had advised that it did not sell biosolids into the catchment. A response from Severn Trent was awaited; this was published after the meeting in (post-meeting) Supplement A (link).

A remote attendee commented on the intrinsic value of farm data.

A board member commented on the differences in distance factors to water sources or water courses for the purpose of spreading on fields, as compared to domestic outputs.

26. WIDER UPDATES FROM MEMBERS OF THE BOARD

The principal points included:

i. Attention was drawn to the film ‘A story of one British River – The River Wye’ by documentary filmmaker Mykyta Osadchyi.

ii. There was brief discussion about the challenges around obtaining position statements on court rulings from responsible bodies. A board member suggested that an open discussion with representatives of planning / legal teams may enhance understanding of the approaches being taken by planning authorities.

iii. In response to a question about the Natural Resources Wales (NRW) press release 'Environmental permit change consultations launched', as referenced at the previous meeting, Ann Weedy said that a written update would be provided; this was published after the meeting in (post-meeting) Supplement A (link).

iv. Updates were provided on CPRE's Hedgerow Heroes Herefordshire campaign and the Mud Spotter initiative in conjunction with the Environment Agency.

27. DATE OF THE NEXT MEETING

The date of the next scheduled meeting: Wednesday 15 January 2025, 2.00 pm.

The meeting ended at 4.15 pm **Chairperson**

Questions received for the 21 January 2026 meeting

Questioner: James Marsden [received 14 January 2026]

Context

Taken together, the Office for Environmental Protection (OEP) report on protected sites in England (December 2025) and progress report on improving the natural environment in England 2024/25 (January 2026), make grim reading.

https://www.theoep.org.uk/report/review-implementation-laws-terrestrial-and-freshwater-protected-sites-england

https://www.theoep.org.uk/report/progress-improving-natural-environment-england-20242025

The OEP progress report (January 2026) foreword states:

"There has been no step change in progress in this last year. Instead of seeing positive progress overall, we continue to find that government remains largely off track to meet its environmental targets and obligations, including biodiversity targets set under the Environment Act and the UK's twin 30 by 30 commitments for protected areas and, additionally, for restoring degraded ecosystems.

To meet or to miss 2030 targets is now a choice for this government.

In December 2025, government published a revised Environmental Improvement Plan (EIP25). Government describes EIP25 as a roadmap for improving the natural environment and as a prioritised, systems-based plan that is clear on what, how and who will deliver environmental ambitions."

EIP25 includes:

- Commitment 26: Reduce total nitrogen, phosphorous and sediment pollution from agriculture to the water environment: a by at least 12% by December 2030, compared to 2018 levels, and b by at least 18% in catchments containing protected sites in unfavourable condition due to nutrient pollution by December 2030 (Environment Act interim targets).

In addition to this EIP25 interim target by 2030, there is a long-term Environment Act (EA21) national water quality target for 40% reduction in P nutrient and sediment load by 2037, using 2018 baseline.

Both EIP25 and EA21 targets against 2018 baseline fall woefully short of 85% reduction the DWPP shows needed to achieve WFD WQ targets for the Lugg.

Question to NMB

Whether, and if not why not, the Board will adopt and promote a nutrient and sediment target for the River Wye/Lugg SSSIs and SAC aligned with EIP25 Commitment 26, such as:

Reduction in total N , P and sediment pollution (tonnes) from agriculture by at least 18% by December 2030 from 2018 baseline.

The new Wye Catchment Management Plan (CMP) should at least align with EIP25, and arguably should be more ambitious, so a nutrient and sediment target (eg as proposed above) could be adopted now without pre-empting what the CMP may say about the 'what, where, how and who by when' trajectories to achieve the target?

Environment Agency

Diffuse Water Pollution Plan

River Wye Special Area of Conservation

November 2025

We are the Environment Agency. We protect and improve the environment.

We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.

We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

Prepared by:

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Contents

Sign Off

Natural England and the Environment Agency commit to work together to gather evidence and implement necessary remedial measures, as guided by this plan, to reduce diffuse pollution and support favourable condition in the River Wye Special Area of Conservation.

Organisation	Signed	Date
Environment Agency	 Marc Lidderth (Area Director, West Midlands)	11th November 2025
Natural England	 Emma Johnson (Area Deputy Director, West Midlands)	11h November 2025

Document Version Control

Version	Date	Author(s)	Rational/changes
1.0	11/11/2025	L. McNamara (EA)	Signed off

This is an internal, working document prepared in accordance with the Environment Agency’s Diffuse Water Pollution Plans: Operational Instruction LIT 73041. It represents the position at time of the most recent update (see version log for date). It is under periodic review and therefore subject to change.

Executive Summary

Introduction

This Executive Summary provides an overview of the Diffuse Water Pollution Plan (DWPP) for the River Wye Special Area of Conservation (SAC). Developed jointly by the Environment Agency (EA) and Natural England (NE), the plan outlines the current condition of these protected sites, identifies the sources and impacts of diffuse pollution, and sets out the strategic priorities and actions required to achieve favourable condition status. The plan focuses specifically on phosphate and sediment, and integrates technical findings, modelling outputs, and stakeholder input to guide effective action.

Context and Legal Framework

SACs are part of the "Natura 2000" network, a suite of internationally important sites originally designated under the European Union Habitats Directive to protect rare and threatened habitats and species. Together with Special Protection Areas (SPAs), they are collectively referred to as "European" sites and form key elements of biodiversity conservation in the UK. In England, NE is the statutory body responsible for ensuring that SACs and Sites of Special Scientific Interest (SSSIs) achieve and maintain favourable condition status, while the EA regulates activities that may impact water quality, issues permits, monitors compliance, and enforces environmental legislation to manage pollution risks and support measures to improve site condition.

In 2015, a Judicial Review brought by WWF-UK, the Angling Trust, and Fish Legal resulted in a legally binding consent order requiring EA and NE to evaluate and identify the measures necessary to achieve protected area objectives in European sites affected by diffuse pollution. This DWPP fulfils the requirement for the English sections of the River Wye SAC. It also updates and supersedes (for England) the 2014 River Wye SAC Nutrient Management Plan (NMP) and the 2021 River Wye SAC NMP Phosphate Action Plan.

DWPPs are non-statutory plans designed to support the reduction of pollution pressures on biodiversity and ecosystem health at water-dependent protected sites, particularly SACs, SPAs, and Ramsar sites. While they do not carry regulatory authority or dedicated funding, they provide strategic direction and can support cross-sector coordination. Their recommendations are intended to inform investment, policy development, and delivery mechanisms aimed at restoring sites to favourable condition status.

Scope of the Plan

This DWPP applies exclusively to the English sections of the River Wye SSSI/SAC and River Lugg SSSI, and focusses on the mitigation of phosphate and sediment, as these pollutants are currently failing the water quality conservation objectives for these designated sites. While the River Wye and its tributaries span both England and Wales, this plan does not cover Welsh catchments, which are managed separately by Natural Resources Wales (NRW). Inflows from Wales are reviewed, but Welsh regulatory frameworks and data are generally outside the scope of this document. Nevertheless, restoring the Wye and Lugg catchments to favourable condition status will require ongoing, concerted effort and cooperation by stakeholders on both sides of the Wales/England border, and the EA and NE remain committed to cross border co-operation.

The River Wye Catchment

The River Wye is one of the most iconic and ecologically important rivers in the UK. It is designated as a SAC due the presence of characteristic aquatic vegetation, specifically *Ranunculion fluitantis* and *Callitricho-Batrachion* communities, as well as its river habitats, migratory fish, native crayfish, and otters.

The Wye catchment also plays an important role in regional food production, supporting a diverse and productive agricultural sector that contributes to both local economies and national food security.

Nutrient and Sediment Pressures

As with many UK rivers, the Wye and Lugg have been affected by diffuse pollution linked to agricultural intensification since the mid-20th century. Grazing in the uplands and arable farming in the lowlands and floodplains have contributed to sediment, nutrients, and other pollutants entering watercourses.

Additional loads of nutrients enter the river from sewage treatment works and sewer overflows, septic tanks and urban runoff. The impact of sewage has received much scrutiny in recent years, including in the Wye and Lugg catchments. However, these “point” sources of nutrients are now more effectively managed than they have been, due in large part to public scrutiny, the Water Industry National Environment Programme (WINEP) and permitting of water company discharges, and many related government and industry initiatives. Ongoing vigilance is required to ensure that point sources of nutrients are effectively mitigated, and systems are in place to ensure that this occurs.

Phosphorus (P), a key nutrient, is used as an indicator of the naturalness of catchment conditions. Statutory conservation objectives focus on phosphate, which is the most bioavailable form of P and has a direct influence on ecological health. In the Rivers Wye and Lugg, phosphate thresholds are set to reflect near-natural background concentrations. Where phosphate levels exceed these thresholds, reductions are required to support the recovery of the river’s protected habitats and species.

Elevated levels of nutrients disrupt aquatic ecosystems by encouraging excessive algal growth, which smothers riverbed gravels and vegetation, increases water turbidity, and depletes oxygen, potentially resulting in fish kills. Algal blooms not only degrade water quality but also impair recreational use, create unsightly conditions, and can release toxins harmful to both humans and wildlife.

At the same time, accumulations of silt bury gravel beds vital for salmon and trout spawning, further threatening biodiversity. These sediment deposits often result from runoff that carries both fine particles and P, particularly during rainfall events. The P bound to sediment can be released under certain conditions, contributing to nutrient enrichment and exacerbating algal growth.

Reducing P and sediment inputs is therefore essential to achieving compliance with statutory conservation targets. While other nutrient forms, such as nitrate, may also contribute to ecological degradation, they are not currently identified as contributing to unfavourable condition and thus fall outside the immediate scope of this plan.

Water Framework Directive classification data show that many tributary water bodies across the wider Wye catchment are currently failing to achieve good status for phosphate. This widespread non-compliance reinforces the need for phosphate reduction measures across the catchment, even where the main River Wye channel is meeting its phosphate target.

Agricultural land is now the dominant source of nutrient and sediment pollution across the Wye catchment. Most phosphate, and nearly all excess sediment, originates from farmed fields and degraded riverbanks adjacent to agricultural land. Nutrient enrichment in the catchment is a long-standing issue, with applications of fertilisers and manures historically exceeding the total nutrient offtake in crops and livestock products. Although fertiliser use has declined in recent years, legacy nutrient accumulation in soils continues to pose a challenge. More recently, the expansion of intensive poultry units has added an additional source of nutrient input, particularly in the form of manure. Although not the original cause of nutrient imbalance, this newer pressure has drawn attention to the ongoing mismatch between nutrient inputs and outputs across the catchment. Initiatives such as the Sustainable Poultry Roadmap, which came into effect in January 2024, have reduced direct manure applications in the area. However, the continued presence of intensive poultry units underscores the need for coordinated, ongoing, catchment-wide nutrient management.

The greatest impact from nutrients and sediment is seen in the River Lugg, where phosphate targets are exceeded by a wide margin, mostly due to diffuse pollution from agriculture. Agricultural sources of nutrients and sediment in the Lugg are therefore the focus of most attention in this plan. Nevertheless, action is needed across the Wye and Lugg catchments, including in Wales, where similar issues affect the SAC.

The Big Picture

Diffuse water pollution is not solely a farming issue. It is a global, systemic challenge embedded in the entire food supply chain. In the Wye catchment, nutrients originate from several sources, including manure application on farmland, the import of animal feed and fertiliser products, the use of crops and organic waste in anaerobic digestion (AD) plants, and population pressures and household consumption patterns that influence food production and waste generation. These sources are influenced by national policies, trade, regulation, and operational decisions across multiple sectors. Diffuse pollution results from the combined and interacting effects of these activities, rather than any single driver. The challenge is often oversimplified, but the interplay of diverse sources, sectors, and environmental processes means diffuse pollution exhibits many characteristics of a “wicked” problem.[1] Climate change intensifies this complexity by influencing rainfall patterns, water temperature, erosion, and residence times, all of which shape how nutrients move through and affect freshwater systems.

In their report (Defra 2024 p. 69), the Nutrient Management Expert Group noted that there is an urgent need to take a “*holistic approach*” to nutrient management, and “*recognise that different actors are aiming to achieve different results in their use and treatment of nutrients, over different timescales, and that these interests need to be brought together to build a more coherent response to policy*”.

Although many of these broader issues lie outside the scope of this plan, addressing diffuse pollution in the Wye and Lugg catchments will require collaborative effort, a departure from “business as usual” and strategic, long-term commitment across sectors.

Nutrient Neutrality

The Lugg catchment in England is subject to Nutrient Neutrality requirements due to excessive P levels affecting the Lugg section of the River Wye SAC. The Nutrient Neutrality approach is a means of ensuring that new developments do not add to existing nutrient burdens so there is no net increase in nutrients because of the development (i.e., it “consumes its own smoke”). Development proposals must demonstrate, through nutrient budget calculations, that any additional nutrient pollution from their project is offset by equivalent nutrient reduction measures.

Other Critical Issues

The main River Wye is currently achieving its phosphate water quality targets at most monitoring points most of the time, yet signs of eutrophication and sedimentation persist. These symptoms indicate that ecological pressures remain, despite compliance with phosphate targets. Emerging evidence suggests that changes in water temperature, hydrological regimes, and the presence of other nutrients, including nitrates, may be playing a significant role in shaping macrophyte and algal communities. This highlights the need to consider a broader range of environmental drivers, beyond phosphate alone, when assessing ecological condition and planning interventions.

Declines in Atlantic salmon and brown trout populations continue to be observed across the catchment. While these trends are not unique to the Wye, they are likely influenced by a combination of factors including climate change, habitat degradation, and water quality

[1] “Wicked problem” is a term used in environmental and policy contexts to describe challenges that are complex, interconnected, and resistant to straightforward solutions. These problems typically involve multiple causes, stakeholders, and feedback loops, making them difficult to resolve through standard approaches (see Rittel and Webber 1973).

pressures. These pressures may be acting cumulatively across different life stages and habitats, both within the catchment and in the marine environment.

White-clawed crayfish have also experienced a dramatic contraction in range across the Wye and Lugg catchments. The decline is primarily driven by invasive signal crayfish and crayfish plague, with poor water quality and habitat loss as contributing factors.

Together, these issues underscore the importance of a holistic, catchment-wide approach to water and habitat management, recognising the complex and interacting pressures on ecological health, and the limitations of focusing on single pollutants or indicators in isolation.

Modelling

Modelling using SAGIS-SIMCAT shows that improvements at sewage treatment works (STWs) are expected to continue to reduce P loads from point sources in both the Wye and Lugg catchments.

In the River Wye, most areas are projected to meet the point source sector's[2] "fair share" of the phosphate targets by 2030, although minor exceedances of their share may occur downstream of Rotherwas STW. The diffuse sector is also expected to continue to meet its fair share of the targets, and overall, the River Wye section of the SAC is expected to remain compliant with its phosphate objectives.

In contrast, the River Lugg section of the SAC will not meet phosphate targets. Although the point sector is forecast to perform better than required to meet its fair share of the targets, diffuse sector contributions will far exceed target levels. Average phosphate concentrations of around 0.09 mg/l are expected, compared with targets of 0.015 mg/l (upstream of Leominster) and 0.03 mg/l (downstream of Leominster). Even under optimistic modelled scenarios involving high regulatory compliance, and widespread uptake of voluntary mitigation measures, in-river concentrations would remain elevated at 0.053 mg/l, and targets would remain unmet. The current suite of agricultural mechanisms and measures currently in place will not be sufficient, and more transformative approaches are needed to address diffuse pollution in the Lugg.

Reducing Nutrient and Sediment Loads

Achieving the conservation objectives for the River Lugg will require a more concerted and strategically coordinated effort, particularly in relation to agricultural land management.

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[2] "Point sector" and "diffuse sector" refer to categories used in EA's revised "polluter pays principle" methodology to apportion nutrient reductions between the two broad source types. The point sector includes permitted discharges such as STWs and sewer overflows. The diffuse sector typically includes inputs from rural and urban runoff and leaching.

Current mitigation measures are insufficient to deliver the scale of nutrient and sediment reductions required. Modelling using FARMSCOPER and SAGIS-SIMCAT suggests that catchment-scale adjustments in land use and farming systems will be necessary to meet the reductions needed to support favourable condition status. Mitigation should focus on reducing losses from farmland, particularly in riparian areas and high-connectivity zones. Long-term strategies must include nutrient balancing at both the farm and catchment scale, alongside measures to draw down legacy P from soils and sediments.

While the main River Wye is largely within phosphate targets, ecological degradation suggests that other pressures, such as climate, nitrogen, sediment, and altered hydrology, may also be contributing. This complexity reinforces the need for a broader, more integrated response. Despite uncertainty around the relative contribution of different pressures, action should not be delayed. Interventions that are likely to deliver significant, stepwise improvements should be prioritised, supported by ongoing collaboration with farmers, partner organisations, and agri-food supply chains, with awareness of wider government policy developments.

Recommendations

Improving water quality and river health in the River Wye and River Lugg requires a coordinated, long-term approach that addresses both immediate pressures and legacy issues. The following holistic and system-wide actions will help to reduce nutrient and sediment inputs, address other factors that contribute to eutrophication impacts, and support ecological recovery:

- Prioritise land use change in high-risk areas, for example by converting intensively managed arable land on steep slopes, floodplains or adjacent to watercourses into low-input uses like extensively managed grassland, to reduce erosion and nutrient runoff.
- Target interventions in the upper catchment to reduce runoff, erosion, and pollutant transport during rainfall events. These may include Natural Flood Management (NFM) measures in headwater areas to slow and store water, as well as land management practices such as cover cropping, buffer strips, and soil improvement in areas where flow pathways increase connectivity between farmland and the river.
- Enhance riparian zone management by increasing vegetative cover to stabilise banks, reduce water temperatures, and improve habitat quality. Where livestock access contributes to bank erosion and nutrient input, implement measures to reduce poaching, such as fencing and alternative drinking sources.

Additionally, measures are required that specifically target over-supply and over-application of nutrients in the catchment. These efforts should be prioritised in the Lugg catchment but should also be applied in the Wye catchment to prevent further build-up of soil P, which poses a long-term risk to water quality. These include measures that:

- Ensure that farm-scale nutrient inputs align with crop requirements and soil capacity.

- Further reduce P inputs below off-take levels in areas where soils have accumulated legacy P, to actively draw down excess stores in soils and sediments, recognising that this does not apply across the entire catchment.
- Carefully manage large-scale sources and movements of organic nutrients, including manure, slurries, poultry litter, digestate and biosolids.

Planned, ongoing improvements at STWs, and reductions in sewer overflow discharges are also critical to reducing nutrient loads. As demand grows, it will be important that these systems continue to support long-term water quality improvements.

Reductions in less significant sources of nutrients should also be sought, for example through upgrading old and outdated septic tanks and package treatment plants, and reductions in urban diffuse pollution sources, including through sustainable drainage systems (SuDS) and other pollution control measures that limit nutrient and sediment inputs from non-agricultural sources.

Strategic Priorities

The interventions above that can make the biggest reductions in nutrient losses to rivers have been captured in five over-arching strategic priorities:

1. **Farm gate nutrient balancing** – P inputs (from feed, fertiliser, etc.) should not exceed outputs in crops and livestock. Tracking and actively managing this balance helps reduce pollution, improve nutrient efficiency, and address legacy P in soils.
2. **Catchment-scale management of bulk organic nutrients** – Support better use and redistribution of manures, sludges, biosolids and digestates to avoid local nutrient surpluses and reduce pollution risks. Building on work by Herefordshire Council through its Minerals and Waste Local Plan (Policy W3), and efforts to reduce poultry manure applied in the catchment through the Sustainable Poultry Roadmap, this priority aims to extend similar principles to other farms and systems generating organic waste. Solutions may differ between sectors and will continue to evolve as the evidence base grows, and technology enables more effective nutrient management.
3. **Reducing the impact of high-risk crops on high-risk land** – Work with growers to reduce the environmental impact of high-risk crops like maize and root vegetables on vulnerable land through improved soil cover, crop rotation, field selection, and other mitigation measures such as buffer strips. The aim is to better balance land use and productivity with catchment health.
4. **Targeted use of Environmental Land Management schemes, advice and funding** – Environmental Land Management schemes (ELMs) are evolving and should be used to support water quality improvements, including promoting suitable Countryside Stewardship Higher Tier (CSHT) options. Additional funding and advice should be targeted where they can achieve the greatest nutrient reductions, and aligned with Welsh evidence, emerging Environmental Delivery Plans and Local Nature Recovery Strategies. Delivery mechanisms may need to adapt to support implementation of these new environmental planning frameworks. Catchment Sensitive Farming will remain central to land management change

across arable and grazing systems, while the upcoming River Wye Catchment Management Plan will help guide and coordinate local action.
5. **Supply chain engagement and accountability** – Engage agri-food businesses to drive widespread adoption of nutrient management practices by embedding environmental standards, incentives, and support into supply chains. This enables faster, large-scale improvements in water quality while promoting resilient, sustainable farming systems.

These strategic priorities set out five key areas for action to reduce diffuse pollution from agriculture in the catchment. They are intended to guide collaborative efforts, inform future interventions, and support the development of practical solutions over time.

The Action Plan of this DWPP identifies a range of investigations and delivery actions that help improve catchment understanding and deliver better nutrient management. To support delivery of the strategic priorities, six new investigations have been identified through an Options Appraisal process. These investigations will help identify measures and mechanisms that can drive large-scale nutrient reductions:

1. **"Unlocking" and "mining" P** – Undertake field research to investigate methods for maintaining productivity with lower soil P indices and drawing down legacy P.
2. **Standardising calculation of farm gate nutrient balances** – Standardised approaches are needed to support farm gate nutrient balancing.
3. **Sediment fingerprinting** – Sediment fingerprinting can improve our understanding of sources of sediment and help prioritise mitigation efforts.
4. **Substrate sediment sampling** – Sediment in substrate is a source of phosphate that may drive algal growth in the Wye catchment, but its role is not well understood.
5. **Learn from innovative work in other catchments** – Lessons can be learned from work undertaken elsewhere. Severn Vale CaBA's collaborative, nature-based projects and NE's Protected Site Strategy in the Clun are examples of innovative approaches that align nutrient management and habitat protection.
6. **Evaluation of Water Protection Zone (WPZ) as a mitigation mechanism** – Undertake a targeted analysis to assess the feasibility of a WPZ under Section 93 of the Water Resources Act 1991 as a tool to reduce nutrient and sediment pollution in the Lugg or wider Wye catchment. This should include evidence gathering, stakeholder engagement, modelling and feasibility assessment.

WPZ as a Regulatory Option

A WPZ remains a potential regulatory mechanism for addressing nutrient and sediment pollution in the Wye, and particularly the Lugg catchment. Although only one WPZ has ever been designated in the UK, the tool allows for bespoke controls on land use and pollution-generating activities within a defined area.

Designing and applying a WPZ, including defining its scope, coordinating delivery, and ensuring fair and effective compliance, would be complex and require robust stakeholder collaboration, careful assessment of environmental, economic and practical impacts, and an evidence-led approach to regulation.

The DWPP Action Plan includes an investigation to further evaluate a WPZ as a potential regulatory option, recognising stakeholder interest and the need for innovative approaches to long-standing pollution challenges. Progressing this evaluation, and any future steps, will depend on organisational capacity and the practical feasibility of implementing a regulatory framework that is unprecedented in this context. The challenge applies not only to regulators and other potential delivery bodies, but also to affected landowners, who would need to navigate new requirements and expectations. These considerations will require additional evidence and further analysis.

Conclusion

Diffuse pollution from agriculture, especially in the Lugg catchment, remains a critical barrier to achieving phosphate targets. Despite targeted advice and funding, there has not yet been the scale of change required to see a marked reduction in in-river P levels. Even under optimistic modelled scenarios, the current suite of mitigation measures and mechanisms will not deliver the reductions needed. This reinforces the importance of focusing on the five strategic priorities identified in this plan. These priorities provide a clear, actionable framework for tackling nutrient and sediment pressures at scale. Delivering on these priorities will be essential to restoring the health of the Rivers Wye and Lugg, and to building a more resilient, sustainable catchment for the future.

Part 1: Evidence and Supporting Information

Plan Purpose, Coverage and Contacts

Plan Purpose, Coverage and Contacts

This plan is an update of the 2014 Wye SAC Nutrient Management Plan (NMP) for England only. Recommendations for meeting the SSSI/SAC conservation objectives have been made in the Options Appraisal.

Where diffuse pollution is preventing Wye SSSI/SAC and Lugg SSSI from achieving favourable condition this Diffuse Water Pollution Plan (DWPP):

- Identifies the causes, evidence of impacts and knowledge gaps.
- Identifies remedies and plan when and how action should be taken.
- Identifies the monitoring required to validate remedies.

The plan will be reviewed and updated as the evidence base improves, as measures are implemented, as new measures become available, and as major changes occur within the catchment. As such it should be considered a “live” document.

This DWPP is “owned” by the EA and NE who, in partnership with other national regulatory stakeholders, local stakeholders, and delivery partners, will implement actions to achieve compliance with conservation objectives and attain favourable condition status.

Layout

This DWPP is comprised of two parts. Part 1 outlines the evidence base for the DWPP. Part 2 is an Action Plan, which includes a list of actions being undertaken to address diffuse sources of pollution, including recently completed actions, current actions and investigations, and actions and investigations identified in the “Options Appraisal”. The Options Appraisal (Appendix A) identifies the additional measures and mechanism that move us closer to meeting the SSSI/SAC conservation objectives.

The links between the DWPP and other plans and strategies for the Wye are outlined in Appendix B. Also, much has happened in terms of management of point and diffuse pollution nationally since the 2014 NMP was produced. Major national developments since 2014 are outlined in Appendix C.

Coverage

This plan covers the English portions of the catchment areas that feed into the River Wye SAC in England (Figure 1).

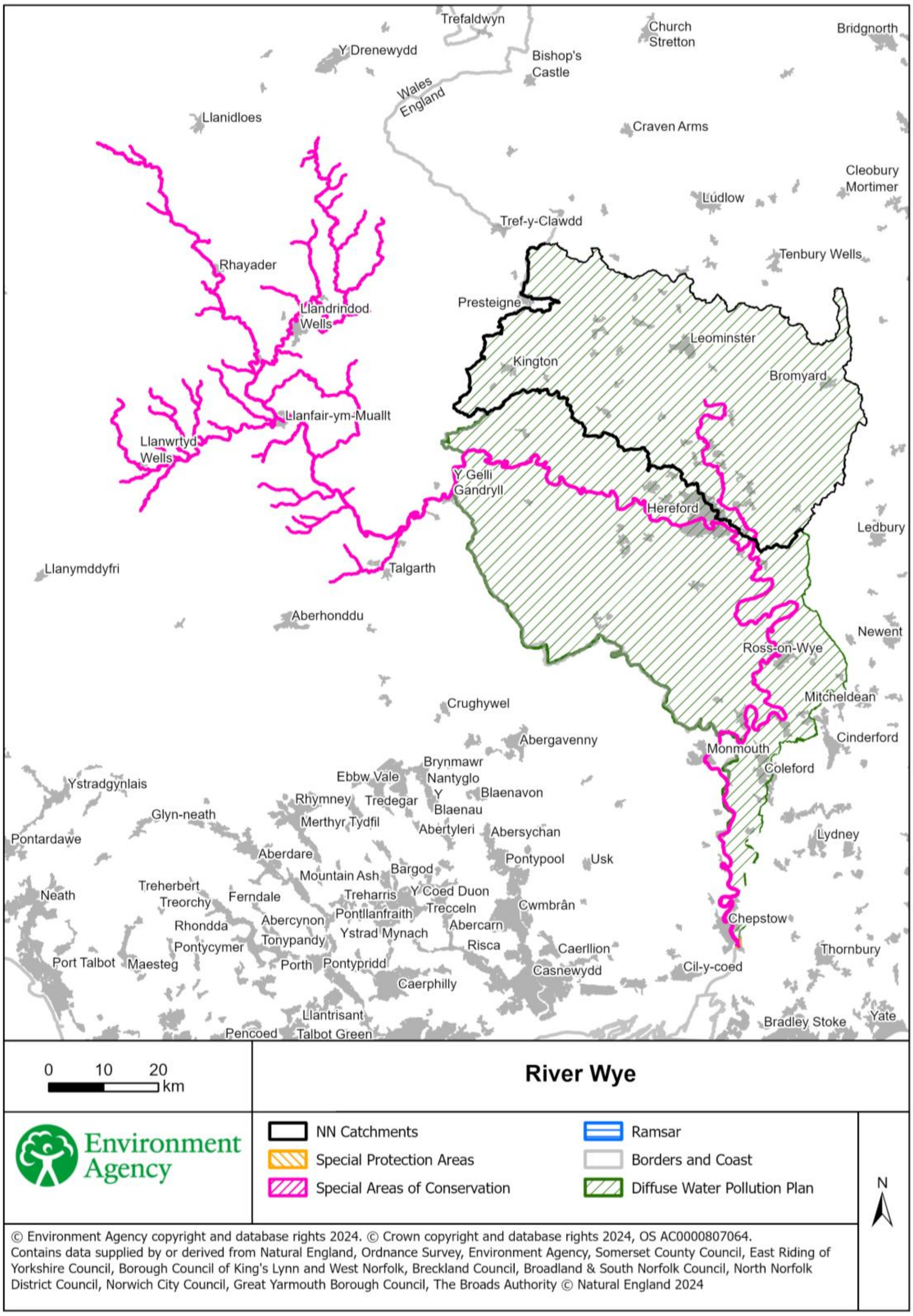

Figure 1. DWPP coverage.

DWPP Contacts

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Catchment Description

The River Wye catchment spans parts of Wales and western England, encompassing a diverse landscape shaped by its underlying geology and topography. The catchment includes upland areas in the Cambrian Mountains and lower-lying regions in Herefordshire and Gloucestershire. Its geology is varied, with older Silurian and Ordovician rocks dominating the uplands, while the lowlands feature more recent Devonian sandstones and mudstones. These geological formations influence the river's morphology and hydrology, contributing to steep gradients and fast-flowing tributaries in the upper catchment, and broader floodplains downstream. The catchment is also characterised by a mix of land uses, including agriculture, forestry, and urban development, which interact with the natural landscape to shape erosion patterns and runoff dynamics.

Soils within the River Wye catchment are equally diverse, reflecting the underlying geology and land management practices. In the upland areas, soils tend to be thin, acidic, and poorly drained, often supporting rough grazing and coniferous forestry. In contrast, the lowland areas have deeper, more fertile soils, particularly in the Herefordshire region, which are well-suited to intensive agriculture. These soils range from clayey and loamy types to sandy soils in some valley bottoms, influencing both water retention and nutrient transport. Soil erosion is a notable concern in parts of the catchment, especially where agricultural practices disturb the soil structure on sloping land. The interplay between geology, soil type, and land use is central to understanding the catchment’s physical characteristics and its response to environmental pressures.

The River Wye

The River Wye is one of the most iconic rivers in the UK, known for its scenic beauty, ecological significance, and cultural heritage. Its popularity is reflected in its recognition as the public's favourite river in England and Wales in a national vote, underscoring its enduring environmental and social value. The river flows for approximately 250 km from the uplands of central Wales, through the counties of Powys and Monmouthshire in Wales, and Herefordshire and Gloucestershire in England, to the Severn Estuary at Chepstow. The Wye, together with the River Monnow and River Lugg tributaries, forms part of the border between England and Wales at multiple points.

Upper (Welsh) Wye Catchment

In Wales, the Wye catchment is dominated by soils derived from Silurian mudstones and sandstones. These are typically thin, acidic, and poorly structured, with high runoff potential. This part of the catchment exhibits flashy responses to rainfall, due to steep slopes, thin soils and high rainfall. Soils here tend to be less erodible due to vegetation cover, but they can contribute fine sediments during storm events.

Lower (English) Wye Catchment

The English part of the catchment is predominantly low-lying, although upland areas in Wales, such as the Black Mountains and Radnor Forest, contribute significantly to the region's hydrology.

The catchment features predominantly fertile alluvial and loamy soils, often overlying gravels or clay. These soils are highly productive for agriculture but can be prone to erosion and have low buffering capacity, especially on sloping ground or where soil structure is degraded. However, they are generally better structured and less intensively cultivated than in much of the Lugg catchment.

The main river channel exhibits a more stable flow regime than in Wales due to gentler topography and deeper soils, which allow for greater infiltration and baseflow contribution. However, the river is still prone to flooding due to high rainfall, soil compaction from agriculture, and historic land drainage and loss of floodplain connectivity. Low flows in summer are also an issue, especially in dry years, affecting water quality and ecology.

The river flows through a broad, lowland valley underlain by Old Red Sandstone, with deep sandy and clay loam soils that support agriculture but are vulnerable to structural degradation, especially under arable cultivation. Here, the catchment supports a mix of intensive arable and livestock farming. Arable farming (e.g., cereals, maize, oilseed rape, and horticultural crops) dominates in the south and east. Livestock farming (beef and dairy cattle, sheep) remains common, especially in mixed systems. The area is also known for horticulture and vegetable production, which often requires irrigation and nutrient inputs.

Between Hereford and Chepstow, the river is the central feature of the Wye Valley National Landscape. Before reaching Chepstow and the Severn estuary, the river cuts through Carboniferous Limestone and sandstone to form the Wye Valley Gorge. The river becomes faster flowing and more confined, with limited floodplain development. Soils are thinner, less fertile, and often skeletal on slopes, making the area less suitable for agriculture. As a result, land use shifts toward woodland, conservation, and recreation, with lower erosion risk but increased sensitivity to bank erosion during high flows.

The River Lugg

The River Lugg is a major tributary of the Wye, rising in central Wales and flowing through the lowlands of Herefordshire. In contrast to the upper Wye and the Monnow, the Lugg exhibits more stable baseflows, largely due to its deeper soils, thick valley aquifers in the upper catchment, and consistent groundwater contributions.

The catchment's soils, primarily clay loams and sandy loams, are fertile and permeable but prone to erosion, particularly under intensive agricultural use. Soil degradation and compaction have reduced infiltration capacity in many areas, increasing the risk of surface runoff, sediment transport, and nutrient loss during rainfall events.

Agriculture in the Lugg catchment is characterised by a mix of intensive arable and livestock farming, reflecting the region's productive soils and gentle topography. Arable land is widely used for cereals, maize, and root crops, which are especially vulnerable to erosion on sloping ground or when left bare over winter. Livestock farming, particularly beef and dairy cattle, is also prevalent, supported by permanent pasture and improved grassland. Smaller pastures are found on higher ground, while steeper hills are typically wooded. Traditional land uses such as hop yards and cider apple orchards also remain a feature of the landscape.

Overall, the combination of intensive land use, soil compaction, and rainfall-driven runoff makes the Lugg catchment particularly susceptible to sediment and P losses, with significant implications for water quality in the river and its tributaries.

Due to high P loads, the catchment is subject to Nutrient Neutrality (NN) regulations, which aim to prevent further ecological degradation of the river system.

The River Monnow

The Monnow is another significant tributary of the River Wye. The river is not designated as a SSSI, SAC or SPA.

The catchment features a distinctive geography and hydrology that reflect its position along the England–Wales border. The river's headwaters originate near Craswell on Cefn Hill, below the Black Mountains, and it flows mostly southward, joining Wye just south of Monmouth.

The catchment features transitional soils between upland and lowland types, with moderate fertility and variable structure. The flow regime is influenced by upland rainfall from the Black Mountains, and as with the upper Wye, flows can be flashy due to steep slopes, thin soils and high rainfall.

Agriculture in the Monnow catchment is dominated by livestock grazing, particularly sheep and beef cattle. The steep terrain, high rainfall, and relatively poor soils make the area largely unsuitable for arable farming. Permanent pasture and rough grazing are the primary land uses, with some improved grassland in lower-lying areas.

These land use patterns have a direct impact on sediment and nutrient delivery to the river. Livestock that access watercourses can cause bank erosion and trampling, increasing fine sediment inputs. Overland flow from grazed pastures, especially during heavy rainfall, can transport both sediment and nutrients, particularly P, into the river system. The limited vegetation cover in some riparian areas further reduces the landscape's ability to buffer runoff.

Note on Coverage

Descriptions of Welsh catchment areas are included for context only. All recommendations, actions, and assessments in this DWPP apply solely to the English portions of the catchment.

Protected Site Designations and Interest Features

SSSI and SAC Designations

The River Wye and the River Lugg are designated sites in England and Wales. The River Wye is a SSSI and a SAC in England and Wales. The River Lugg is a SSSI in England and Wales but is also partially covered by the River Wye SAC designation on the English side (from Hope-under-Dinmore). Natural Resources Wales (NRW) provides advice for SACs and SSSIs in Wales and these are not covered in this DWPP.

Interest Features

River Wye SAC and River Wye SSSI

Together the River Wye (Lower Wye) and the River Wye (Upper Wye) SSSIs and several of their tributaries represent a large, linear ecosystem which acts as an important wildlife corridor, an essential migration route, and a key breeding area for many nationally and internationally important species. The Wye is of special interest for its plant and animal communities, including its diverse invertebrate assemblages. The river spans a range of types from an upland base-poor stream to an estuarine, silty lowland river. The river's overall diversity is a product of its underlying geology, soil type, adjacent land use and near natural fluvio-geomorphological regime. The Lower Wye (referred to as The River Wye throughout the rest of this report) is a rare example of a near natural, large western eutrophic river, which unlike many of the rivers of this type, has not been subject to significant straightening and other modification by human activity. The River Wye is mostly low-lying, with the Radnor Forest and Black Mountains being the only significant upland areas. It drops just 72 metres between Hay-on-Wye and the sea, following a meandering course typical of lowland rivers.

The River Wye SAC is designated to protect key habitats and species. The features that make the River Wye SAC important also form part of the underpinning SSSI designations. Annex I habitats and Annex II species that are a primary reason, or qualifying features (qf), for SAC selection of this site are:

Annex I Habitats

- Water courses of plain to montane levels with the *Ranunculion fluitans* and *Callitricho-Batrachion* vegetation
- Transition mires and quaking bogs (qf)

Annex II Species

- White clawed crayfish *Austropotamobius pallipes*
- Sea lamprey *Petromyzon marinus*
- Brook lamprey *Lampetra planeri*
- River lamprey *Lampetra fluviatilis*
- Allis shad *Alosa alosa* (qf)
- Twaite shad *Alosa fallax*
- Atlantic salmon *Salmo salar*
- Bullhead *Cottus gobio*
- Otter *Lutra lutra*

The river supports a diverse range of habitats, including gravel beds, which are crucial for salmon spawning, and clean, well-oxygenated waters that are essential for the survival of white-clawed crayfish.

River Lugg SSSI

From its upland source in Powys in mid-Wales to its confluence with the Wye below Hereford in England, the River Lugg is considered to be one of the best British mainland examples of both a clay river and a river displaying a transition from nutrient-poor to naturally nutrient-rich water chemistry. Despite being canalised in some small sections of its 101 km length and running through an intensively farmed catchment in its middle and lower reaches, it is a largely natural river and supports river plant communities and otter populations.

Although the entire length of the river is designated as a SSSI, only the lowest site unit, up to Hampton Court Bridge, is included within the River Wye SAC. The SAC designation ends here due to a historical barrier (a weir) that prevented salmonoid migration, which was a key reason for the SAC’s selection. The Welsh section of the river is also a SSSI, managed by NRW.

The SSSI designation focuses on the ecological value of river habitats for fish, crayfish, aquatic plants and invertebrates.

Management Units

The Wye and Lugg SSSIs are divided into seven and four Management Units respectively. Management Units do not always correspond to WFD water bodies. All 11 units have been classified as "unfavourable – declining", reflecting ongoing ecological pressures and deterioration in species and habitat conditions.

SSSI/SAC Water Quality Conservation Objectives and Status

Water Quality Conservation Objectives

Each SSSI/SAC has conservation objectives, including water quality targets, that outline the desired conditions for the habitats and species they aim to protect. Targets may vary along the course of the river, reflecting changes in natural background conditions. Targets are set using Common Standards Monitoring Guidance (CSMG) for Rivers, which provides a framework for selecting attributes and setting targets to assess the condition of protected sites. This guidance states "*nutrient targets for the river should reflect natural/background concentrations and limit enrichment to levels at which adverse effects on characteristic biodiversity are unlikely.*" These targets are generally more stringent than those set by the Water Framework Directive (WFD), to ensure the protection of sensitive habitats and species.

An overview of all water quality targets is provided in Table 1. More detailed site-by-site information for the River Wye and River Lugg are given below, in Table 2 and Table 3 respectively. The tables show the corresponding management unit and water body ID. Some monitoring points are shown on the map in Figure 2.

Table 1. Water quality conservation objectives (Wye and Lugg).

Element	Target
Soluble Reactive Phosphorus ("orthophosphate" expressed as P) (annual and growing season mean)	Variable: 0.015 mg/l to 0.039 mg/l
Dissolved Oxygen (DO) (% saturation at 10th percentile)	85% (all units)
Total Ammonia NH3-N (90th percentile)	Variable: 0.2 mg/l to 0.25 mg/l
Mean Biological Oxygen Demand	1.5 mg/l
Un-ionised Ammonia (95th percentile)	0.025 mg/l or 0.02 mg/l
Siltation	No unnaturally high levels of siltation

Note that SSSI/SAC targets refer to soluble reactive phosphorus (SRP), while WFD targets are based on orthophosphate expressed as P (OP). Although the terms differ, they both represent the bioavailable fraction of P in freshwater systems and are functionally equivalent in most monitoring contexts. SRP may include trace amounts of other reactive forms, but is predominantly OP. In the DWPP, we refer to both SRP and OP as “phosphate”. This simplification is widely accepted in water quality assessments as both forms are measured using the same method.

Review of Conservation Objectives for Phosphate (2022)

In 2022 NE and the EA reviewed and updated the phosphate targets for water quality in the SSSIs/SAC on the Wye and the Lugg. At the time, there was concern that targets applied by NRW in Wales were tighter than those applied in England.

Following an analysis, it was agreed that the phosphate target for the Wye and Lugg SSSIs should be set at CSMG “near natural” or high WFD status (where this is lower). The updated targets became more stringent. The new phosphate target for the Lugg became 0.03 mg/l, except upstream of Leominster, where it became 0.015 mg/l. For the River Wye the updated targets range from 0.021 mg/l at the Welsh border to 0.039 mg/l as the river enters the Severn estuary. After the review, the English reaches of the River Wye SSSI are assessed against WFD high status, and the Lugg reaches are assessed against the CSMG near natural target.

Table 2. River Wye SSSI management units, WFD water bodies, monitoring sites and targets.

River Wye SSSI									
					Targets				
SSSI Unit	**Name**	**Water body ID**	**Monitoring Site**	**Map key**	**Phosphate** (mg/l)	**Dissolved Oxygen** (saturation at 10th percentile)	**Total Ammonia** (mg/l NH3-N 90th percentile)	**Un-ionised ammonia** (mg/l 95th percentile)	**Standard**
1	CSMG for Rivers does not apply to tidal estuary								
2	Brockweir Bridge to Monmouth	GB109055037111	H0000072 Redbook Railway Bridge	W13	0.039	85%	0.25	0.025	WFD High Status
3	Monmouth to Ross		50028 800m d/s Kerne Bridge, Goodrich	W11	0.035				
			50029 Huntsham Bridge, Symonds Yat.	W12	0.036				
4a	Ross to Lugg Confluence	GB109055037112	50027 Wilton Bridge	W10	0.034				
			50810 Hole-in-the-Wall Footbridge	W9	0.033				
			50026 Hoarwithy Bridge	W8					
			50807 Holme Lacy Bridge	W7	0.030				
4b	Lugg Confluence to Hereford		50024 Carrots Pool	W5	0.026				
		GB109055037113	50023 Victoria Bridge				0.2	0.02	
5	Hereford to Bredwardine Br.		50022 Sollars Bridge	W3	0.024				
6	Bredwardine Br. to Whitney Toll		50183 Bredwardine Bridge	W2	0.023				
		GB109055037116 (NRW water body)	RSN0695 Crowe Farm						
7	Whitney Toll to Hay		50021 Whitney Toll Bridge	W1	0.021				

Table 3. River Lugg SSSI management units, WFD water bodies, monitoring sites and targets.

<table>
<tr><th colspan="11">River Lugg SSSI</th></tr>
<tr><th rowspan="2">SSSI Unit</th><th rowspan="2">Name</th><th rowspan="2">Water body ID</th><th rowspan="2">Monitoring Site</th><th rowspan="2">Map Key</th><th colspan="5">Targets</th></tr>
<tr><th>Phosphate (mg/l)</th><th>Dissolved Oxygen (saturation at 10th percentile)</th><th>Total Ammonia (mg/l 90th percentile)</th><th>Un-ionised ammonia (mg/l 95th percentile)</th><th>Standard</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Wye Confluence to Bodenham Weir (SAC)</td><td rowspan="4">GB109055036790</td><td>50050 Mordiford Bridge</td><td>L5</td><td rowspan="5">0.030</td><td rowspan="7">85%</td><td rowspan="4">0.25</td><td rowspan="4">0.025</td><td rowspan="7">CSMG Near Natural</td></tr>
<tr><td>50047 Wergins Bridge</td><td>L4</td></tr>
<tr><td>RSN1762 Lugg d/s Moreton on Lugg</td><td></td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">Bodenham Weir to Leominster</td><td>50043 Ford Bridge</td><td>L3</td></tr>
<tr><td rowspan="3">GB109055042030</td><td>50042 Eaton Bridge</td><td>L2</td><td rowspan="3">0.2</td><td rowspan="3">0.02</td></tr>
<tr><td>3</td><td>Leominster to Mortimers Cross</td><td>50039 Mortimers Cross Bridge</td><td>L1</td><td rowspan="2">0.015</td></tr>
<tr><td>4</td><td>Mortimers Cross to Presteigne</td><td>No active sampling points</td><td></td></tr>
</table>

Interim Condition Assessment (2022)

Each SSSI/SAC is assigned a condition status that reflects the health and quality of its designated habitats and species. This condition status is determined through regular assessments and monitoring, ensuring that conservation objectives are being met. Within each SSSI/SAC, specific management units and features are individually evaluated. These assessments help identify areas that are thriving (i.e., in favourable condition) and those that may require additional conservation efforts. By focusing on both the overall SSSI/SAC and its individual components, targeted measures can be implemented to maintain or improve the ecological integrity of these protected sites.

In 2022, NE undertook an interim assessment of the River Wye and River Lugg SSSIs, focusing on the condition of Atlantic salmon, native white-clawed crayfish, and the Rivers and Streams habitat feature. The latter was assessed using two ecological indicators: macrophyte communities and water quality.

The findings of the assessment were summarised as follows:

River Wye: "*In the River Wye we can see declines in macrophytes, salmon and white-clawed crayfish. The Wye is not currently failing its water quality targets. Although the River Wye is close to its phosphate targets on some of the monitoring points, the latest evidence indicates levels have been stable. Nutrient Neutrality advice does not apply to the Wye as it is not failing its water quality targets."*

River Lugg: *"Our recent assessment has identified that the River Lugg is showing declines in Atlantic salmon, and white clawed crayfish. The Lugg is failing its water quality targets and the water quality in the Lugg is declining. Nutrient Neutrality advice remains in place for the Lugg."*

CSMG requires that if any one of the features or its indicators is classed as either "unfavourable", "unfavourable – no change" or "unfavourable – declining", the whole unit of the river is classed as such, irrespective of the status of the other interest features.

As a result of the assessment, in 2023 the Atlantic salmon, white-clawed crayfish and Rivers and Streams habitat features (Table 4), and all site units in both English SSSIs were classified as unfavourable – declining (Table 5). The reasons for the downgrade differed between the two rivers. For the River Wye, the decline was due to deteriorating conditions for salmon, white-clawed crayfish and macrophytes, while the River Lugg also failed to meet phosphate targets.

Table 4. Summary of feature condition in the River Wye SSSI. Features have the same classification in the River Lugg SSSI.

Feature	Condition	Assessment date
River supporting habitat	Not recorded	
Rivers and Streams	Unfavourable - Declining	29/5/2023
Invert. assemblage W111 shingle bank	Not recorded	
Invert. assemblage W114 stream & river margin	Not recorded	
Invert. assemblage W122 riparian sand	Not recorded	
Annex II species		
Allis shad, Alosa alosa	Not recorded	
Atlantic Salmon, *Salmo salar*	Unfavourable - Declining	29/5/2023
Breeding population of nationally rare fish species – *Allis shad*, *Alosa alosa*	Not recorded	
Brook lamprey, *Lampetra planeri*	Not recorded	
Bullhead, *Cottus gobio*	Not recorded	
Otter, *Lutra lutra*	Not recorded	
River lamprey, *Lampetra fluviatilis*	Not recorded	
Sea lamprey, *Petromyzon marinus*	Not recorded	
Twaite shad, *Alosa fallax*	Not recorded	
Vascular plant assemblage	Not recorded	
White-clawed crayfish, *Austropotamobius pallipes*	Unfavourable - Declining	29/5/2023

Table 5. Change in condition for River Wye SSSI and River Lugg SSSIs site units.

Unit	SSSI	Reach	Condition prior to 30 May 2023	Updated condition from May 2023
1	Wye	Tidal river - Estuary to Brockweir Bridge	Favourable	Unfavourable - Declining
2	Wye	Brockweir Bridge to Monmouth	Unfavourable - Recovering	Unfavourable - Declining
3	Wye	Monmouth to Ross	Unfavourable - Recovering	Unfavourable - Declining
4	Wye	Ross to Hereford	Unfavourable - Recovering	Unfavourable - Declining
5	Wye	Hereford to Bredwardine Bridge	Unfavourable - Recovering	Unfavourable - Declining
6	Wye	Bredwardine Bridge to Whitney Toll	Unfavourable - Recovering	Unfavourable - Declining
7	Wye	Whitney Toll to Hay	Unfavourable - Recovering	Unfavourable - Declining
1	Lugg	Bodenham Weir to Confluence with Wye	Unfavourable - Recovering	Unfavourable - Declining
2	Lugg	Bodenham Weir to Leominster	Unfavourable - Recovering	Unfavourable - Declining
3	Lugg	Leominster to Mortimers Cross	Unfavourable - Declining	Unfavourable - Declining
4	Lugg	Mortimers Cross to Presteigne	Unfavourable - Recovering	Unfavourable - Declining

Condition Assessment (Ongoing)

NE and the EA began a full two-year assessment of the condition of the Wye SAC in 2024. The results of the assessment are expected to be available in 2026.

Compliance with SSSI/SAC Water Quality Targets

Phosphate

Phosphate targets for the River Wye and Lugg SSSI/SAC must be met using two averages: one for the growing season (March to September) and one for the full calendar year. Both are calculated from data pooled over a three-year period.

Table 6 presents the results of phosphate monitoring, based on the average of all data points collected between 2022 and 2024. Note that some samples have been excluded from the assessment at three Lugg SSSI monitoring sites due to concerns about data reliability. Results both before and after excluding these data are shown in the table. At one location, excluding the data changed the outcome from fail to pass.

For WFD compliance assessments, at least eight samples over a three-year period are required to ensure statistical robustness. At two of the locations, removing suspect data reduced the number of samples available for assessing the growing season mean to fewer than eight. Additionally, no water quality data at all were collected at these two sites after July 2023. As a result, confidence in the assessment at these locations is reduced. Further information about the suspect data is provided under the heading “Data Quality Issues” later in this plan.

Based on three-year averages, the River Wye section of the SSSI/SAC in England is not failing against the phosphate targets, except for sampling point, H0000072: Redbrook Railway Bridge, which failed due to one unusually high result. However, many sites are only meeting the phosphate target by a narrow margin.

The River Lugg in England was already failing to meet phosphate targets before the targets were tightened and now falls further outside the acceptable range. The highest mean concentrations occur in the lower reaches, where all monitoring points significantly exceed the revised threshold. Consequently, the river habitat feature in this stretch of the Wye SAC is in unfavourable condition and is failing its conservation objectives due to high phosphate levels. As a result, this stretch is not contributing to favourable conservation status for the river habitat, and other designated (qualifying) features of the SAC that depend on this habitat are also unlikely to achieve favourable conservation status.

Table 6. English Wye and Lugg SSSI 2022-2024 total and growing season means and phosphate compliance by site (2022-2024 inclusive). Map key relates to Figure 2.

SSSI	Map Key	SSSI Monitoring Site	Phosphate target (mg/l)	2022-2024 Growing season mean (mg/l)	2022-2024 Growing season compliance	2022-2024 Total mean (mg/l)	2022-2024 Total compliance
	L1	50039: Mortimers Cross Bridge†*	0.015	0.007 (0.072)	Pass	0.007 (0.063)	Pass
	L2	50042: Eaton Bridge, Leominster†*	0.030	0.035 (0.056)	Fail	0.031 (0.052)	Fail
Lugg	L3	50043: Ford Bridge†	0.030	0.043 (0.053)	Fail	0.041 (0.051)	Fail
	L4	50047: Wergins Bridge	0.030	0.071	Fail	0.070	Fail
	L5	50050: Mordiford Bridge	0.030	0.082	Fail	0.084	Fail
	W1	50021: Whitney Toll Bridge	0.021	0.007	Pass	0.010	Pass
	W2	50183: Bredwardine Bridge	0.023	0.008	Pass	0.013	Pass
	W3	50022: Bridge Sollars	0.024	0.009	Pass	0.013	Pass
	W4	RSN0138: Broomy Hill	0.024	0.010	Pass	0.013	Pass
	W5	50023: Victoria Bridge	0.026	0.016	Pass	0.017	Pass
	W6	50024: Carrots Pool	0.026	0.013	Pass	0.015	Pass
Wye	W7	50807: Holme Lacy Bridge	0.030	0.024	Pass	0.027	Pass
	W8	50026: Hoarwithy Bridge	0.033	0.024	Pass	0.027	Pass
	W9	50810: Hole-In-The-Wall Footbridge	0.033	0.030	Pass	0.029	Pass
	W10	50027: Wilton Bridge	0.034	0.023	Pass	0.027	Pass
	W11	50028: 800m D/S Kerne Bridge, Goodrich	0.035	0.023	Pass	0.028	Pass
	W12	50029: Huntsham Br. Symonds Yat	0.036	0.022	Pass	0.028	Pass
	W13	H0000072: Redbrook Railway Bridge	0.039	0.028	Pass	0.040	Fail**

† Values in parentheses are based on raw data, before exclusion of suspect data relating to suspect data Issue 1 (see “Data Quality Issues” below).
* No data were collected at these sites after July 2023 due to health and safety concerns. Monitoring resumed in spring 2025. As a result, the growing season result is based on only seven samples and does not meet the threshold required for WFD compliance assessment. The total compliance result includes sufficient samples but is not representative of the full 2022-2024 period.
** The failure at this site is due to one unusually high result in 2023.

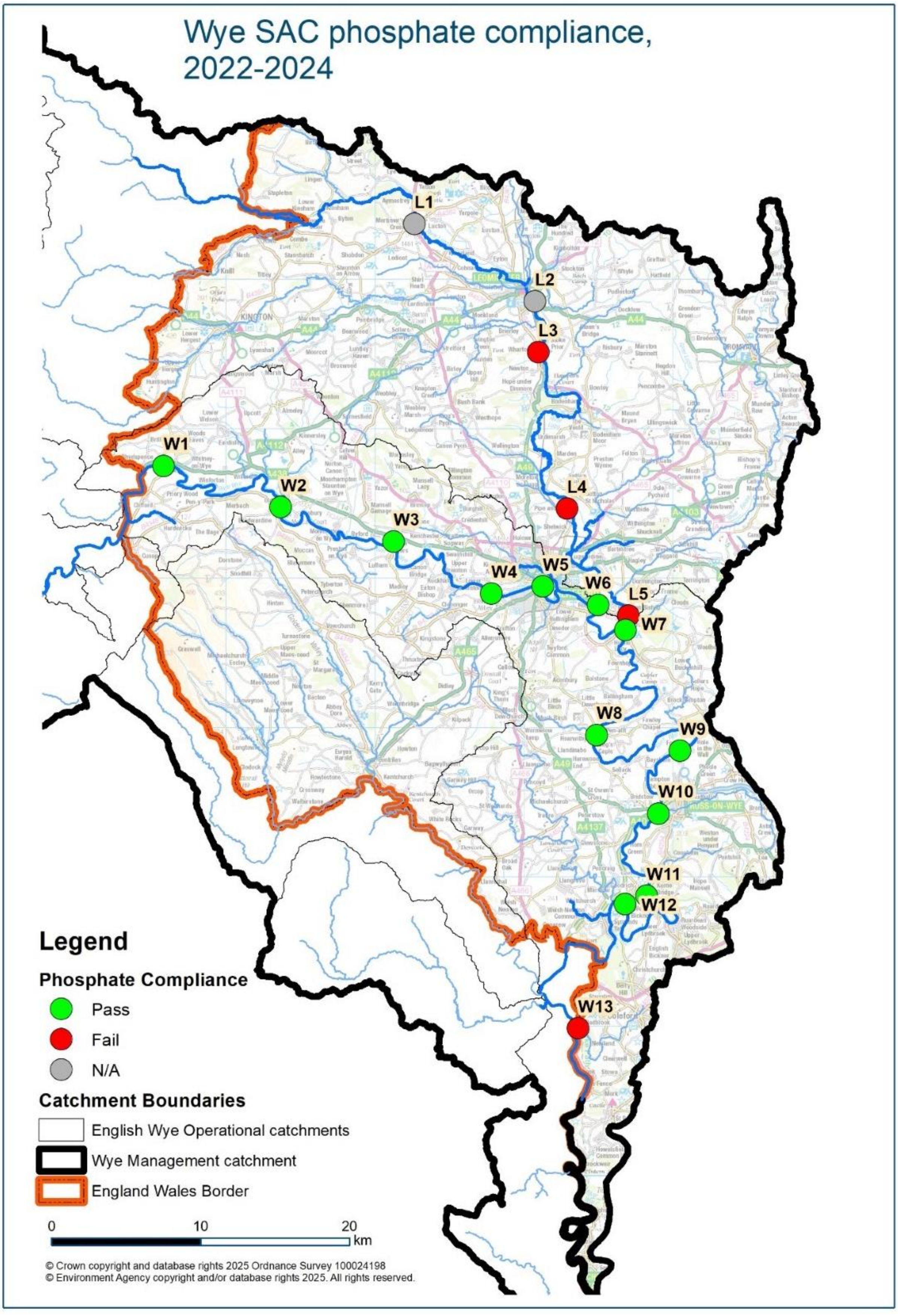

Figure 2. Compliance with phosphate targets in the Wye and Lugg SSSIs (2022-2024).

Sediment and Other Parameters

To meet the sediment conservation objective, there should be no evidence of any unnatural or artificially elevated levels of siltation or sedimentation within the designated riverine habitats. Current monitoring data and field observations indicate that this target is not being met, with excessive fine sediment deposition observed in multiple reaches, adversely affecting habitat quality and ecological function.

Other water quality parameters are within target levels.

Data Quality Issues

Suspect Data Issue 1

During 2022 and 2023, elevated phosphate concentrations were recorded at several monitoring locations within water bodies of the Clun SAC, part of the River Teme catchment, north of the Lugg catchment. In response, the EA undertook field investigations and data analysis to assess the nature and extent of the observed increases.

A subset of monitoring data was identified in which phosphate levels were notably higher than anticipated, while other water quality indicators remained within expected ranges. Comparative analysis was conducted using additional datasets, including records collected by citizen science initiatives at similar locations and times. Based on this review, the elevated phosphate results are unreliable and have been classified as suspect.

Some water quality samples from sites within the Lugg catchment fall within this suspect data subset. Table 7 provides a summary of the affected SSSI/SAC monitoring locations, along with the corresponding suspect samples. The suspect data will be excluded from WFD classification and have been excluded from evaluation of compliance with the SSSI/SAC conservation objectives in this plan.

Table 7. Suspect data samples that have been excluded from WFD classification.

Monitoring site ID and Name *Water body ID and Name*	**Date**	**Phosphate result (mg/l)**
50039 Mortimers Cross Bridge *GB109055042030* *Lugg – conf Norton Bk to conf R Arrow*	22/07/2022	0.18
	25/08/2022	0.21
	21/09/2022	0.28
	27/10/2022	0.05
	24/11/2022	0.13
	09/12/2022	0.03
	30/01/2023	0.014
50042 Eaton Bridge, Leominster *GB109055036790* *Lugg – conf R Arrow to conf R Wye*	22/07/2022	0.052
	25/08/2022	0.18
	18/08/2022	0.048
	21/09/2022	0.089
	27/10/2022	0.026

	24/11/2022	0.076
	09/12/2022	0.028
	30/01/2023	0.074
50043 Ford Bridge *GB109055036790* *Lugg – conf R Arrow to conf R Wye*	22/07/2022	0.067
	25/08/2022	0.22
	27/10/2022	0.072
	24/11/2022	0.11
	09/12/2022	0.045

Suspect Data Issue 2

Phosphate data from a further twelve water samples (Table 8) have been confirmed as suspect by the EA's National Laboratory Service. These were also removed from the analyses used to assess compliance with water quality targets. The samples are considered suspect because the measured phosphate levels were greater than the total phosphorus (TP) levels – a situation that is impossible because phosphate is a component that makes up TP.

Table 8. Samples where phosphate monitoring results exceeded TP.

Monitoring Site	Date	Phosphate (mg/l)	TP (mg/l)
50022 Bridge Sollars	04/01/2022	0.027	0.011
RSN0138 Broomy Hill	04/01/2022	0.028	0.016
50183 Bredwardine Bridge	19/05/2023	0.36	0.019
RSN0138 Broomy Hill	15/06/2023	0.078	0.047
H0000072 Redbrook Railway Bridge	27/06/2023	0.26	0.071
50026 Hoarwithy Bridge	05/07/2023	0.088	0.057
50183 Bredwardine Bridge	12/01/2024	0.55	0.028
50022 Bridge Sollars	27/02/2024	0.12	0.037
50183 Bredwardine Bridge	01/03/2024	0.66	0.043
50029 Huntsham Br.Symonds Yat	29/08/2024	0.15	0.06
H0000072 Redbrook Railway Bridge	29/10/2024	0.64	0.055
50022 Bridge Sollars	19/11/2024	0.26	0.095

Water Framework Directive

The European Union's WFD came into force in December 2000, with the stated objective of aiming to achieve good ecological status and good chemical status for surface waters and other water bodies by 2015. However, due to the complexity and scale of the task, many water bodies did not meet this target, leading to an extension of the deadline to 2027.

In England and Wales, the WFD was transposed into law through The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. These regulations replaced the earlier 2003 regulations and set out the duties of the Secretary of State, Welsh Ministers, the EA, and NRW to secure compliance with the requirements of the

WFD. The regulations include provisions for preparing and publishing River Basin Management Plans, monitoring programmes, and the setting of environmental objectives and establishment of programmes of measures to protect water quality.

Good ecological status involves maintaining a balanced, sustainable aquatic ecosystem, while good chemical status requires meeting specific chemical standards. WFD targets are designed to assess overall ecological status and are not specifically tailored to the conservation requirements of protected habitats and species within SSSI/SAC-designated water bodies. For this reason, SSSIs and SACs are assessed using CSMG targets and site-specific conservation objectives. In some cases (including the English reaches of the River Wye SSSI), phosphate targets for SSSI/SAC sites are aligned with WFD High status thresholds, particularly where these provide a more stringent basis for assessing ecological condition.

The next comprehensive update of classifications in all water bodies is due late in 2025

River Wye Management Catchment

Under the WFD, the River Wye is part of the Wye Management Catchment (MC), which spans the Welsh–English border and includes the catchments of the River Lugg and the River Monnow. The MC is divided into four Operational Catchments (OCs): i) Arrow Lugg and Frome, ii) Monnow, iii) Wye OC, and iv) Wye – Ithon to Hay (Figure 3). While the Wye – Ithon to Hay OC is mostly located in Wales, it includes one water body that falls mainly in England: Hay Dulas Brook – source to confluence with River Wye (GB109055037010). All four OCs cross the border between England and Wales.

WFD Water Bodies

Within each OC, the river system is further divided into water bodies, each assessed individually for ecological and chemical status. The River Wye SSSI falls within four separate WFD water bodies:

- GB109055037111 – Wye - conf Walford Bk to Bigsweir Br
- GB109055037112 – Wye - Hampton Bishop to conf Kerne Br
- GB109055037113 – Wye - Bredwardine Br to Hampton Bishop
- GB109055037116 – Wye - Scithwen Bk to Bredwardine Br (Monitored by NRW)

The River Lugg SSSI falls within two separate WFD water bodies:

- GB109055036790 – Lugg – confluence River Arrow to confluence River Wye
- GB109055042030 – Lugg – confluence Norton Brook to confluence River Arrow

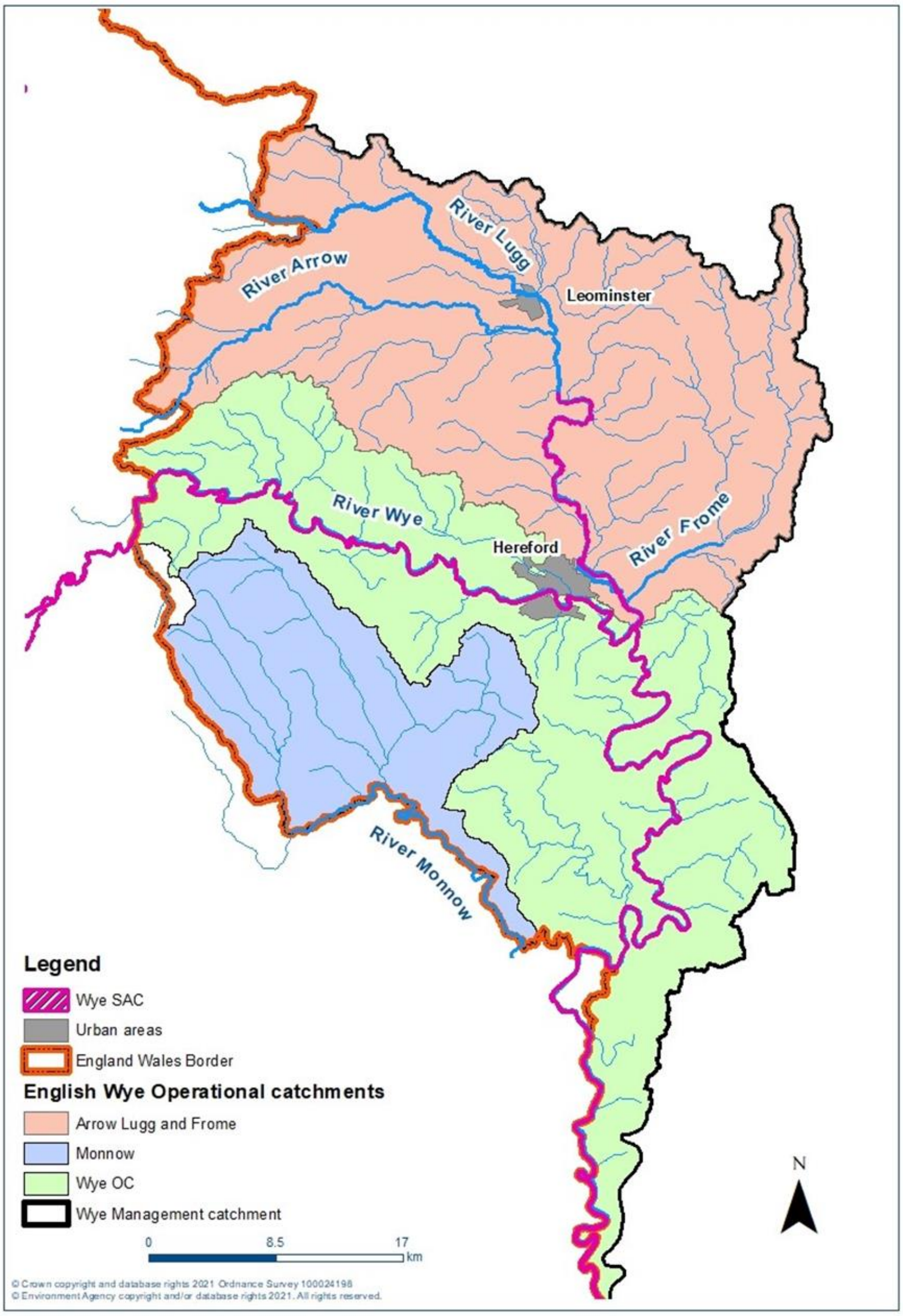

Figure 3. River Wye MC (England) and the three main English OCs.

WFD Classifications

WFD classifications are typically run every three years for ecological elements, which include the physico-chemical elements (i.e., physical and chemical components such as temperature and phosphate that influence the organisms present). For ecological elements, WFD uses the previous three years of available data for classification, except for fish, which use the previous six years. The 2022 classification used data from 2019 to 2021. 2025 classifications are in preparation and will be based on data between 2022 and 2024.

Macrophytes and phytobenthos surveys in the River Wye are challenging due to natural conditions such as low alkalinity, which affects their reliability for ecological classification. Monitoring of diatoms (a type of algae used to assess water quality) recently switched to a new DNA-based method, which caused a temporary gap in data while the method was being approved. Although there is now a regular programme to monitor invertebrates and diatoms, some issues with data collection have affected its consistency. A reliable dataset is expected from 2025, but it won't be used in official classifications until 2028.

2022 WFD classifications for each water body that comprise part of the Wye and Lugg SSSIs are given in Table 9 and Table 10 respectively. Phosphate classifications for the water bodies between 2015 and 2022 are given in Table 11.

Table 9. River Wye SSSI/SAC WFD Classifications for 2022. Biological and physico-chemical quality elements only.

	Water body		
	GB109055037111 Wye - conf Walford Bk to Bigsweir Br	GB109055037112 Hampton Bishop to conf Kerne Br	GB109055037113 Wye - Bredwardine Br to Hampton Bishop
Ecological Status	Moderate	Good	Moderate
Biological quality elements	Moderate	Good	Moderate
Fish	N/A	N/A	N/A
Invertebrates	N/A	Good	Good
Macrophytes and Phytobenthos Combined	Moderate*	Good*	Moderate*
Macrophytes Sub Element	Moderate*	Good*	N/A
Phytobenthos Sub Element	N/A	N/A	Moderate*
Physico-chemical quality elements	Good	Good	Good
Acid Neutralising Capacity	High	N/A	High
Ammonia (Phys-Chem)	High	High	High
Biochemical Oxygen Demand	Good	N/A	N/A
Dissolved oxygen	High	High	High
Phosphate	High	High	High
Temperature	Good	Good	Good
pH	High	High	High
Hydromorphological Supporting Elements	Not High	Not High	Not High
Hydrological Regime	Supports Good	Supports Good	Supports Good
Morphology	Not High**	Not High**	Not High**

Asterisk (*) indicates that the classification was rolled forward from: * 2016; ** 2013.

Table 10. River Lugg SSSI WFD Classifications for 2022. Biological and Physico-chemical quality elements only.

	Water Body	
	GB109055036790 R Lugg – confluence River Arrow to confluence River Wye	GB109055042030 R Lugg – confluence Norton Brook to confluence River Arrow
Ecological Status	Moderate	Moderate
Biological quality elements	Moderate	Moderate
Fish	N/A	Moderate

Invertebrates	High*	High*
Macrophytes and Phytobenthos Combined	Moderate	Moderate
Macrophytes Sub Element	Moderate	Moderate
Phytobenthos Sub Element	N/A	N/A
Physico-chemical quality elements	Moderate	Moderate
Acid Neutralising Capacity	High	N/A
Ammonia (Phys-Chem)	High	High
Dissolved oxygen	High	High
Phosphate	Moderate	Moderate
Temperature	High	High
pH	High	High
Hydromorphological Supporting Elements	Not High	Not High
Hydrological Regime	Supports Good	Supports Good
Morphology	Not High**	Not High**

Asterisk (*) indicates that the classification was rolled forward from: * 2016; ** 2013.

Table 11. WFD phosphate classifications for water bodies in the Wye and Lugg main river sections (England) between 2015 and 2022.

Catchment, water body and water body ID	**Phosphate Classification** 2015	2016	2019	2022
River Wye Conf Walford Bk to Bigsweir Br GB109055037111	Good	High	High	High
River Wye Hampton Bishop to conf Kerne Br GB109055037112	High	High	Good	High
River Wye Bredwardine Br to Hampton Bishop GB109055037113	High	Good	High	High
R Lugg Confluence River Arrow to confluence River Wye GB109055036790	Good	Good	Good	Moderate
R Lugg Confluence Norton Br to confluence River Arrow GB109055042030	High	Good	Moderate	Moderate

WFD Status of Tributaries

The EA compared 2022 WFD classifications with 2019 classifications across all water bodies in the English part of the Wye MC (EA 2024a). There was a decline in phosphate status in 11 water bodies, all of which were within the Arrow Lugg and Frome OC. Nine water bodies recorded an improvement in status.

A map showing the 2022 phosphate status of water bodies across the catchment as of the 2022 classification is provided in Figure 4. Only 14% of water bodies achieve a high classification for phosphate, and 66% did not achieve good status (Figure 5).

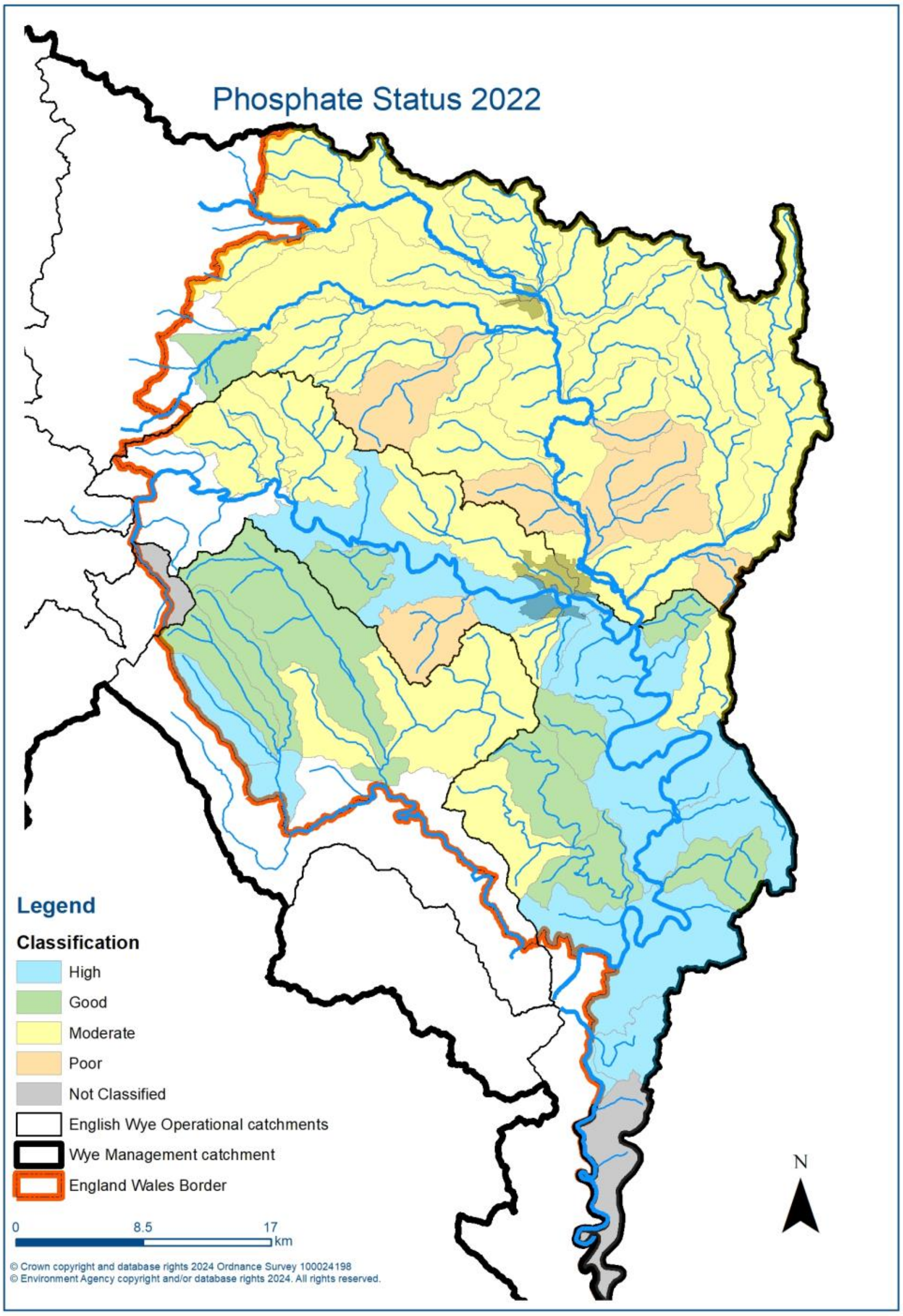

Figure 4. Phosphate status of water bodies across the Wye MC (England only).

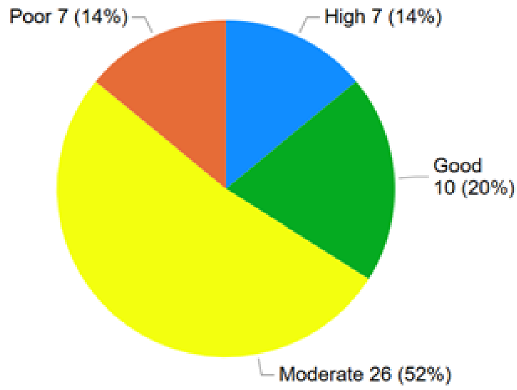

Figure 5. Proportion of water bodies in the Wye MC by WFD phosphate status in 2022 (England only).

Inflows from Wales

The River Wye forms the border between Wales and England between Hay-on-Wye and Whitney-on-Wye. Phosphate targets on the river are met at the nearest monitoring points to the border in both England and Wales.

The River Lugg crosses the border from Wales into England at Rosser's Bridge, east of Presteigne. This point is in the EA-managed water body Lugg – conf Norton Bk to conf R Arrow (GB109055042030). There is a NRW sampling point at the bridge (S50037). The average phosphate concentration at Rosser's Bridge between 2022 and 2024 (inclusive) was 0.016 mg/l. The SSSI/SAC target at this unit of the River Lugg SSSI is 0.015 mg/l.

Several NRW-monitored water bodies flow into EA-monitored water bodies in the Lugg catchment. These are outlined in Table 12.

Table 12. Status of Welsh water bodies that flow into water bodies monitored by the EA.

English WB **ID** ***2022 WFD Classification*** **(Certainty)**	**Welsh WB** **ID**	**Welsh 2024 Interim Classification for phosphate (Certainty)**	**Result at sampling points (based on most recent data to end 2024)**
Lugg **Conf Norton Bk to conf R Arrow** GB109055042030 *Moderate* (No certainty data)	**Norton Bk - source to conf R Lugg** GB109055042040	Poor (Uncertain)	S50545 **0.029 mg/l** n=11, 2022-24*
	Lugg - conf Cascob Bk to conf Norton Bk GB109055042010	N/A	No data
Hindwell Bk **Conf Knobley Bk to conf R Lugg** GB109055041930 *Moderate* (Quite certain)	**Knobley Bk - source to conf Hindwell Bk** GB109055041980	High (Very certain)	S50841 **0.014 mg/l**** n=8, 2020-22
	Hindwell Bk - source to conf Knobley Bk GB109055041970	High (Very certain)	S50835 **0.012 mg/l**** n=8, 2020-22

Arrow **Conf Gilwern Bk to conf R Lugg** GB109055041840 *Moderate* (Quite certain)	**Gilwern Bk - source to conf R Arrow** GB109055041830	Moderate (Quite certain)	MD-50052 **0.089 mg/l***** n=13, 2020-21
Arrow **Conf Gladestry Bk to conf Gilwern Bk** GB109055036620 *Good 2022* (No certainty data)	**Gladestry Bk - source to conf R Arrow** GB109055036600	N/A	No data
	Arrow - source to conf Gladestry Bk GB109055036590	Good (Uncertain) *Rolled forward from 2021*	S50828 No data****

* This is not the same timeframe used by NRW to generate their 2024 classifications.
** Classified based on 2020-2022 data. No data collected after 2022.
*** Uses EA sampling point MD-50052. No data collected after 2021.
**** No data collected after 2019.

Evidence of Impact

The occurrence of excessive nutrients in the water body can impact competitive interactions between higher plant species and between higher plants and algae, resulting in a loss of characteristic aquatic vegetation. Changes in plant growth, community composition, and structure can have cascading effects, influencing the diversity and abundance of invertebrates, fish, and other fauna.

Elevated nutrient levels, particularly P, can also reduce dissolved oxygen concentrations, especially during periods of algal die-off and decomposition, leading to hypoxic conditions that stress or exclude sensitive species. Additionally, nutrient enrichment can alter substrate conditions, promote the growth of filamentous algae, and contribute to sediment smothering, which affects spawning gravels and benthic habitats.

Siltation is another significant pressure, particularly in lowland rivers like the Wye and Lugg. Excess fine sediment can blanket the riverbed and reduce light penetration, impairing macrophyte growth, and degrading habitats for invertebrates and fish. Siltation also interacts with nutrient dynamics, as P can bind to sediment particles, prolonging its residence time in the system and contributing to long-term ecological stress.

In the River Lugg, these impacts are particularly pronounced. The catchment is failing to meet its P targets under both the WFD and the SAC objectives. Monitoring data show consistently elevated levels of phosphate and TP.

Algal Growth and Ecological Change in the River Wye

The River Wye is generally meeting its phosphate targets, yet visible symptoms of ecological stress, often associated with eutrophication, are evident, including changes in aquatic vegetation and increased algal growth.

The WFD classification for macrophytes and phytobenthos in the River Wye SAC water bodies shows good status at one site and moderate status at the remaining two sites. However, macrophyte data in the Wye are considered less reliable for WFD assessments due to the river’s physical characteristics, low alkalinity and species composition.

Phytobenthos data are more robust and are now being prioritised when assessing ecological status.

Changes in aquatic vegetation, including a decline of *Ranunculus* beds (and more recently signs of recovery), have been noted. However, these changes are not necessarily linked to eutrophication. The dominant *Ranunculus* species *(R. fluitans* – river water crowfoot) in the Wye is tolerant of elevated nutrient levels and was abundant during periods of higher phosphate concentrations in the 1980s (Jones 1984). Instead, excessive sedimentation and altered flow regimes are more likely contributors to these changes.

Algal growth in the Wye occurs in two main forms:

- *Planktonic (free-floating) algae*, including colonial diatoms such as *Cyclotella*, can form seasonal blooms in the River Wye. In the summer of 2020, a widely reported bloom drew significant public attention to the river's health. While the bloom was reportedly extensive and prompted increased scrutiny, scientific monitoring has not consistently recorded large-scale phytoplankton blooms of similar magnitude in recent years. Historical data from the 1980s show that algal cell counts were higher during that period. This suggests that while blooms may not be intensifying in terms of biomass, their presence may be influenced by changing environmental conditions, such as warmer temperatures and lower summer flows, which favour algal proliferation.
- *Benthic (filamentous) algae*, which grow on the riverbed and can smother gravels and submerged plants. These blooms are highly variable and are more strongly associated with temperature and low flow conditions than with nutrient levels alone.

One notable benthic species is the colonial diatom *Melosira*, which forms slimy brown mats on submerged surfaces, particularly in spring and warm weather. These mats can impact habitat quality for invertebrates and fish.

The EA continues to monitor algal dynamics in the Wye. Since 2024, new equipment has enabled the measurement of algal biomass alongside traditional cover estimates. This advancement will improve understanding of the environmental drivers of algal growth and help inform management strategies across the catchment.

Phosphate as a Proxy for Eutrophication

In England, phosphate (OP or SRP) is the standard used for assessing P levels in rivers. This is because phosphate is a direct measure of the most bioavailable form of P that can directly fuel algal growth and contribute to eutrophication.

However, there is a growing body of evidence, including research undertaken by Cardiff University through the Wye Algae Project (Bellamy et al. 2024), suggesting that phosphate alone may not be an adequate proxy for eutrophication. Eutrophication and algal blooms are influenced by multiple factors, including other nutrient levels, water temperature, sunlight, and river flow.

Updated Guidance

A UK Chemicals Strategy was initially proposed in 2018 as part of the 25 Year Environment Plan. It was expected to provide updated guidance on priority chemical pollutants, including nutrients such as nitrogen and P, appropriate monitoring frequencies and locations, and the integration of chemical and biological indicators to assess ecosystem health. The Environmental Improvement Plan (EIP) 2023 reaffirmed the intention to publish the Strategy. However, in May 2025, the Government confirmed that the Chemicals Strategy would not be developed as a standalone document. Instead, its approach to managing chemicals will be incorporated into the 2025 update of the EIP, although the extent to which this will address the original objectives of the Chemicals Strategy remains unclear.

Total Phosphorus

TP accounts for all forms of P in the water, including both particulate and dissolved forms. This provides a comprehensive picture of the nutrient load compared to just measuring phosphate alone. While elevated levels of TP are often correlated with increased algal growth, the relationship can vary depending on the bioavailability of the P forms present.

The EA has been monitoring TP in addition to phosphate at SAC assessment sites since 2022. However, there isn't a standard to assess TP against for the Wye SAC, nor is there a long-term dataset or baseline to identify trends. As such, while TP data may offer useful supplementary insights, it currently cannot be used for formal condition assessments or trend analysis.

Role of Nitrogen

Nitrogen has not traditionally been regarded as a limiting factor for algal growth in freshwater environments and is often not present in concentrations that are ecologically problematic. However, it may still be relevant for other receptors such as drinking water supplies, where thresholds are more stringent. The ecological impact of nitrogen depends on its form, concentration, and environmental conditions, and may be underestimated by routine monitoring.

The UK Technical Advisory Group on the WFD considered the issue of nitrogen targets in their 2008 Final Report and concluded:

"*To use the standards we need good supporting evidence of cause and effect. For phosphorus there is a balance of evidence and the strong view of most experts that phosphorus is instrumental in the eutrophication in freshwaters. It is this understanding that underpins the standards proposed in this report.*

Although nitrogen may have a role in the eutrophication in some types of freshwaters, we consider the general understanding of this to be insufficient at present for it to be used as a basis for setting standards or conditions. The possibility is too strong that the statistical associations produced by these methods would represent correlation between nitrogen and phosphorus (and other factors), and not the standards for nitrogen that are truly *needed to protect the biology. For these reasons no standards for nitrogen are proposed in this report.*"

Despite this, recent evidence suggests that nitrogen levels may be elevated in some catchments, including the Wye, and could be contributing to eutrophication, especially in areas with arable cropping. No formal investigation has yet been undertaken to determine whether nitrogen targets are appropriate or necessary for the Wye, or what such a target might be. For context, the Clun SAC, part of the River Teme SSSI, is currently the only designated river site in the West Midlands with a nitrogen target (Total Oxidised Nitrogen: 1.5 mg/l), set specifically to protect freshwater pearl mussels.

Nitrogen can be found in water bodies in several forms:

- *Ammonia and Ammonium (NH_3 and NH_4^+)* – Together referred to as Total Ammoniacal Nitrogen. Ammonia is highly toxic to aquatic life, especially at higher pH and temperature. Ammonium is less toxic and more prevalent in water with lower pH. Both forms contribute to nutrient pollution and eutrophication, potentially leading to excessive growth of algae and aquatic plants. Routine monthly monitoring may miss spikes in ammonia levels caused by rainfall, agricultural runoff, and wastewater discharges. Main sources include agricultural inputs (fertiliser and animal waste), residential sources (cleaning products and septic tank discharges), industrial processes, and STWs.

- *Nitrite (NO_2^-)* – An intermediate form in the nitrogen cycle, produced during nitrification and denitrification. It is usually present in lower concentrations because it is quickly converted to nitrate or nitrogen gas. Nitrite is also toxic to aquatic life.

- *Nitrate (NO_3^-)* – The most oxidized form of nitrogen, highly soluble in water and a major nutrient for plants and algae. While essential for growth, excessive nitrate can contribute to eutrophication, leading to algal blooms and oxygen depletion.

- *Organic Nitrogen* – Found in organic compounds and must be broken down by microbial activity to be converted into inorganic forms usable by plants.

- *Nitrogen Gas (N_2)* – The most abundant form of nitrogen in the atmosphere, which can dissolve in water. Certain bacteria can fix nitrogen gas into forms usable by plants, playing a crucial role in the nitrogen cycle.

The ratio of available P to nitrogen (P:N) in a water body is a key factor in determining which nutrient limits algal growth. In freshwater systems, P is often the limiting nutrient, but when P levels are reduced and nitrogen remains abundant, the balance can shift. A low P:N ratio may favour the growth of certain types of algae, including potentially harmful cyanobacteria. Understanding and monitoring P:N ratios can help identify nutrient imbalances and guide more effective eutrophication management strategies.

In the River Wye, anecdotal evidence suggests that there may have been an increase in the number and scale of problematic algal blooms despite a reduction in phosphate levels over recent decades. The causes are difficult to ascertain and may result from changes in weather and climate, or land management. The recent research by Cardiff University suggests that nitrogen, and potentially the availability of other forms of P apart from phosphate (i.e., insoluble and organic forms of P that are measured together with phosphates as TP), might be contributing to algal blooms and declines in river health.

Note on Ammonia

Although routine monthly monitoring of ammonia is undertaken in the Wye and Lugg, this may miss spikes in ammonia levels caused by rainfall, agricultural runoff and wastewater discharges. Ammonium is less toxic than ammonia and is more prevalent in water with lower pH. While ammonium is less harmful, ammonia and ammonium contribute to nutrient pollution and eutrophication and can potentially lead to excessive growth of algae and eutrophic aquatic plants.

Sediment

Sediment is a significant pressure inter-linked with phosphate. Excess sediment can degrade aquatic habitats by smothering gravels, reducing oxygen availability, and impairing the feeding and reproduction of invertebrates and fish. It also acts as a transport medium for other pollutants, including P, pesticides, and heavy metals.

P is frequently bound to soil particles, meaning that erosion and runoff are key pathways for its movement into watercourses. As such, reducing soil loss is critical for controlling sedimentation and mitigating P pollution.

There is currently no ecological water quality standard for sediment in rivers, which complicates regulatory responses. However, field observations, such as reports of algae and scum accumulating on gravels, may indicate sediment-related impacts rather than nutrient enrichment alone.

Multiple sources contribute to sediment pressures in the catchment. These include erosion from floodplain soils converted to arable use, particularly for maize and root crops, which are associated with higher erosion risk. Anecdotal evidence suggests that the expansion of these crops has increased sediment mobilisation in recent years.

In addition to land use, biological factors also play a role. Invasive species such as the signal crayfish, which are widespread and abundant in the English part of the Lugg catchment, burrow extensively into riverbanks, destabilising them and accelerating erosion.

Other Pollutants

Other pollution hazards are present. Nitrates, sulphates, chlorides, heavy metals, hydrocarbons, glycols, alcohols, oils, salts, detergents, herbicides, insecticides, fungicides, organic matter, bacteria, viruses, particulates and various other chemicals are also potentially hazardous.

The 2014 River Wye Site Improvement Plan noted that there are localised sources of metal pollution from mining waste and upland acidification affecting river pH values (in Wales), and historical issues with pesticides (e.g., pyrethroids, cypermethrin and metaldehyde). These have not been reviewed for this plan.

Concerns have been raised by our partners and the wider community about these and other hazardous substances (including pharmaceuticals) in the Wye. Management of these pollutants once they are in the environment is difficult and, in some cases, currently impossible with existing technology, and mitigation often relies on regulation at the source.

Note on Sulphate

Sulphate in fertilisers and soil amendments has been identified as a potential concern in the catchment, partly because of its role in eutrophication. Once applied, sulphate can leach into water bodies, where it may be converted into sulphide, a compound that is toxic to aquatic life, especially under low-oxygen conditions. In soils, sulphate can influence nutrient cycling processes in ways that increase the mobility of P and other nutrients, such as nitrogen. This is particularly the case in poorly drained or nutrient-enriched soils, where changes in microbial activity and soil chemistry can lead to greater nutrient losses from land to water. Sulphate can also contribute to the release of P from sediments, making water pollution problems like eutrophication harder to control.

Priority substances

As well as the physico-chemical water quality elements (BOD, ammonia, phosphate, etc.), WFD water bodies can fail to achieve good ecological status due to exceeding permissible concentrations of hazardous substances. Currently, 33 substances are defined as hazardous or priority hazardous substances, with others under review. Such substances may pose risks both to humans (when present in drinking water) and to aquatic life and animals feeding on aquatic organisms. Chemical status is particularly affected by priority hazardous substances including PBDEs, PFOS, and mercury, which can accumulate through the food chain. These substances are managed by a range of different approaches, including UK, EU, and international bans on manufacturing and use, targeted bans, selection of safer alternatives and end-of-pipe treatment solutions.

Weather, Climate and Flow

During warmer weather, there is an increase in the number of reports of algal blooms in the catchment. During periods of warm, settled, dry weather conditions are ideal for growth and algae can proliferate, leading to algal blooms. In turn, high summer river temperatures and possibly increased frequency and severity of winter floods are changing the vegetation structure in the Wye.

Observed climate trends across the catchments include warmer, wetter winters with increased rainfall intensity and more frequent high-flow events, alongside hotter, drier summers with prolonged low-flow conditions, and more frequent summer storms. These changes are influencing nutrient and sediment transport from agricultural land. Agricultural intensification contributes to reduced infiltration and increased surface runoff, resulting in more variable and responsive flow regimes. In 2022, water temperatures in the River Wye exceeded 20°C, coinciding with reports of 64 dead salmon. In contrast, only two dead salmon were reported in 2023, a year with cooler summer conditions. Elevated water temperatures are associated with increased algal growth, particularly when combined with longer residence times during low-flow periods. Additionally, high winter flows are considered the most likely cause of the observed loss of *Ranunculus* beds, a key indicator species of river health. Reduced perennial plant cover, including *Ranunculus*, may further contribute to algal proliferation by decreasing shading and nutrient uptake.

Pollution Sources and Source Apportionment

The relative inputs of phosphate from point sources, rural diffuse sources, urban diffuse sources and septic tanks were presented in the EA's Indicative Catchment Statistics for Nutrient Pollution report (EA 2024b) for the whole Wye/Lugg catchment and the Arrow Lugg and Frome OC (Figure 6). These relative loads were calculated using SAGIS modelling. In these sector groupings, point sources include STWs, storm overflows and permitted industrial discharges; rural land use includes farmland, woodland/forestry, grassland and other rural sources; urban includes runoff from urban areas and contamination from misconnected drains; and septic tanks includes septic tanks and small package treatment plants. Data were based on in-river concentrations before 2020, and do not include water company infrastructure upgrades undertaken as part of the AMP7 (2020-2025) and AMP8 (2025-2030) investment periods, part of the water industry's five-year Asset Management Plans regulated by Ofwat.

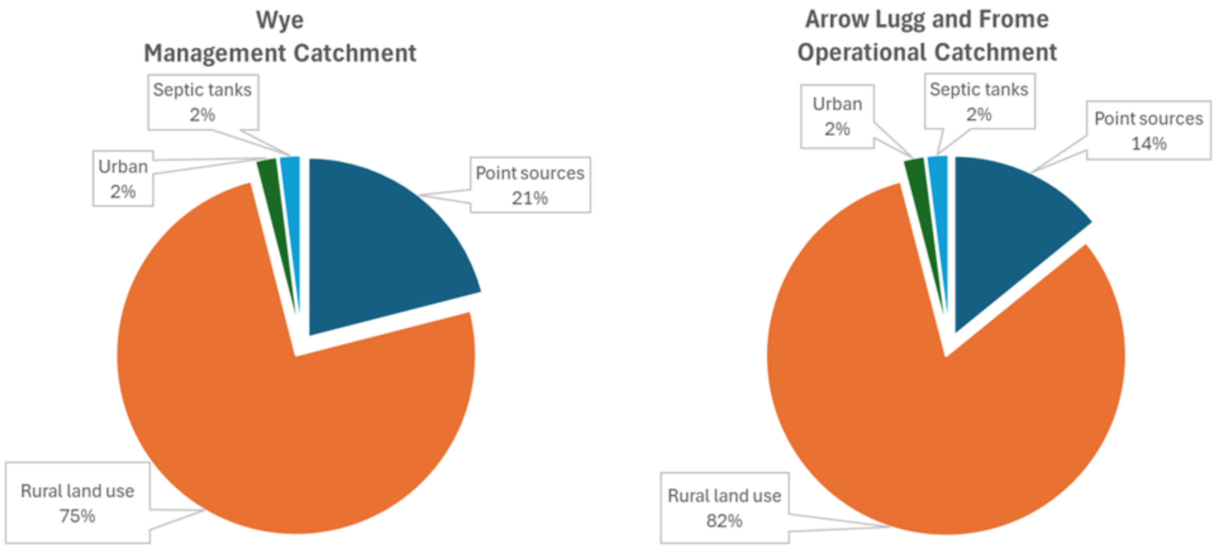

Figure 6. Phosphate source apportionment for the Wye MC and Arrow Lugg and Frome OC (prior to AMP7 and AMP8 water company upgrades). Data are for England and Wales combined[3].

Point Sources

Most known point sources of P originate from water company discharges via STWs, as well as intermittent releases from combined sewer overflows and storm overflows. P is present in sewage because it occurs naturally in human waste and is also found in some detergents. Additionally, phosphate is sometimes added to drinking water to reduce lead solubility in older pipework (a process known as plumbosolvency treatment).

Permit improvement conditions and Event Duration Monitoring will play a significant role in managing and reducing phosphate inputs from these point sources. The EA regulates sewage discharges through a system of environmental permits, with compliance monitoring carried out by both the EA and the operator of the treatment works. To meet permit requirements, STWs typically require additional treatment processes to remove P, most commonly through chemical dosing with iron.

STWs in the catchment are operated by Welsh Water. As a company that operates "wholly or mostly in Wales". Many legal obligations that apply to operators of STWs in England do not apply to Welsh Water.

[3] Note that Farmscoper data are not available for all water bodies within the Wye MC or Arrow Lugg and Frome OC. Source apportionment results are based solely on the areas for which data are available.

Diffuse Sources

Diffuse sources are sources of pollution that are widespread within the catchment and arise from multiple sites. Each individual source of a pollutant may be small; however, the widespread nature of these sources results in significant contributions of phosphate and sediment across the catchment.

Most phosphate pollution in the Wye MC and Arrow Lugg and Frome OC comes from the rural diffuse sub-sector (75% and 82% respectively prior to AMP7 improvements). Urban diffuse pollution and septic tanks make relatively small contributions, but these may be locally significant in some river reaches or tributaries.

Rural Diffuse Pollution

Rural diffuse sources of phosphate and sediment pollution are mostly related to agriculture. Diffuse water pollution from agriculture is driven by a combination of nutrient losses and soil erosion processes. Both are considered major contributors to water quality impacts and should be addressed with equal priority in catchment management planning. Nutrient losses may arise from current practices such as the application of fertilisers and organic manures, particularly where these exceed crop requirements or are poorly timed in relation to rainfall and runoff events. In addition, P accumulated in soils from historic applications, referred to as legacy P, continues to pose a risk to water quality. This legacy P can be mobilised through subsurface drainage pathways, even in the absence of recent nutrient inputs. Soil erosion plays a critical role by transporting sediment-bound nutrients and organic matter into watercourses. Effective mitigation therefore requires an integrated approach that addresses both current nutrient management and the long-term impacts of legacy P, alongside measures to reduce soil loss and improve soil structure.

Urban Diffuse

Urban development has a relatively minor impact on water quality (2% each across the Wye MC and the Arrow Lugg and Frome OC). Hereford and Leominster are the largest English towns in the Wye MC, with populations of around 50,000 and 12,000 respectively.

Urban diffuse sources of P include:

- *Stormwater runoff* – Rainwater running off impervious surfaces like roads, parking lots, and rooftops can carry P from various sources into water bodies.
- *Park and garden fertilisers* – Excess fertilisers used in residential parks and gardens can wash into storm drains and eventually reach rivers and lakes.
- *Pet waste* – P from pet waste left on the ground can be washed into water bodies during rainfall.
- *Erosion from construction sites* – Soil erosion at construction sites can carry P-laden sediments into nearby water bodies.

- *Misconnections* – Incorrect plumbing connections, where wastewater from homes is mistakenly connected to stormwater drains instead of the sewer system, leading to direct discharge of P into water bodies.

Septic tanks

Septic tanks, including package treatment plants, also have a relatively small impact on phosphate loads (2% each across the Wye MC). Although septic tanks are a minor source of nutrient pollution, they can be significant sources in certain catchments, such as headwater streams.

Since 2015, a regime involving general binding rules for most septic tank and small package treatment plants has been in place, with permits required for higher risk situations. Managing discharges from septic tanks presents an ongoing challenge nationally, especially in rural catchments with older properties and poorly maintained septic systems.

Actions Underway to Achieve Favourable Condition

Reducing Point Source Pollution

The main pollutants in water arising from water company discharges are permitted within limits, and include P, ammonia, biochemical oxygen demand (BOD, a measure of organic pollution) and chemicals. Water company investment and improvements have resulted in large reductions in these pollutants discharged to rivers from sewage treatment works and storm overflows. However, water industry performance remains under scrutiny and there is a community expectation that more needs to be done by the sector.

Permitting

Permits under the Environmental Permitting Regulations set effluent standards for P discharge from STWs. These standards are designed to protect water quality and are informed by the Water Industry National Environment Programme (WINEP), which identifies where new or tighter permits are required to meet environmental objectives.

The Water Environment Transformations Programme

The Water Environment Transformations Programme (WETP) is a strategic initiative of the EA aimed at improving water company performance and environmental outcomes. It includes enhanced inspections, enforcement, and investment planning, and supports innovative permitting approaches such as nature-based solutions (NbS), including constructed wetlands, as part of a more integrated regulatory framework.

Innovative Permitting

The EA's Innovative Permitting team, established in 2022 under the WETP, develops new regulatory approaches to support PR24 and beyond. These include catchment-based permitting and the integration of NbS and digital tools to deliver more flexible, outcome-focused regulation.

An example of innovative permitting is Regulatory Position Statement (RPS) 260, which allows third party-operated nutrient treatment wetlands to treat final effluent without an environmental permit, provided strict conditions are met. This supports the use of NbS in NN schemes.

WINEP and Asset Management Plans

The WINEP is a regulatory framework that defines the environmental obligations of water companies in England and Wales. It sets out the actions required to comply with statutory requirements and deliver environmental improvements. WINEP is embedded within five-year investment cycles known as Asset Management Plans (AMPs), which are regulated by Ofwat, the economic regulator for the water sector. The current cycle is AMP8 (2025–2030).

Over the past decade, WINEP and its predecessor, the National Environment Programme, have driven significant reductions in nutrient loads from STWs. AMP7 (2020–2025) focused on P removal to support compliance with the WFD and the Conservation of Habitats and Species Regulations. AMP8 continues this focus, with an expanded scope that includes further nutrient and chemical reductions, enhanced monitoring, and alignment with new statutory duties under the Environment Act 2021.

AMP8 introduces numeric concentration limits at many STWs, several of which are receiving such permits for the first time. This enables more consistent compliance assessment and enforcement. For the Wye and Lugg catchments, limits are detailed in Table 13 (England) and Table 14 (Wales), and in Figure 7, illustrating the scale of intervention currently being undertaken to meet environmental objectives.

Table 13. Sewage Treatment Works and TP permit limits in the English Wye and Lugg catchments. "-" indicates that no quantitative limit or no change.

Sub-catchment	Site	Permit Limits (TP mg/l)		
		AMP7 & prior England (2020-25)	AMP8 England (2025-30)	NN Wetlands (AMP 7+) (2023-25)
Wye u/s Lugg	Clehonger STW	-	1	
Wye u/s Lugg	Eign STW	0.4	-	
Wye u/s Lugg	Kingstone & Madley STW	2	0.3	
Wye u/s Lugg	Rotherwas STW	0.4	-	
Arrow	Dilwyn STW	-	-	2
Arrow	Lyonshall STW	-	1.5	
Arrow	Weobley STW	1.5	0.3	
Lugg	Canon Pyon STW	-	3	2
Lugg	Kingsland STW	-	0.5	
Lugg	Leominster STW	0.5	-	
Lugg	Luston & Yarpole STW	-	-	2
Lugg	Presteigne STW	1	-	
Lugg	Shobdon STW	-	0.3	
Frome	Bishops Frome STW	5.7*	2*	
Frome	Bromyard STW	1	0.4	

Frome	Pencombe STW	-	1.5	
Frome	Tarrington STW	4.6*	0.4**	2
Wye d/s Lugg	Little Dewchurch STW	-	2	
Wye d/s Lugg	Woolhope Village STW	-	2.5	
Monnow	Much Dewchurch STW	-	0.4	
Monnow	Pontrilas STW	1.8	-	

* Modelled sector share. These figures were applied in DWPP SAGIS modelling.

** The development of this NN wetland began before the WINEP obligation to reduce discharge concentration to 0.4 mg/l was identified.

Table 14. Sewage Treatment Works and TP permit limits in the Welsh Wye and Lugg catchments. "-" indicates that no quantitative limit or no change.

Sub-catchment	Site	Permit Limits (TP mg/l)	
		AMP7 Wales (2020-25)	AMP8 Wales (2025-30)
Wye Source to Ithon	Elan Village STW	-	5
Wye Source to Ithon	Llangurig STW	5	-
Wye Source to Ithon	Llanwrthwl STW	-	5
Wye Source to Ithon	Llanyre STW	5	-
Wye Source to Ithon	Newbridge on Wye STW	5	-
Wye Source to Ithon	Rhayader STW	3	-
Ithon	Crossgates STW	-	2
Ithon	Llanbadarn Ffrnydd STW	-	5
Ithon	Llanbister	5	4
Ithon	Llandegley STW	5	1
Ithon	Llandewi Ystradenny STW	-	5
Ithon	Llandrindod Wells STW	0.8	-
Ithon	Penybont STW (nr Llandrindrod Wells)	5	-
Wye - Ithon to Hay	Aberedw STW	-	5
Wye - Ithon to Hay	Aberllynfi (Three Cocks) STW	-	3.5
Wye - Ithon to Hay	Builth Road STW	5	3
Wye - Ithon to Hay	Builth Wells STW	2.5	-
Wye - Ithon to Hay	Erwood STW Erwood Builth Wells	-	5
Wye - Ithon to Hay	Hundred House STW	5	4
Wye - Ithon to Hay	Llanfilo STW	-	2
Wye - Ithon to Hay	Painscastle STW	-	3.5
Wye - Ithon to Hay	Talgarth STW	0.6	0.25
Irfon	Beulah STW	-	3
Irfon	Cilmery STW	5	4
Irfon	Garth STW	5	5
Irfon	Llangammarch Wells STW	-	5
Irfon	Llanwrtyd Wells STW	-	2
Irfon	Tirabad STW	5	4
Wye us Lugg	Clyro STW	5	0.5
Wye us Lugg	Glasbury STW	5	5
Wye us Lugg	Llanigon STW	5	0.5
Wye us Lugg	Llyswen STW	5	-
Lugg	New Radnor STW	5	-
Lugg	Norton (Old) STW	Pumped to Presteigne	
Wye ds Lugg	Monmouth STW	2	-
Monnow	Grosmont STW	5	5
Monnow	Pandy STW	5	-
Trothy	Dingestow STW	-	5
Trothy	Llandewi Rhydderch STW	5	-

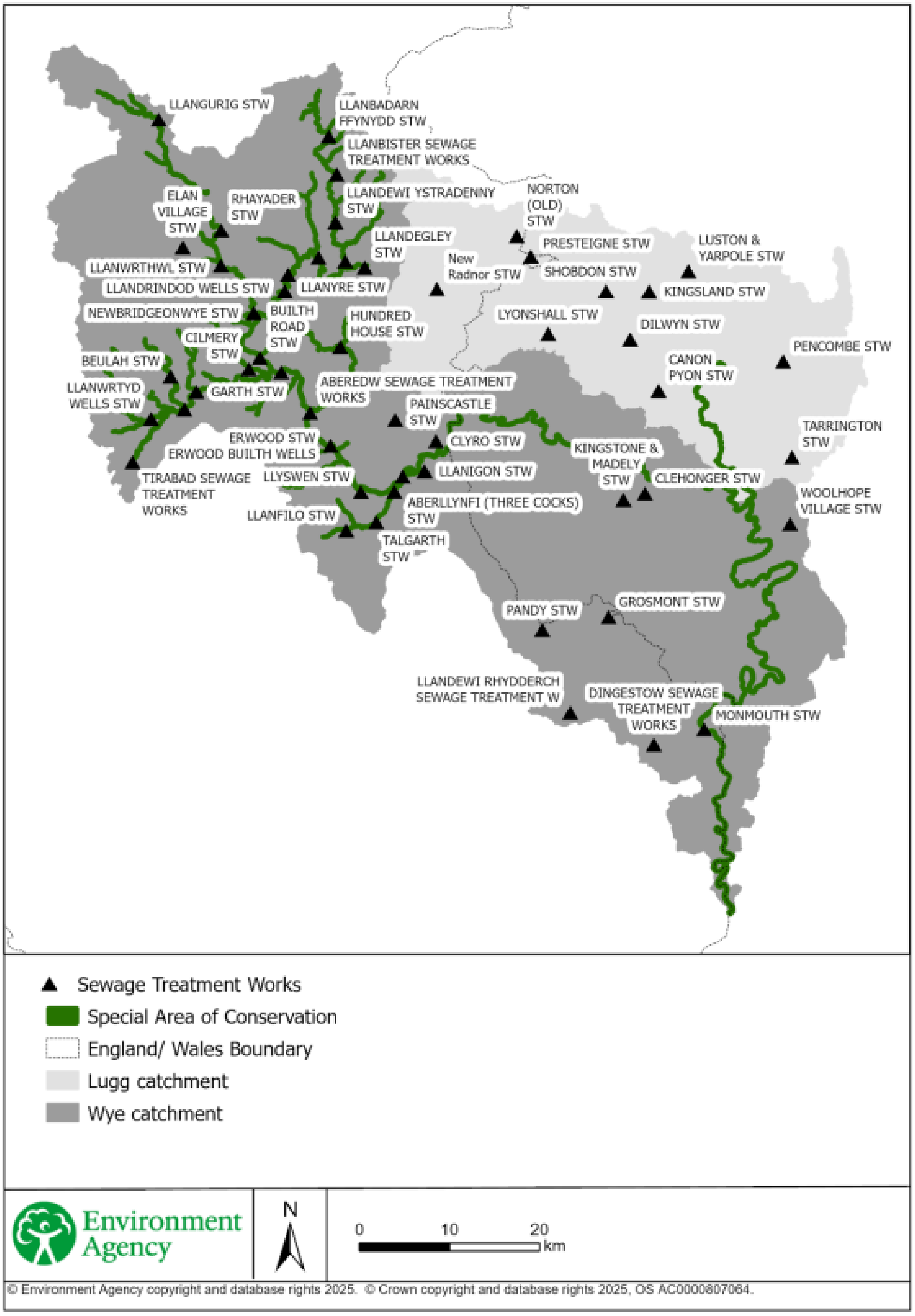

Figure 7. STWs in the Wye Catchment (England and Wales) with AMP7 or AMP8 investment in place or planned.

Progressive improvements in wastewater treatment under WINEP have contributed to improved water quality. With the implementation of AMP8 measures, the point source sector is expected to deliver its proportional contribution ("fair share") to achieving P targets, in line with the Polluter Pays Principle.

Welsh Water Actions

Welsh Water is implementing a series of P reduction measures across the Wye and Lugg catchments as part of its obligations under the AMP8 (2025–2030) investment programme.

In the English part of the catchment, including Herefordshire and the Forest of Dean, actions include:

- Discharge limits tightened at 13 sewage treatment works in line with WFD requirements.
- Upgrades to septic tank systems at three sites to provide secondary treatment.
- Storm capacity improvements at Eign STW in Hereford.
- Investigations into 47 named storm overflows to inform future investment and compliance planning.

In the Welsh part of the catchment, covering Powys and Monmouthshire, the programme includes:

- P removal upgrades at nine STWs (five previously planned, four added in the Final Determination).
- Storm tank capacity increases at Builth Wells STW.
- Sanitary determinations improvements at 12 STWs.
- Investigation of remaining storm overflows not addressed in AMP7.
- A growth scheme at Monmouth STW, including surface water separation.

Tree planting and other land-based measures are also included in Welsh Water's AMP8 programme. In the Wye and Lugg catchments, these actions are intended to manage surface water, reduce runoff, and stabilise soils, thereby helping to reduce sediment and nutrient inputs to watercourses. These measures are designed to complement infrastructure upgrades and contribute to catchment resilience by mitigating the effects of extreme weather. They also support Welsh Water's wider environmental strategy, including its target to achieve net zero operational carbon emissions by 2040.

Additional AMP8 commitments relevant to the Wye and Lugg catchments are outlined in Welsh Water's 2023 Manifesto for Rivers in Wales. These include:

- Investment of £133 million to eliminate 90% of P discharges from STWs in SACs by 2030, with a target of 100% by 2032.
- A programme to reduce the impact of storm overflows in SAC catchments, aiming for all overflows to be classified as "very low or no harm" by 2040.
- Expansion of real-time monitoring and public reporting of storm overflow activity.
- Development of wetlands and other NbS to support phosphate reduction.
- Exploration of catchment permitting and nutrient trading approaches to support cross-sector nutrient management.

Welsh Water's Drainage and Wastewater Management Plan sets out long-term strategies for managing wastewater and stormwater across its operational area. The plan identifies risks and priorities at the catchment level, including combined storm overflows, wastewater treatment works, and sewerage pumping stations. Although the plan is developed under Welsh Government direction, it incorporates cross-border planning units and supports collaborative approaches to infrastructure investment and pollution reduction in shared catchments like the Wye.

Despite these commitments, Welsh Water currently holds a two-star environmental performance rating from NRW, indicating that improvement is needed. The rating reflects concerns over pollution incidents, permit compliance, and self-reporting. Welsh Water is also subject to ongoing legal proceedings relating to alleged sewage discharges in the Wye and Lugg catchments. These issues underline the importance of the AMP8 programme and wider efforts to improve water quality across the region.

Welsh Water as a Welsh Undertaker

Welsh Water is designated as a sewerage undertaker that operates "wholly or mainly in Wales". As such, certain regulatory requirements that apply to undertakers operating wholly or mainly in England do not apply to Welsh Water, even in relation to its assets located in England.

For example, the following provisions do not apply to Welsh Water's English assets:

- Section 81 of the Environment Act 2021, which mandates near real-time reporting of storm overflow discharges, applies only to undertakers operating wholly or mainly in England.
- The Storm Overflows Discharge Reduction Plan (SODRP), published under the Environment Act 2021, sets statutory targets and reporting duties that are not applicable to undertakers regulated by Welsh Ministers.
- Provisions under the Levelling-up and Regeneration Act 2023, including NN requirements and planning-related environmental duties, are implemented differently in Wales and do not automatically extend to undertakers operating under Welsh jurisdiction.

Instead, Welsh Water is regulated by NRW and the Welsh Government, which have developed separate policy frameworks, including the Better River Water Quality Taskforce and the Environmental Regulation of Overflows Action Plan.

Welsh Water also operates within the framework of the Well-being of Future Generations (Wales) Act 2015, which places a legal duty on public bodies in Wales to consider the long-term impact of their decisions on environmental, social, economic, and cultural well-being. This includes commitments to ecosystem resilience and sustainable resource management, which align with catchment-based approaches to improving water quality in the Wye.

These frameworks reflect devolved priorities and legislative powers under the Government of Wales Act 2006. As a result, while Welsh Water assets in England are subject to EA permitting and compliance, they are not bound by certain statutory duties introduced for English undertakers under recent UK legislation.

Event Duration Monitoring

Event Duration Monitoring (EDM) data are reported annually to NRW in Wales and the EA in England. Welsh Water EDM data are available on Welsh Water's Event Duration Monitoring website, and near real-time Information about their storm overflow activity is reported on their storm overflow map website.

Nutrient Neutrality

Although not intended as a catchment restoration measure, the implementation of Nutrient Neutrality (NN) has prevented additional nutrient loading from new development within the River Lugg catchment. Since 2019, Herefordshire Council has only permitted development proposals that can demonstrate nutrient neutrality through the Habitats Regulations Assessment process.

Herefordshire Council Integrated Wetlands Project

To meet NN requirements, developers must quantify the phosphate load associated with their proposals and secure appropriate mitigation. In the Lugg catchment, this is typically achieved through off-site measures, specifically constructed wetlands designed to remove P from treated wastewater. Luston Wetland is one such scheme developed to support mitigation. While this approach has enabled some development to proceed, mitigation capacity remains limited, and delays persist due to constrained credit availability.

To support the delivery of NN, Herefordshire Council established the Integrated Wetlands Project. As part of this initiative, the Council acquired land adjacent to the Luston STW (operated by Welsh Water) and secured planning permission for a wetland designed to treat final effluent and reduce P concentrations. A phosphate credit scheme was established to enable developers to offset nutrient loads from new housing.

Further wetland schemes are in progress, including sites at Tarrington (under construction) and Titley (with planning permission), with additional locations under consideration, such as Dilwyn and Canon Pyon.

Reducing Diffuse Pollution

Policy and Planning

River Basin Management Plans and the WFD

River Basin Management Plans (RBMPs) are comprehensive plans produced under the WFD Regulations, outlining how the water environment across river basins will be protected and improved.

England is divided into 10 River Basin Districts, each with its own River Basin Management Plan. These plans are developed by the EA and updated every six years. The last update was in 2022, and forms the third cycle of RBMPs, covering the period 2021-2027. The River Wye is included in the Severn River Basin District.

RBMPs set out the environmental objectives for all water bodies (rivers, lakes, estuaries, coastal waters, and groundwater), identify pressures (e.g., pollution, abstraction, habitat loss), and summarise measures to improve or maintain water quality and ecological health.

Work to develop the fourth cycle of RBMPs has already begun, with the EA conducting the “Working Together” consultation between November 2024 and May 2025. Significant input from catchment partners will be essential to ensure local priorities and pressures are properly reflected in the next cycle.

Herefordshire Council Minerals and Waste Local Plan

Local government has key role to play in assessing the potential impacts of agricultural developments on the environment. Relevant legislation includes the Town and Country Planning Act 1990, Town and Country Planning (Environmental Impact Assessment) Regulations 2017 and the National Planning and Policy Framework.

In March 2024, the Local Planning Authority for Herefordshire Council adopted a new Minerals and Waste Local Plan, including an agricultural waste policy that requires new developments to prevent nutrient surpluses. This was unusual because agricultural activities are not typically subject to planning control and are generally regulated by non-planning statutory instruments, including FRfW.

The plan included policy W3, which addressed the issue of “natural agricultural waste”. Policy W3 requires that a waste management method statement is submitted with all applications for livestock units on agricultural holdings. The statement must include details on the following matters as relevant for either the proposed development or the whole agricultural holding, dependent on the scale of development:

- The type and quantity of livestock.
- The type and quantity of by-products likely to arise.
- Methods for dealing with inputs and outputs.
- Pollution controls.
- Transportation requirements.
- Other reasonable matters as requested by Herefordshire Council.

The aim of policy W3 is to ensure that the agricultural sector contributes to achieving “*at least nutrient neutrality, if not betterment in the River Wye SAC*”. Actual wording of the policy follows:

Policy W3: Agricultural waste management including for livestock units

1. *Waste management method statements will be required for proposals for livestock unit(s) on agricultural holdings that:*
   a. *for non-EIA development, demonstrates that both natural and non-natural wastes generated by the proposed development will be appropriately managed both on and off-site; or*
   b. *for EIA development, demonstrates that both natural and non-natural wastes generated by the whole agricultural unit will be appropriately managed both on and off-site.*

2. *Anaerobic digestion will be supported where its use is to manage only natural wastes generated primarily on the agricultural unit within which it is located.*

3. *All proposals for livestock unit(s) and anaerobic digestion and any other waste management proposals on agricultural holdings within the River Wye SAC or the River Clun SAC will be required to demonstrate at least nutrient neutrality.*

In relation to AD plants, the policy specifically does not support the development of AD facilities fed on crops grown for that purpose (i.e., maize or other “energy crops”).

Local Nature Recovery Strategy

A Local Nature Recovery Strategy (LNRS) is a spatial planning tool in England established under the Environment Act 2021. They help guide and coordinate efforts to restore and enhance biodiversity across local areas. Developed by local authorities in collaboration with stakeholders, LNRSs identify priority habitats and species, map opportunities for nature recovery, and align environmental goals with broader land-use planning. While their scope includes a wide range of ecological concerns, LNRSs are relevant to water quality issues, as they promote nature-based solutions like wetland restoration, riparian buffer zones, and sustainable drainage systems. These interventions not only support biodiversity but also help reduce nutrient runoff, improve river health, and mitigate pollution, making LNRSs a mechanism for integrating water quality improvements into local environmental strategies.

As the Responsible Authority, Herefordshire Council leads LNRS development in Herefordshire and are responsible for delivery of the strategy. NE acts as the formal supporting authority for the LNRS, providing guidance and expertise to Council throughout its development. They also ensure consistency and alignment between neighbouring authorities.

The Herefordshire LNRS includes an interactive mapping tool that identifies opportunities for habitat restoration, including areas where wetland creation and floodplain reconnection could support both biodiversity and water quality improvements. These spatial priorities are informed by ecological data and align with wider environmental objectives in the county. While the LNRS itself is a strategic framework, focused on identifying priorities rather than delivering interventions, it complements other initiatives in the region, including the Wyescapes; Food, Nature and Water and Ridge to River Landscape Recovery projects. These delivery-focused programmes share similar goals around restoring natural hydrology and reducing nutrient pollution in the Wye and Lugg catchments. Together, these efforts will help contribute to a coordinated, landscape-scale approach to nature recovery and water management.

Gloucestershire County Council also leads the LNRS development for Gloucestershire, of which part covers the Wye Catchment.

Wales does not use LNRSs as defined in England. They deliver similar outcomes through the non-statutory Nature Recovery Action Plan (NRAP) and a network of Local Nature Partnerships (LNPs). These partnerships develop locally tailored action plans that support habitat restoration, species conservation, and ecological connectivity, aligned with national biodiversity goals. While not statutory, these plans are supported by Welsh legislation and contribute to coordinated nature recovery across the country. For the Wye, Lugg and Monnow catchments, the relevant LNPs include Monmouthshire and Powys, both of which contribute to local biodiversity planning and action aligned with NRAP objectives

Monitoring

SSSI/SAC Condition Assessment

In 2024, NE and the EA began to undertake a full field assessment of the condition of management units and designated features of the Wye SAC and Lugg SSSI. This review is due to be completed in 2026.

WFD and Water Body Classification

The EA monitors water quality under the WFD. Data are made publicly available through the Open Water Information Management System (Open WIMS).

Under the WFD, surface water and groundwater bodies in England are assessed for their ecological and chemical status. The goal is for all water bodies to achieve at least good status. Monitoring includes:

- Biological quality (e.g., fish, invertebrates, plants)
- Physico-chemical quality (e.g., nutrients, oxygen levels, pH)
- Hydromorphological conditions (e.g., flow, structure)
- Specific pollutants (e.g., pesticides, metals)

Each water body in England is classified under the WFD based on its ecological and chemical status. Ecological status is graded on a five-point scale, high, good, moderate, poor, or bad, while chemical status is either good or fail. The overall classification follows the "one out, all out" rule: the lowest scoring element determines the final status.

Classifications are updated on a six-year cycle aligned with RBMPs. The most recent full update was in 2022 (delayed from 2021 due to the Covid-19 pandemic), and the next is due in 2027. However, an interim classification update is being prepared for 2025, based on monitoring data collected between 2022 and 2024. Classification data are publicly available on the Catchment Data Explorer website.

Additional monitoring and desktop or field-based investigations may be undertaken to identify the cause if a water body is deteriorating. The EA “Monitoring Commission” is the process that sets the objectives, principles and standards for agreeing on programmes of monitoring that meet the EA’s data and information requirements. The commissioning process ensures that monitoring is affordable, deliverable, multi-year and outcome focused.

EA Algae Surveys and Sonde Deployment

Since 2022, the EA has been routinely surveying algae in the River Wye on a monthly basis, where conditions allow (Figure 8). The purpose of the algal monitoring is to detect algal blooms in conjunction with sonde and physico-chemical data, and to assess ecological indicators of nutrient pollution.

Two types of algae survey are conducted:

- Water column samples targeting free-floating (planktonic) algae, typically single-celled (sometimes colonial), microscopic algae and cyanobacteria;
- Channel bed (RAPPER) surveys for filamentous algal, which are multi-cellular and attach to stones and submerged vegetation.

Figure 8. EA officers undertaking RAPPER surveys.

During 2023 seven sites were surveyed and eight sondes were deployed (Figure 9). This was undertaken to refine spatial monitoring of suspected localised areas of poor water quality which had been identified in 2022.

Figure 9. Sonde deployed in the Wye.

The additional sondes and surveys did not identify compelling evidence of localised water quality issues during 2023. In 2024, the number of algae surveys on the main stem of the Wye was reduced to four: Broomy Hill, Hampton Bishop, Holme Lacy, and Ross-on-Wye. Each survey site was co-located with a sonde. One additional sonde was installed on the River Lugg at Lugg Meadows, although no algae surveys were carried out at that location. In 2025, algae surveys were introduced at Mordiford on the River Lugg to enable comparison with a eutrophic site. This provides a useful contrast with the Wye sites, which typically meet their phosphate targets.

The sondes are in place from April until the end of September. They are removed during the winter months to protect them from damage due to flood conditions. Parameters measured by the sondes include temperature, conductivity, dissolved oxygen, pH, ammonium, turbidity and chlorophyl. Live readings from the sondes are publicly available on the internet.

Citizen Science

Citizen science is the involvement of volunteers from the public in scientific research activities. People from various backgrounds and different levels of expertise collect and analyse data, conduct experiments, or contribute to scientific investigations.

In 2022, the EA launched the Supporting Citizen Science project to strengthen collaboration with citizen science initiatives across England and promote the integration of community-generated data into environmental monitoring and decision-making. As part of this effort, the EA published a Technical Advisory Framework that outlined a 4-tier approach to engaging with citizen science groups (see Figure 10), offering guidance on data quality, validation, and appropriate use within regulatory and operational contexts. The EA continues to refine methodologies for incorporating citizen science data into formal evidence bases, ensuring that such contributions are both credible and impactful.

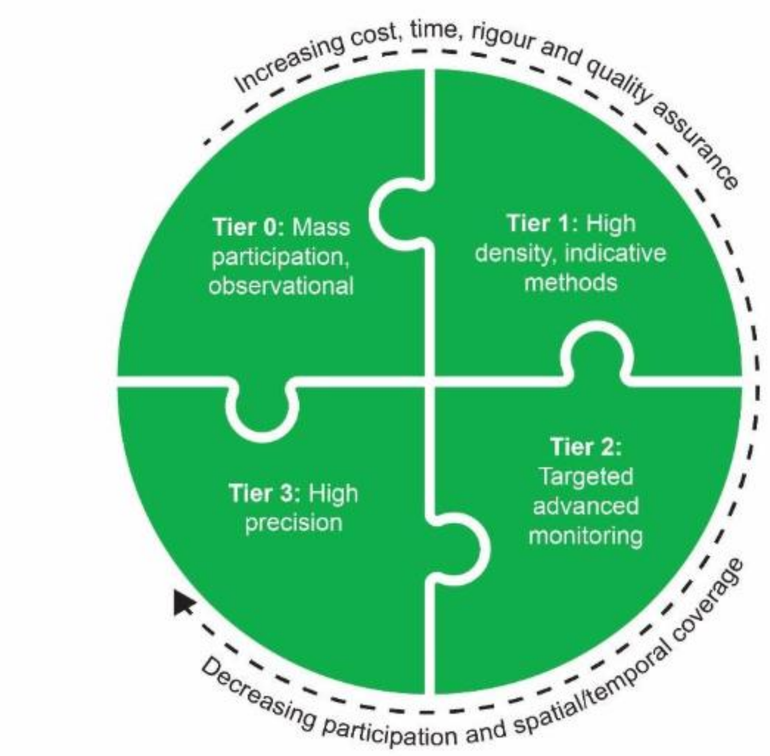

Figure 10. A 4-tier approach to engagement with citizen science groups and projects.

There are over 400 active citizen scientists testing water quality in the River Wye catchment, and a large amount of valuable data and information are being collected and reported by citizen science groups. Some groups within the Wye catchment have formed the Wye Alliance. The Wye Alliance is a collection of groups that follow aligned methodologies when collecting data within the catchment. This collaborative approach helps them combine data, expertise and decision-making. Data collected is uploaded to the EPICOLLECT database as one data set, rather than individual data sets. The Wye Alliance has also created its own dashboard using the data they have collected, which is publicly accessible via the WyeViz platform. As part of ongoing developments, the Mud Spotter tool is also being introduced in the catchment to help identify and record sources of fine sediment entering the river system.

Regular meetings between the EA and Wye Alliance citizen science groups commenced in 2025. These meetings support coordinated data sharing on water quality issues across the Wye catchment. Monitoring data from headwater sites is being used proactively to refine the spatial targeting of resources and the delivery of mitigation measures.

A growing strength of the citizen science data is its consistency and coverage. With numerous sampling points distributed across the catchment, the data spans a wide geographical area and is collected at a high frequency, typically on a weekly basis. Over extended periods, the rich dataset provides useful insights into changes and long-term trends in water quality at multiple locations throughout the catchment and adds to the weight of evidence that helps target point and diffuse source mitigation efforts in areas where eutrophication and other water quality issues are observed.

Much of the phosphate data collected by citizen scientists is gathered using Hanna Phosphate Low Range Handheld Colorimeters (“Hanna phosphate checkers”). These devices currently provide the best widely available method of field phosphate measurement. While results can be affected by turbidity and low temperatures, making them potentially less reliable than laboratory analysis, trials conducted over the past three years have shown a good correlation between field measurements and lab results. These findings have helped build confidence in the method, and the data are now widely trusted, despite the device’s known limitations.

Citizen science data shows that there are several parts of the Wye catchment that are hotspots for phosphate pollution. Figure 11 shows that high mean annual phosphate readings occurred across several water bodies within the central, southern and eastern parts of the Lugg catchment, tributaries of the River Wye, and eastern parts of the Monnow catchment. While this broadly corresponds with EA laboratory data, several citizen science sites show higher means than corresponding EA data. This might partially reflect a difference in sampling location, with many citizen science sites situated in the upstream parts of water body catchments and potentially closer to sources of phosphate, while the majority of EA monitoring takes place at the downstream end of water bodies.

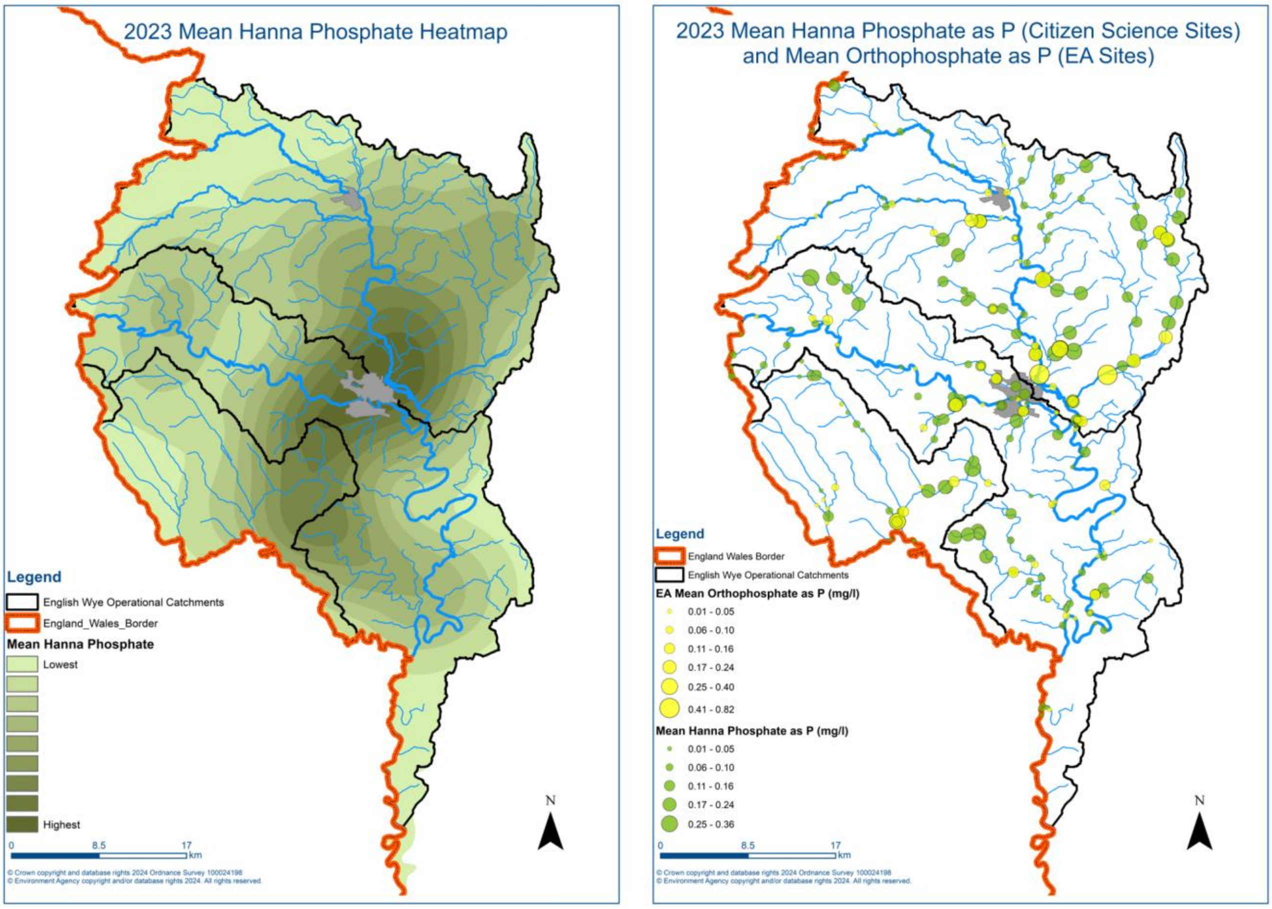

Figure 11. Mean Hanna phosphate for all Wye citizen science sites in England, shown as a heatmap (left), and as point data alongside EA measurements (right) (2023) (EA 2024a)

Table 15 shows the water bodies that have the highest 3-year average phosphate levels based on citizen science data. Note that Hanna phosphate checkers report concentrations as phosphate (PO_4^{3-}), whereas the EA reports phosphate as phosphate-P in mg/l. To ensure comparability between datasets, Hanna readings have been converted to the EA format by multiplying by a factor of 0.326.

Table 15. Water bodies with the highest average phosphate levels based on citizen science data collected over the last three years.

Water body and Water Body ID	Hanna Readings Phosphate (reactive as PO_4^{3-}) 3-year average mg/l	Converted data: Phosphate (reactive as P) mg/l
Little Lugg – source to conf R Lugg GB109055036720	0.77	0.25
Bodenham Bk – source to conf R Lugg GB109055036740	0.60	0.20
Worm bk – source to conf R Dore GB109055036840	0.56	0.18

There are two EA monitoring sites, situated on the Withington Marsh Brook and Tarrington Brook, which consistently produce lab results for phosphate that are much higher than the mean phosphate levels obtained from citizen science data, although there are currently no citizen science monitoring points situated on the latter water body.

Citizen scientists also sample for nitrate, turbidity, temperature and conductivity, and they make visual observations of flow, water level and signs of pollution. These are useful parameters for giving a broad picture of water body health that can add to other evidence sources to aid in decision-making.

Regulation

Environmental Permitting

The Environmental Permitting (England & Wales) Regulations 2016 is a mechanism for controlling activities that release emissions to land air and water or waste management. This includes discharges to groundwater or surface waters and includes the recovery to land by landspreading of listed waste materials. It is an offence to cause or knowingly permit the entry of polluting matter to inland freshwaters or coastal waters.

Intensive livestock operations that exceed livestock number thresholds require an installations permit under the Environmental Permitting Regulations. Permits cover such aspects of farm operation such as waste management, emissions control, and overall environmental impact. Thresholds are as follows:

1. Poultry: More than 40,000 places for poultry.
2. Turkeys: More than 11,500 places for turkeys.
3. Pigs: More than 2,000 places for production pigs (over 30 kg).
4. Sows: More than 750 places for sows.
5. Ducks: More than 40,000 places for ducks.
6. Geese: More than 40,000 places for geese.

2017 BAT (Best Available Techniques) Conclusions Document

The 2017 BAT (Best Available Techniques) conclusions document, formally known as Commission Implementing Decision (EU) 2017/302, was issued under the Industrial Emissions Directive (2010/75/EU). It specifically addresses intensive rearing of poultry or pigs and sets out environmental performance benchmarks and techniques that large-scale livestock operations must follow to minimise pollution. After the UK left the European Union, the 2017 BAT conclusions, originally part of EU law, were retained in UK law.

Until January 2025, 2017 BAT conclusions were only applied in the Wye catchment, however, the requirements have now been extended to all permitted poultry and pig farms across England.

In relation to nutrients in runoff:

- BAT 13 requires operators to monitor total nitrogen and P excreted in manure. This is crucial for understanding nutrient loads and planning appropriate manure management strategies.
- BAT 18 recommends techniques to reduce emissions to soil and water, including appropriate storage and application of manure to minimize nutrient runoff.
- BAT 19 specifically addresses landspreading of manure, encouraging practices that reduce the risk of P leaching and runoff, such as:
    - Avoiding spreading on frozen or water-saturated ground.
    - Incorporating manure into the soil shortly after application.
    - Using precision application techniques (e.g., trailing shoe or injection systems).

When applying for or renewing an installations permit, operators must demonstrate how they will comply with relevant BAT conclusions. The EA uses BAT to set emission limits and operational conditions in the permit.

Farming Rules for Water

From April 2018 all farmers in England have needed to comply with The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018, commonly referred to as the "Farming Rules for Water" (FRfW). The rules were introduced to reduce agricultural pollution and have standardised good farming practices.

The Regulations include eight core rules (Regulations 3-8), summarised below:

1. *Regulation 3* – Fertiliser or manure must not be applied to waterlogged, flooded, snow-covered, or frozen soil.
2. *Regulation 4* – Fertiliser or manure applications must not exceed crop and soil needs and avoid significant pollution risk.
3. *Regulation 5* – Soil testing of cultivated land is required (at least every five years) to inform nutrient applications.
4. *Regulation 6* – Manufactured fertiliser must not be applied within 2 m of watercourses or springs.
5. *Regulation 7* – Organic manure must not be applied within 10 m of watercourses or coastal waters (or 6 m with precision equipment).
6. *Regulation 8* – Organic manure must not be applied within 50 m of a spring, well or borehole.
7. *Regulation 9* – Organic manure must not be stored within 10 m of watercourses or coastal waters or within 50 m of a spring, well or borehole.
8. *Regulation 10* – Land managers must ensure that poaching is prevented within 5 m of inland freshwaters or coastal waters, and that livestock feeders are not positioned on agricultural land within 10 m of inland freshwaters or coastal waters, or within 50 m of a spring, well or borehole.

FRfW are enforced by the EA. In June 2025, updates were made to the Government's statutory guidance on applying the FRfW. These changes were intended to clarify expectations, strengthen enforcement consistency, and address common compliance issues, especially missing soil tests and nutrient plans.

Silage, Slurry and Agricultural Fuel Oil Regulations

Farmers in England must comply with the Control of Pollution (Water Resources)(Silage, Slurry and Agricultural Fuel Oil)(England) Regulations 2010 (SSAFO). SSAFO regulations were first introduced in 1991 and were tightened in 2010, with more stringent rules around the design and maintenance of storage facilities. SSAFO regulations ensure proper storage and handling of silage, slurry, and agricultural fuel oil to prevent leaks and spills.

Nitrate Vulnerable Zones

Most of the Wye catchment in England is designated as a Nitrate Vulnerable Zone (NVZ) (Figure 12). Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. They are established to protect water quality by controlling nitrate levels, which can cause environmental and human health issues if they become too high. The legislation governing NVZs in England is primarily the Nitrate Pollution Prevention Regulations 2015. These regulations implemented the requirements of the EU Nitrates Directive (91/676/EEC) into domestic law. Approximately 55% of agricultural land in England is designated as NVZs.

Farmers and land managers in NVZs must follow specific rules to reduce nitrate pollution. This includes managing the use of nitrogen fertilisers and organic manures and implementing measures to prevent runoff and leaching into watercourses. Key requirements include limits on the amount of nitrogen fertiliser that can be applied to crops and grassland, designated periods during which the application of nitrogen fertilisers is prohibited, requirements for the storage of organic manure to prevent nitrate leaching, and the keeping of detailed records of fertiliser and manure applications.

Until recently only 2.3% of the area of Wales was covered by an NVZ. The Welsh Government introduced an all-Wales NVZ designation under the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021. These regulations replaced the previous Nitrate Pollution Prevention (Wales) Regulations 2013, making the entire country subject to NVZ rules.

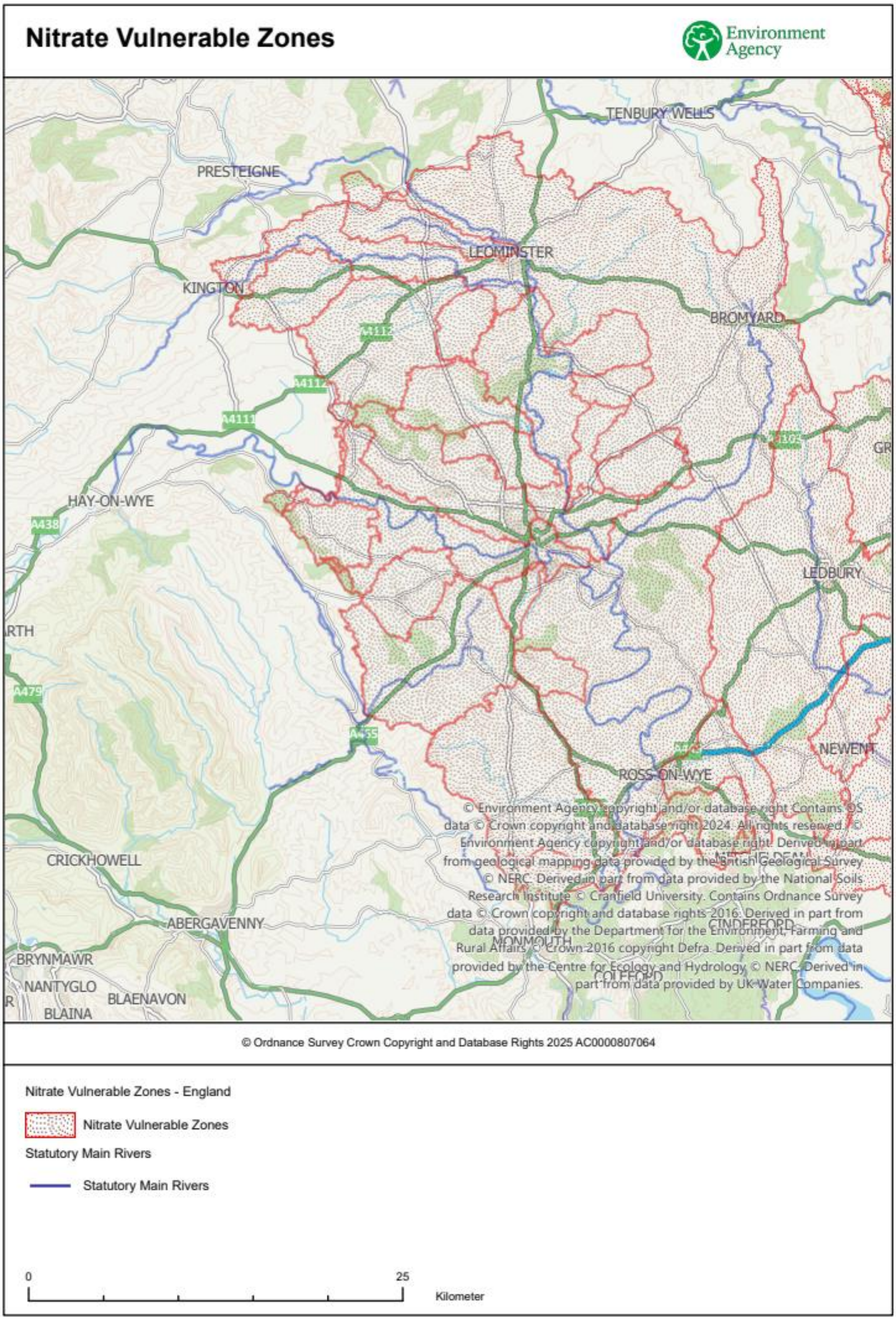

Figure 12. Nitrate Vulnerable Zones in the Herefordshire and surrounds.

Sludge Use in Agriculture Regulations

The application of sewage sludge (biosolids) to agricultural land in England is currently governed by the Sludge (Use in Agriculture) Regulations 1989. These regulations require that both the sludge and the receiving soils are tested for contaminants such as heavy metals, and that records are kept of where and how much sludge is applied.

Also, water companies operating in the region are active participants in the industry-led Biosolids Assurance Scheme. The scheme is a voluntary certification scheme that sets standards for the safe and sustainable recycling of biosolids to land. It includes requirements for treatment, testing, record-keeping, and environmental protection.

Farm Inspections

Farm inspections are undertaken by the EA in England. They focus on enforcement of FRfW, NVZ rules, and SSAFO regulations. The EA takes a proportionate, risk-based approach to regulation, as set out in the Regulators' Code. This is in line with the Government's expectations of the EA. EA farm inspections are advice-led, and the EA normally only takes further action where farmers repeatedly fail to take necessary action. If advice is not heeded, sanctions may include civil penalties, cautions or prosecutions, in line with the EA's Enforcement and Sanctions Policy.

The River Wye catchment in England is a priority for EA regulatory teams and in recent years there has been an expansion in the number of farms being inspected. In 2020, additional funding from the Agricultural Regulatory Taskforce programme enabled the EA to increase the number of full-time agricultural inspection officers. Between April 2022 and February 2023, for example, more than half of all farm inspections carried out by the EA across the West Midlands took place in the Wye catchment, mostly focussed on high-risk locations, previously non-compliant farms, and farming sectors of greatest concern.

As of mid-March 2025, the EA had carried out 153 farm inspections in the Wye catchment during the 2024/25 reporting year, including 34 inspections of permitted poultry sites. Overall, these inspections resulted in 379 actions across 125 farms, with the most common issues relating to nutrient management planning, soil testing, and manure storage. At the time of reporting, 173 actions had been completed and 206 remained in progress. Enforcement responses were issued in 57 cases where non-compliance required further regulatory intervention.

During the 2025-2026 reporting year, the teams will use intelligence gathered from Project TARA (Testing Approaches to Regulation of Agriculture) to conduct comprehensive assessments of infrastructure and soil and nutrient management practices at some sites, including farms growing high-risk crops, poultry farms and anaerobic digestor sites. Dedicated resources have been allocated to inspections of intensive pig, poultry and dairy farms, and for responding to pollutions reports received via the Incident Communication Service.

Drinking Water Protection Designations

There are Drinking Water Surface Water Protected Areas (DrWPAs) on the water bodies of the River Lugg between Presteigne and Leominster (GB109055037113), the Wye between Bredwardine and Hampton Bishop (GB109055037113), and two in the vicinity of Symonds Yat and Monmouth (GB109055037111, GB109055029670). Additionally, much of the land adjacent to the Rivers Wye, Lugg and Frome are included in the Herefordshire Middle Wye Surface Water Safeguard Zone (SgZ) (SWSGZ2104) (Figure 13). There are no groundwater SgZs in the catchment. There are also a number of Groundwater Source Protection Zones (SPZs) within the English portion of the catchment (Figure 14).

DrWPAs are statutory designated water bodies identified under the WFD where water is abstracted for human consumption. Their aim is to protect raw water quality and reduce the need for treatment.

SgZs are non-statutory designated areas within or around DrWPAs aimed at protecting the quality of drinking water sources from pollution. They are created when a DrWPA is identified as being at risk of failing to meet drinking water standards. Within SgZs, specific actions and measures are implemented to address potential sources of pollution. This can include regulating land use practices, managing agricultural runoff, and monitoring water quality. While SgZs are non-statutory, they often come with guidelines that landowners and farmers must follow to minimise pollution risks, especially regarding the use of fertilizers and pesticides.

SPZs are spatially defined based on hydrogeology to prevent pollution reaching groundwater sources such as wells, boreholes and springs that are used for drinking water supply. These are also non-statutory designations but are used in land use planning decisions for long-term pollution prevention.

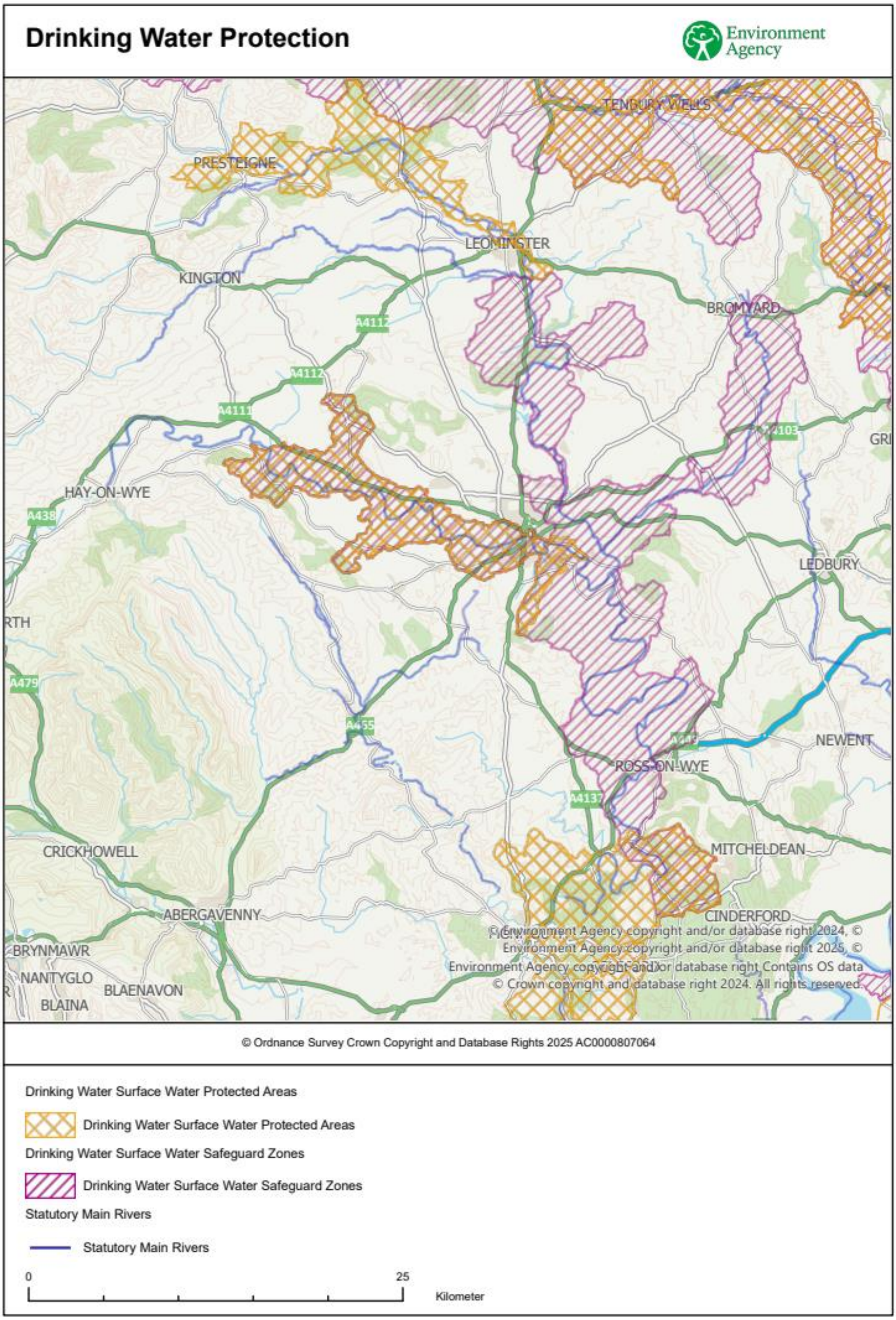

Figure 13. Drinking Water Protected Areas and Safeguard Zones in the vicinity of the English Wye catchment.

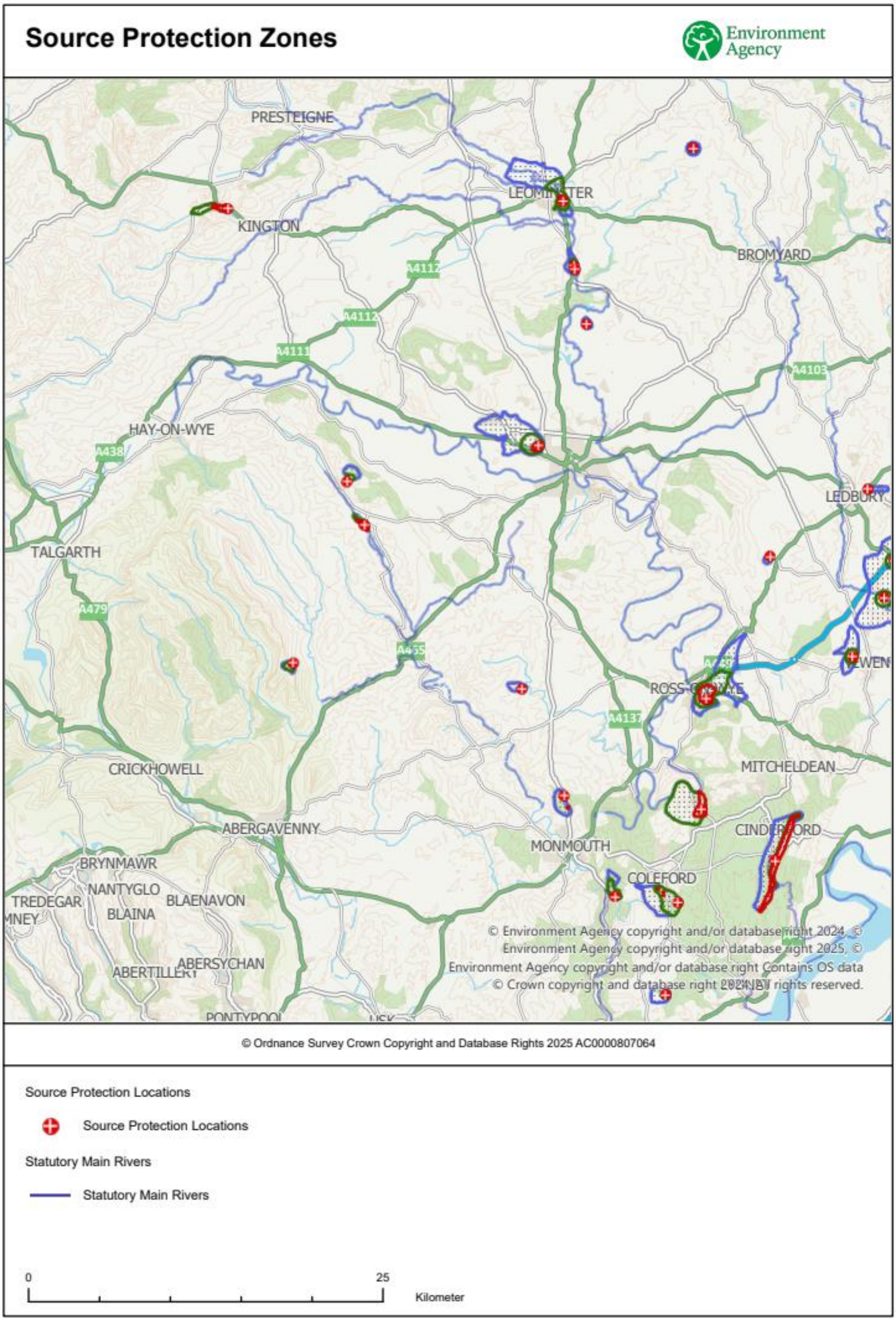

Figure 14. Source Protection Zones in the vicinity of the English Wye catchment.

Special Nature Conservation Order

There are also civil actions under regulatory regimes that can be utilised to protect the Wye. Where damage is occurring a Special Nature Conservation Order (SNCO) and follow-up Stop Notice could be utilised. These are powers held by NE, providing a strict, regulatory way of stopping damage to a protected European site. They can be used to limit activities both on and near to a European site (SAC or SPA). A SNCO Stop Notice would need to be applied to a specific action and requires approval by the Secretary of State.

Regulatory Reform

In April 2025, Defra published the results of the Corry Review into Defra's regulatory landscape. Amongst the findings was Recommendation 12: "*Defra should swiftly develop plans to reform slurry application and storage to help address diffuse water pollution from agricultural sources. This is likely to involve changing the Farming Rules for Water and wider regulations relating to slurry application and storage. This should aim for a single set of regulations which farmers can understand and comply with*".

In May 2025, at a session of the House of Lords Environment and Climate Change Committee's enquiry into the efficient use and management of nitrogen, Emma Donnelly, Defra's deputy director for international nature, climate and development, and Emma Hardy, water and flooding minister, advised that Government had plans to reform farming regulations and update FRfW. Updated statutory guidance on the Farming Rules for Water was issued in June 2025.

Alongside these developments, the Independent Water Commission chaired by Sir Jon Cunliffe concluded its review of water sector regulation. Published in July 2025, the Cunliffe Review made 88 recommendations to improve regulatory coherence, strengthen oversight, and enhance environmental outcomes. Key proposals included the creation of a single integrated regulator for England, stronger regulation of abstraction of water, sludge, and water quality, and the establishment of regional systems planners to lead planning and investment. The recommendations address point and diffuse pollution, with implications for how regulation, enforcement, and planning are coordinated across sectors.

Advice

Catchment Sensitive Farming

Catchment Sensitive Farming (CSF) is a Defra-funded programme delivered in partnership by NE, the EA, and the Forestry Commission. It plays a vital role in reducing agricultural pollution and has benefited from increased investment in recent years.

CSF provides confidential, tailored advice and support to farmers, alongside access to grants that help protect water, air, and soil quality. Services include one-to-one on-farm visits, nutrient and soil management advice, infrastructure assessments, and slurry and water management planning.

CSF also supports the delivery of actions under both existing and new ELMs. It helps farmers understand regulatory requirements and access funding to implement improvements that benefit the environment.

By offering locally targeted advice, CSF enables farmers to adopt best practices in:

- Nutrient, slurry, and manure management
- Soil health and erosion control
- Ammonia reduction
- Farm infrastructure and machinery
- Pesticide handling
- Natural Flood Management

Since 2015, CSF has engaged with over 980 farms across the English Wye catchment, resulting in nearly 12,000 tailored recommendations (Figure 15). Of these:

- 36% focused on nutrient management
- 27% addressed farm infrastructure
- 24% related to soil and land management
- The remainder covered pesticide use and livestock management

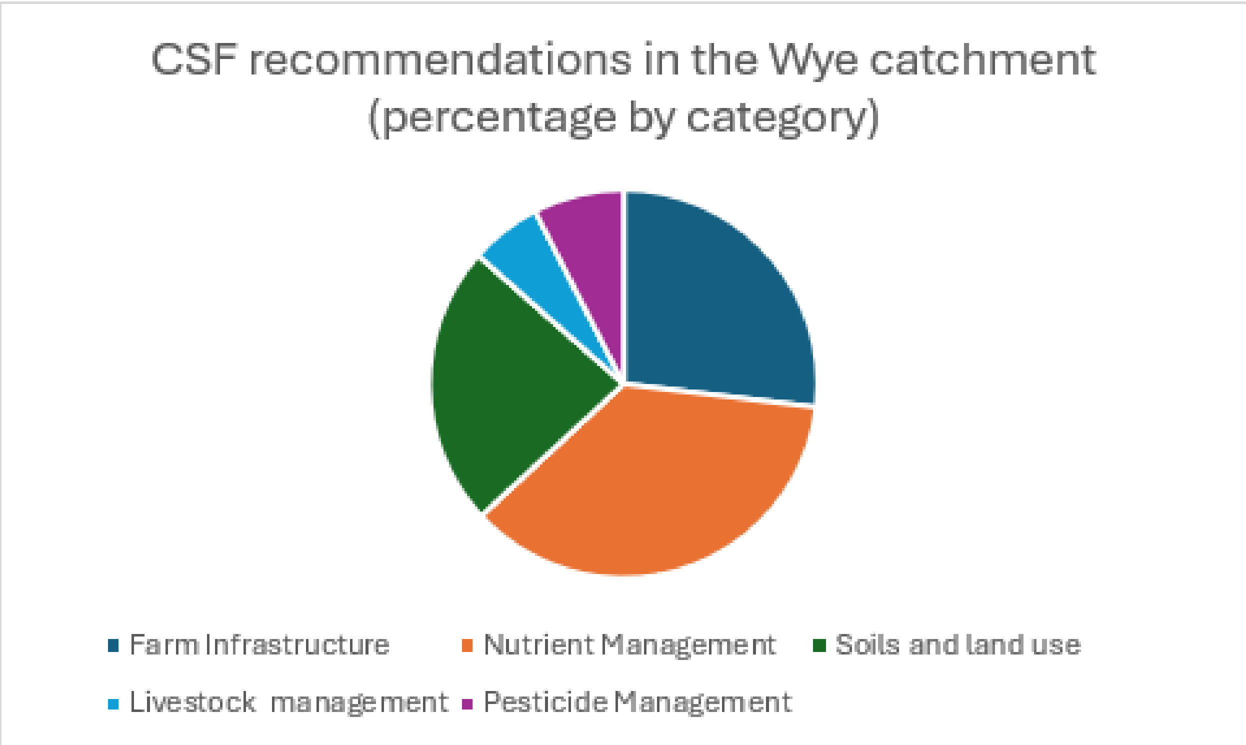

Figure 15. CSF recommendations in the Wye catchment, England – percentage by category.

The Lugg catchment has seen particularly high engagement, with 614 farms (62% of total contacts) receiving support. This has led to over 1,200 nutrient management recommendations in the past decade.

A total of 935 farms have received one-to-one visits during this timeframe, and 279 have attended CSF events. These events have covered topics ranging from soil health and nutrient management, to adapting maize and livestock systems for environmental benefit. Just over half of these holdings are located within the Lugg catchment.

CSF advisers have increasingly provided broad and integrated support, including detailed guidance on the full range of Countryside Stewardship Mid Tier options during the period they were available. These options supported multi-year management agreements and capital items aimed at delivering wide-ranging environmental benefits. CSF advice often goes beyond water and air quality, encompassing wider nature recovery goals, practical land management solutions, and support across multiple environmental themes. This breadth of support has made CSF visits a comprehensive source of farm advice.

Natural England Farm Advice

NE provides a broad range of advisory services to farmers and land managers, with a focus on supporting nature recovery, habitat creation, and the management of protected sites such as SSSIs. This advice is tailored to help landowners enhance biodiversity, improve ecological connectivity, and manage land in ways that contribute to regional and national environmental goals.

The service plays a key role in supporting applications to Countryside Stewardship Higher Tier (CSHT) agreements, where NE advisers help design and assess land management plans for complex or environmentally sensitive sites. It also includes guidance on delivering biodiversity net gain, ensuring that developments and land use changes result in measurable improvements to biodiversity.

This advisory support often involves strategic, site-specific ecological planning. It is particularly relevant for landowners managing designated habitats or engaging in landscape-scale conservation initiatives.

Code of Good Agricultural Practice

The Code of Good Agricultural Practice (COGAP) provides guidance for farmers and land managers on how to protect the environment while carrying out agricultural activities. Some key aspects are:

Manure Management: COGAP offers detailed advice on the storage, handling, and spreading of manure to minimise the risk of water pollution. This includes guidelines on the timing and methods of spreading to reduce nutrient runoff.

Soil Management: It emphasises the importance of maintaining soil health through practices like crop rotation, cover cropping, and reduced tillage. Healthy soils are better at retaining nutrients and water, reducing the risk of erosion and pollution[1].

Water Protection: The code includes measures to protect watercourses from contamination by agricultural activities. This involves creating buffer zones, managing field drainage, and ensuring that livestock are kept away from water bodies.

Nutrient Management: COGAP advises on the efficient use of fertilisers and organic manures to match crop needs, thereby reducing the risk of nutrient leaching into watercourses.

Pesticide Use: It provides guidelines on the safe and effective use of pesticides to minimise their impact on the environment and human health.

Wildlife and Biodiversity: The code encourages practices that support wildlife and biodiversity, such as maintaining hedgerows, creating wildlife corridors, and protecting natural habitats.

The Nutrient Management Guide (RB209)

RB209 is a nutrient management guide produced by the Agriculture and Horticulture Development Board (ADHB). RB209 provides detailed recommendations on the use of fertilisers and organic materials to optimise crop yields while minimising environmental impact. It includes guidelines on nutrient requirements for different crops, soil testing, and the economic and environmental benefits of efficient nutrient use. It helps farmers make informed decisions about fertiliser application rates and timing to ensure nutrients are used effectively and sustainably.

Sources of Local Advice and Support

Advisory and support work aimed at reducing agricultural sources of pollution to the River Wye is also delivered by catchment partners, including the Wye and Usk Foundation, Herefordshire Wildlife Trust, Herefordshire Rural Hub, and the National Farmers' Union (NFU). These organisations offer a range of services, including technical advice and training, grant support and policy guidance. Other partners also work through Farm Herefordshire, which is a collaborative partnership that supports sustainable farming.

Agri-environment Schemes

Before Brexit, most payments to farmers were in the form of farm subsidies under the Basic Payment Scheme (BPS). While primarily area-based, BPS also required compliance with basic environmental standards through Cross Compliance and Greening rules, which linked payments to practices like crop diversification and reserving parts of farmland for nature-friendly features such as hedgerows, buffer strips, or fallow land to support wildlife. In 2024, BPS was replaced with a Delinked Payments scheme, paid to help farmers during the transition to new schemes, including ELMs. Delinked Payments are based on historic BPS payments and are reduced each year. They will be phased out completely by 2027.

ELMs (SFI, CSHT and Landscape Recovery) are now the primary programme in the UK aimed at helping land managers implement sustainable practices that deliver environmental benefits like biodiversity enhancement, carbon sequestration and water quality improvement, alongside food production. New and updated ELMs are being rolled out across England. These schemes move away from traditional subsidies tied to agricultural productivity and focus on rewarding the delivery of ecosystem services. This presents opportunities for farmers to enhance environmental outcomes while maintaining or improving farm incomes.

Recent changes to ELMs and Capital Grants include:

- Higher payment rates ("uplifts") for *existing* Higher Level Stewardship (HLS) schemes.
- The SFI was expanded and provided new and higher paying options. New options included no tillage farming, precision farming and spring-sown or summer-sown cover crops. However, the SFI scheme was closed to new applications in March 2025 due to budget exhaustion. Existing agreements remain active, and a revised SFI scheme is expected to be launched in summer 2026.
- A new and larger CSHT offer has been introduced, designed to make it easier to plan and deliver environmental benefits while running resilient, productive farms. NE are developing prioritisation methods to maximise environmental benefits. New CSHT options include *Make Room for the River to Move (CSW12)*, *Connect River and Floodplain Habitats (CSW22)*, and *Manage Riparian and Water Edge Habitats (CSW25)*. CSHT schemes are currently open by invitation only.
- The Capital Grants scheme re-opened on 3 July 2025 and closed by the end of month. New spending caps have been introduced to prioritise smaller farms and high-impact projects. Further funding is expected in 2026.

The following sections provide a more detailed overview of each scheme, including their objectives, eligibility, and how they support environmental outcomes across different landscapes.

Higher Level Stewardship

Higher Level Stewardship (HLS) was an agri-environment scheme designed to support farmers and land managers in delivering significant environmental benefits in high-priority areas. It focused on objectives such as wildlife conservation, landscape enhancement, protection of natural and historic resources, and promoting public access to the countryside. Unlike simpler schemes, HLS involved more complex and tailored land management practices, often requiring expert advice and a detailed Farm Environmental Plan. Entry was competitive and discretionary, with agreements typically lasting ten years and payments varying based on the specific environmental actions undertaken.

The HLS scheme is now closed to new applicants. Current government support is focused on increasing payment rates for existing HLS agreement holders and encouraging new applicants to consider the CSHT scheme.

Sustainable Farming Incentive

SFI is a key component of the ELMs. The SFI offers payments to adopt sustainable farming practices and deliver environmental improvements alongside food production. Supported activities include establishing buffer strips along watercourses, maintaining cover crops to protect bare soil, and managing low-input grasslands that reduce fertiliser use. The scheme also supports nutrient management planning, encouraging more precise application of fertilisers to match crop needs and minimise excess. Improving soil health is another priority, as healthier soils are better at absorbing water and retaining nutrients, reducing the risk of pollutants being washed into nearby water bodies. These practices benefit water quality and contribute to flood mitigation and drought resilience.

SFI agreements typically last three years, offering flexibility and annual entry points. Although new applications are suspended, existing agreements continue, and a refreshed offer is expected in 2026.

Countryside Stewardship Higher Tier

CSHT is a targeted scheme that supports farmers and land managers in delivering complex and ambitious actions to maintain, restore and create habitats. It focuses on protecting and enhancing high-value habitats, historic sites, and landscapes, including floodplains, peatlands, woodlands, wetlands, moorlands, and SSSIs. Agreements are tailored and can last 5 to 20 years, depending on the actions chosen. CSHT includes both revenue-based land management actions and capital grants for infrastructure or habitat creation.

Due to budget and resource constraints, entry to the scheme is currently by invitation only. Pre-application advice provided by NE or the Forestry Commission to ensure that applicants select the most suitable actions for their land and environmental goals. The EA also supports applicants with preparation of feasibility studies for more complex water-related schemes, including river restoration.

Landscape Recovery

Landscape Recovery is the highest tier of ELMs. The scheme was launched in 2022 and invites groups or individuals to make long-term (20 years or more) landscape-scale environment improvement across areas greater than 500 ha. Unlike the other elements of ELMs, Landscape Recovery enables groups of land managers to work collaboratively to design connected, bespoke schemes that include a blend of public and private finance. There are two Landscape Recovery projects in the Wye catchment, Ridge to River and Wyescapes; Food, Nature, Water. Both are from Round 2 and currently in a project development phase.

Ridge to River involves 25 landholders and tenants covering over 3,000 ha. It aims to improve the condition of Moccas Park, The Flits and River Wye SSSI by creating and connecting wildlife habitats, farm more sustainably to reduce emissions and nutrient losses and increase carbon storage and to improve management of woodland and parkland. Many rare species have been targeted such as beetles, soldier flies, crane flies, snail flies, willow tit, lapwing, skylark, curlew, cuckoo and numerous lichen species.

Wyescapes; Food Nature, Water comprises 49 land holdings covering more than 5,000 ha along the main corridors of the Lugg and Wye rivers, spanning Herefordshire from

Leominster in the north to Symonds Yat in the south, acting as a collective to restore the Wye, recover habitats and species while producing high quality food and produce. Participating farmers are working to identify actions they can make to restore the river corridor, including reduced nutrient use, reverting high risk fields from arable cropping to grassland, creating new wetlands, floodplain meadows and woodlands. Wyescapes; Food, Nature and Water aims to increase the area of habitat and wildlife sites, enhance connection by creating corridors between habitats, create new habitats and enhance the condition of existing priority habitats. In addition, the project seeks to enhance access and engagement through creating new access routes, increasing accessibility to more user groups, enhancing understanding and engagement with the farmed landscape and opportunities to get involved in monitoring.

During the development phase, the EA is the lead support for Wyescapes; Food, Nature and Water, while NE is leading for Ridge to River. Implementation will be shaped by the coordinating body (i.e., the Single Legal Entity) and land managers. Nationally, the EA will work with Defra on monitoring and evaluation for all Landscape Recovery projects, including evaluation of water quality improvements. FARMSCOPER will be used to calculate pollutant load reductions and environmental benefits of the interventions using baseline and forecast data collected by Defra from each of the projects.

Capital Grants

Capital Grants provide funding to farmers, land managers, and woodland owners to support environmental improvements and infrastructure. They are part of the Countryside Stewardship and ELMs. The grants cover:

- Woodland Tree Health (WTH): Supports restoration of woodlands affected by disease.
- Capital and Management Plans: Outline how capital items (e.g., fencing, tree planting) will meet environmental goals; often required for CSHT.
- Protection and Infrastructure: Funds works like fencing, tracks, and water supplies to protect habitats and reduce erosion.
- Higher Tier Capital Grants: Three-year agreements for capital works on high-value environmental sites, requiring consultation with NE or the Forestry Commission.

For 2025–2026, funding caps apply: £25,000 each for water and air quality, and NFM; £35,000 for boundaries, trees, and orchards. These limits don’t apply to WTH, Capital or Management Plans, or Higher Tier grants.

CSF advisers play a key role in approving grants related to water and air quality, ensuring alignment with local environmental priorities.

The scheme has been very popular and over 50% of available funding had been allocated within three weeks of opening in July 2025. Further improvements to the scheme are planned and a new round is expected to open in 2026.

Farming Investment Fund

The Farming Investment Fund is a government initiative designed to support farmers, growers, and foresters in improving productivity, sustainability and animal welfare. It includes several schemes, including a Farming Equipment and Technology Fund and Slurry Infrastructure Grant, both of which offer funding to help farmers manage and store slurry more effectively.

Partnerships and Collaboration

Collaboration is a key component of efforts to protect and improve the River Wye catchment. A wide network of agencies and organisations work across the catchment and on both sides of the Welsh and English borders. NE and the EA work with NRW on regulation, monitoring, and strategic planning. The NFU, local government (especially Herefordshire Council) and local and regional groups, including the Wye and Usk Foundation, Wye Valley National Landscape, Friends of the River Wye, the Herefordshire Rural Hub, Herefordshire Wildlife Trust and other environmental groups, organisations and trusts add further capacity through community engagement, habitat restoration, and targeted advice. Other partners, such as Welsh Water, fisheries groups, citizen scientists, and recreational river users, including anglers, canoeists, and wild swimmers, also play important roles in their respective areas, improving sewage treatment and water quality, helping restore natural river processes, gathering data, and raising awareness to inform future conservation strategies.

The Catchment Based Approach and the Wye Catchment Partnership

The Catchment Based Approach (CaBA) is a national initiative supported by Defra and the EA, aimed at improving the catchment health through collaborative, locally-led partnerships. It has played a key role in addressing sediment and nutrient pollution across the country.

In the Wye catchment, CaBA is delivered through the Wye Catchment Partnership (WCP), which was established in 2014. This cross-border partnership, covering both England and Wales, brings together a wide range of stakeholders, including environmental organisations, government bodies, farming groups, water companies, local businesses, and individuals with a shared interest in the river's health. Herefordshire Council has recently taken on the role of host and secretariat for the WCP, succeeding the Wye and Usk Foundation.

The WCP works to coordinate and deliver practical actions that improve water quality, restore habitats, and build resilience to flooding and drought. These include measures to reduce phosphate and sediment runoff, enhance riparian habitats, and support sustainable land management. To this end, the WCP is working toward the development of an overarching Wye Catchment Management Plan (CMP) that will provide a strategic framework to guide future efforts, align priorities, and support integrated catchment management across the Wye catchment. The CMP will be an evidence-led document to address the following issues:

- *Flood and Droughts* – The increasing frequency of high and low flows, elevated water temperatures, compounded by human activity.
- *Water Quality* – Its various influencers including but not limited to, excess nutrients, sediment, pesticides, herbicides and pH.
- *Biodiversity Loss* – Decline in species abundance & distribution, loss of habitat and connectivity, invasive non- native species.
- *Geomorphological Limitations* – Brought about by human activity including weirs, overgrazed channels, channel straightening and restricted sediment supply.

The CMP will be informed by a participatory systems mapping exercise and modelling from the EA-funded Understanding the Wye Catchment Project. Funding has been secured to support the development of the updated CMP, with tenders expected to be published in autumn 2025.

Nutrient Management Board

The Wye Nutrient Management Board (NMB) is a cross-sector forum established to address nutrient pollution in the River Wye catchment (England and Wales), particularly the high levels of phosphate affecting the river's ecological health. While it holds no formal powers, the NMB plays a key advisory and influencing role, bringing together stakeholders from government agencies, farming groups, water companies, and environmental organisations. Its main functions are to influence decisions, advise statutory bodies, and challenge actions that impact the catchment.

The River Wye Statutory Officers Group is a related body made up of officers from statutory bodies with responsibilities within the Wye catchment. Its purpose is to reach agreements on how they will collectively use their powers and resources to improve the catchment condition. It includes representatives from the EA, NE, NRW, Local Authorities and Welsh Water.

In early 2025, the board appointed Dr Louise Bodnar to specifically represent the interests of the River Wye, and to vote on behalf of the River in Board decisions.

Engagement HQ Website

The EA uses its Engagement HQ website to share detailed, up-to-date information about the River Wye and its catchment. This online portal is designed to improve transparency and public engagement by making environmental data and monitoring results accessible to a wide audience. It includes summaries of water quality monitoring, ecological surveys, and updates on the agency's actions in the catchment.

The platform features data from a range of sources, including automated sondes, autosamplers, remote sensing, and citizen science. These tools help track key indicators like phosphate levels, algal blooms, and biodiversity. Engagement HQ also hosts seasonal reports, such as the Wye Growing Season Monitoring Summary, which outlines trends and findings from the latest fieldwork. By centralising this information, the EA aims to support evidence-based decision-making and foster collaboration among stakeholders working to improve the health of the Wye.

Agri Food Supply Chain Project

The Agri Food Supply Chain Project is a key initiative under Project TARA (Testing Approaches to Regulation of Agriculture), aimed at reducing nutrient inputs, particularly P, into river catchments from diffuse agricultural sources. It complements conventional environmental measures by focusing on collaboration across the food supply chain.

The project is being piloted in the West Midlands, with a strong emphasis on the River Wye catchment. It targets specific agricultural sectors, including poultry, potatoes, and energy crops, with plans to expand into dairy, horticulture, beef, lamb, and combinable crops.

The project treats nutrient pollution as a “food systems problem”, requiring a comprehensive understanding of nutrient flows into and out of catchment. Engagement with stakeholders across the supply chain has shown positive results in reducing agricultural nutrient loads.

Many of the project’s actions are being delivered through the Wye Agri Food Partnership, with links to the EA’s National Agri Food Working Group. This ensures coordinated efforts and consistent messaging across the supply chain, involving supermarkets, processors, farm assurance bodies, investors, universities, and government departments.

Poultry Sector Actions (Broilers)

The EA works closely with the poultry sector, through the Wye Agri Food Partnership to identify issues and develop solutions for the reduction of nutrients from poultry manure. The Agri-food Supply Chain Project has been actively working with the poultry broiler sector in the Wye Catchment since December 2022. This work led to the development of a Sustainable Poultry Roadmap, and the launch of a pilot programme managing poultry manure use across 30 sites.

As part of this effort, around 75,000 tonnes of poultry manure from Avara Foods are now being exported out of the Wye Catchment. This has significantly reduced the surplus of P in the catchment and helps prevent potential over-application in sensitive areas.

A digital portal was created to track manure movements from source to destination, ensuring transparency and accountability. The portal also includes detailed nutrient management plans to ensure manure is applied according to crop needs. An auditing mechanism is being developed to build trust among stakeholders and verify compliance. To prevent environmental impacts in receiving areas, mapping tools are being used to monitor water body catchments outside the Wye. These tools will be shared with relevant authorities and stakeholders. The portal system is intended for broader use across the poultry sector and potentially other agricultural sectors. While manure export is a short- to medium-term solution, the project is also exploring long-term strategies for phosphate treatment and recovery.

Overall, the initiative supports more sustainable practices in the poultry sector, aiming to reduce environmental impact while maintaining agricultural productivity.

Poultry Sector Actions (Free Range)

Further engagement with the poultry sector has identified several environmental challenges and opportunities for improvement. A key focus has been on drainage issues at free-range poultry sites, particularly the risk of nutrient-rich runoff from veranda and yard areas impacting on surface water and field drainage systems. Discussions have addressed manure storage and the potential use of constructed wetlands. EA agricultural specialists have led conversations with national regulatory colleagues to clarify legal and practical considerations, and guidance has been shared with the sector. The specialists are also working to develop guidance that will improve understanding of the environmental standards required for free-range poultry sites more broadly.

Clarification of Bird Numbers

Establishment of a poultry sector sub-group has enabled greater clarification and confidence concerning the number of poultry places in the Wye. Information on poultry places was requested through the sector group to compare numbers against estimated values. A figure of 23 million bird places in the Wye catchment (England and Wales combined) at any one time is the updated value that will be used in catchment investigations going forward.

This figure reflects both regulated (permitted) and non-regulated poultry operations. While regulated sites are documented through environmental permitting, non-regulated sites, typically smaller and below permitting thresholds, are harder to quantify and often rely on industry estimates or local intelligence. The sector group's input has helped improve confidence in the overall estimate, though some uncertainty remains due to the dynamic nature of the industry and limitations in data coverage.

Potato Sector Actions

The Agri Food Supply Chain Project has been actively engaging with potato growers, packers, and processors to promote more sustainable farming practices. A major initiative was the Sustaining Soils Project, which was funded through the Water Environment Improvement Fund. The project focused on soil erosion and risk mapping in the Garren Brook and Gamber Brook sub-catchments of the Wye OC. In the Arrow Lugg and Frome OC, collaborative work is under way addressing nutrient runoff and flood risk in the Tippets Brook catchment, where recent flooding has impacted local infrastructure. Strategies are being developed to identify high-risk fields and implement interventions such as water attenuation and storage.

The project is also promoting practices that build soil organic matter and improve soil health across the rotation cycle. Healthier soils support better water infiltration and storage, and enhance the uptake efficiency of legacy P. Several sustainable farming practices are being trialled through ongoing discussions with sector partners. These include:

- Financial incentives for implementing soil and nutrient management plans tailored to crop variety.
- Planting into land with established cover crops to avoid bare soil.
- Participation in carbon footprint and energy reduction schemes.
- Bonus payments for ecological enhancements, such as nectar and wildlife mixes.
- Penalties for failing to establish a follow-on crop within 28 days of harvest.

The EA is also working with local business networks to explore funding and support mechanisms for these initiatives, and there are plans to hold a sector-wide event that will bring together growers, packers, and processors, linking soil risk mapping with practical solutions for wider adoption.

Energy Sector Actions

The Agri Food Supply Chain Project is engaging with the energy crop sector to promote more sustainable farming practices, particularly in relation to the increasing cultivation of maize. Maize production for AD has grown significantly across England and Wales over the past decade, including in the Wye catchment.

To address the environmental impacts of this trend, the project is working with agronomists, growers, and regulatory colleagues in the EA to encourage the adoption of sustainable maize-growing practices. These include:

- Careful site selection using soil risk assessment tools.
- Choosing early-harvest maize varieties.
- Using cover crops, including under- and over-sowing techniques.
- Implementing soil and nutrient management plans tailored to crop needs.

A maize growers' group has been established under the Wye Agri Food Partnership to share knowledge and best practices. This group includes growers producing maize for both energy and livestock feed, helping to align sustainability efforts across sectors.

The project is also exploring how the energy sector can contribute more broadly to the promotion of sustainable farming practices for energy crops, ensuring that environmental impacts are minimised as demand continues to grow.

UK Food and Drink Pact (formerly Courtauld 2030) Collective Action Project

This initiative is led by WRAP (The Waste and Resources Action Programme), with support from the Wye and Usk Foundation and input from the EA through the Agri-food Supply Chain Project.

One of the Pact's three core goals is to ensure that 50% of all fresh food is sourced from areas practicing sustainable water management, including the Rivers Wye and Usk. This includes promoting sustainable soil and nutrient management practices across agricultural supply chains.

Over 100 organisations, including food and drink businesses, sector bodies, trade associations, charities, and NGOs, have committed to improving water quality, availability, and resilience through the UK Food and Drink Pact Water Roadmap.

A major output of this work has been the development of "Recommended Key Practices" for eight agricultural sector groups. These practices are designed for both retailers and supply chain businesses operating in the catchments and focus on reducing diffuse agricultural pollution. Key actions include avoiding the application of surplus nutrients, minimising nutrient and sediment losses, and protecting watercourses, especially during extreme weather events when losses are harder to control. The recommendations were shaped through extensive stakeholder engagement, with technical input from the EA via the Agri-food Supply Chain Project.

It's important to note that these are recommendations, not mandatory requirements. Further work is needed to explore how they can be implemented in practice and to identify and address any barriers to adoption.

This work is coordinated through the Wye Agri Food Partnership roundtable, which ensures a consistent and effective approach to delivering supply chain outcomes across both the English and Welsh parts of the Wye Catchment. The model also has potential for replication in other catchments beyond the Wye.

Voluntary Quality Assurance Schemes

Industry-led Quality Assurance Schemes such as Red Tractor play a role in promoting sustainable and environmentally responsible farming practices. These schemes set standards for food safety, animal welfare, environmental protection, and traceability across the supply chain. Red Tractor certification, for example, requires compliance with rules on slurry and manure management, promotes buffer zones and soil protection measures, and is subject to audits and inspections, providing an additional layer of accountability and continuous improvement.

Funding

Water Environment Improvement Fund

The Water Environment Improvement Fund (WEIF) is a UK Government initiative, delivered by the EA, aimed at enhancing the quality of water bodies across England.

The Local Water Environment Grant is the current delivery mechanism for the WEIF. It enables the EA to provide targeted partnership funding to local authorities and environmental partners for projects that improve the water environment, aligned with priorities in the EA Environment Programme Team Medium Term Plan.

WEIF projects contribute to tackling WFD pressures by enabling effective collaboration among government bodies, local authorities, landowners, environmental organisations, farmers, academia, businesses, and water companies. Through these catchment-based partnerships, projects are developed and delivered to improve water quality, enhance biodiversity and often provide wider benefits such as flood risk reduction and access to additional funding streams such as SFI.

In the 2024-2025 financial year, there were seven WEIF partnership projects in the Wye catchment, with total funding of £271,999:

- Restoring our Rivers – Herefordshire Wildlife Trust.
- Soils, Nutrients and Compliance (SNAC) – Herefordshire Rural Hub.
- Wye – P on the Arrow Project – Wye and Usk Foundation.
- Wye Lugg Agroforestry – Wye and Usk Foundation.
- Sustaining Soils – Wye and Usk Foundation.
- Rooting for Better Soils – Herefordshire Meadows.
- CaBA – Wye Catchment Partnership.

These projects have supported improving the water environment through a variety of measures, including:

- NbS to reduce diffuse pollution and the impact of climate change
- Supporting Herefordshire farming compliance through education and farm nutrient balances
- Supporting land use change to reduce diffuse pollution, sediment loss and enhance natural capital for future farming
- Increasing infiltration rates and riparian shading through tree planting and providing meadow habitat.
- Applying a risk-based mapping approach to support targeted environmental improvements

Flooding and Coastal Erosion Risk Management

Funding is available through the EA for Flooding and Coastal Erosion Risk Management, including NFM projects, in both urban and rural areas. These schemes support a range of interventions, from engineered flood defences to NbS such as wetland creation, leaky dams, and riparian buffer zones. Flood mitigation projects often deliver ancillary benefits, including reductions in sediment and nutrient loads in receiving water bodies, improved habitat connectivity, and enhanced climate resilience. Opportunities for co-delivery with water quality objectives are increasingly being recognised and supported through integrated catchment planning.

An example of this integrated approach is the Herefordshire Council NFM Project, funded through EA Local Levy and Grant in Aid. Operating across seven priority sub-catchments, it delivers NFM interventions such as leaky dams, wetland creation, and improved soil management, with benefits for flood mitigation, water quality, and soil health.

£15 million Farming Futures Research and Development Nutrient Management Fund

The £15 million Farming Futures Research and Development Nutrient Management Fund is a major UK-wide investment designed to support innovative solutions in nutrient management that provides a potential funding stream for research activity. Delivered through the Farming Futures programme by Innovate UK in partnership with Defra, the fund provides grants for projects aimed at enhancing the efficient use of nutrients, boosting crop yields and reducing environmental impacts like nutrients in runoff and soil erosion. The competition is divided into two strands, one for feasibility studies and another for industrial research, to encourage collaborative projects that tackle nutrient management challenges in both livestock and cropping systems.

Investigations and Research

A significant volume of research has been undertaken in the catchment in England since the 2014 NMP was produced. Major initiatives are outlined below.

RePhoKUs

RePhoKUs (Re-focusing Phosphorus Use in the UK Food System) was a collaborative research project between Lancaster University, the University of Leeds, Agri-Food and Biosciences Institute, University of Technology Sydney, UK Centre for Ecology and Hydrology, and the N8 AgriFood Programme. It aimed to make P use in the UK food system more efficient, sustainable, and resilient.

Several RePhoKUs-related projects have been undertaken in the Wye catchment. These are known as RePhoKUs phases 1, 2, 3a and 3b.

Phase 1: Re-focusing Phosphorus use in the Wye Catchment

In 2021/22, Lancaster University's RePhoKUs team investigated P management in the Wye catchment, examining P inputs and outputs, their impact on water quality, and how stakeholders are responding to the challenge of improving P sustainability while maintaining productive agriculture. The study highlighted the catchment's high risk of P loss due to intense input pressures and poorly buffered soils, where fluctuating pH levels can mobilise soil-bound P, increasing the risk of leaching into waterways.

Substance flow analysis models used in the report (Withers at al. 2022) showed that the largest P import into the catchment is in livestock feed, with poultry feed being a significant contributor. The largest internal flow of P is in livestock manure, with poultry manure being a significant component. Poultry farming has expanded rapidly in the Wye catchment in recent years. As a result, poultry have overtaken cattle as the main producer of manure P in the Wye catchment. The total manure P production from poultry alone exceeds the requirement for P by cropland and grassland in the catchment by a wide margin. This excess P is accumulating in catchment soils, adding to the already substantial legacy soil P reserves.

Some figures in the report have been updated, although these have not been published. The new figures use revised livestock diet data for the broiler industry (less P in feed) and include significant manure exports (75% of broiler manure produced in the catchment) from the catchment under Avara's Sustainable Poultry Roadmap. Based on updated figures, the Wye catchment imports around 5,700 tonnes of P in feed and 1,200 t/yr in fertiliser annually, with a catchment food system efficiency of 65%. On balance, the catchment has an annual P surplus of around 2,300 t/yr, or 1,800 t/yr when the broiler manure exports are included. The surplus was originally reported as 3,000 t/yr.

A substance flow analysis was also undertaken for a "zero P agricultural balance" scenario that reduced surplus P to zero tonnes and an "agricultural P drawdown scenario" with a P *deficit* of 1,250 t/yr. Theoretically, the large amount of legacy soil P could potentially sustain crop yields for many years without additional P inputs. Reducing soil P levels to a P Index of 2 or lower, would therefore improve sustainability and water quality. In practice, however, this is very challenging and would take some time.

In summary, the RePhoKUs team modelled four scenarios. The revised results were:

1. Current situation (without Avara manure exports) – Surplus 2,300 t P.
2. 75% of broiler manure is exported from the catchment (Avara manure exports): Surplus 1,800 t P.
3. P fertiliser down 80%, manure P down 27% – Surplus 0 t P (legacy P still impacts water quality).
4. Agricultural P drawdown scenario – P fertiliser down 90%. Manure P down 50% (all housed manure): Surplus -1,250 t P.

Each scenario assumes that crop and livestock productivity can be maintained under reduced nutrient application.

The authors concluded that stakeholders show willingness to adopt better P management practices but face challenges like insufficient resources and regulatory support. They recommended improved regulation, financial incentives, and better stakeholder engagement to enhance P stewardship. They noted that improving P sustainability requires that P input pressure is reduced, livestock diets are optimised, excess manure is exported out of the catchment, and technological solutions for manure treatment and P recovery are found.

<u>Phase 2: Soil Phosphorus Status and Water Quality in the River</u>

The EA commissioned the RePhoKUs team to conduct a phase 2 study to research the fate of P in poultry manure and other organic manures in the River Wye catchment, and to understand how changes in land use and P balances may contribute to water quality and the P status in the River Wye catchment. The RePhoKUs team examined three aspects of P in the catchment: variations in the P balance and soil levels, and associated risk to river P in selected Wye sub-catchments; historic trends in land use, livestock numbers, and fertiliser use; and potential future changes in land use and livestock numbers and how they may influence P in the Wye catchment going forward.

This study provided insights into the potential risk associated with nutrient losses to the environment and indications of farming's pressure on the environment and how that may change over time with or without intervention. The research found a build-up of surplus P in the soils, creating a legacy equivalent to 1.86 tonnes per hectare in the arable and productive grassland in the catchment. Only 30-60% of the legacy P input is found in the top 30 cm of soils, suggesting significant migration of P into the subsoil and water. The progressive saturation of P into the soil and its accelerated leakage into water is a major concern.

The report (Withers et al. 2023) highlighted that historical and current P surpluses are due to manure application, particularly from the expansion of the poultry industry. Significant surpluses of P have accumulated in soils. The report suggests that better management practices and potential land use changes are necessary to mitigate P losses to water but maintaining productivity while protecting the environment is challenging. Some scenarios were examined. For instance, converting grassland to cereal crops could reduce P surpluses but increase erosion risks, leading to more P runoff into water bodies. Conversely, converting grassland to maize for AD could exacerbate both P surpluses and losses to water. These scenarios highlight the need for careful management to mitigate negative impacts on water quality.

Phase 3a and 3b

Phase 3 work focussed on P (Olsen-P) sampling in the of the topsoil at depths of 0-15, 15-30, 30-60 and 60-90 cm. Soil samples to 90 cm depth (0-15, 15-30, 30-60 and 60-90 cm) were collected from 60 fields (fifteen farms) located across Wye catchments in England. The farms were all in arable production and/or mixed farming, were receiving variable types of P inputs (fertilisers, poultry manure, pig slurry, cattle farmyard manure, anaerobic digestate) and on a range of soil types (sandy, silty and loamy soils) representative of this part of the Wye catchment.

As expected, soil Olsen-P concentrations decreased down the soil profile, however, there was evidence of P enrichment of the subsoil layers (30-60 and 60-90 cm) on some farms. Migration of P down the soil profile became much more evident once soil Olsen-P levels exceeded P Index 2. Previous soil surveys suggested that 55% of the sampled area in the English part of the Wye catchment have soil Olsen-P concentrations at P Index 3 and above. Subsoil P enrichment is likely to be quite widespread across the English part of the Wye catchment.

In conclusion, the final report from the project (Withers et al. 2025) stated:

"*The results suggest Wye catchment soils in Herefordshire quickly become P saturated when surplus P inputs lead to accumulation of Olsen-P and reinforces the recommendations from the RePhoKUs report* [Withers et al. 2022] *that long-term management actions need to be taken to drawdown soil P levels to reduce the on-going eutrophication risk associated with farming. As suggested in the Phase 1 report, soils may need to be farmed at P Index 1 in the Wye catchment to reduce the eutrophication threat provided this does not unduly affect crop production. This will require fundamental system level change as 76% of the sampled soils in this Phase 3 study exceeded soil P Index 1. Further research is required to assess the potential implications in terms of yield and productivity of reducing soil test P (Withers et al. 2017), and to justify the level of system change required*".

NEW-Harmonica

NEW-Harmonica (Harmonised Nutrient Load Reduction Approaches Within Safe Ecological Boundaries in Catchments Located in North-West Europe) was a project that examined the sources and flows of nitrogen and P in surface and groundwater across three cross-border river basins of northwestern Europe: the Meuse (Netherlands and Belgium), Neagh-Bann (Ireland and Northern Ireland), and the River Wye (Wales and England). The project aimed to support authorities and policy-makers in implementing effective nutrient pollution reduction strategies. Lancaster University carried out the work in the Wye catchment, supported by UKRI grant 10047759.

NEW-Harmonica has published a series of reports and resources, which are available via the project website.

Understanding the Wye Catchment Project

The EA commissioned Mott MacDonald to coordinate a project with the WCP called "Understanding the Wye Catchment". The project had two components:

1. *Systems mapping* – a participatory process that collated knowledge from catchment experts to better understand how the catchment functions
2. *Numerical modelling* – The Water System Integrated Model (WSIMOD) was used to understand the impact of potential interventions identified through the systems mapping exercise.

The catchment system map showed how different activities such as agriculture, housing and tourism interacted with each other via their influence on the river. Insights from system mapping were used to identify what interventions could be made and how the results would combine to create overall improvements across the catchment.

The WSIMOD model assesses water quality and river flows at the water body scale. Five different types of interventions were modelled:

1. Increase in tree cover in the catchment.
2. Decrease in manure and fertiliser application rates in the catchment.
3. STW upgrades.
4. Improvements to soil permeability in the catchment.
5. Decrease in soil permeability (as a risk rather than an opportunity).

These five changes were also run in combination with each other under lower magnitude (lower ambition) and higher magnitude (higher ambition) combinations.

In relation to water quality, the study found that reducing manure and fertiliser application across the catchment results in the most significant water quality improvements. Improving soil health at large-scale with a focus on increasing infiltration also has a large impact on improving water quality. Increasing tree cover and upgrading STWs will also improve water quality, particularly in the lower Wye.

This work will be used by the WCP to develop a new Wye Catchment Management Plan.

Wye Algae Project (WAP) PhD Study

In 2022, the Wye and Usk Foundation commissioned Cardiff University to investigate the cause of algal blooms in the Wye catchment. Various water quality parameters were sampled, together with environmental DNA (eDNA), to establish the causes of algal community dynamics within the Wye catchment, with the objective of enabling the identification of intervention strategies that may be implemented to improve the ecology of the river.

No algal blooms were observed at any of the sampling locations (in Wales or England) at any time point during the duration of the sampling period.

This research found that phosphate was likely to be only a partial cause of algal blooms. Other factors may be more important, particularly high winter and low summer flows, higher water temperatures, removal of riparian vegetation, and the presence of nutrients other than phosphate. High winter flows are problematic because they can scour riverbeds of aquatic vegetation and remove habitat for algae-eating invertebrates and deposit large amounts of sediment and nutrients into the river. Low summer flows cause the river to be shallower and move more slowly, making water warmer and more prone to algal blooms. Removal of riparian vegetation can expose more of the water to sunlight. And increases in all forms of plant nutrients, including ammonia and organic P during rainfall events, can also stimulate problematic algal growth.

The study found that "…*it is becoming apparent that the focus on the levels of P alone within the catchment, and the focus on algal blooms may be detracting from a holistic overview of river management, and that other factors may need to be considered, such as levels of N inputs into the river, changes to the course of the river that may have unduly affected flow rate during times of dry weather and thus increasing retention time, and the changes to riparian cover that mean algae are receiving increased solar radiation"* (Bellamy et al. 2024).

The study also found that NO_3^- readings are closely correlated with phosphate readings, and total nitrogen readings are closely correlated to TP readings. These parameters follow similar patterns in their relative concentrations, suggesting that nitrogen and P may share common sources of ingress across the Wye and its tributaries.

Project TARA

Project TARA (Testing Approaches to Regulation of Agriculture) was a Defra-funded project, established in 2021, that tested innovative ways to improve regulatory compliance on farms. Eight of the 14 EA Area teams were selected to participate in the project, including the Wye and Lugg catchments in the West Midlands.

In the West Midlands, the project included several initiatives:

- The use of drone surveys, satellite imagery and other mapping tools to assist with the EA's regulatory work, supported by a new National Enforcement Team and a new National Agriculture Remote Sensing Team.
- Inspections and work with the poultry sector to understand the scale of poultry manure production and use.
- Work with manure "brokers" to ensure that manure is transferred from farm to farm responsibly.
- Inspections of dairy farms to ensure that manure is being used responsibly.
- Audits of on-farm AD sites, covering waste permit issues and assessment of compliance with SSAFO, NVZ and FRfW.
- Inspection of NVZ records on farms that receive digestate.
- Regulatory assessments to ensure compliance with the FRfW and the NVZ Regulations. These checks aimed to ensure that the nutrients within poultry manure are being utilised effectively for crop production and do not pose a risk of causing diffuse pollution.
- Work with different elements of farming supply chains to drive better compliance (see below).
- The appointment of an Agricultural Engagement Specialist and communication and engagement with farmers, including through video production, social media and attendance at farming events.

Although funding for the pilot project has finished, aspects of the work have been embedded into the EA's ways of working, including:

- The Agricultural Engagement Specialist role is ongoing. Further attendance at livestock markets and other regional events is planned and the EA is developing links with agricultural universities and colleges. Additional content creation and outreach is also planned, including the production of a new video demystifying the FRfW.
- Work of the National Agriculture Remote Sensing team continues to provide pre-inspection reports, virtual "catchment walkovers" and undertaking drone work that support regulatory enforcement.
- Farm, poultry manure use, and AD site regulatory inspections now include more detailed infrastructure and soil and nutrient management evaluations, resulting in improved compliance rates.
- The Agri-food Supply Chain Project is ongoing.

The outputs from Project TARA are currently being reviewed and collated and will inform future reporting on nutrient management in the River Wye catchment. Initial findings provide insights into phosphate dynamics within the poultry and anaerobic digestion sectors, particularly regarding manure application practices and environmental risks. Early evidence suggests that, on some farms, phosphate inputs from poultry manure may be below crop offtake, which could contribute to reductions in soil phosphate levels over time.

Sustaining Soils

This project developed a soil erosion and risk mapping tool to support decision-making, including site selection and adoption of mitigation methods for improving land management. Development of the tool was funded through the WEIF and built on the existing Agriculture Land Environment Risk and Opportunity Tool (ALERT).

ALERT is a collection of detailed remotely sensed data such as slope and landform (LIDAR), satellite imagery, and many derived datasets and analyses that show the risk of pollution and opportunities for pollution mitigation. The tool can be accessed via the CSF pages of the Farming Advice Service website.

Project activities included working with growers to assess soil erosion risk rating and develop mitigation plans. Processors and packers were also involved, and a knowledge-sharing event was held.

Development of the mapping tool was led by the Wye and Usk Foundation and was focused on the Garren catchment. This catchment was identified by the RePhoKUs Project as having some of the highest concentrations of P in its soils with a mean P soil index of 4.1 and 94% of soils sampled above P index 2. The catchment is also significant in terms of impacts related to potato production due to lighter, sandy, siltier type soils which increases the risk of soil erosion and associated nutrient loss.

The risk mapping tool can help identify erosion risk, taking into consideration the soil and crop types, topography/slope, aspect and rainfall, together with mitigation options to reduce risk. The tool can also quantify soil and nutrient loss for different mitigation options in terms of cost. This will be used to balance the cost incurred against the cost of mitigation and will support the wider engagement across the potato sector on innovative ways to reduce nutrient inputs.

Wye Soils, Nutrients and Compliance Project

The Wye Soils, Nutrients and Compliance (SNAC) Project is a collaborative initiative that supports farmers in making sustained changes to their farm systems by promoting responsible nutrient management, demonstrating water-friendly practices, and linking with wider research such as RePhoKUs to improve soil health and regulatory compliance across the Wye catchment.

Part of the SNAC Project involves trialling farm gate nutrient balancing to provide a more accurate and locally grounded picture of nutrient flows on farms. Led by Herefordshire Rural Hub and supported by Farm Herefordshire partners, the initiative uses the PLANET nutrient management decision support tool to help participating farmers record nutrient imports and exports across a range of enterprises. This approach enables farmers to assess nutrient use efficiency and identify opportunities for improvement.

The pilot confirmed that livestock feed, particularly compound and concentrate feeds, are a major source of P entering farms. This highlights the importance of feed management in addressing P surpluses and improving nutrient balance. The pilot also demonstrates the value of farmer-led data collection in building trust, supporting evidence-based decision-making, and enabling the agricultural sector to better understand and communicate its environmental performance. Participants have reported increased awareness of nutrient flows and expressed strong interest in continuing the process to track changes over time.

In its second year, the SNAC Project is building on its initial approach by expanding delivery across the catchment and linking with wider research, including RePhoKUs. This phase also introduces a targeted focus within a specific water body to demonstrate the impact and value of the approach in more detail.

SAGIS Modelling of In-river P Concentrations for the DWPP

The Source Apportionment Geographical Information Systems (SAGIS) model, developed jointly by the EA and the water industry, was used to understand the sector apportionment of phosphates within the rivers and to understand the compliance gap between current conditions and the target levels set out by NE.

EA normally updates SAGIS models every five years. One of the main uses of these models is to inform the water industry price review process and to identify environmental improvements that go into the water companies AMPs. For the DWPP, FARMSCOPER (v5) (see below) was run for 10 different current and future agricultural scenarios. Three of the scenarios were used in SAGIS modelling. These are described below:

- *FARMSCOPER Scenario 2* – Current implementation of measures (based on default FARMSCOPER measures)
- *FARMSCOPER Scenario 4* – Full (100%) compliance with required regulatory measures, 25% for FRfW “reasonable” regulatory measures, current regulation of voluntary and other measures
- *FARMSCOPER Scenario 10* **–** Maximum (100%) uptake of all measures (theoretical maximum)

Modelling results are summarised in the Options Appraisal section (Appendix A). The results suggest that over the long-term, P targets in the Wye can continue to be met through ongoing reductions in loads from point and diffuse sources in the Wye and Lugg catchments. However, for the Lugg, an 85% reduction of loads is required from diffuse sources, and targets are unlikely to be attainable through current suites of agricultural measures.

EA FARMSCOPER Modelling for the DWPP

The EA used the Defra-developed and supported FARMSCOPER model (FARM SCale Optimisation of Pollutant Emission Reductions) to estimate the potential reduction in losses of phosphate, nitrate and sediment from different farm types by implementing certain suites of land management mitigation measures. The model includes the functionality and input data required for it to be applied at a catchment scale through the automated creation of multiple farms that are representative of the farming within the catchment. The farming systems used in the modelling tool reflect typical management and environmental conditions across England.

Only the default livestock, fertiliser, manure, and land use inputs from FARMSCOPER v5 have been used. Livestock numbers and land areas for each farm type are derived from the 2019 Defra June Agricultural Survey (JAS). It is important to note that the modelling was conducted prior to clarification of poultry numbers in the Wye catchment. As a result, poultry figures in the model are under-estimated. Conversely however, the model also does not account for manure exports from the catchment under the Sustainable Poultry Roadmap. While these figures do not fully reflect current conditions, they are sufficient for the strategic insights intended in this plan. The model provides a useful basis for understanding the potential effectiveness of mitigation measures. Further refinement could improve accuracy, particularly at smaller spatial scales, but would not materially affect the conclusions presented in this plan.

FARMSCOPER contains an extensive library of over 100 mitigation methods and can be used to assess the impact of multiple measures on pollutant transport. Measures are listed in the diffuse pollution mitigation manual (see Newell Price et al. 2011). Although the model cannot take account of all agricultural diffuse measures that exist, it is a good starting point to understand the scale of improvements that could be made by on-farm action within the agricultural sector.

To develop different modelling scenarios, the FARMSCOPER mitigation measures were split into three types – regulatory, voluntary, and other measures:

- *Regulatory* – A subset of 44 regulatory measures, as advised by Agriculture Regulatory Taskforce officers. Measures include increasing the capacity of farm slurry stores to improve timing of slurry applications; covering solid manure stores with sheeting; and re-siting gateways away from high-risk areas. A subset of the Regulatory measures is listed as "FRfW Reasonable" because the FRfW state some activities that must be undertaken or avoided, but also lists some activities that could be undertaken as a "reasonable precaution" to avoid pollution. FRfW measures include establishing cover crops in the autumn; fencing off rivers and streams from livestock; and locating out-wintered stock away from watercourses.
- *Voluntary* – 40 voluntary measures that aim to provide enhanced mitigation of water pollution from agricultural sources. These are measures that relate to primarily to incentive and advice schemes, notably ELMs and CSF. Examples include establishing in-field or riparian buffer strips, using clover in place of fertiliser nitrogen, composting solid manure, constructing bridges for livestock crossings, and reducing dietary nitrogen and P intakes in livestock.
- "*Other" measures* – FARMSCOPER includes 31 measures that are not classified as Regulatory or Voluntary, these are classified as "Other". These include additional targeted bedding for straw-bedded cattle housing; AD of livestock manures and monitor and amend soil pH status for grassland.

Ten different scenarios were modelled with FARMSCOPER and used to estimate potential load reductions. Information from Defra project WT1594 (Elliott, 2019) and agricultural planning assumptions used for the RBMP cycle 3, have been used to inform the FARMSCOPER scenarios. Results for the Arrow Lugg and Frome OC are shown in (Table 16). Scenario 4 and scenario 10 were used with SAGIS to estimate the potential impact of higher uptake of voluntary and regulatory mitigation measures on in-river phosphate concentrations.

Table 16. Scenarios modelled by the EA using FARMSCOPER. Load reductions are given for the Wye catchment compared against scenario 2.

Scenario	Description	Level of Reduction (Arrow Lugg and Frome OC)		
		P	Nitrate	Sediment
1	No measure implementation - this represents agricultural pollutant loads without any prior uptake of mitigation methods i.e., zero current implementation ("naïve baseline").	-	-	-
2	Current implementation of all measures - this represents pollutant load reductions from a suite of land management measures required under regulation and through uptake of voluntary schemes from a best estimate of current implementation rates (based on default values in FARMSCOPER). This is "business as usual" (BAU) and represents a low level of ambition to achieve water quality objectives.	-	-	-
3	High (85%) compliance with required Regulatory measures, 25% for FRfW reasonable Regulatory measures, Scenario 2 for Voluntary and Other measures – this represents pollutant load reductions based on a high compliance rate with regulatory measures.	11%	3%	10%
4	Full (100%) compliance with required Regulatory measures, 25% for FRfW reasonable Regulatory measures, Scenario 2 for Voluntary and Other measures – this represents pollutant load reductions from a full compliance rate for required regulatory measures.	15%	4%	13%
5	BAU (55%) level of ambition for Voluntary measures, Scenario 2 for Regulatory and Other measures.	9%	3%	14%
6	High (70%) level of ambition for Voluntary measures, Scenario 2 for Regulatory and Other measures.	14%	4%	21%
7	Full (100%) implementation of Voluntary measures, Scenario 2 for Regulatory and Other measures.	23%	6%	35%
8	High (85%) level of ambition for Regulatory required measures, 25% for FRfW reasonable Regulatory measures, 70% for Voluntary measures, Scenario 2 for Other measures	23%	6%	27%
9	Full (100%) compliance with required Regulatory measures, 25% for FRfW reasonable Regulatory measures, full (100%) uptake of Voluntary measures, Scenario 2 for Other measures.	34%	10%	40%
10	Maximum (100%) uptake of all measures - theoretical maximum.	42%	13%	47%

These results highlight that even under the most stringent mitigation scenarios, P targets in the Lugg are unlikely to be met through conventional suites of on-field and on-farm mitigation measures included in FARMSCOPER.

Natural England FARMSCOPER Investigation

In 2024, NE used FARMSCOPER v5 to predict the potential reductions in nutrient loading in the River Wye (England and Wales combined) under various management scenarios (Gooday and Palmer 2025). This iteration of the model used different assumptions for some parameters than the FARMSCOPER v5 default values used by the EA. In particular, the NE version of the model used livestock data from the Animal and Plant Health Agency (APHA), with higher poultry numbers (Table 17) than in the EA model; higher soil P indices (derived from RePhoKUs); and the number of pig and poultry farms were reduced in the 600-700 mm rainfall category and increased in the 700-900 mm category.

Table 17. Default FARMSCOPER livestock data and APHA livestock data.

	Livestock counts ('000s)	
Category	**FARMSCOPER default**	**APHA data**
Cattle	168	164
Sheep & Lambs	2,110	1,547*
Pigs	39	38
Poultry	10,697	29,497**

* Data provided were for sheep only. This total assumes one lamb per sheep.

** The current best estimate for chicken numbers across the catchment (England and Wales) is now 23 million.

Based on the assumptions used, the model found that a little over half on the P losses from agricultural land were associated with soil erosion. Poultry manure accounted for 63% of P and 49% of nitrate in excreta.

P loads from agriculture were modelled for ten different scenarios (The land use change scenarios 7a and 7b incorporated both land use change and mitigation measures. Under scenario 7a, land use change (to zero-input grassland) was applied to 30% of the most phosphorus-polluting land, while the remaining 70% of land continued with current levels of mitigation. P reduction under scenario 7a was 45%. Under scenario 7b, the same 30% of land was targeted for land use change as in 7a, but the remaining 70% of land included all available mitigation measures in FARMSCOPER (Scenario 6). P reduction under scenario 7b was 60%.

In terms of mitigation measures, the most effective were cover cropping, riparian buffer strips, and reduced cultivation systems. As with the EA iteration of the model, the reductions in P and nitrate losses anticipated from increased regulatory compliance and higher uptake of voluntary measures were small relative to the nutrient reductions required in the River Lugg catchment.

P loads from agriculture were modelled for ten different scenarios (Table 18). Under the mitigation scenarios (scenarios 3-6), the maximum reduction in P relative to current implementation (scenario 2) was 38%. With land use change (scenarios 7a and 7b), the maximum reduction was 60%.

Table 18. Scenarios modelled by NE using Farmscoper. Load reductions are compared against scenario 2.

Scenario	Description	Level of P Reduction (whole Wye catchment)
1	No measure implementation.	-
2	Current – Current implementation of measures.	-
3	Current + FR4W – 100% compliance with regulatory measures, scenario 2 for other measures.	6%
4a	Current + CSF – 100% implementation of the CSF recommended measures, Scenario 2 for other measures.	14%
4b	Current + FR4W + CSF – 100% implementation of the CSF recommended measures, Scenario 3 for other measures.	18%
5a	Current + Top 5 – 100% implementation of the Top 5 measures, Scenario 2 for other measures.	22%
5b	Current + FR4W + Top 5 – 100% implementation of the Top 5 measures, Scenario 3 for other measures.	26%
6	All Measures – Maximum possible reduction achievable through measures.	38%
7a	Land use change (30% changed to zero input grassland), plus Scenario 2.	45%
7b	Land use change (30% changed to zero input grassland), plus Scenario 6.	60%

The land use change scenarios 7a and 7b incorporated both land use change and mitigation measures. Under scenario 7a, land use change (to zero-input grassland) was applied to 30% of the most phosphorus-polluting land, while the remaining 70% of land continued with current levels of mitigation. P reduction under scenario 7a was 45%. Under scenario 7b, the same 30% of land was targeted for land use change as in 7a, but the remaining 70% of land included all available mitigation measures in FARMSCOPER (Scenario 6). P reduction under scenario 7b was 60%.

In terms of mitigation measures, the most effective were cover cropping, riparian buffer strips, and reduced cultivation systems. As with the EA iteration of the model, the reductions in P and nitrate losses anticipated from increased regulatory compliance and higher uptake of voluntary measures were small relative to the nutrient reductions required in the River Lugg catchment.

The model predicted that poultry excreta was the dominant source of P in the catchment, contributing 63% of all excreta P. Concerns have been raised that this estimation might be too high, but even at this rate, poultry would be directly responsible for only 9% of annual average agricultural P. This discrepancy can be explained by the following factors:

- *Application practices* – Poultry manure is often applied in ways or at times that reduce runoff risk.
- *Location* – Poultry manure is typically applied in lower-risk areas, whereas cattle and sheep are more often in wetter, upland areas with higher runoff potential.
- *Direct deposition* – Cattle, especially beef, are assumed to have direct access to watercourses, increasing their contribution to P loss.

The largest source of P is from residual P within the soil, which includes the longer-term contributions of fertiliser and manure applications. This research found that soil erosion is likely the dominant source of P loss in the Wye catchment. The findings emphasise the importance of soil health interventions, particularly those that address erosion and compaction. Targeted land use changes on high-risk soils were shown to significantly reduce P losses, especially when combined with other measures. Overall, soil type and condition are central to understanding and managing nutrient pollution in the area.

£1 million Joint Research Initiative

In March 2025, the Welsh and UK Governments jointly announced plans to contribute £1 million to a new research fund that will be used to address water quality issues in the Wye catchment. The scope of the research programme will be to:

- Investigate the sources of the pollution and pressures affecting the river.
- Study the impacts of changing farming practices and land management.
- Develop and test new ways to improve water quality.
- Examine what is driving wildlife decline and water flow – the movement and quantity of water which is crucial for habitats and species.

Knowledge Gaps

The ongoing initiatives described above have generated, and will continue to generate, new evidence to inform future delivery decisions. However, achieving favourable condition status for the River Wye SAC requires a more detailed understanding of nutrient and sediment sources, transport pathways, ecological responses, and the effectiveness of mitigation measures and mechanisms. While existing evidence provides a foundation for action, there are several areas where data and knowledge are incomplete or where further investigation is required to support effective and proportionate decision-making.

Legacy P stored in soils and sediments continues to contribute to eutrophication, even where current nutrient inputs have been reduced. The mechanisms by which this P is mobilised and made bioavailable are not fully understood. There is also uncertainty regarding the contribution of sediment-bound P to algal growth. The relative importance of different sediment sources and the extent to which they influence ecological condition require further investigation. This includes both catchment-derived sediments and in-channel substrate deposits.

Nutrient budgeting and balancing are likely to be a key mechanism for preventing nutrient surpluses and drawing down legacy P. At the farm scale, nutrient management practices vary, and there is a need to better understand how nutrient inputs and outputs can be measured to identify and prevent over-application of fertilisers and manures.

Additional work can also be undertaken to explore the potential effectiveness and feasibility of actions that might be included in a WPZ. This will require a thorough and transparent evaluation of the environmental and economic implications of such measures.

Investigations to address these knowledge gaps are included in the DWPP Action Plan and are discussed later in this report (see "Proposed Measures and Actions").

Priority Locations for Mitigation Actions

The identification of priority locations for mitigation helps ensure that resources are directed where they will have the greatest impact on improving water quality. The following locations have been identified as providing opportunities for targeted interventions to address diffuse pollution pressures:

- **River Lugg and tributaries**
  The Lugg is a key focus for P and sediment mitigation. Catchment-wide action is needed to address diffuse pollution from agriculture.
- **Other water bodies with WFD failures**
  Water bodies across the Wye with documented WFD phosphate failures should be prioritised for nutrient and sediment mitigation. These failures highlight areas where water quality pressures are persistent.
- **Garren and Gamber catchments**
  These tributaries have been the focus of ongoing work to develop a spatial targeting tool for identifying high-risk nutrient loss areas. Lessons learned here should be applied in other water bodies and sub-catchments to prioritise interventions elsewhere.
- **Septic tank pollution**
  Mitigation should focus on small, slow-flowing tributaries across the catchment, where septic tanks and package treatment plants are suspected of causing persistent, localised nutrient and contaminant pollution.
- **Sediment source hotspots**
  In the Lugg and Arrow catchments, Cheaton and Ridgemoor Brooks (Lugg) and Curl and Moor Brooks (Arrow) were identified as major sediment sources (see Stopps 2018). Additional problem areas may be identified using tools such as MudSpotter, which support spatial analysis of sediment risk. Targeted actions, such as cover cropping, fencing, and track improvements, are needed to reduce sediment and nutrient inputs. Key issues include erosion-prone arable land, livestock poaching, and poorly managed farm tracks and gateways.
- **Sites identified through citizen science monitoring**
  Citizen science delivers frequent, high-resolution environmental data, helping to detect pollution incidents early and identify priority locations for targeted mitigation. Based on the last three years of data, water bodies with the highest phosphate readings include two sites in the Lugg catchment: Little Lugg – source to conf R Lugg (GB109055036720) and Bodenham Bk – source to conf R Lugg (GB109055036740), and one in the Monnow catchment: Worm Bk – source to conf R Dore (GB109055036840). The EA and Wye Alliance citizen scientists meet regularly to support coordinated data sharing on sites where water quality issues may be emerging. Monitoring data from headwater locations is used proactively to refine the spatial targeting of resources and the delivery of mitigation measures.

Additional Mitigation Measures and Mechanisms

Scale of the Challenge

In recommending water quality targets under the Environment Act 2021, the Water Expert Advisory Group (WEAG) proposed a 40% reduction in nutrient (P and nitrogen) and sediment loads by 2037, using a 2018 baseline. This target was subsequently adopted through The Environmental Targets (Water) (England) Regulations 2023. In its deliberations, WEAG noted that a 50% reduction in agricultural loads would be more likely to achieve good ecological outcomes in many water bodies, but concluded that the scale of change required, both in farming practices and land use, would be too disruptive to the sector to be considered feasible at a national level.

In the Lugg catchment, modelling indicates that an 85% reduction in P load from agriculture is required to meet the phosphate target, far exceeding the national ambition and highlighting the exceptional challenge this sub-catchment presents. Analysis using FARMSCOPER and SAGIS suggests that current field- and farm-based mitigation measures and supporting mechanisms, even when fully implemented, are unlikely to deliver the reductions needed. Achieving the necessary reduction in loads will require significant change in how land is managed, going beyond incremental improvements and business-as-usual approaches. This plan cannot resolve these challenges outright, but the strategic priorities outlined in the following section provide pathway to more ambitious, better coordinated action to tackle diffuse water pollution. They aim to guide ongoing work, while also identifying areas where innovation, policy refinement, and stronger alignment across sectors will be essential to close the gap between current conditions and conservation objectives.

Strategic Priorities

Although the River Wye itself is generally meeting phosphate targets, research from RePhoKUs shows that P inputs across the catchment remain excessive. This surplus represents a long-term risk to water quality and ecosystem health, particularly where legacy P persists in soils.

The Lugg sub-catchment is of particular concern. It is failing to meet its phosphate targets, and the gap between observed water quality and the target levels is significant. An adequate suite of measures capable of achieving these objectives has not been identified. Restoration of the Lugg will require P inputs to be reduced to levels at or below those removed in agricultural produce, and for soil P in some areas to be reduced substantially.

To begin addressing these challenges, five strategic priorities have been identified. These are intended to guide coordinated, catchment-scale action and support progress towards the conservation objectives of the River Wye SAC. The priorities also highlight where further research may be needed, where existing policies or schemes could be refined, and where enforcement efforts might be more effectively targeted. While not all recommendations may be deliverable under current arrangements, the priorities provide a clear and practical framework to inform decision-making, shape future interventions, and support voluntary and collaborative efforts across the catchment. The five strategic priorities are:

1. Farm gate nutrient balancing.
2. Catchment-scale management of bulk organic nutrients.
3. Reducing the impact of high-risk crops on high-risk land.
4. Targeted use of Environmental Land Management schemes, advice and funding.
5. Supply chain engagement and accountability.

1. Farm gate nutrient balancing

Farm gate nutrient balancing (FGNB) is needed to address persistent nutrient pollution in the River Wye, and particularly in the Lugg catchment. Its core objective is to reverse P accumulation by ensuring that nutrient inputs at the farm scale do not exceed outputs in crops and livestock products. Over time, this approach would also aim to deplete the surplus P already present in soils.

One of the strengths of FGNB is that it offers an actionable and immediate mitigation strategy that can be implemented by local and regional stakeholders. It complements existing efforts to improve soil health, drainage, and erosion control through mechanisms such as CSF and ELMs and is supported by a growing body of evidence and ongoing research.

FGNB involves systematically accounting for all nutrient inputs and outputs at the farm level. To support this effort, further research is needed into profitable and sustainable farming practices that can draw down P locked in soils. Equally important is the development of robust tools for accurately tracking P stocks and flows. Insights from the RePhoKUs Project and other studies highlight the need for more frequent and systematic testing of soils, manures, and post-harvest residues. Current nutrient management planning often relies on estimated values, which can obscure real nutrient dynamics. A shift toward evidence-based nutrient accounting would significantly improve the precision and effectiveness of nutrient management strategies.

Complementary measures, such as reducing P content in animal feed and using biochar as a bedding additive to reduce ammonia emissions and P runoff, can further support the implementation of FGNB.

Some farm-scale nutrient balancing work is already underway in the catchment, notably through the Wye SNAC Project, led by the Herefordshire Rural Hub. This initiative may provide a foundation for scaling up FGNB across the catchment.

Implementation of FGNB should be prioritised in the Lugg and on farms with high P inputs and elevated soil P indices. Farms that rely solely on farmyard manure or slurry as fertiliser may find it easier to transition to more balanced nutrient management systems. Less intensive systems with low soil P levels may be a lower priority for this type of intervention. All relevant data and evidence should be used to prioritise locations and farm types for further investigation and implementation of this type of measure, including citizen science data and incident reporting. Engagement with farmers and other partners is also essential. Providing tailored advice and guidance will be critical to help land managers understand their options and implement effective changes as part of FGNB.

Developing and refining tools to support nutrient balancing is a key enabling action. While the PLANET tool is currently in use, further work is underway to explore alternatives, including an EA Phosphorus Loss Tool, to improve accuracy and usability.

2. Catchment-scale management of bulk organic nutrients

Managing large nutrient sources at the catchment scale is essential to complement farm-level nutrient balancing and reduce nutrient loads in the Wye and Lugg catchments. Effective management of bulk organic nutrients requires enforcement, coordination, and innovation. Project TARA, Avara's Sustainable Poultry Roadmap, Herefordshire Council's Minerals and Waste Local Plan, and the Agri-Food Supply Chain Project have highlighted opportunities to improve nutrient use and management across sectors. New and emerging technologies may also support more efficient handling and redistribution of manures, biosolids and digestate. This priority aims to reduce nutrient surpluses and losses by improving how large organic nutrient sources are managed at catchment scale.

Organic materials such as manures, poultry litter, anaerobic digestate, and sewage sludge can contribute significantly to P surpluses when mismanaged or applied in excess of crop requirements. Poultry production has been a particular concern across the catchment. Nutrients are introduced via imported feed, often sourced from outside the region or overseas, and applied to land around intensive poultry units. The widespread application of poultry manure near these units has contributed to nutrient accumulation in soils. The Avara Sustainable Poultry Roadmap provides a positive example of industry-led action to reduce the impacts of feed and manure, but broader engagement and action across the agri-food supply chain is needed to ensure consistent standards and accountability.

AD presents both opportunities and risks. AD can improve the transportability of manures, generate renewable energy, and reduce reliance on imported and synthetic fertilisers. However, many AD plants rely on co-digestion materials such as maize, a high-risk crop for sediment and nutrient loss, or food waste brought in from outside the region, which can increase the nutrient burden in the catchment. The conversion of grassland to maize for AD feedstock may further exacerbate P surpluses and environmental losses.

Sewage sludge is another significant source of organic nutrients. Its storage and application to land are subject to regulatory oversight, including farm inspections. Water companies provide nutrient planning advice to farmers receiving sludge, but it is essential that this advice is fit for purpose and that farmers are following it. Regulatory teams must ensure that these practices are monitored and enforced effectively.

To manage these bulk nutrient sources sustainably, applications should only occur where there is a demonstrated agronomic need and should not exceed crop uptake. In some cases, exporting surplus nutrients out of the catchment may be necessary to avoid further accumulation. However, reliance on voluntary measures alone is problematic. For example, exported manure may be replaced by fertilisers sourced externally, including phosphate from overseas, undermining the environmental benefits. Stronger mechanisms, such as targeted incentives and regulatory tools, may be required to ensure a level playing field and drive consistent uptake of best practices.

3. Reducing the impact of high-risk crops on high-risk land

In addition to poultry and AD, a focus of mitigation action is "high-risk" crops, especially maize, potatoes and other root vegetables. These crops are considered high risk due to their potential to cause soil erosion and water pollution. They typically require intensive soil cultivation, which disrupts soil structure and leaves large areas of bare soil vulnerable to heavy rainfall.

"High-risk land", refers to places where:

- Bare earth is present.
- Soil health is an issue (compaction, low levels of organic matter).
- Agriculture occurs near to watercourses (even if land management is compliant with FRfW).
- Slopes are steep.
- Growing high-risk crops is much more likely to lead to increased surface runoff and loss of sediment, nutrients, and agrochemicals into nearby water bodies.

Potatoes and other root crops are a high-risk crop for nutrient and sediment loss because they require frequent soil disturbance through deep tillage and harvesting, which impacts soil structure and increases the risk of erosion. Additionally, their shallow root systems and wide row spacing leave soil exposed, making it more susceptible to runoff carrying nutrients and sediments into nearby waterways.

Maize is typically grown as a monoculture with soil between the rows often left exposed. It is also usually harvested late, leaving soil bare at vulnerable times of the year when it may be too wet or cold for germination of follow-on crops. Maize growing has likely increased because it is a popular co-digestion material in AD plants, due to its high gas yield.

The impact of growing high-risk crops can be reduced through the adoption of sustainable farming practices, including:

- *Cover Cropping* – Planting cover crops like clover or rye between growing seasons helps protect the soil from erosion and improves soil health by adding organic matter.
- *Reduced Tillage* – Minimising soil disturbance helps maintain soil structure and reduces erosion risks. No-till or low-till practices can be particularly effective.
- *Contour Farming* – Planting crops along the natural contours of the land can reduce runoff and soil erosion.
- *Buffer Strips* – Establishing vegetative buffer strips along waterways can trap sediments and nutrients before they enter water bodies.

- *Crop Rotation* – Rotating root vegetables with other crops can improve soil structure and reduce pest and disease pressures.
- *Precision Agriculture* – Using technology to apply fertilisers and water more efficiently can reduce nutrient runoff and improve crop yields.

However, modelling with FARMSCOPER suggests that these types of measures alone will not be sufficient to significantly reduce the environmental pressures. Land use change is likely to be required to substantially reduce nutrient and sediment loads. In the Lugg catchment especially, achieving meaningful reductions in nutrient loads will require more widespread adoption of sustainable land use and land management practices than is currently being achieved through advice- and incentive-based mechanisms such as CSF and ELMs. To support this, the EA is working with partners to prioritise farm inspections in areas where the risk of diffuse pollution is highest. This includes the use of tools such as the ALERT system and SCIMAP to identify high-risk land and target regulatory resources more effectively.

Several ongoing initiatives are contributing to this effort. Project TARA has piloted approaches to improve the management of manures and digestate. The Bare Soils Project has used remote sensing to identify erosion-prone fields, while the Sustaining Soils Project has developed risk mapping tools for soil erosion in the Garren and Gamber catchments. The SNAC Project has supported farmer engagement, including efforts to improve understanding of relevant regulations, and nutrient balance assessments, while the Herefordshire Agri Group continues to promote good practice among local growers.

The EA is also working with the agri-food supply chain, including processors, retailers, and AD plant operators, to drive more sustainable cropping practices. Building on successes in the poultry sector, this work is expanding into other sectors, including potato and root vegetable production. Continued collaboration between regulators, farmers, and supply chain actors will be essential to ensure that high-risk cropping is managed in a way that protects soil and water resources.

4. Targeted use of ELMs, advice and funding

In the 2025 Spending Review, the Government announced increased funding for ELMs and said that reformed schemes will be more simplified and targeted to better meet priorities on food, farming and nature. Further details are being released through 2025 and 2026.

The EA and NE are committed to adapting as ELMs evolve, to deliver targeted, high-ambition interventions that achieve the greatest impact. The three elements of ELMs, SFI, CSHT and Landscape Recovery, all contribute to reversing ecological decline and meeting statutory conservation targets. Together, ELMs aim to:

- Bring soil under sustainable management.
- Reduce agricultural emissions.
- Create and maintain woodlands.
- Halt species decline.

- Reduce the main agricultural pollutants entering watercourses.
- Restore rivers, lakes and other freshwater habitats.
- Increase resilience to the impacts of climate change, including flooding, coastal erosion and drought.

The SFI, though temporarily closed, is expected to reopen in 2026 with a reformed offer that will focus on maximising the environmental impact, simplifying the application process, improving returns to farmers, and increasing transparency in budget application.

The 2025 CSHT scheme, has been significantly expanded and refined and offers significant potential, over the long term, to restore natural function with the Wye catchment. It now includes many actions that are tailored to deliver high-impact outcomes, including wetland and riparian restoration, nutrient and sediment control and water quality improvements, species recovery, and woodland and agroforestry management. These actions are particularly relevant to the Wye and Lugg catchments, where diffuse pollution, habitat degradation, and hydrological pressures are undermining ecological integrity.

CSHT is currently being rolled out by invitation only, with NE and the Forestry Commission providing pre-application advice to ensure high-quality, site-specific proposals. New CSHT options typically have higher payment rates than alternative schemes, and many options are new or significantly updated. These options also tend to have longer durations, ranging from 5 to 20 years, which may support more sustained environmental outcomes. Their potential uptake and impact could be significantly higher than previous schemes. Promising water-related options are shown in Table 19.

Table 19. Water-related CSHT Options

Action	Rate and duration	Aim & purpose
6 m to 24 m 3-dimensional (3D) buffer strip	£1,182/ha 5 years	Create vegetated buffer strips with raised ridges to intercept runoff, improve infiltration, water quality, drought resilience, flood mitigation, and wildlife corridors.
Make room for the river to move	£1,489/ha 20 years	Restore dynamic river and floodplain habitats, allow seasonal flooding, reduce erosion and downstream flooding, and support nutrient management.
Flood mitigation on arable reversion to grassland	£740/ha 5 years	Store floodwater on reversion land and reduce diffuse pollution by shifting from high-risk cropping.
Connect river and floodplain habitats	£1,242/ha 10 years	Reconnect rivers with floodplains to create wetland mosaics, reduce pollution, and improve water quality and biodiversity.
Manage features on arable land for flood and drought resilience and water quality	£1,241/ha 5 years	Use features like bunds and sediment traps to reduce runoff, store water, and improve flood resilience and water quality.
Manage grassland for flood and drought resilience and water quality	£938 10 years	Modify grassland topography to retain water, reduce flooding, and enhance drought resilience and water quality.
Manage riparian and water edge habitats (12 m – 24 m)	£1,186/ha 10 years	Maintain water-edge habitats to support biodiversity, flood and drought management, and water quality.
Enhanced floodplain storage supplement	£366 5 years	Increase floodplain water retention to slow flow and support flood and drought management.

Wetlands **Create fen, reedbed or wetland mosaics**	£1,605/ha 10 years	Establish wetland habitats to boost biodiversity, store carbon, reduce flood risk, improve water quality, and protect archaeological sites.

Landscape Recovery schemes are designed for ambitious, long-term restoration efforts and are supported by both public and private funding and resources. Two Landscape Recovery projects are in the development phase in the Wye catchment, Wyescapes; Food, Nature and Water and Ridge to River. Wyescapes; Food, Nature and Water is focussed on the river corridors of the Rivers Wye and Lugg, and includes plans for floodplain meadow restoration, wetland creation, hedgerow planting, and nutrient management. The Ridge to River Project spans the Upper Wye Valley, including Moccas Park and neighbouring areas. These projects represent a landscape-scale, multi-stakeholder effort to restore the ecological health of the Wye catchment and are strategically aligned with NE and the EA's priorities for reversing the river's decline and delivering long-term environmental resilience.

To maximise impact, funding and advice should be coordinated with emerging planning frameworks. This includes aligning delivery with Welsh monitoring data and evidence and integrating with future Environmental Delivery Plans and Local Nature Recovery Strategies. As these frameworks mature, delivery mechanisms may need to evolve to support them. The River Wye Catchment Management Plan will play a key role in guiding local action, helping to prioritise interventions and coordinate efforts across stakeholders. CSF will continue to underpin practical change on the ground, offering advice and support to farmers and land managers across both arable and livestock systems.

5. Supply chain engagement and accountability

Agricultural pollution is shaped by decisions across the whole supply chain. Tackling it at scale means coordinated action from producers, processors, retailers, regulators, and consumers.

The EA has made supply chain engagement a strategic priority for nutrient mitigation, recognising its potential to drive catchment-scale change. The Agri-food Supply Chain Project, developed under Project TARA, focuses on phosphate pollution in the Wye by working across the food system. It has so far targeted poultry, potatoes, and energy crops, with plans to expand into dairy, horticulture, beef, lamb, and combinable crops.

The project treats nutrient pollution as a food system issue, requiring a clear understanding of nutrient flows and joined-up action across the supply chain. It works with the Wye Agri Food Partnership and aligns with the EA's National Agri Food Working Group to ensure consistent messaging and coordinated delivery.

Key achievements in the agri-food supply chain to date include:

- *Poultry*: Development of a poultry roadmap, export of 75,000 tonnes of manure from the Wye Catchment, and creation of a digital portal for tracking nutrient flows and ensuring compliance.

- *Potatoes*: Implementation of the Sustaining Soils Project, promoting erosion control, soil health, and nutrient management in high-risk sub-catchments.
- *Energy Crops*: Promotion of sustainable maize cultivation practices through a dedicated growers' group and tailored agronomic guidance.

The UK Food and Drink Pact is a national agri-food supply chain initiative led by WRAP that is supported by the Wye and Usk Foundation with technical input from the EA via the EA's Agri-food Supply Chain Project. One of the Pact's core goals is to ensure that 50% of all fresh food is sourced from areas practicing sustainable water management, including the Wye and Usk catchments.

Over 100 organisations, including food and drink businesses, trade associations, NGOs, and charities, have committed to improving water quality, availability, and resilience through the Pact's Water Roadmap. A major output has been the development of "Recommended Key Practices" for eight agricultural sectors. These practices aim to avoid surplus nutrient application, minimise nutrient and sediment losses, and protect watercourses, especially during extreme weather events. The recommendations provide a foundation for voluntary action. Further work is underway to explore practical implementation and overcome barriers to adoption. The Wye Agri Food Partnership plays a central role in coordinating these efforts across both the English and Welsh parts of the Wye Catchment.

Proposed Measures and Actions

The following investigations have been identified through the Options Appraisal process as necessary to support reductions in nutrient and sediment loads in the River Wye SAC. Each is designed to build on existing delivery approaches and align with the strategic priorities of this plan. Collectively, they aim to generate the evidence and tools needed to accelerate the pace and scale of future nutrient reduction efforts.

"Unlocking" and "mining" phosphorus

This measure involves investigating methods to draw down legacy P from soils while maintaining agricultural productivity. The aim is to reduce the long-term risk of P loss to water by encouraging crop uptake of surplus soil P, improving nutrient use efficiency and soil health.

Standardising calculation of farm gate nutrient balances

A consistent and transparent approach to calculating nutrient balances at the farm level is essential for identifying surpluses and improving nutrient management. This action will support the development or refinement of tools and methodologies that enable farmers and advisors to assess P inputs and outputs more accurately, helping to reduce diffuse pollution.

Sediment fingerprinting

Understanding the sources of sediment within the catchment is critical for targeting interventions effectively. Sediment fingerprinting will help identify where erosion is occurring and which land uses or practices are contributing most to sediment and associated P losses. This evidence will inform more precise and cost-effective mitigation strategies and actions.

Substrate sediment sampling

Many macrophyte survey sites in the River Wye catchment are not achieving good status, suggesting that eutrophication may be adversely affecting most surveyed locations. Sites that do achieve good or high status are typically found in shaded sections of the channel, where reduced light availability likely mitigates eutrophication. It is possible that channel bed sediments are acting as a source of phosphate, contributing to eutrophication that is not being detected through water sampling. Riverbed sediments can serve as a reservoir of P, sustaining algal growth via internal loading even when external inputs are reduced. This action will assess the extent and mobility of P in channel substrates to better understand the role of legacy sediment in driving eutrophication and to inform future management.

Learn from innovative work in other catchments

This action will draw on lessons from other catchments, particularly those using NbS, collaborative planning, and community engagement, to inform the design and delivery of measures in the Wye. It will help ensure that local strategies are grounded in best practice and emerging evidence. For example, lessons can be learned from Severn Vale CaBA's collaborative, nature-based projects, including Wilder Frome and Forest to Sea. Although Severn Vale faces different pressures, these case studies provide examples of how strategic planning and community engagement can improve water quality and biodiversity. We can also learn from the approaches and innovations emerging in other CaBA groups. NE's Protected Site Strategy in the Clun will also offer a useful model for aligning nutrient management with habitat protection.

Detailed evaluation of a Water Protection Zone (WPZ) as a mitigation mechanism

A WPZ could serve as an additional statutory mechanism for reducing pollution. This action will explore the feasibility, design considerations, and potential benefits of a WPZ in the Wye or Lugg catchments. It will assess the evidence base required and consider how such a designation might drive more consistent compliance, enable targeted enforcement, and support long-term improvements in water quality. Other mechanisms may offer similar benefits, and this evaluation will help determine the most effective and proportionate approach.

Constraints

While the ambition to tackle diffuse water pollution is clear, several systemic barriers continue to limit the pace and scale of delivery. These challenges are complex and long-standing and overcoming them will require sustained commitment from all sectors, stakeholders, and levels of government. Key constraints include:

Scaling Up Voluntary Measures

- Achieving catchment restoration at the required pace and scale is challenging when progress relies predominantly on voluntary action.
- The agricultural sector is highly diverse, with variable and often insufficient uptake of best practices. There is a need to broaden and balance participation in nutrient reduction efforts to ensure fairness and effectiveness.
- The current mix of regulatory, advisory, and incentive-based tools have not provided strong enough signals to drive the necessary scale of change, either through rewarding sustainable practices or deterring poor environmental performance.

Regulatory Delivery Considerations

- The FRfW provide an important regulatory foundation for managing nutrients and protecting water quality. Improving their effectiveness depends on consistent interpretation and robust implementation. The June 2025 update to the Government's FRfW guidance provided some clarification on how the EA assesses compliance, with particular emphasis on nutrient management planning and site-specific risk factors. The practical implications for compliance, enforcement activity, and water quality outcomes will require ongoing evaluation.
- Rising environmental expectations are placing new demands on existing regulatory frameworks. Delivering impact in complex catchments increasingly depends on the ability to target action, prioritise effort, and make best use of available tools.
- The full range of regulatory options need to be kept under review, including WPZs, to ensure that proportionate and effective measures remain available should voluntary and existing regulatory approaches prove insufficient.

Uncertainty – Ecological, Economic, Institutional and Behavioural

- There is considerable uncertainty for land managers around the most effective and proportionate pathways to deliver change. A more robust evidence base is still needed to assess the efficacy, cost-effectiveness, and social acceptability of different interventions, especially at landscape scale.
- It is difficult to identify ecological, economic, and behavioural tipping points, where timely and targeted action is needed to avoid irreversible harm and accelerate recovery. Where known, these thresholds should trigger consideration of additional interventions.

Operational Delivery Constraints

- The scale of transformation will be influenced by the capacity of advisory services (e.g., CSF), agri-environment schemes (e.g., ELMs), regulatory enforcement, planning, and modelling.

- Public bodies are working to deliver increasingly ambitious environmental outcomes. Innovative and collaborative delivery models (e.g., the Agri-food Supply Chain Project, citizen science, blended finance opportunities) that extend capacity to achieve change are being explored, refined and implemented.
- Agencies such as NE and the EA need to prioritise support for actions that align with their core statutory responsibilities, while continuing to explore new opportunities.

Other Issues

Housing Growth in Herefordshire

Herefordshire Council is currently preparing a new Local Plan under the plan-making process introduced by the Levelling-up and Regeneration Act 2023. This plan will guide development across the county from 2025 to 2045 and is being shaped in the context of national policy encouraging housing delivery.

The Government's National Planning Policy Framework requires Herefordshire to plan for approximately 27,000 new homes over the next 20 years. This target is supported by mandatory housing delivery benchmarks and a presumption in favour of development where local authorities fail to meet them. These expectations could become more stringent under the Planning and Infrastructure Bill, which introduces new enforcement mechanisms to ensure housing targets are met.

This level of growth poses a challenge for the River Wye SAC, which is already affected by diffuse nutrient pollution. To ensure that development proceeds in a way that safeguards water quality, growth will need to be accompanied by a clear and coordinated strategy to assess and manage cumulative impacts across the catchment.

At present, there is no published nutrient budget or strategic framework that sets out how the nutrient implications of housing growth will be assessed and addressed across the county. The previous Local Plan was due to be replaced in 2025, but the updated version is now expected to be finalised in 2028. In the interim, the absence of a strategic overview makes it difficult to evaluate the combined impact of multiple developments on the Wye and Lugg catchments.

As the Local Plan progresses, it will be important to ensure that housing allocations and supporting infrastructure are planned in a way that is compatible with the objectives of the DWPP. This includes understanding where growth is likely to occur, what the associated nutrient pressures will be, and how these can be managed in a way that supports both housing delivery and river recovery.

Drainage Management and Water Quality

The Lugg Internal Drainage Board (IDB), as the statutory authority responsible for managing land drainage in parts of the catchment, plays an important role in supporting agricultural productivity and flood risk management. However, there is growing interest in exploring whether current drainage practices could be adapted to better support water quality objectives.

Farm drainage networks, while essential for land management, may act as rapid pathways for nutrients and sediments to enter watercourses, particularly in areas with high P loads. This raises the question of whether some drains could be contributing disproportionately to nutrient transport, and whether targeted changes in maintenance or design could help mitigate these impacts.

Modelling and mapping tools could help identify critical drains or sub-catchments where interventions might have the greatest benefit. There may also be opportunities to integrate NbS, such as sediment traps, buffer zones, or constructed wetlands, into the existing drainage infrastructure.

Working collaboratively with the Lugg IDB and other partners could help ensure that drainage management continues to meet its core functions while also contributing to the wider goal of reducing diffuse pollution in the catchment. This may require a shift in thinking about how land is managed, particularly where conventional drainage practices unintentionally counteract environmental improvements made by land managers. There could be scope to explore more integrated approaches, where flood risk and water quality objectives are considered together.

Water Protection Zone as a Mitigation Mechanism

Water Protection Zones (WPZs) are a statutory mechanism available under Section 93 of the Water Resources Act 1991, designated by the Secretary of State for Environment, Food and Rural Affairs in England. WPZs enable the establishment of additional legal provisions to prohibit or restrict polluting activities within defined geographical areas, thereby protecting water quality and resources from degradation.

Purpose and Scope

WPZs form part of a broader suite of regulatory and voluntary mechanisms aimed at preventing water pollution in both urban and rural settings. They are designed to start, stop, or limit specific activities, depending on the nature and severity of the pollution issue. WPZs may address:

- *Point-source pollution* – originating from a single, identifiable source.
- *Diffuse pollution* – arising from multiple dispersed sources with cumulative impacts.
- *Physical damage* – affecting the morphology and ecological integrity of water bodies.

A WPZ is tailored to the specific needs of the catchment or sub-catchment area that it covers. Breach of WPZ requirements constitutes a criminal offence, potentially resulting in significant fines or custodial sentences.

To date, only one WPZ has been designated: the River Dee WPZ, established in 1999. It was created to control the storage of dangerous substances within the freshwater catchment area, with the objective of protecting drinking water abstractions from regulated substances entering surface waters.

Implementation

WPZs are considered as part of a strategic, hierarchical approach to catchment management. They are considered when existing measures are unlikely to achieve the required environmental objectives in water bodies. The EA's WPZ Planning and Engagement Process outlines a step-by-step framework for evaluating the need for a WPZ:

1. WFD Investigations and actions identify local areas where further action is needed to meet environmental objectives.

2. Area teams assess which measures and mechanisms may be effective, supported by decision-making tools developed by the WPZ project.

3. A hierarchy of mechanisms is established, prioritising advice and incentives (where available) before considering regulatory actions.

4. A Statement of Intent (SoI) is communicated, indicating that due to the pressures faced, a WPZ may be necessary if other approaches do not deliver the required outcomes. This includes defined tests and timescales for assessment and agreement among stakeholders on escalation pathways.

5. Progress is monitored against agreed criteria. If insufficient progress is made, a WPZ may be proposed, supported by evidence of need, options analysis and impact assessment.

If the above process indicates that a WPZ is appropriate and necessary, because it demonstrates that additional statutory controls are required to reduce pollution, the EA prepares an application for a draft WPZ Order, which is sent to the Secretary of State and publicly consulted upon. If the Secretary of State agrees with the application, they can make a WPZ Order, subject to consideration of public consultation. This ensures that WPZs are implemented only when justified by robust evidence and stakeholder engagement, and when other mechanisms have proven insufficient to meet environmental targets.

EA review of WPZ Candidate Sites (2011)

In 2011, the EA explored the potential use of WPZs at seven candidate sites across England, including the River Lugg. A suggestion at the time was that a WPZ could require land managers to undertake field-based risk assessments and apply appropriate mitigation to prevent water quality impacts.

In relation to the Lugg, reviewers highlighted three key considerations:

- The need for more and better communication between partners and stakeholders, to ensure that groups had a common understanding of key issues and worked together effectively.
- The need for a culture shift in farm management, with practices focussed on minimising environmental using the source-pathway-receptor model. Reviewers noted that farmers were more likely to adopt changes where there was clear evidence of benefit.
- The potential effectiveness of Anti Pollution Works Notices (APWNs), though their implementation was recognised as resource-intensive (Note: the FRfW, introduced in 2018, are now more applicable to diffuse agricultural pollution than APWNs).

Although WPZs were initially considered a possible solution at all sites, including the Lugg, reviewers ultimately favoured non-regulatory approaches or the use of existing powers. WPZs were not recommended for short-term implementation but were retained as a potential option if problems proved persistent. It should be noted that this review pre-dated several regulatory developments, including the introduction of the FRfW in 2018.

Given that nutrient and sediment pressures on the river remain, it is understandable that the WPZ option continues to be raised by stakeholders.

Natura 2000 Judicial Review (2015)

In 2015, WWF-UK, the Angling Trust, and Fish Legal initiated a judicial review against the Secretary of State and the EA. The challenge centred on the perceived failure to consider WPZs as a mechanism to address diffuse pollution affecting Natura 2000 sites in England.

A consent order was agreed in November 2015, requiring the EA and NE to:

- Evaluate existing measures to reduce diffuse pollution and their effectiveness in achieving conservation objectives.
- Appraise alternative mechanisms, including WPZs.
- Publish findings as appendices to DWPPs jointly owned by both agencies.

This DWPP has been developed as part of the EA and NE's response to the Consent Order.

Herefordshire Council Call for a WPZ (2022)

In 2022, Herefordshire Council wrote to the Parliamentary Under Secretary of State for Defra requesting a WPZ for the Wye. The council cited concerns about the efficacy of FRfW and lack of resource in the EA to investigate Category 3 pollution incidents and argued that existing voluntary and regulatory measures were insufficient.

They looked at Poole Harbour and their "glide path" of nutrient (nitrate) reduction (the Poole Harbour Nutrient Management Scheme), and considered that the same approach might be used to reduce phosphate pollution in the River Wye.

Wye Manifesto (2024)

The Wye Manifesto is a plan created by a coalition of environmental groups to address pollution affecting the River Wye. Amongst other measures, the manifesto called for the creation of a WPZ that would include a reduction in livestock numbers, responsible sourcing of animal feed, the reduction of sewage releases and reduced application of fertiliser and chemicals.

WPZ Feasibility in the Wye and Lugg Catchments

At present, a WPZ is not being progressed for the Wye or Lugg catchments. While there is clear evidence of P and sediment pressures from agricultural sources, we have not yet been able to identify a suite of measures and mechanisms that would deliver the substantial reductions required to meet environmental objectives. Without a clear and deliverable set of interventions, it is not possible to define the regulatory approach or build the necessary consensus to move forward with WPZ planning.

Developing a first-of-its-kind WPZ to address diffuse nutrient and sediment pollution would be a complex undertaking. It would require thorough consideration of the environmental risk, the proportionality of proposed measures, and the limitations of existing mechanisms. In addition, any WPZ proposal would need to account for potential economic impacts on farmers and rural communities, the administrative burden on land managers, the feasibility of compliance within existing delivery frameworks, and the risk of unintended consequences.

More action is clearly needed to reduce nutrient loads in the River Lugg and to address the causes and effects of eutrophication across the Wye catchment. The most effective way to achieve this is by tackling the problem at source. Evidence from RePhoKUs shows that excessive P is being applied to soils across parts of the catchment, and that certain land uses and locations contribute disproportionately to nutrient and sediment losses. If a WPZ were to be implemented, it could directly target these high-risk areas and practices. The five strategic priorities identified in this plan could provide a foundation for developing WPZ measures, should that pathway be pursued further in future.

Given that the Wye and Lugg catchments span the England-Wales border, any consideration of a WPZ in England must take into account cross-border issues. Although WPZs can only be designated by the Secretary of State for areas in England, Welsh Ministers hold equivalent powers to designate WPZs in Wales. Engagement with NRW will be important in securing catchment-wide outcomes.

However, a WPZ is not the only route to achieving significant improvements in water quality and river health. A range of targeted initiatives are already underway in the catchment, many of which align with the objectives a WPZ would seek to deliver. These include:

- Farm gate nutrient balancing through the SNAC Project.
- The £1 million Joint Research Initiative, investigating the drivers of wildlife decline and testing new approaches to improve water quality.

- The Agri-Food Supply Chain Project, working across sectors to improve nutrient management.
- New and expanded ELMs, increasing payments for actions that deliver environmental outcomes.
- The Sustaining Soils Project, which has developed tools and approaches that help evaluate and manage risk of soil and nutrient loss.
- Work in the Clun catchment to develop a Protected Site Strategy and Nature Recovery Blueprint, which may also provide insights about how significant reductions in nutrients can be achieved using NbS in the Wye and Lugg catchments.

While a WPZ remains under review, its progression depends on identifying a realistic, evidence-based and enforceable set of measures capable of delivering the necessary reductions in nutrient and sediment loads. This includes understanding what actions are most effective, how they can be applied across the catchment, and over what timeframe measurable improvements can be achieved. Further work is also needed to assess how existing mechanisms could be used or adapted to support delivery, and to ensure any future approach is proportionate, practical, and supported by robust evidence. The DWPP Action Plan outlines the types of investigations required to build this evidence base, and many of these are already underway.

We remain committed to working with partners to continue to strengthen the evidence base and explore all viable options for improving water quality across the catchment.

Conclusion

P surpluses across the Wye catchment continue to pose a significant risk to water quality and ecological health. While the main River Wye in England is largely compliant with P targets, legacy P accumulation in soils and ongoing nutrient inputs remain a concern. The River Lugg, in particular, exceeds P thresholds by a wide margin, necessitating additional, targeted intervention.

The DWPP sets out five strategic priorities that offer significant potential for reducing nutrient losses: farm gate nutrient balancing, catchment-scale management of bulk organic nutrients, mitigation of high-risk cropping on vulnerable land, targeted use of ELMs, advice and funding, and supply chain engagement. These priorities provide a structured framework for delivering improvements at scale.

In support of these priorities, six targeted investigations have been identified to improve understanding and inform future delivery. These include research into legacy P drawdown, standardisation of nutrient balance calculations, in-river nutrient cycling, sediment source tracking, learning from work in other catchment areas, and more detailed evaluation of a WPZ as a regulatory mechanism.

Successful implementation of the measures in the DWPP will depend on sustained effort, robust evidence gathering, and proactive implementation of existing and new regulatory, advisory, and incentive-based mechanisms tailored to local conditions.

Part 2. List of Actions Needed to Achieve Favourable Condition

Achieving favourable condition for the River Wye SAC, and particularly for the Lugg sub-catchment, will require a coordinated and sustained programme of action. The scale of P reduction needed, especially in the Lugg, goes beyond what can be achieved through current delivery alone. This section sets out our strategic priorities for the catchment and provides a structured list of actions that reflect both the scale of the challenge and the need for innovation, collaboration, and evidence-led decision-making.

The tables below present a comprehensive overview of the actions identified through the DWPP Options Appraisal process and wider stakeholder engagement. They are grouped to reflect different types of activity and their role in supporting progress toward the phosphate targets:

- **Table A: Strategic Priorities** – High-level priorities identified through the DWPP Options Appraisal process, which provide a framework for guiding action across the catchment.
- **Table B: Options Appraisal Actions** – Specific actions considered important for delivering strategic priorities and achieving reductions in nutrient loads at pace and scale.
- **Table C: Delivery Actions** – Ongoing activities using existing mechanisms and approaches, including those delivered through regulatory programmes, agri-environment schemes, and voluntary initiatives.
- **Table D: Evidence Actions** – Investigative and monitoring activities that are planned or underway, aimed at improving understanding of pollution sources, pathways, and intervention effectiveness.
- **Table E: Completed Actions** – Past activities that have informed current delivery and provide a foundation for future learning and adaptation.

Table A. Strategic priorities identified through the DWPP Options Appraisal process.

Strategic Priority	Rationale	Related Actions
1: Farm gate nutrient balancing	P inputs from feed, fertiliser, and other sources should not exceed outputs in crops and livestock products. By accounting for P at the farm gate, we can identify surpluses that contribute to pollution, support efficient nutrient use, and address legacy P accumulation in soils.	Delivery Actions and Investigations: Wye CMP, Wye SNAC Project, CSF, ELMs, Farm regulatory inspections, RePhoKUs 3. Options Appraisal actions: “Unlocking” and “mining” P investigation, Standardising calculation of farm gate nutrient balances, Substrate sediment sampling trial, Evaluate WPZ as a mitigation mechanism.
2: Catchment-scale management of bulk organic nutrients	Reducing the environmental impact of bulk organic nutrients, such as slurry, poultry litter, digestate, and biosolids requires a coordinated, catchment-scale approach that matches nutrient supply with land that can absorb it safely and effectively. This is essential to reduce localised nutrient overloads, improve resource efficiency, and protect long-term soil and river health. This priority aims to build on existing work in the catchment, including policy W3 in the Herefordshire Council Minerals and Waste Local Plan, the Avara Sustainable Poultry Roadmap, Project TARA, and the Agri-food Supply Chain Project. Other approaches and innovative technologies for managing bulk organic nutrients across different farming systems and sectors should be explored.	Delivery Actions and Investigations: Wye CMP, Herefordshire Council Minerals and Waste Local Plan, Avara Sustainable Poultry Roadmap, Farm/AD regulatory inspections, CSF, ELMs, Agri-food Supply Chain group, Wye SNAC Project, RePhoKUs 3. Options Appraisal actions: Standardising calculation of farm gate nutrient balances, Evaluate WPZ as a mitigation mechanism.
3: Reducing the impact of high-risk crops on high-risk land	Maize, potatoes and other root vegetables are important crops in the Wye catchment, but when grown on vulnerable land, such as sloping, light, or poorly drained soils, or near watercourses, they significantly increase the risk of nutrient loss and soil erosion. This priority recognises the importance of working with growers to identify practical ways to reduce environmental impacts, such as improving soil cover, refining rotations, or adjusting field selection. While land use change may need to be considered in some cases, the focus is on supporting farmers to make informed decisions that better balance productivity with catchment health. This will be supported through mechanisms such as CSF, ELMs, collaboration with the agri-food supply chain, targeted farm inspections, and ensuring compliance with the FRfW.	Delivery Actions and Investigations: Wye CMP, Farm regulatory inspections, CSF, ELMs, Wye SNAC Project, RePhoKUs 3. Options Appraisal actions: Sediment fingerprinting, Learn from innovative work in other catchments, Evaluate WPZ as a mitigation mechanism.

Strategic Priority	Rationale	Related Actions
4: Targeted use of ELMs, advice and funding	ELMs are evolving, with recent updates offering more flexible options and improved incentives for farmers delivering environmental benefits. This priority aims to support farmers in capitalising on these opportunities by aligning ELMs participation with the specific needs of each catchment. A key part of our approach is promoting the new CSHT schemes, complemented by targeted, collaborative advice to ensure farmers receive the right support in the right places. To maximise impact, funding and advice should be consistent with emerging planning frameworks, including Environmental Delivery Plans (EDPs), LNRSs, the Wye Catchment Management Plan (CMP), and Welsh data and evidence. Delivery mechanisms may need to evolve to support more integrated and locally tailored approaches.	Delivery Actions and Investigations: Wye CMP, ELMs, farm regulatory inspections, Wye SNAC Project, RePhoKUs 3, EDPs, LNRS, WEIF funded projects. Options Appraisal actions: Learn from innovative work in other catchments, sediment fingerprinting, Evaluate WPZ as a mitigation mechanism.
5: Supply chain engagement and accountability	Agri-food businesses have the reach and influence to accelerate the adoption of nutrient management practices across large areas. By embedding environmental standards, incentives, and support into supply chains, this priority enables action at pace and scale, helping to deliver measurable improvements in water quality while supporting resilient, sustainable farming systems.	Delivery Actions and Investigations: Agri-food Supply Chain Project, Avara Sustainable Poultry Roadmap, Standardising calculation of farm gate nutrient balances. Options Appraisal actions: Learn from innovative work in other catchments, Evaluate WPZ as a mitigation mechanism.

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Table B. Options Appraisal Actions

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
“Unlocking” and “mining” P	Phosphate, soil health	Investigation	English Wye	EA	Prospective	Field research is needed to investigate methods for maintaining productivity with lower soil P indices and drawing down legacy P.
Standardising calculation of farm gate nutrient balances	Phosphate	Investigation	English Wye	EA	Prospective (related work with PLANET and the EA Phosphorus Loss Tool is ongoing)	Standardised approaches are needed to support farm gate nutrient balancing. Alternative methodologies could be based on PLANET, the EA Phosphorus Loss Tool, or another tool. The SNAC Project is using the existing version of PLANET. EA is working with the potato sector to refine and test the Phosphorus Loss Tool (at farm and field scale).
Sediment Fingerprinting	Phosphate, sediment	Investigation	Lugg	EA, NE	Prospective	Sediment fingerprinting will improve our understanding of sources of sediment in the Wye and Lugg catchments. Some sediment fingerprinting has been undertaken in the Lugg above the confluence with the River Frome (Stopps 2018).
Substrate sediment sampling	Phosphate	Investigation	EA	EA	Prospective	Sediment in substrate is a source of phosphate that may drive algal growth in the Wye catchment. EA wish to trial methods for sediment sampling. This work will likely need to be outsourced.
Learn from innovative work in other catchments	Multiple	Investigation	English Wye	EA, NE	Prospective	Lessons can be learned from Severn Vale CaBA’s collaborative, nature-based projects, including Wilder Frome and Forest to Sea. Although Severn Vale faces different pressures, these case studies provide examples of how strategic planning and community engagement can improve water quality and biodiversity. We can also learn from the approaches and innovations emerging in other CaBA groups. NE’s Protected Site Strategy in the Clun will also offer a useful model for aligning nutrient management with habitat protection.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
Detailed evaluation of Water Protection Zone (WPZ) as a mitigation mechanism	Phosphate, sediment	Investigation	English Wye or only the Lugg catchment	EA	Prospective	A WPZ under the Water Resources Act 1991, could help reduce nutrient pollution in the Lugg or wider Wye catchment. WPZs provide strong regulatory powers but require careful design, solid evidence, and assessment of feasibility. Investigations in this Action Plan will support the evidence base and may support WPZ development. This option remains under review and consideration.

Table C. Delivery Actions: Existing actions using current approaches

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
Catchment Based Approach (CaBA) – Wye Catchment Partnership (WCP)	Multiple	Collaborative governance and stakeholder coordination	Whole Wye	Wye and Usk Foundation, NRW, EA, NE, local authorities, NGOs	Ongoing	Supports multiple initiatives. Facilitates alignment between funding, policy goals, and on-the-ground action. A key platform for integrated catchment management.
Wye Catchment Management Plan (CMP)	Multiple	Catchment Planning	Whole Wye	WCP	In development	The CMP will be a holistic, catchment-wide plan aimed at restoring the Wye SSSI/SAC. It will address issues relating to climate (flow and water temperature), water quality, biodiversity and geomorphological issues. It will be based on a participatory systems mapping exercise and modelling from an EA-funded Understanding the Wye Catchment Project.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
ELMs	Multiple	Incentives	English Wye	Defra, EA, NE	Ongoing	ELMs will play an ongoing role in improving land management. Schemes include the SFI, CSHT, Landscape Recovery and Capital Grants. EA and NE will work together to optimise the use of new CSHT options.
Catchment Sensitive Farming	Multiple	Advice, incentives	English Wye	NE, EA, Defra	Ongoing	Provides farmers with tailored advice, support, and grants to protect water, air, and soil. Existing and new ELMs.
Farm/AD regulatory inspections	Nutrients, sediment	Regulation/ Enforcement	English Wye	EA	Ongoing	Routine compliance visits (SSAFO, NVZ, FRfW). Additional resources for regulatory visits were allocated to European sites (SACs and SPAs) in 2021, including the Wye/Lugg catchments. In April 2026, overall funding for farm inspections nationwide will increase.
River Wye Bare Ground Project	Soil, land management	Remote sensing, regulation	Whole Wye	EA	2023. Will resume in 2025-26	Undertaken by the National Agriculture Remote Sensing team with West Midlands Area.
River Wye Water Quality Page @ Engagement HQ	Multiple	Engagement/ outreach	English Wye	EA	Ongoing	A web portal with reports and other information about monitoring and catchment management activity in the Wye.
Delivering Innovative Markets for Ecosystems (DIME)	Multiple	Green finance investigation and delivery	English River Monnow headwaters	Wye and Usk Foundation, The Rivers Trust, Nature Finance, EA	Ongoing	Natural Environment Investment Readiness Fund project. Working with farmers to improvement catchment resilience through improved land management practices.
Herefordshire Integrated Wetlands Project	Phosphate, unlocks development under NN	NN	Lugg catchment	Herefordshire Council	Ongoing (Luston fully operational)	A Nutrient Mitigation Scheme to enable home building. Wetlands have been constructed at a site close to the Welsh Water STW at Luston. Work has begun on second wetland site at Tarrington STW. Another site at Titley STW has planning permission. Other sites are under consideration.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
WINEP sewage treatment and sewer overflow improvements	Nutrients	Reduction in loads from sewage treatment and sewer overflows	Whole Wye	Welsh Water	Ongoing	Upgrades at sewage works and storm overflows in AMP8 will result in the point sector mostly meeting its fair share of nutrient load reductions required to meet the SSSI/SAC water quality targets. Additional effort may be needed to reduce point sector P inputs affecting the River Wye immediately downstream of Rotherwas STW.
Welsh Water tree planting schemes	Carbon, climate change resilience	Tree planting, INNS management	Whole Wye	Welsh Water	Ongoing (included in AMP8)	Tree planting, INNS management. Part of Welsh Water's Carbon Net Zero Plan.
Wye Soils, Nutrients and Compliance Project (SNAC)	Soil health, nutrients	Research, education	Herefordshire	EA, Herefordshire Rural Hub, Farm Herefordshire, NFU	Ongoing through 25-26	WEIF project. Work with farmers to address issues of soil health and nutrient losses. The project helps fund the Farm Herefordshire partnership. As part of the SNAC Project, videos have been produced which promote good practice on farms. The project includes work with the Herefordshire Agri Group to develop farm nutrient balances.
Herefordshire Agri Group	Nutrients. Soil health.	Education	Herefordshire	Herefordshire Rural Hub	Ongoing	Supported by Defra's Facilitation Fund. A group open to farmers that wish to collaborate to reduce agriculture's impact on water quality. The group aims to increase knowledge of actions that will reduce diffuse pollution. The group participates in the SNAC Project.
Herefordshire Local Nature Recovery Strategy	Biodiversity	Catchment planning	Herefordshire	Herefordshire Council, NE, EA	In preparation	The LNRS aims to reverse the ongoing decline of nature and biodiversity through practical and coordinated action. Partners involved in working groups include Herefordshire Wildlife Trust, Wye Valley and Malvern National Landscapes, Forestry Commission, Countryside Land and Business Association and Herefordshire Biological Records Centre.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
Wye Adapt to Climate Change	Multiple	NFM, NbS	Herefordshire priority areas are Wellington Brook catchment, Yazor Brook catchment, and various Wye tributaries between Bredwardine and Hay-On-Wye	Radnorshire Wildlife Trust (Wales), Herefordshire Wildlife Trust, Wye Valley National Landscape	Ongoing	Funded by The National Lottery Climate Action Fund. Engaging with land managers and communities in the Wye catchment to work together and build landscape resilience to climate change. Explores NFM and NbS to mitigate and adapt to climate change impacts.
Wye – P on the Arrow (Arrow Valley Diversity Project)	Water quality, soil erosion, soil health, biodiversity	Sustainable farming	Arrow catchment	EA, Wye and Usk Foundation	Ongoing through 25-26.	WEIF project. Promoted regenerative farming practices to increase water quality, biodiversity and reduce diffuse pollution. Followed on from the Go Wild on the Curl Project. Farmers were offered a detailed farm report that identified opportunities and maps for agricultural and natural capital improvements. ELMs are used to deliver capital interventions.
Wilder Lugg	Hydrology, flood mitigation	Advice, NFM	Lugg river corridor (England and Wales)	Herefordshire Wildlife Trust, Radnorshire Wildlife Trust (Wales)	Ongoing	Aims to empower the local rural community to bring about a long-term vision for the health and maintenance of the River Lugg. Funding and other support is provided for NFM works.
Project TARA	Nutrients	Regulation/ Enforcement	English Wye	EA	Completed March 2025	Regulatory inspections of dairy and poultry farms and anaerobic digester sites. Aspects of the project continue through the Agri-food Supply Chain Project, EA remote sensing unit, EA engagement officer, and farm and AD site inspection methodologies.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
Wyescapes; Food, Nature and Water (Landscape Recovery)	Multiple	Changes to land use and land management	Herefordshire	EA, NE, Herefordshire Rural Hub, Wye Valley AONB Partnership, Herefordshire Wildlife Trust, Wye and Usk Foundation	In 2-year development phase	A Landscape Recovery project. If the development phase is completed and the project passes DEFRA's assurance process, it may be offered funding to enter the 20-year Implementation Phase. Farmers will be supported to improve the sustainability and resilience of food production and create more diverse habitats in the floodplain.
Wye Valley Ridge to River (Landscape Recovery)	Soil health, nutrients, biodiversity	On-farm mitigation, regenerative farming	Blakemere	Duchy of Cornwall Estate, Moccas Estate. Local farmers	In development phase	A Landscape Recovery project. Soil health, habitat and water quality improvement on farms near Lower Blakemere Farm.
Farm Herefordshire on-farm events	Nutrients, soil health	Engagement, education	Herefordshire	NE, Rural Hub, Farm Herefordshire	Ongoing	Calendar of events coordinated and delivered by Farm Herefordshire.
EA agricultural engagement	Multiple	Engagement, education	English Wye	EA	Ongoing	Evolved from Project TARA. EA appointed an Agricultural Engagement Specialist to work with the farming community. Activities include video production, social media and attendance at farming events. Additional content creation and outreach is also planned, including the production of a new video demystifying the Farming Rules for Water.
"River Friendly Farming"	Multiple	On-farm mitigation	Whole Wye	WCP	Ongoing	A suite of mitigation measures that will be included in the Wye CMP.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
Power for Soils	Multiple. Visual amenity	On-ground action	Wye Valley National Landscape	Wye Valley National Landscape, Herefordshire Meadows	Starts April 2025	Partnered through WEIF. National Grid Landscape Enhancement Initiative (LEI). Provides funding for projects aimed at improving the visual impact of its National Grid infrastructure. The initial LEI project, named "Wye Valley Magnificent Meadows, Tremendous Trees and Wonderful Wetlands," focuses on a 3km buffer zone near power lines. Activities funded include pond restoration, NFM, woodland planting, orchard tree planting, and the creation of species-rich grassland.
The Severn Trent Environments Protection Scheme (STEPS)	Pesticide	Farm infrastructure upgrades	Drinking water safeguard zone (SWSGZ210)	Severn Trent Water	Ongoing	Funding available for parts of the Wye/Lugg catchment under the STEPS Pesticide Washdown Offer.

Table D. Evidence Actions

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
SSSI/SAC Condition Assessment and	Multiple	Investigation	SSSI/SAC	NE, EA	Ongoing	A two-year assessment of the management units and designated features of the Wye SAC. Update feature condition in CMSi and Designated Sites View
Citizen Science Investigations	Multiple	Monitoring	Whole Wye	Volunteers, the Wye Alliance, Wye and Usk Foundation, EA, Welsh Water, Cardiff University	Ongoing	Volunteers collect and analyse data, conduct experiments and contribute to scientific investigations. Information is being recorded and downloaded onto EPICOLLECT. Citizen Scientists have also created their own dashboard using the data they have collected which is publicly accessible via the Wye Viz platform. P monitoring is undertaken using Hanna P meters. EA supports citizen science through the EA Supporting Citizen Science Project.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
Rephokus 3	Phosphate, soil health	Investigation	Whole Wye	EA	Ongoing	A research project to better understand the fate and transport of P through the soil profile. Measuring P at different soil depths helps quantify how much P is retained or lost within the soil profile, enabling more accurate accounting of P stocks and flows across agricultural and environmental systems.
Sonde and autosampler investigation	Water quality, water temperature, algal blooms	Monitoring	Wye SAC	EA	Ongoing	EA undertakes monitoring using sondes and autosamplers to monitor water quality and temperature, investigate local sources of pollution leading to algal blooms, and priorities regulatory inspections. Live readings from the sondes are publicly available on the internet.
Algae Surveys	Algal blooms	Monitoring	Wye SAC	EA	Ongoing	Water column and RAPPER surveys in the growing season, plus reactive surveys when algal blooms are present.
NEW-Harmonica	Nutrients	Investigation	Whole Wye	Lincoln University	Ongoing. Completes August 2025	Supported by UKRI grant 10047759. A project to support authorities and policymakers in taking measures to prevent nutrient pollution.
PLANET tool revision	Nutrients	Decision Support Tools	National	Defra, EA	Ongoing	EA are working with Defra on a revised nutrient management tool that will be an update of the PLANET nutrient management decision support tool.
Nature Restoration Fund (NRF) and Environmental Delivery Plans (EDPs)	Nutrients, biodiversity	Financial mechanism/ offsets	National	NE	In development	Announced by the Government in the 2024 budget. The NRF is proposed in the Planning and Infrastructure Bill to streamline environmental mitigation processes associated with select impacts of certain development projects. The NRF aims to balance the acceleration of infrastructure and housing development with the restoration and protection of natural habitats and species. It introduces EDPs and a Nature Restoration Levy, enabling developers to optionally contribute to strategic, landscape-scale mitigation rather than undertake project-specific measures, where an EDP is in place.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	Progress	Comments
£1M Wye cross-border research fund	Multiple	Research	Whole Wye catchment (England and Wales)	Defra and others	Announced	A cross-border research programme that aims to investigate sources of the pollution and pressures, study the impacts of changing farming practices and land management, develop and test new ways to improve water quality, and examine what is driving declines in river health.
£15M Farming Futures Research and Development fund	Nutrients	Research	National	Innovate, Defra	Ongoing	The £15 million Farming Futures Research and Development Nutrient Management Fund supports innovative solutions in nutrient management.
UK Chemicals Strategy	Nutrients (and other chemicals)	Planning	National	Defra, JNCC, UKCEH	To be absorbed into the 2025 EIP	A new UK Chemicals Strategy was expected to be included in the 2025 revision of the EIP. However, in May 2025, it was announced that the EIP would include the Government's approach to managing chemicals into the plan, rather than publish a Chemicals Strategy as a separate document. The strategy is expected to include updated guidance on which nutrient forms should be prioritised for monitoring, how monitoring should occur, and how chemical and biological indicators should be integrated to assess ecosystem health.

Table E. Recently Completed Actions

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	When?	Comments
RePhoKUs 1 Re-focusing Phosphorus use in the Wye Catchment	Phosphate	Research	Whole Wye catchment	Lancaster University, EA	2021-22	A study of P inputs and outputs in the Wye catchment, their impact on river water quality, and stakeholder responses to maintaining food and water security. The report concluded that the catchment has an annual P surplus of around 3,000 tonnes. P accumulates in soils (as "legacy" P) and poses an ongoing risk to water quality.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	When?	Comments
RePhoKUs 2 **Land Use Change and Phosphorus Balances in the Wye Catchment**	Phosphate	Research	Whole Wye catchment	Lancaster University, EA	2023	A study of land use change and P balances. The research found a build-up of surplus P in soils, creating a legacy equivalent to 1.86 tonnes per hectare in the arable and productive grassland in the catchment. Only 30-60% of the legacy P input is found in the top 30 cm of soils, suggesting significant migration of P into the subsoil and water (see RePhoKUs 3).
Understanding the Wye Catchment Project	Multiple	Catchment Planning	Whole Wye catchment	EA, WCP, Mott Macdonald	2023-24	A project undertaken by WCP members to understand links between catchment interventions and outcomes. The project included two parts – a participatory systems mapping exercise, and numerical modelling using WSIMOD to understand the impact of potential interventions. The outputs will inform development of the Wye CMP.
Wye Algae PhD Project	Algal blooms, nutrients	Research	Whole Wye catchment	Cardiff University, Wye and Usk Foundation	2022-24. Report produced in 2025	An investigation into the causes of algal blooms. The research found that the causes of algal blooms are complex, and may relate to issues relating to flow, water temperature, retention times, solar radiation, as well as nutrient dynamics.
Johnson-Su Compost Trial	Phosphate	Research/trials	Ross-on-Wye	Townsend Farm, EA, Wye and Usk Foundation	2022	A WEIF project to establish a sustainable method to unlock legacy phosphate in soils. Funding was in place to develop coordination and demonstration of best practice through 2022.
Go Wild in the Curl	Nutrients and sediment. Biodiversity	Sustainable farming, community engagement	Curl Brook (Arrow)	Wye and Usk Foundation, local farmers	2016-21	A project to improve water quality and biodiversity in the Curl Brook catchment. The project tackled pollution from P, sediment, and nitrates through sustainable farming practices, habitat restoration, and public engagement. It achieved a reduction in P levels and enhanced local wildlife habitats while promoting long-term environmental stewardship. Learning from the project was used in the Wye – P on the Arrow Project.

Action/Measure	Benefits and pollutants addressed	Type of action/ measure	Where?	Who?	When?	Comments
Rooting for Better Soils	Biodiversity, nutrients, soil health (infiltration and water holding)	Habitat creation	Lugg catchment (Arrow, Frome)	EA, Herefordshire Meadows	Completed March 2025	WEIF project. Restoring water dependent habitats including Lowland Meadows. Farm visits; stakeholder events; feasibility work on evidence-base and barriers to uptake of increasing sward diversity as a key part of the transition to sustainable farming practices that limit soil and nutrient loss to water.
Woodlands for Water	Multiple	Tree planting	Dore, Dulas and Lugg catchments	Defra, Riverscapes Partnership, Rivers Trust, Beaver Trust, Wye and Usk Foundation	Completed March 2025	Delivered through Nature for Climate funding. The aims of the project were to improve water quality, preventing erosion, manage flood risks, enhance biodiversity, make rivers more resilient against climate change by providing shade and lowering water temperature, and aiding fish adding to create wildlife corridors.
Sustaining Soils	Sediment, soil health, nutrients	Investigation	Garren Bk catchment	Wye and Usk Foundation	Completed March 2025	WEIF project. A desk-based feasibility study on mitigating soil erosion risk in the Garren Catchment and Gamber catchments. The study aimed to develop a risk mapping tool that identifies areas of the Gamber catchment are most at risk of soil erosion, and a methodology that can be applied elsewhere in the West Midlands and beyond. Pilot implementation may be delivered through agri-food supply chain work.
Wye/Lugg Agroforestry Project	Multiple	Tree planting	English Wye	EA, Wye and Usk Foundation	Completed March 2025	WEIF project. Established agroforestry (wood pasture, shelterbelts and riparian planting) in priority locations for water quality and riparian shading.
Restoring our Rivers	NFM, habitat, biodiversity, fish	NFM, NbS	Lugg: Wellington catchment, Yazor Brook.	Herefordshire Wildlife Trust, NE, EA	Completed March 2025	WEIF project. Commenced 2023 and delivered NFM interventions and NbS within the Wellington catchment (Lugg).

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Acronyms

25YEP	25 Year Environment Plan
AA	Appropriate Assessment
AD	Anaerobic Digestion
ALERT	Agriculture Land Environment Risk and Opportunity Tool
AMP	Asset Management Plan
APHA	Animal and Plant Health Agency
APWN	Anti-Pollution Works Notice
BAS	Biosolids Assurance Scheme
BAU	Business as Usual
BPS	Basic Payment Scheme
CaBA	Catchment Based Approach
CMP	Catchment Management Plan
COGAP	Code of Good Agricultural Practice
CSF	Catchment Sensitive Farming
CSHT	Countryside Stewardship – Higher Tier
CSMG	Common Standards Monitoring Guidance
Defra	Department for Environment, Food and Rural Affairs
DIME	Delivering Innovative Markets for Ecosystem services
DrWPA	Drinking Water Protected Areas
DWPP	Diffuse Water Pollution Plan
EA	Environment Agency
EDM	Event Duration Monitoring
EDP	Environmental Delivery Plan
EIP	Environmental Improvement Plan

ELMs	Environmental Land Management schemes
FARMSCOPER	FARM SCale Optimisation of Pollutant Emission Reductions
FGNB	Farm gate nutrient balancing
FRfW	Farming Rules for Water
HLS	Higher Level Stewardship
INNS	Invasive Non-Native Species
JAS	June Agricultural Survey
LNP	Local Nature Partnership
LNRS	Local Nature Recovery Strategy
MC	Management Catchment
NbS	Nature-based Solutions
NE	Natural England
NFM	Natural Flood Management
NFU	National Farmers' Union
NGO	Non-Governmental Organisation
NN	Nutrient Neutrality
NMEG	Nutrient Management Expert Group
NRAP	Nature Recovery Action Plan
NVZ	Nitrate Vulnerable Zones
NRF	Nature Restoration Fund
NRW	Natural Resources Wales
OC	Operational Catchment
OP	Orthophosphate
P	Phosphorus
RB209	Reference Book 209 (now known as the Nutrient Management Guide)
RBMP	River Basin Management Planning

SAC	Special Area of Conservation
SAGIS	Source Apportionment Geographical Information System (model)
SIMCAT	Simplified Catchment Model
SFI	Sustainable Farming Incentive
SgZ	Surface Water Safeguard Zone
SIP	Site Improvement Plan
SPA	Special Protection Area
SPZ	Source Protection Zone
SRP	Soluble Reactive Phosphorus
SSAFO	Silage, Slurry and Agricultural Fuel Oil
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
TARA	Testing Approaches to the Regulation of Agriculture
TP	Total Phosphorus
WAP	Wye Algae Project
WCP	Wye Catchment Partnership
WEAG	Water Expert Advisory Group
WEIF	Water Environment Improvement Fund
WETP	Water Environment Transformations Programme
WFD	Water Framework Directive
WINEP	Water Industry National Environment Programme
WSIMOD	Water System Integrated Model
WTH	Woodland Tree Health

Appendix A: Options Appraisal

Options Appraisal Template
Diffuse Water Pollution Plan/Nutrient Management Plan

European site (s) covered	River Wye Special Area of Conservation
Diffuse Water Pollution Plan/Nutrient Management Plan Name	River Wye SAC Diffuse Water Pollution Plan
Environment Agency Area Name	West Midlands
Natural England Area Name	West Midlands
Date	11/11/2025
Version	1.0
Author(s)	Les McNamara - EA

Objective

Reductions required to meet River Wye SAC water quality conservation objectives

Water quality conservation objectives for the River Wye SSSI/SAC and River Lugg SSSI are shown in Table 20. Targets for soluble reactive phosphorus (referred to as "phosphate" throughout the DWPP) are not being met at any monitoring point on the River Lugg portion of the River Wye SAC. Reducing P loads throughout the Wye catchment, but especially in the Lugg is the main objective of the River Wye SAC (England) DWPP.

Siltation is also thought to be excessive throughout the catchments and plays a role in the transport and storage of P. Reduction in P and sediment loads need to be considered in tandem.

Table 20. Summary of water quality conservation objectives.

Parameter	Target
Soluble Reactive Phosphorus ("orthophosphate" expressed as P) (mg/l, annual and growing season mean)	Variable: 0.15 mg/l to 0.39 mg/l
Dissolved Oxygen (% saturation at 10th percentile)	85%
Total Ammonia (90th percentile)	Variable: 0.2 mg/l - 0.25 mg/l
Un-ionised Ammonia	Variable: 0.025 mg/l - 0.02 mg/l
Siltation	No unnaturally high levels of siltation

EA monitoring data show that the phosphate target is not being met for all of the SSSI units in the River Lugg that fall within the River Wye SAC. The main River Wye is narrowly passing over the 2022-2024 period, except at monitoring site H0000072 (Table 21).

Table 21. Compliance with SSSI targets 2022-2024 (3-year average).

SSSI	Monitoring Site	Phosphate target (mg/l)	2022-2024 Growing season mean (mg/l)	2022-2024 Growing season compliance	2022-2024 Total mean (mg/l)	2022-2024 Total compliance
Lugg	50039: Mortimers Cross Bridge*	0.015	0.007	Pass	0.007	Pass
	50042: Eaton Bridge, Leominster*	0.03	0.035	Fail	0.031	Fail
	50043: Ford Bridge	0.03	0.043	Fail	0.041	Fail
	50047: Wergins Bridge	0.03	0.071	Fail	0.070	Fail
	50050: Mordiford Bridge	0.03	0.082	Fail	0.084	Fail
Wye	50021: Whitney Toll Bridge	0.021	0.007	Pass	0.010	Pass
	50183: Bredwardine Bridge	0.023	0.008	Pass	0.013	Pass
	50022: Bridge Sollars	0.024	0.009	Pass	0.013	Pass
	RSN0138: Broomy Hill	0.024	0.010	Pass	0.013	Pass
	50023: Victoria Bridge	0.026	0.016	Pass	0.017	Pass
	50024: Carrots Pool	0.026	0.013	Pass	0.015	Pass
	50807: Holme Lacy Bridge	0.03	0.024	Pass	0.027	Pass
	50026: Hoarwithy Bridge	0.033	0.024	Pass	0.027	Pass
	50810: Hole-In-The-Wall Footbridge	0.033	0.030	Pass	0.029	Pass
	50027: Wilton Bridge	0.034	0.023	Pass	0.027	Pass
	50028: 800m D/S Kerne Bridge, Goodrich	0.035	0.023	Pass	0.028	Pass
	50029: Huntsham Br. Symonds Yat	0.036	0.022	Pass	0.028	Pass
	H0000072: Redbrook Railway Bridge	0.039	0.028	Pass	0.040	Fail**

* No data were collected at these sites after July 2023 due to health and safety concerns. Monitoring resumed in spring 2025. As a result, the growing season result is based on only seven samples and does not meet the threshold required for WFD compliance assessment. The total compliance result includes sufficient samples but is not representative of the full 2022-2024 period.
** The failure at this site is due to one unusually high result in 2023.

Source apportionment

The input load source apportionment for the Lugg catchment was outlined in the Indicative Catchment Statistics for Nutrient Pollution report (Table 22). These data are based on modelled outputs at the downstream end of each catchment.

Table 22. Phosphate input load source apportionment (does not include AMP7 or AMP8 water company investment measures, or Avara exports of broiler manure). Includes data available in FARMSCOPER for England and Wales.

	Point	**Rural Diffuse**	**Urban Diffuse**	**Septic tanks**	**Other**
Whole catchment	21%	75%	2%	2%	0%
Lugg	14%	81%	2%	2%	0%

FARMSCOPER modelling scenarios

Ten different scenarios were modelled using FARMSCOPER. Two of the scenarios were used with SAGIS to estimate the potential impact of higher uptake of voluntary and regulatory mitigation measures on in-river phosphate concentrations:

- *Scenario 4*: 100% compliance with regulation, 25% implementation of FRfW "reasonable" measures, and "current" uptake rate of voluntary and other measures.
- *Scenario 10*: 100% uptake of all FARMSCOPER mitigation measures ("theoretical maximum").

Scenario 4 is a "full compliance" scenario based on national assumptions about uptake rates, and Scenario 10 is a "theoretical maximum". Under scenario 10, reductions are based on 100% uptake of all nutrient mitigation measures modelled in FARMSCOPER. This is not a "real world" scenario as some of the mitigation measures cannot feasibly implemented at the same time on the same parcel of land. A feasible best-case scenario based on current land use and conventional approaches to best management practice, and current regulatory mechanisms, voluntary initiatives and incentives would be a reduction that is likely to be significantly lower than the theoretical maximum.

Note that FARMSCOPER only models certain measures contained within the diffuse pollution mitigation manual and therefore does not take account of all agricultural diffuse measures that exist. Also, the modelling scenarios use default livestock numbers in FARMSCOPER and do not include updated information about poultry numbers, or adjustments based on Avara's commitments in their Sustainable Poultry Roadmap. Nevertheless, it is a useful starting point to understand the scale of improvements that could be made by conventional on-farm mitigation within the agricultural sector.

SAGIS Modelling

The EA Nutrients and Nature Recovery Programme undertook SAGIS-Simcat modelling to determine source apportionment and the effect of mitigation measures on phosphate concentrations in the SAC. Full details of the modelling methodology are explained in the EA internal report titled Nutrients and nature Recovery Modelling, Summarised River Water Quality Modelling Methodology, updated in December 2023.

The Source Apportionment Geographical Information Systems (SAGIS) model was developed jointly by the EA and the water industry. SAGIS has been used to understand the sector apportionment of phosphates within the rivers and to understand the compliance gap between current conditions and the conservation objectives. EA normally updates SAGIS models every five years, and one of its main uses is to inform the water industry price review process and to identify environmental improvements that go into water industry Asset Management Plans (AMPs).

To support DWPP preparation, SAGIS was used to calculate nutrient source apportionment against a 2009 baseline year (to align with the start of the River Basin Management Planning cycle). This ensures that any reductions or increases in pollutant load since 2009 are accounted for and attributed to the relevant sector (i.e., diffuse or point) under the revised polluter pays principle. The source apportionment was then used to calculate a "sector share" of the phosphate target, and the sector share reductions required to meet protected site conservation objectives.

The effect of mitigation measures on phosphate concentrations was modelled using several management scenarios for the point and diffuse sectors. Point sector improvements were captured using details derived from the AMP process. For diffuse inputs from agriculture, the EA Agriculture, Risk and Evaluation team carried out a "National Once" assessment of pollutant load reductions for the Wye and Lugg catchments using FARMSCOPER (v5). FARMSCOPER modelled reductions in P loads (in kg) from agricultural land in response to mitigation measures, which were then incorporated into SAGIS using the *percentage* reductions from livestock and arable land uses. Only the percentage reductions in nutrient loads calculated by FARMSCOPER were used in SAGIS modelling due to incompatibilities in the way the models simulate catchment processes.

For loads from the point source sector (sewage treatment works), a "baseline" model and "at permit" model was used. The baseline model is based on current discharges at sewage treatment works (STWs) and provides more "optimistic" predictions. The at permit model assumes that all STWs are discharging effluent at fully permitted levels ("pessimistic"). The results presented in the analyses below are based on discharges from STWs after AMP8 improvements.

CSMG targets are for soluble reactive phosphorus, and this parameter was modelled by SAGIS to assess the effect of measures on achieving the sector share of the phosphate target. This parameter is presented as "orthophosphate reactive as P" in EA monitoring data. The default values used by FARMSCOPER are for total phosphorus (TP), with an underlying assumption that the difference in percentage reduction between TP and phosphate is small. Percentage load reductions derived from FARMSCOPER are used in SAGIS rather than absolute loads (typically expressed in kg).

The Wye DWPP area covers the whole of the Wye catchment in England, focussing on the main River Wye and the River Lugg, both of which are part of the River Wye SAC. Only the Lugg, a Nutrient Neutrality (NN) catchment, is failing to meet its phosphate targets. The rivers have different *average* CSMG phosphate targets: 0.029 mg/l for the Wye, and 0.026 mg/l for the Lugg. Both catchments were subdivided into sub-catchments for modelling purposes to aid with interpretation (Figure 16). The Wye has been divided into upstream and downstream of the River Lugg. Meanwhile the Lugg catchment (i.e., the Arrow Lugg and Frome operational catchment) was divided into the individual Lugg, Arrow and Frome sub-catchments. The Monnow Operational Catchment was not adjusted.

Note that modelling was undertaken using micrograms per litre (µg/l). Values have been converted to mg/l in the body of the report.

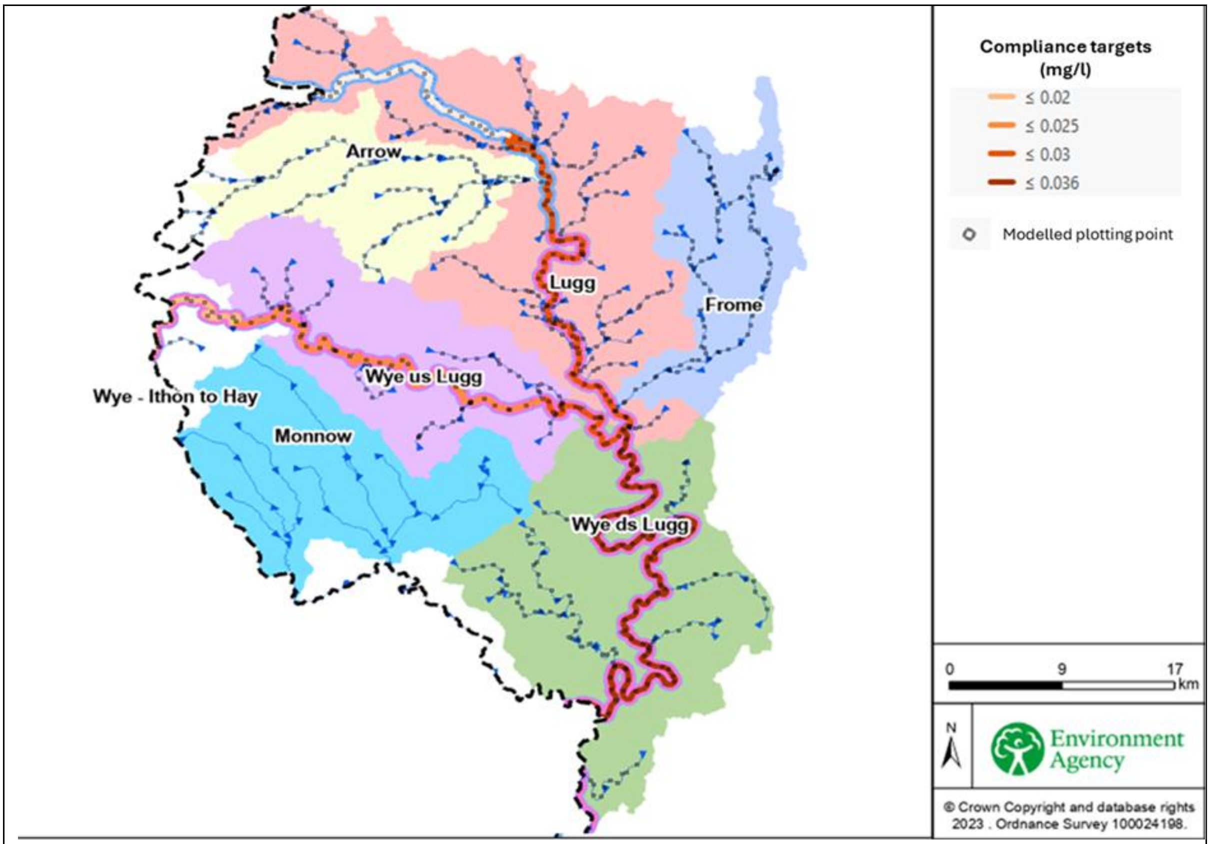

Figure 16. Modelled sub-catchments of the Rivers Wye and Lugg (with plotting points).

<u>Results</u>

River Wye

Modelled data indicate that (at the end of the AMP8 period in 2030) the River Wye should remain mostly compliant with P targets. When the "at permit" model is used (all STWs discharge at their full permitted levels) parts of the river downstream of Rotherwas STW and downstream of the confluence with the Lugg will exceed the phosphate target by a small margin (Figure 17, left). In the Wye upstream of the Lugg, the failure is due to the point sector share not being met, and downstream of the Lugg it would be due to the diffuse sector share not being met. Using the AMP8 "baseline" model, the whole of the Wye is expected to meet the P target, except for a single plotting point (sample point 50807 – Holme Lacy Bridge), immediately downstream of the Lugg catchment where the total mean concentration is predicted to be very slightly (0.00047 mg) over the 0.03 mg/l target, due to diffuse sector loads in the Lugg (Figure 17, right). This level of exceedance would be too small to be detected through laboratory analyses.

While the overall target is met under the AMP8 "baseline" scenario, the point sector share is not met immediately downstream of Rotherwas STW (Figure 18, left). Compliance with targets in this part of the river is therefore due to the diffuse sector loads being below the diffuse sector share, and low enough to be maintain sufficiently low in-river phosphate concentrations. Similarly, although the diffuse sector share is exceeded in the Wye downstream of the Lugg, point sector concentrations are low enough for the targets to be met.

These results suggest that over the long-term, P targets in the River Wye can be ensured through ongoing reductions in loads from point and diffuse sources in the Wye and Lugg catchments.

River Lugg

Under both the AMP8 “at permit” and “baseline” models the Lugg catchment is not compliant with the P water quality targets (Figure 17, left and right). The reason for non-compliance is due to the diffuse sector exceeding its share of the target (Figure 18, right). There are no parts of the catchment where the point sector exceeds the point sector share in the more optimistic “baseline” scenario (Figure 17, left). The Lugg catchment average diffuse concentration is 0.09 mg/l (90 µg/l), well above not only the diffuse sector share (0.013 mg/l : 13 µg/l), but also the overall CSMG target which is 0.03 mg/l (30 µg/l) for most of the catchment (0.015mg/l : 15 µg/l between Leominster and Presteigne).

Diffuse concentrations in the Lugg catchment therefore need to reduce by 85% as a catchment average. At specific points in the designated reaches reductions of between 56 – 89% are required (Figure 19, right). Under the AMP8 “baseline” scenario the point sector concentrations are estimated to be less than 0.009 mg/l (9 µg/l) as a catchment average across the Lugg catchment, below the point sector share (0.013 mg/l : 13 µg/l). Taking this into account means that the diffuse sector concentration needs to reduce by a lower figure of ~73%.

Modelling the AMP8 measures alongside a 11% reduction in losses from arable land and a 19% reduction in losses from livestock across the Lugg catchment (FARMSCOPER Scenario 4), reduces the diffuse sector catchment average concentration from 0.09 mg/l (90 µg/l) to 0.075 mg/l (75 µg/l) and the targets continue to be exceeded throughout (Figure 20). Similarly, when the 39% and 46% reduction in phosphate losses from arable and livestock land respectively is modelled in the Theoretical Maximum scenario (AMP8 measures and FARMSCOPER Scenario 10), the catchment average diffuse concentrations remain high (0.053 mg/l : 53 µg/l) and the targets continue to be exceeded throughout the catchment Figure 21).

Unlike the Wye, modelling suggests that Lugg P targets are unlikely to be attainable through current suites of agricultural measures.

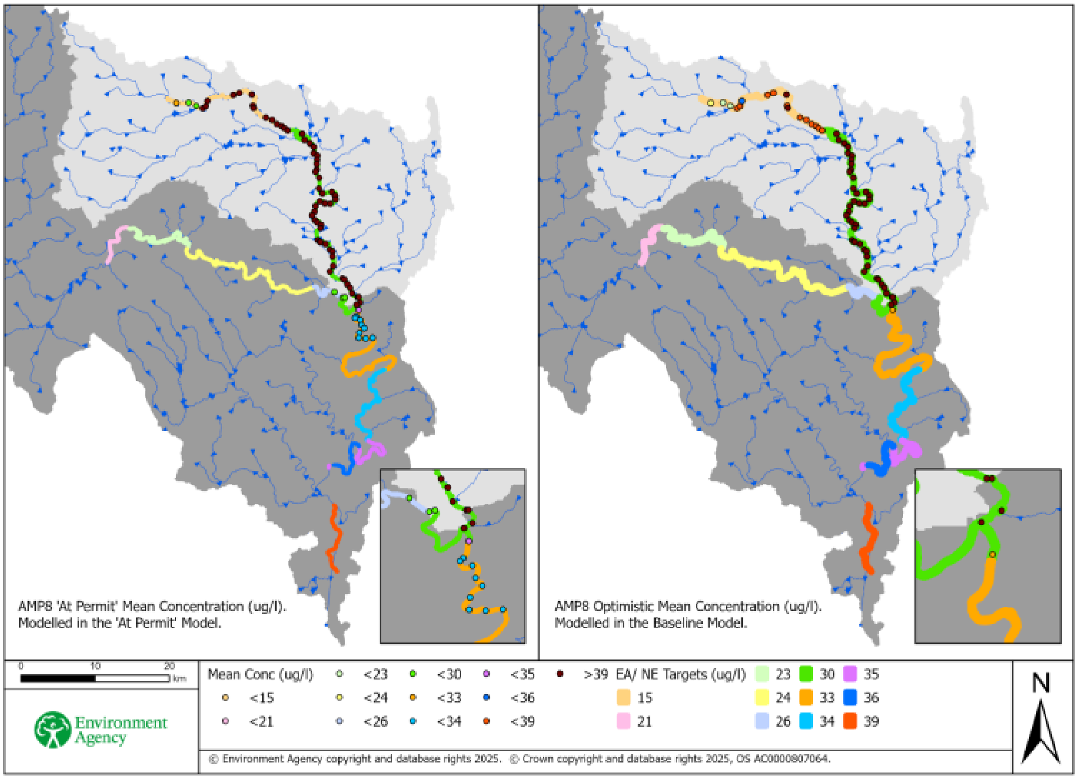

Figure 17. Mean overall (point and diffuse) concentrations (µg/l) at modelled plotting points where the P targets are exceeded. AMP8 "at permit" model (left) and "baseline" model (right).

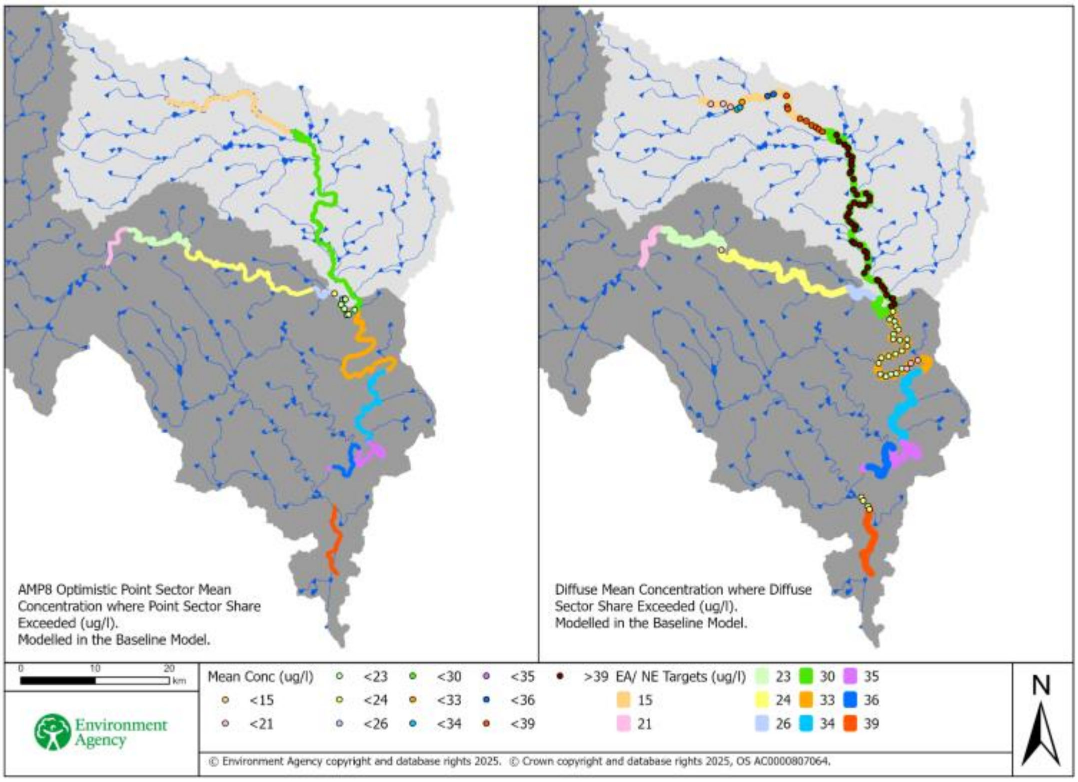

Figure 18. Baseline model point sector concentrations where the point sector share is exceeded (left), and diffuse sector concentrations where the diffuse sector share is exceeded (right).

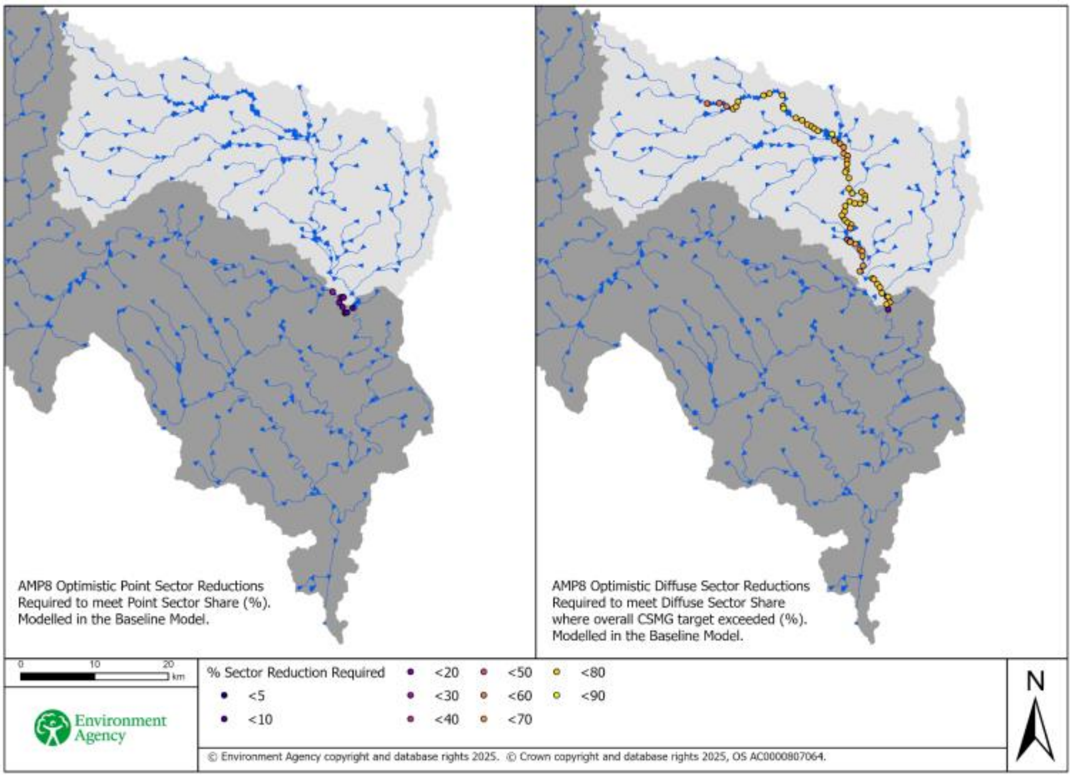

Figure 19. From the AMP8 baseline model, locations where point (left) and diffuse (right) sector reductions are required to meet respective sector shares.

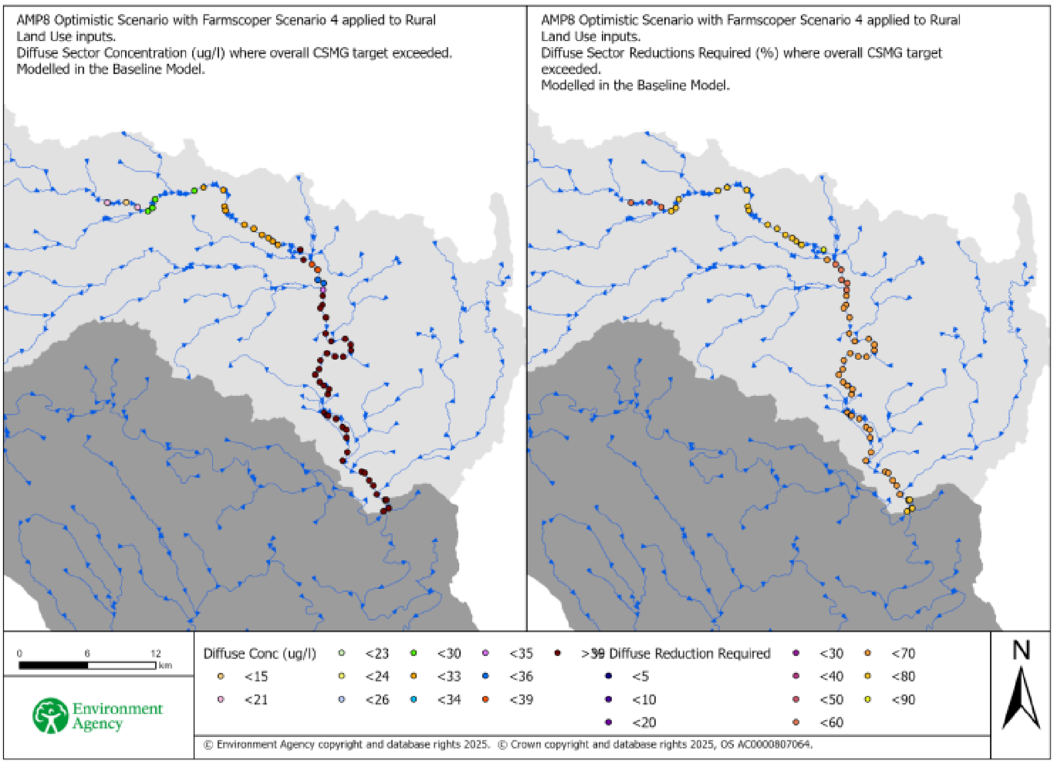

Figure 20. FARMSCOPER scenario 4 diffuse sector concentrations (µg/l) (left) and reductions required (%) (right). Includes AMP8 measures alongside a 11% reduction in losses from arable land and a 19% reduction in losses from livestock across the Lugg catchment (FARMSCOPER Scenario 4). Modelled using the baseline model.

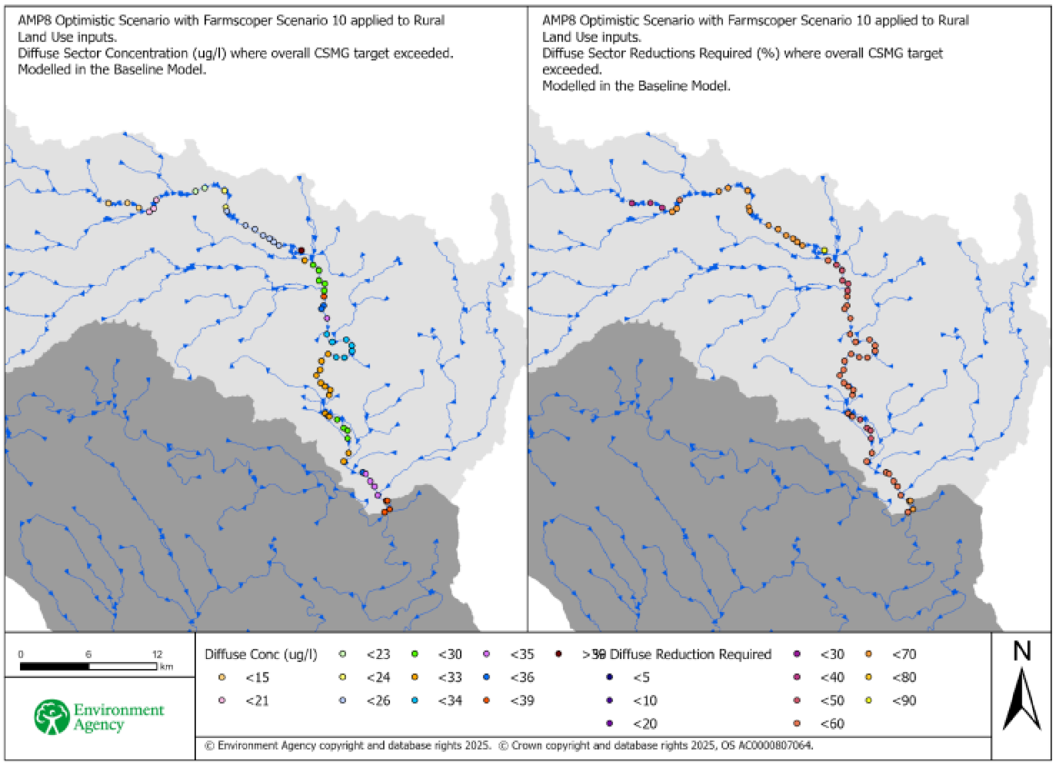

Figure 21. Theoretical Maximum diffuse sector concentrations (µg/l) (left) and reductions required (%) (right). Includes AMP8 measures alongside a 39% reduction in losses from arable land and a 46% reduction in losses from livestock across the Lugg catchment (FARMSCOPER Scenario 10). Modelled using the baseline model.

Reduction Strategy

Point sources

Proposed AMP8 upgrades at STWs are key to achieving the point sector fair share of the phosphate target for the Wye SAC in both the River Wye and the River Lugg. Additional effort may be needed to reduce point sector share of P loads immediately downstream of Rotherwas STW.

Diffuse sources

River Wye

Although the River Wye is narrowly meeting its SAC water quality targets, ongoing vigilance is required to ensure that mitigation efforts continue to occur across the Wye catchment, including in the tributaries of England and Wales, and especially where WFD water bodies fail to achieve good status. Mitigation actions in the Wye should be focussed around “river-friendly farming” and aim to restore all aspects of river health - by managing nutrients and sediment, restoring riparian habitat, reducing water temperature, and naturalising water flow. Evidence suggests that improvements in all these factors are needed to reduce the occurrence of algal blooms and restore river habitats.

River Lugg

Significant additional mitigation is required in the Arrow Lugg and Frome OC to meet the phosphate targets for the Lugg SSSI and Lugg section of the Wye SAC.

Options Appraisal Workshops

Options Appraisal workshops were held in July and September 2024, bringing together a broad range of stakeholders, including farmers, regulators, scientists, farm advisors, NGOs, and others, to explore practical and strategic responses to diffuse water pollution in the River Wye and especially the River Lugg catchment.

Participants emphasised the need for more accurate and meaningful data to guide action. Concerns were raised about the current focus on phosphate rather than TP, and the limitations of using concentration data without explicitly considering loads. There was strong interest in improving data resolution, integrating citizen science, and using farm-scale assessments to better understand nutrient balances and loss pathways.

Farmers expressed a desire for clearer information about what is happening on their land, particularly regarding soil health, nutrient surpluses, and the specific areas contributing to water quality issues. There was support for tools and advice that could help identify and manage these risks more effectively.

The workshops also highlighted the importance of managing organic materials, such as manures and digestate, more strategically across the catchment. While some producers have taken voluntary steps to reduce P inputs, participants noted that these efforts are not matched across all farms and sectors. There were calls for more consistent regulation, targeted incentives, and bespoke schemes that reflect the unique challenges of the Wye.

Land use practices were another area of concern, particularly where high-risk crops are grown on vulnerable soils. Participants discussed the need for better guidance and support to reduce erosion and runoff, including through improved rotations, soil cover, and field selection.

There was strong interest in aligning environmental land management schemes with local priorities, and in making these schemes more accessible and effective for farmers. Participants also recognised the potential of supply chains to drive change, and called for environmental standards, incentives, and accountability to be embedded in contracts and assurance schemes.

Finally, the workshops underscored the need for a more joined-up approach, combining regulation, advice, incentives, and public engagement, to support long-term improvements in water quality and catchment resilience.

The insights gathered through these workshops have directly informed the framing of our strategic priorities and the development of the Action Plan. They provide a foundation for evidence-led approach set out in the following sections.

Identification of *measures* required to achieve the WFD objectives

What on-the-ground measures e.g., on the farm/in the field are required to achieve reduction strategies?

FARMSCOPER and SAGIS modelling highlight that conventional on-farm mitigation measures alone cannot be relied on to meet the phosphate targets for the River Lugg part of the SAC. Achieving additional reductions in nutrients will require a departure from “business as usual” and implementation of measures that prevent event increases in nutrients at their source.

Nevertheless, previous work using FARMSCOPER has provided us with a good indication of the most effective on-ground measures. In general, the models show that the focus of conventional on-farm mitigation is most effective when it is directed towards improving soil health and preventing soil loss and managing manure and fertiliser applications. The 2014 NMP identified the “Top 5” measures for the whole Wye catchment across five different farm types:

- *Horticulture* – Establish cover crops in the autumn; adopt reduced cultivation system; cultivate compacted tillage soils; establish riparian buffer strips; loosen compacted soil layers in grassland fields.
- *Roots and combinable* – Establish cover crops in the autumn; adopt reduced cultivation system; Allow field drainage systems to deteriorate; use a fertiliser recommendation system; incorporate manure into the soil.
- *Mixed combinable* – Establish cover crops in the autumn; adopt reduced cultivation system; Establish riparian buffer strips; Store solid manure heaps on an impermeable base and collect effluent; incorporate manure into the soil.
- *Upland Grazing* – Do not spread farmyard manure to fields at high-risk times; Capture dirty water in dirty water store; Use dry cleaning techniques to remove solid waste from yards prior to cleaning; Establish and maintain artificial wetlands - steadying runoff; Fence off rivers and streams from livestock.
- *Lowland Grazing* – Do not spread farmyard manure at high-risk times; Avoid spreading manufactured fertiliser to fields at high-risk times; Fence off rivers and streams from livestock; Do not apply P fertiliser to high P index soils; Uncropped cultivated areas.

Natural England FARMSCOPER modelling (Gooday and Palmer 2024) identified sets of Top 5 mitigation measures for dairy, extensive grazing, and “other” land use types (Table 23). This implementation of FARMSCOPER estimated that adoption of the Top 5 measures across the whole of the Wye catchment (England and Wales) could reduce P losses by 22%. The report noted that land use change may be needed to drive further reductions

Table 23. Top 5 most effective measures for reducing agricultural P loss, by farm type. Measures differ for dairy, extensive grazing and all other farm types. Identified by NE FARMSCOPER modelling for the whole Wye catchment.

Measure	Dairy	Extensive Grazing	Other
Establish cover crops in the autumn	1	2	1
Establish riparian buffer strips	4		2
Plant areas of farm with bird seed / nectar flower mixtures	5		3
Establish in-field grass buffer strips			4
Cultivate compacted tillage soils			5
Use slurry injection application techniques	2		
Early harvesting and establishment of crops in the autumn	3		
Loosen compacted soil layers in grassland fields		3	
Fence off rivers and streams from livestock		4	
Reduce the length of the grazing day/grazing season		1	
Construct troughs with concrete base		5	

Additional measures required

The following holistic and system-wide actions will help to reduce nutrient and sediment inputs, address other factors that contribute to eutrophication impacts, and support ecological recovery:

- Prioritise land use change in high-risk areas, such as converting intensively managed arable land on steep slopes, floodplains or other high-risk areas adjacent to watercourses to low-input uses, such as extensively managed grassland, to reduce the risk of erosion and nutrient runoff.

- Target interventions in the upper catchment to reduce runoff, erosion, and pollutant transport during rainfall events. These may include Natural Flood Management (NFM) measures in headwater areas to slow and store water, as well as land management practices such as cover cropping, buffer strips, and soil improvement in areas where flow pathways increase connectivity between farmland and the river.
- Enhance riparian zone management by increasing vegetative cover to stabilise banks, reduce water temperatures, and improve habitat quality. Where livestock access contributes to bank erosion and nutrient input, implement measures to reduce poaching, such as fencing and alternative drinking sources.

Additionally, measures are required that specifically target over-supply and over-application of nutrients in the catchment. These efforts should be prioritised in the Lugg catchment but should also be applied in the Wye catchment to prevent further build-up of soil P, which poses a long-term risk to water quality. These include measures that:

- Ensure that farm-scale nutrient inputs align with crop requirements and soil capacity.
- Further reduce P inputs below off-take levels in areas where soils have accumulated legacy P, to actively draw down excess stores in soils and sediments, recognising that this does not apply across the entire catchment.
- Carefully manage large-scale sources and movements of organic nutrients at the catchment-scale, including manure, slurries, poultry litter, digestate and biosolids.

Five strategic priorities have been identified to guide future planning, investment, and regulatory focus. These priorities reflect the need for coordinated, catchment-scale interventions that go beyond incremental change and support a transition to more sustainable land and nutrient management systems. They are:

1. **Farm Gate Nutrient Balancing**
   Establishing P balances at the farm level is essential for identifying and mitigating nutrient surpluses that contribute to diffuse pollution. We need to develop and apply standardised nutrient accounting methodologies, enable accurate quantification of inputs, outputs, and legacy P stocks, and support farmers in transitioning towards low-P farming systems.
2. **Catchment-Scale Management of Bulk Organic Nutrients**
   Managing organic materials such as slurry, poultry litter, digestate, and biosolids at the catchment scale is essential to reducing nutrient surpluses and localised pollution risks. We need to improve spatial planning of nutrient applications, align nutrient supply with land that can absorb it safely, and strengthen coordination across farming sectors, regulators, and supply chains.
3. **Reducing the Impact of High-Risk Crops on High-Risk Land**
   Certain crops, including maize and root vegetables, pose a heightened risk of nutrient loss and soil erosion when grown on vulnerable land. We need to support growers to make informed decisions about crop placement and rotations, promote practices that maintain soil cover and structure, and ensure compliance with environmental standards on high-risk sites.
4. **Targeted use of Environmental Land Management schemes (ELMs), advice and funding**
   Evolving ELMs offer an opportunity to deliver environmental outcomes at scale. Support for schemes should be aligned with catchment priorities, with high-impact interventions targeted through Countryside Stewardship Higher Tier and Landscape Recovery. Funding and advice should be informed by Welsh data and evidence, the upcoming Wye Catchment Management Plan, and emerging planning frameworks, including Environmental Delivery Plans and Local Nature Recovery Strategies.

5. **Supply Chain Engagement and Accountability**
   Agri-food supply chains have significant influence over farming practices and land management decisions. We need to work with supply chain actors to embed environmental expectations into assurance schemes and advisory services, promote consistent standards for nutrient management, and support coordinated action across sectors to deliver measurable improvements in water quality.

These priorities provide a framework for aligning regulatory, advisory, and investment activity across the catchment. They are intended to inform the development of delivery plans, guide the targeting of resources, and support the design of future policy interventions.

In parallel with identifying strategic priorities, the Options Appraisal has highlighted a number of investigative actions that will help inform future delivery. These actions are intended to improve our understanding of nutrient dynamics, pollution sources, and potential mitigation approaches. While they do not constitute delivery measures in themselves, they represent important steps toward building the evidence base needed to support more targeted and effective interventions. The proposed investigations include:

- Research into methods for drawing down legacy P in soils ("Unlocking and mining P").
- Standardising the calculation of farm gate nutrient balances to support nutrient budgeting and compliance.
- Sediment fingerprinting to better understand sediment and nutrient sources.
- Substrate sediment sampling to investigate the role of sediment in nutrient cycling and algal growth.
- Learning from innovative approaches in other catchments.
- An investigation of the feasibility and utility of implementing mitigation measures using a Water Protection Zone.

Alongside these investigations, there are existing programmes and initiatives that already align with the strategic priorities identified in this Options Appraisal. Projects such as SNAC and ongoing supply chain engagement activities are helping to build capacity, generate data, and support behavioural change. While further work is needed to assess their impact and scalability, these efforts provide a foundation on which future delivery can be developed.

Identification of *mechanisms* needed to achieve the WFD objectives

What mechanisms are currently in place and how far will they go towards remedying the problem, and by when?

Conventional mitigation measures remain important to improving land use and management and restoring river health. Approaches include:

Regulation

- Farming Rules for Water; Storing silage, slurry and agricultural fuel oil; Nitrate Vulnerable Zones continue to provide a regulatory baseline for nutrient management. Expectations of farmers in relation to the Farming Rules for Water have were clarified in June 2025.
- Farm inspections are being scaled up, with additional resources allocated to priority catchments. Where appropriate, inspections may be supported by remote sensing technologies, including satellite imagery and drones.

- Environmental Permitting Regulations apply to intensive livestock units, anaerobic digesters, and waste spreading activities. These permits are a key mechanism for managing nutrient inputs and ensuring compliance with environmental standards.

Advice and incentives

- Catchment Sensitive Farming continues to provide tailored advice and grant support to farmers in high-risk areas.
- ELMs offer an opportunity to incentivise land use change. Current and new ELMs should be fully utilised.
    - The WyeScapes; Food, Nature and Water Landscape Recovery Project is in a development phase. The benefits of the scheme should be evaluated by the EA and Defra in 2025.
    - The Wye Valley Ridge to River Landscape Recovery Project is soil health, habitat and water quality improvement on farms near Lower Blakemere Farm.
- Green finance initiatives, such as the DIME Project, are exploring how private investment can support nutrient reduction and nature-based solutions.

Engagement

- Key sectors (e.g., poultry, dairy, arable) across supply chains are being engaged to raise awareness of nutrient issues and promote improved support, guidance, and environmental assurance.
- Outreach is being delivered through organisations such as the NFU, Herefordshire Rural Hub, Farm Herefordshire, the Wye Catchment Partnership (WCP), and local Wildlife and Rivers Trusts, including the Wye and Usk Foundation, as well as smaller farmer alliances and NGO groups.
- The EA appointed an Agricultural Engagement Specialist to improve communication and engagement with farmers, including through video production, social media and attendance at farming events.
- Agri-food supply chain initiatives are helping to embed environmental expectations into farm assurance schemes and advisory services.

Catchment Planning

- The Wye Catchment Management Plan (CMP), currently in development by the WCP, will be central to identifying the suite of mitigation measures needed to improve catchment health. This will include a set of priority actions under the umbrella of "River Friendly Farming", which aim to align land management with water quality, biodiversity, and climate resilience goals.
- Local authority planning mechanisms, including innovative tools such as the Herefordshire Minerals and Waste Local Plan, can influence the location and management of nutrient-intensive activities. These plans should be aligned with catchment objectives wherever possible.
- NN schemes, including the Herefordshire Integrated Wetlands, are being used to offset development impacts. Their effectiveness should be monitored and integrated into wider catchment planning.

Research

- Citizen science groups are contributing to water quality monitoring and are supported to complement EA-led monitoring networks.
- RePhoKUs Phase 3 is improving understanding of P fate and transport in soils.
- The Sustaining Soils Project, led by the Wye and Usk Foundation, trialled methods for identifying erosion risk in the Garren and Gamber catchments and explored how this could inform future mitigation planning.
- Remote sensing and data tools (e.g., sondes, autosamplers, satellite imagery) are being used to improve spatial targeting of inspections and interventions.

- The Understanding the Wye Catchment Project combined systems mapping and numerical modelling to explore the links between land use, nutrient pressures, and ecological outcomes. Its findings are informing the development of the Wye CMP.

The measures outlined in this plan represent ongoing improvements in the management of land and nutrients across the Wye catchment. While these actions are expected to contribute to reductions in diffuse P losses, current evidence suggests they are unlikely, at current uptake rates, to achieve the scale of reduction required to meet the phosphate target in the River Lugg.

In recognition of these limitations, this Options Appraisal identified five strategic priorities that may help guide future planning, investment, and coordination. These priorities, farm gate nutrient balancing, catchment-scale management of organic materials, reducing the impact of high-risk cropping, targeted use of ELMs, advice and funding, and supply chain engagement, are intended to enable more strategic and locally responsive action. While the mechanisms to deliver these priorities at scale are not yet fully in place, they provide a framework for aligning future activity with catchment needs.

With the current (or proposed) mechanisms in place, will all the measures needed to ensure SAC objectives also be delivered.

Unlikely.

If NO, what are the options (alternative or additional mechanisms) to get all the required measures in place?

This section outlines a range of *potential* mechanisms that could support the implementation of measures under each strategic priority identified above. While not all mechanisms may be feasible or deliverable in the short term, they represent a suite of options that could be explored, adapted, or combined depending on local context, stakeholder support, and available resources.

1. Farm Gate Nutrient Balancing

Mechanisms:

- *Regulatory Compliance* – Enforce nutrient planning and record-keeping through FRfW, SSAFO, and NVZ regulations.
- *Supply Chain Standards* – Require nutrient balance reporting through agri-food supply chain contracts and assurance schemes.
- *ELMs* – Provide financial incentives for nutrient planning, soil testing, and nutrient-use efficiency.
- *CSF* – Deliver tailored advice and grants to support nutrient management.
- *WPZ* – Introduce additional soil testing and enforceable nutrient balance thresholds in high-risk areas.

Assumptions and Rationale:

- Voluntary uptake may be insufficient to address legacy P.
- Supply chain mechanisms offer scalability and influence.
- WPZ provides a regulatory backstop if other mechanisms fail.

Interdependencies:

- Relies on appropriate nutrient management tools (e.g., PLANET, Phosphorus Loss Tool).

- Dependent on CSF and ELMs for farmer engagement and delivery.
- Supply chain standards can reinforce regulatory and incentive-based approaches.

2. Catchment-Scale Management of Bulk Organic Nutrients

Mechanisms:

- *Environmental Permitting Regulations* – Strengthen controls on the storage, treatment, and spreading of organic materials.
- *Spatial Planning Tools* – Use nutrient management planning and mapping to match nutrient supply with land capacity.
- *Agri-Food Supply Chain Collaboration* – Coordinate redistribution of organic materials (e.g., poultry litter) across sectors and regions.
- *ELMs* – Fund infrastructure and practices that support safe nutrient use and redistribution.
- *CSF* – Provide technical advice and support for nutrient risk mitigation.
- *WPZ* – Restrict spreading of organic materials in nutrient-saturated or high-risk zones (for example).

Assumptions and Rationale:

- Current permitting and FRfW enforcement may not be fully effective.
- Redistribution requires infrastructure and coordination.
- WPZ could be used to introduce targeted interventions that address persistent hotspots.

Interdependencies:

- Requires integration with farm gate nutrient balancing.
- Dependent on spatial data and mapping tools.
- Supply chain and CSF mechanisms can support uptake and compliance.

3. Reducing Impact of High-Risk Crops on High-Risk Land

Mechanisms:

- *Regulatory Compliance* – Enforce soil cover and erosion control under the Farming Rules for Water.
- *ELMs* – Incentivise cover cropping, buffer strips, and crop rotation on vulnerable land.
- *CSF* – Provide targeted advice and grants for erosion control and soil protection.
- *Supply Chain Standards* – Require sustainable cropping practices through procurement and assurance schemes.
- *WPZ* – Restrict cultivation of high-risk crops in sensitive or erosion-prone areas (for example).

Assumptions and Rationale:

- Voluntary uptake is variable.
- WPZ is a potential driver of change, especially in erosion-prone areas.
- Supply chain standards can drive change at scale.

Interdependencies:

- Linked to sediment fingerprinting and erosion risk mapping.
- CSF and ELMs are essential for delivery and farmer support.
- Regulatory and supply chain mechanisms can reinforce each other.

4. Targeted Use of ELMs, Advice and Funding

Mechanisms:

- *Targeted ELMs Uptake* – Align Countryside Stewardship Higher Tier and Landscape Recovery options with catchment priorities.
- Advisory Support – Use CSF and NE advisers to help farmers access and implement ELMs.
- *Catchment Planning* – Use the CMP and other environmental planning frameworks to spatially prioritise interventions.
- *Supply Chain Co-Funding* – Encourage agri-food businesses to co-invest in ELMs-compatible practices.

Assumptions and Rationale:

- ELMs can be tailored to local needs and scaled through partnerships.
- Advisory support is critical to effective uptake.
- CMP and other frameworks and spatial tools provide a basis for spatial targeting and prioritisation.

Interdependencies:

- Dependent on CSF and emerging tools and frameworks for targeting and delivery.
- Linked to nutrient balancing, erosion control, and biodiversity goals.
- Supply chain co-funding could enhance uptake and impact.

5. Driving Change Through Agri-food Supply Chains

Mechanisms:

- *Voluntary Standards and Assurance Schemes* – Embed nutrient and soil health criteria into supply chain requirements.
- *Supplier Requirements* – Include environmental performance criteria in sourcing policies and supplier agreements.
- *Co-Funding of Measures* – Support infrastructure, advice, and monitoring through joint investment.
- *Data Sharing Agreements* – Could enable tracking of nutrient flows and compliance across the supply chain.

Assumptions and Rationale:

- Supply chains have influence over large areas and can drive rapid change.
- Co-funding and data sharing can improve transparency and accountability.

Interdependencies:

- Reinforces regulatory and incentive-based mechanisms.
- May support delivery of nutrient balancing, erosion control, and organic nutrient management.
- Requires coordination with CSF, ELMs, and regulatory bodies.

What reductions will each of the options identified above achieve and by when?

The reductions required in the Lugg catchment are large. FARMSCOPER modelling shows that an 85% reduction in agricultural in-river concentrations of P is needed for the diffuse sector to meet its “fair share” of the required nutrient reductions - far beyond what can be achieved through conventional on-farm measures alone. While FARMSCOPER is useful for estimating the potential of individual practices, it cannot model the systemic, landscape-scale, and legacy challenges that underpin nutrient pollution in the Wye catchment.

Some effort has been made to model potential P reduction to this level using other tools. Substance flow analysis for RePhoKUs for example predicted that reducing P fertiliser use by 80%, and manure P by 27% might reduce surplus P application to zero, and that further reductions in P application would be needed to draw down legacy P across the catchment. Further analysis, which included evaluation of widespread increases in tree cover, and improvements in soil health, was undertaken using WSIMOD as part of the Understanding the Wye Catchment Project. While these models provide indicative estimates of land management change required, the scale of systemic change needed is such that defining a credible or time-bound delivery trajectory is not feasible.

This DWPP therefore takes a strategic, systems-based approach to these challenges. The strategic priorities outlined in this plan focus on the structural drivers of nutrient pollution, such as legacy P in soils, the spatial mismatch between nutrient supply and land capacity, and the influence of supply chains and land use decisions.

We have not attempted to quantify reductions or timescales. Instead, we have set out a framework for understanding how different measures and mechanisms might contribute to nutrient reduction over time, recognising that:

- Further assessment is needed to estimate the potential reductions associated with available mechanisms or combinations of mechanisms, and the impact that they would have on the farming sector.
- Reductions are likely to be long-term and non-linear, with some mechanisms offering earlier gains and others requiring sustained effort over decades.
- Transparency is essential, and any future analysis should clearly state assumptions and limitations.
- Stakeholder involvement is critical to ensure that any future modelling or prioritisation is grounded in local knowledge and practical realities.

Cost effectiveness and cost benefit of appropriate options

What are the financial costs of each of the options considered?

Unknown.

The financial costs of implementing measures and mechanisms that deliver on the strategic priorities outlined in this plan, both to farmers and to delivery bodies, are not yet understood. Key considerations are listed below.

Potential Costs to Farmers and Land Managers:

- Yield penalties associated with drawing down soil P to lower indices.
- Land taken out of production for buffer strips, wetlands, or land use change.
- Soil testing and nutrient planning, particularly if required at higher frequency or resolution.
- Switching to low-P animal feeds, which may increase feed costs or reduce productivity.
- Infrastructure upgrades (e.g., anaerobic digesters, manure storage, transport logistics).
- Administrative burden of compliance, reporting, and participation in schemes.
- The financial viability of many farm businesses is already under pressure. Any new action must be proportionate, targeted, and supported by appropriate incentives or funding.

Potential Costs to Delivery Bodies (e.g., EA, NE):

- Regulatory enforcement (e.g., inspections, permitting, compliance monitoring).
- Advisory services (e.g., CSF advisers, ELMs support) may be further stretched.
- Catchment planning and coordination and stakeholder engagement.
- Monitoring and evaluation, including sediment sampling (likely outsourced) water quality monitoring, modelling and citizen science support.

Potential Benefits to Farmers and Land Managers:

- Reduced fertiliser use through more efficient nutrient management.
- Reduced soil loss, preserving long-term productivity and reducing sedimentation costs.
- Access to existing funding streams, such as ELMs, CSF grants, and green finance initiatives (e.g., DIME, Landscape Recovery).
- Avoided costs of inaction, including regulatory penalties, reputational damage, and loss of market access.

Potential Benefits to Delivery Bodies:

- The cost-effectiveness of mechanisms will depend on uptake, targeting, and delivery efficiency. Improving supply chain standards may be low-cost but high impact if measures are widely adopted.
- New technologies may drive efficiencies.
- The cost-benefit of interventions will vary by location and pollutant. Effective targeting and prioritisation can lower costs. Measures that reduce multiple pollutants (e.g., sediment nitrogen and P) or deliver co-benefits (e.g., biodiversity, carbon, lower water temperatures) may offer better returns.
- Some mechanisms (e.g., WPZ) may have high upfront costs but may be designed to deliver improved clarity about rules, long-term regulatory certainty, and greater environmental gains.

Summarise the potential positive and negative impacts on ecosystem services for each option

While the DWPP aims to improve water quality and ecological condition, the full range of impacts on ecosystem services that would result from full implementation of all the strategic priorities will depend on how mechanisms are implemented and how they interact in practice.

Potential Negative Impacts

No direct negative impacts on ecosystem services are anticipated from reducing P inputs to sustainable levels. However, several risks may require further assessment:

- *Nutrient displacement* – Export of manures, digestate, or sludge from the Wye catchment may result in nutrient loading in other, less scrutinised catchments.
- *Carbon and Net Zero implications* – Some approaches may be more carbon intensive (e.g., exporting manure and digestate long distances by road).
- *Loss of circularity* – Farmers may substitute locally produced organic fertilisers with imported mineral fertilisers. This could have the perverse effect of reducing system resilience and increasing reliance on external inputs.
- *Land use trade-offs* – Where land is taken out of production or repurposed (e.g., under ELMs), there may be implications for food production, public use, or impacts on established habitats.

- *Administrative burden* – Increased regulatory or reporting requirements (e.g., under nutrient balancing or WPZ scenarios) may impact on the capacity of regulators and farmers to undertake other important land management activities.

These risks are not inherent to the strategic priorities but may arise depending on how mechanisms are implemented.

Potential Positive Impacts

Many of the mechanisms identified in the DWPP are expected to deliver co-benefits for ecosystem services, particularly where they support improved nutrient use efficiency, soil health, and better alignment between land use and environmental capacity:

- *Water quality improvement* – Reductions in P are likely to be accompanied by reductions in nitrogen and sediment, improving aquatic ecosystem function and potentially reducing the frequency and severity of algal blooms.
- *Soil health and function* – Measures that reduce erosion and improve organic matter retention (e.g., through nutrient planning, land use change, or regenerative practices) can enhance infiltration, water holding capacity, and long-term productivity.
- *Biodiversity* – Managing land use in high-risk areas, targeted use of ELMs, advice and funding, and supply chain standards may support habitat creation and improved connectivity, particularly in floodplain and headwater areas.
- *Climate regulation* – Some mechanisms (e.g., land use change, improved soil management) may contribute to carbon sequestration and improved resilience to extreme weather events.

What are the preferred options?

Summarise preferred measures and mechanisms to take forward

The DWPP takes forward all five strategic priorities as part of a coordinated, long-term approach to reducing nutrient pollution in the Wye and Lugg catchments. These priorities reflect the need to address both legacy and ongoing nutrient pressures through a combination of regulatory, advisory, and incentive-based mechanisms.

The five strategic priorities are:

1. *Farm gate nutrient balancing* – Ensuring that P inputs (e.g., feed, fertiliser) do not exceed outputs in crops and livestock products, to reduce surplus accumulation and support efficient nutrient use.
2. *Catchment-scale management of bulk organic nutrients* – Coordinating the use and movement of manures, digestate, and biosolids to match nutrient supply with land that can absorb it safely, reducing localised overloads.
3. *Reducing the impact of high-risk crops on high-risk land* – Supporting growers to reduce soil and nutrient losses from crops such as maize and potatoes, particularly on vulnerable soils or near watercourses.
4. *Targeted Use of ELMs, advice and funding* – Align interventions with catchment needs to support land use change, habitat restoration, and sustainable farming practices.

5. *Supply chain engagement and accountability* – Leveraging supply chain influence to embed environmental standards, incentivise good practice, and deliver improvements at scale.

Given the significant reductions in phosphate loads required in the River Lugg, land use change will likely be required to meet water quality targets. Although not presented as a standalone priority, land use change is embedded across several strategic priorities and mechanisms. For instance, ELMs can support land use change by funding habitat restoration, buffer strips, and transitions to lower-input systems. Similarly, farm gate nutrient balancing may lead to shifts in land use where nutrient inputs consistently exceed outputs, helping to reduce nutrient surpluses. These changes will contribute not only to nutrient reduction but also to broader catchment resilience and ecological recovery.

If appropriate, state why a Water Protection Zone is the recommended mechanism

Despite sustained efforts by the farming sector and other stakeholders, phosphate levels in the River Lugg remain above target. FARMSCOPER modelling and other evidence confirm that conventional voluntary and regulatory measures alone are unlikely to deliver the scale of reduction required, estimated at 85% from agriculture in the Lugg catchment.

In this context, the full range of regulatory options must remain under review, including the potential designation of a WPZ under Section 93 of the Water Resources Act 1991. A WPZ could provide a statutory mechanism to align nutrient inputs with environmental capacity. Depending on its design, it could be used to make certain measures mandatory (e.g., nutrient budgeting and land use restrictions in high-risk areas).

However, a WPZ is not recommended at this time. There is considerable uncertainty around the most effective pathways to deliver change at the pace and scale required. Further work is needed to assess the feasibility, cost-effectiveness, enforceability, and acceptability of measures that could be included in a WPZ, or alternative mechanisms that could deliver similar outcomes.

A detailed evaluation of a WPZ is included as one of the Options Appraisal actions in the DWPP Action Plan. This is part of a broader programme of work to improve the evidence base and explore system-level interventions. Some other relevant actions include:

- Research into methods for drawing down legacy P in soils ("Unlocking and mining P").
- Standardising the calculation of farm gate nutrient balances to support nutrient budgeting and compliance.
- Sediment fingerprinting to better understand sediment and nutrient sources.
- Substrate sediment sampling to investigate the role of sediment in nutrient cycling and algal growth.
- Learning from innovative approaches in other catchments.

Several national, regional and cross-border initiatives have contributed, or are expected to contribute, to the evidence base, including:

- The £15 million Farming Futures Nutrient Management Fund is a national programme that will support the development of innovative tools and practices to reduce nutrient losses from agriculture.
- The Wye Algae PhD Project has highlighted the role of interacting pressures, such as water temperature, flow, and nutrient form, in driving eutrophication.
- Project TARA has piloted new approaches to regulation and compliance, which are now being applied across sectors.
- The Agri-Food Supply Chain Project is exploring how supply chain standards and incentives can drive system-level change.

- The £1 million Joint Research Initiative (UK and Welsh Governments) may investigate pollution sources, assess the impacts of land management change, and test new approaches to improving water quality.

A WPZ remains a potential mechanism, but further investigation is required to address knowledge gaps, identify a suite of measures, and determine whether it is the most appropriate tool. Any future proposal would need to be supported by robust evidence, clear objectives, and thorough and meaningful engagement with those affected, and others with an interest in the Wye and Lugg catchments.

Has a Statement of Intent been agreed between catchment partners?
Yes – Between EA and NE

Outline the Statement of Intent

We (the EA and NE) will continue to work together towards the objectives outlined in the Diffuse Water Pollution Plan and the included Action Plan. We will continue to engage with relevant stakeholders, such as Welsh Water, Herefordshire Council, the National Farmers Union, citizen scientists, landholders and the wider community, to work together to make the nutrient and sediment reductions needed to reach SSSI/SAC conservation targets.

Appendix B: Relationship with Other Plans

Nutrient Management Plan 2014 and Phosphate Action Plan 2021

This Diffuse Water Pollution Plan updates the evidence base and action plan of the 2014 River Wye SAC Nutrient Management Plan (NMP), for England only. The 2014 plan identified the main sources of nutrients in the catchment and set out the measures to manage them. As with the DWPP, the NMP focussed on P. An action plan accompanied the NMP, which was updated in 2021. The NMP covered England and Wales. The DWPP is for England only.

The 2014 River Wye SAC Nutrient Management Plan Action Plan promoted the voluntary uptake of integrated Soil, Water and Nutrient Management Plans. The Wye Catchment Partnership (WCP) was seen as critical to the delivery of the plan. The Nutrient Management Board was established as an oversight body, comprising of Herefordshire and Powys Council, Welsh Water, the EA, NE, NRW, Wye and Usk Foundation, NFU, the Country Land and Business Association.

River Restoration Plans 2015

In 2015, River Restoration Plans were prepared for the River Wye and River Lugg. The plans identified river improvement activities that were needed to return the structure (morphology) and ecology of a river towards a more naturally functioning condition.

In relation to sediment and nutrients, the Lugg plan identified that agricultural practices, particularly intensive arable farming, contributed significantly to sediment delivery and nutrient runoff into the river. Key pressures identified included soil erosion from poorly managed fields, livestock access to riverbanks, and the absence of adequate riparian buffers.

To mitigate these issues, the report proposed several measures: enhancing riparian zones through tree planting and vegetation management to stabilise banks and filter runoff, implementing land management practices that reduce sediment pathways, and creating buffer strips to intercept pollutants before they reach the river. Additionally, the removal or modification of weirs was suggested to improve sediment transport and ecological connectivity. The Wye report also noted the impact of agricultural sources of nutrients and sediment.

However, the Wye report noted that the Wye is characterised by relatively natural morphology and diverse habitats. In contrast, the Lugg faces more significant pressures from agricultural runoff and habitat modifications, which have led to a greater need for targeted restoration efforts. The management strategies for the Wye focussed on enhancing its natural processes, while the Lugg requires more intensive interventions to address its ecological degradation.

A NE review of implementation of River Restoration Plans in January 2024 determined that progress on both had been "slow" (Mathews 2024). There are currently no plans to update these plans as restoration will be a key feature of the Wye Catchment Management Plan, under development with the WCP.

Severn Basin District River Basin Management Plan 2022

The EA, with extensive input and support from NE and NRW, published the updated Severn River Basin Management Plan (RBMP), which includes coverage of the River Wye catchment, in December 2022. The plan sets out environmental objectives and summary of programmes of measures to protect and improve the water environment. It highlights the need for collaborative, catchment-based approaches to tackle pressures, including nutrient pollution, sedimentation, and climate change impacts.

The RBMP sets legally binding objectives for all water bodies (rivers, lakes, estuaries, and groundwater), including:

- Preventing deterioration in water body status.
- Achieving good ecological and chemical status or potential by 2027, where feasible.
- Meeting statutory objectives for Protected Areas, such as European sites, Drinking Water Protected Areas, and Bathing Waters.
- Improving water quality, hydromorphology, and biological elements (e.g., fish, invertebrates, macrophytes).
- Supporting climate resilience and sustainable water use.

In relation to the Rivers Wye and Lugg, the RBMP made the following observations about water quality issues:

- Diffuse agricultural pollution, particularly phosphate is identified as a major driver of water quality failures. It noted that NFM and land management interventions, such as improving soil health and reducing surface runoff, are being used to tackle these issues.
- The Engagement HQ website is being used to keep the community up to date water quality issues.
- Increasing numbers of farm visits have been undertaken to provide advice and ensure compliance with environmental requirements.
- Citizen science is helping identify pollution sources and prioritising locations for mitigation.
- Collaborative working is important to identify data and analyses needs and target regulatory and partnership action.
- The Nutrient Management Board, Welsh Water and the Storm Overflows Taskforce are working together to address pollution from wastewater treatment.

The Plan also noted that joint working between the EA and NRW is essential to address shared challenges such as nutrient pollution, sedimentation, and climate resilience, and that the WCP plays a central role in coordinating efforts across the catchment. It acknowledged the role of the River Severn Partnership in helping people, businesses and the environment prepare for and be resilient to climate change impacts, the Wye and Usk Foundation, with the EA and NRW working in partnership to eradicate invasive non-native species, and collaborative efforts to install fish passes in the River Lugg catchment, and undertake river restoration work across the Wye catchment in England and Wales.

Work to develop the fourth cycle of RBMPs has already begun, with the EA conducting the "Working Together" consultation between November 2024 and May 2025. Significant input from catchment partners will be essential to ensure local priorities and pressures are properly reflected in the next cycle.

Site Improvement Plan 2014

The Severn RBMP includes the 2014 IPENS (Improvement Programme for England's Natura 2000 Sites) Site Improvement Plan (SIP) for the River Wye SAC, jointly agreed between NE and the EA. This SIP and the actions set out within are therefore closely integrated into work to deliver commitments under the WFD. The SIP sets out the issues which are of concern for the habitats and species which underpin this protected site designation and includes a prioritised list of the actions which are considered necessary to protect these features and restore them to favourable condition. It is supported by CSMG targets for favourable condition.

In relation to water pollution, the SIP noted:

"*Water quality is important for all SAC species and habitats, e.g., high water quality is vital to the breeding success of Salmon. Point sources of concern are relatively localised e.g., mining waste, raised metals concentrations and phosphates. Sedimentation and diffuse pollution are key issues in the catchment including upland acidification (affecting river pH values). Implementation of a Diffuse Water Pollution Plan and Nutrient Management Plan is necessary. Pesticides have been a concern historically e.g., pyrethroids, cypermethrin and metaldehydes. Current and future changes in cropping patterns across the catchment could cumulatively impact on the water quality, predominantly through diffuse pollution e.g., planting maize to feed biodigesters, siting of potato fields, irrigation needs, levels of poultry manure. The promotion of sustainable farming practice throughout the catchment is required to help address this*."

Wye Catchment Partnership Plan (2019)

The WCP Plan was published in 2019. The plan included sets of priorities for action in the whole River Wye, and for discrete parts of the Wye, including the following regions in England – The Lower Wye (i.e., below Hay-on-Wye), Monnow and Lugg catchments:

Whole Wye priorities

- Bring the river SSSI and SACs into favourable condition and conservation status.
- Bring the river and its tributaries up to good status under the WFD.
- Reduce phosphate levels from diffuse agricultural sources.
- Reduce phosphate levels from point source discharges.

- Reduce instances of pesticides impacting on drinking water abstractions
- Eliminate non-native invasive species such as Japanese knotweed and American signal crayfish.
- Mitigate flood risk by improving water holding capacity of soils and utilising NFM techniques to protect vulnerable communities and properties.

Lower Wye priorities

- Restore condition of and connectivity to flood plain meadows to provide flood storage and improved biodiversity.
- Install additional phosphate stripping at Eign, Rotherwas, Kingstone & Madley STWs.
- Continue programme to eradicate non-native invasive plant species like giant hogweed and Japanese knotweed.

River Lugg priorities

- Restore condition of and connectivity to flood plain meadows and wetland habitats to provide flood storage and improved biodiversity.
- Bring the level of phosphate within the legal limit to meet Habitats Directive requirements by:
    - installing additional phosphate treatment at Norton (Wales), Presteigne (Wales), Weobley and Leominster STWs.
    - reducing phosphate losses from agricultural sources
- Continue weir removal and fish passage projects to outstanding structures within the catchment which impede movement.

River Monnow priorities

- Install additional phosphate stripping at Pontrilas STW.
- Increase woodland planting to support woodland bird assemblages as well as habitat creation for priority species like curlew and lapwing.
- Maintain eradication programme for Himalayan balsam and mink.

The WCP are leading on preparation of a Catchment Management Plan that will cover the whole of the Wye catchment and consider the effects of all potential impacts upon the river, including flow, temperature, biodiversity and nutrients.

River Lugg Internal Drainage Board Biodiversity Action Plan (2019)

The 2019 Biodiversity Action Plan for the River Lugg Internal Drainage Board (IDB) is a strategic document that updates the original 2010 plan. Its primary purpose is to outline how the IDB will meet its legal and environmental responsibilities to conserve and enhance biodiversity within its drainage district.

The BAP includes the following actions aimed at preventing protecting the river and improving water quality:

- Maintaining and enhancing riparian habitats to enhance biodiversity and reduce runoff and sedimentation.
- Controlling invasive species including Himalayan balsam and Japanese knotweed, which can destabilise banks and affect water quality.
- Promote sustainable land management by working with landholders to reduce nutrient and pesticide runoff.
- Monitoring water quality and tracking the effectiveness of implemented measures.
- Improving ditch and drain maintenance and ensuring that these are managed in a way that supports both drainage and ecological health, reducing pollution and sediment input into the river.

Phosphate Action Plan (2021)

The Action Plan for the 2014 NMP was updated in 2021 as the River Wye SAC Nutrient Management Plan Phosphate Action Plan. The plan was "*first and foremost about restoring the ecological functioning of the river*" and a significant focus of the plan was improving certainty that measures would deliver the reductions necessary to meet targets so that they may be relied on as strategic mitigation, driven by the demands of the Dutch Nitrogen Judgement and Nutrient Neutrality.

River Wye Action Plan (2024)

In 2022 the Secretary of State for the Environment, Food and Rural Affairs hosted a roundtable discussion with partners. This discussion led to the publication of a River Wye Action Plan by Defra in April 2024, which noted the need for a new, overarching catchment-wide plan.

Appendix C: Major National Developments Since 2014

The Dutch Nitrogen Judgment (2018)

The Dutch Nitrogen Judgment is a key legal development that affected the interpretation and application of the Habitats Regulations across Europe. The ruling clarified that where the conservation status of a qualifying feature within a European site (e.g., SAC or SPA) is unfavourable, authorisation of new activities that may further deteriorate that feature must be strictly limited.

Under the Habitats Regulations, any plan or project likely to have a significant effect on a European site must undergo an Appropriate Assessment (AA). This is a legally required process that evaluates whether the proposal will adversely affect the integrity of the site, either alone or in combination with other plans or projects.

The Dutch Nitrogen Judgment established that an AA cannot rely on future mitigation or compensatory measures unless their effectiveness is scientifically certain and guaranteed at the time of assessment. This includes measures proposed within strategic frameworks such as NMPs or DWPPs. Where such plans are used to justify continued or new pressures on sites already failing to meet conservation objectives, the AA must demonstrate that:

- The proposed measures will deliver the required reductions in nutrient loading.
- Implementation is secured and timely.
- Outcomes are supported by robust scientific evidence.

The ruling has had direct implications for European river sites affected by nutrient enrichment, particularly from agricultural and urban sources. It has led to increased scrutiny of development proposals, especially housing, and contributed to the introduction of Nutrient Neutrality policies in England.

Farming Rules for Water (2018)

From April 2018 all farmers in England have needed to comply with The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018, commonly referred to as the “Farming Rules for Water” (FRfW). FRfW were introduced with a view to reducing agricultural pollution and have standardised good farming practices that many farmers already carry out. They encourage farmers to think about the risk of water pollution, how to keep valuable topsoil on their fields and to apply fertilisers only when it is required. The EA is the regulator for these rules and ensures farmers comply through an existing targeted programme of work.

25 Year Environment Plan (2018)

The 25 Year Environment Plan (25YEP) set out a long-term vision for improving the natural environment in England. It established goals aimed at enhancing biodiversity, improving air and water quality, and promoting sustainable land use.

Nutrient Neutrality (2019)

Following the Dutch Nitrogen Judgement, England introduced the concept of Nutrient Neutrality. Nutrient Neutrality mandates that new housing developments must not increase nutrient levels, specifically P and/or nitrogen, at European protected sites that already that fail to meet nutrient conservation targets, including the Lugg catchment.

To implement Nutrient Neutrality, developers are required to conduct detailed nutrient budget calculations. These assessments evaluate the current nutrient status of a site and determine the necessary mitigation measures to offset any potential increases in nutrient pollution from new developments. This could involve onsite solutions, such as sustainable drainage systems, or offsite actions, like purchasing nutrient credits from landowners who have successfully reduced their nutrient outputs. The goal is to ensure that the overall nutrient load does not increase. Local Planning Authorities have launched Nutrient Mitigation Schemes that provide a framework for developers to offset nutrient contributions. Herefordshire Council have published Nutrient Neutrality guidance for developers, based on advice to the council by NE.

Environment Act (2021)

The Environment Act 2021 formalised the process for environmental plans. The Act established the Office of Environmental Protection, biodiversity net gain, protected sites strategies and local nature recovery strategies.

The Act also established legally binding targets for air quality, water quality, waste reduction, and biodiversity, and mandated water companies to monitor the frequency and duration of storm overflow discharges (i.e., Event Duration Monitoring – EDM).

Environment Improvement Plan (2023)

The Environment Improvement Plan (EIP) outlined the targets for improving river health, including targets to:

- Reduce nutrient pollution by 50% by 2030.
- Restore 75% of protected sites to favourable condition by 2042.
- Achieve at least good ecological status at 75% of water bodies by 2027.
- Improve wastewater treatment to reduce pollutants discharged into water bodies by 2027.
- Eliminate overflows from 4,000 combined sewer overflows by 2050.
- Establish a comprehensive monitoring framework for pollutants like microplastics by 2025.

- Ban or restrict harmful chemicals, including microplastics and PFAS by 2025.
- Create or restore 500,000 hectares of wildlife habitat by 2042.
- Protect 30% of land, inland waters, and ocean by 2030.
- Halt the decline in species abundance by 2030.
- Increase tree canopy and woodland cover to 16.5% by 2050.
- Increase monitoring of storm overflows to ensure over 90% are monitored by 2025
- Develop catchment management plans by 2025.
- Ensure that 100% of bathing waters meet good or excellent quality standards by 2025.
- Water companies to reduce leakage by 15% by 2025.
- Average household water use reduced to 110 litres per person per day by 2030.

Land Use Framework (2025)

In January 2025, Defra published a Land Use Consultation document that outlines the Government's vision for land use in England and seeks public input to develop a comprehensive Land Use Framework. The consultation aims to address key challenges such as environmental sustainability, economic growth, and community well-being, and emphasises the importance of balancing various land uses, including agriculture, housing, and conservation, to achieve long-term benefits for society and the environment.

Analyses for the consultation showed that land use change across 19% of agricultural land in England was potentially required to achieve environmental and climate objectives, including 9% of agricultural land becoming non-agricultural.

The consultation closed on 25 April 2025, with the final Land Use Framework originally expected in summer 2025. As of late October 2025, the Framework has not yet been published.

Nature Restoration Fund and Environmental Delivery Plans (2025)

The Nature Restoration Fund (NRF) and Environmental Delivery Plans (EDPs) are proposed mechanisms set out in the Planning and Infrastructure Bill, currently progressing through Parliament. These tools aim to support strategic environmental improvements by allowing developers to contribute to coordinated, landscape-scale restoration projects, rather than relying solely on site-specific mitigation.

Under the Bill, EDPs would be prepared by NE to identify targeted actions that improve the condition of protected habitats and species. These could include wetland creation, buffer strips, land use change, and other interventions that reduce nutrient pollution and enhance ecological resilience. Where an EDP is in place, developers may be able to discharge certain environmental obligations, such as those under the Habitats Regulations, by paying a Nature Restoration Levy into the NRF, which would fund delivery of the plan's measures.

Although these mechanisms are particularly relevant to areas facing nutrient pollution, they are not limited to Nutrient Neutrality catchments. They are designed to be flexible and could apply wherever strategic restoration is appropriate. While not yet in force, they may become relevant in future, especially in areas like the Lugg sub-catchment, which remains subject to Nutrient Neutrality requirements.

AGENDA ITEM 5

PHOSPHORUS IN THE RIVER WYE: EVIDENCE BASE FOR WALES

Evidence base and options appraisal.

Report for: Herefordshire Council

Ricardo ref. ED21132 Issue: 4 08/12/2025

Customer:
Herefordshire Council

Customer reference:
River Wye Nutrient Management Plan: Evidence Base for Wales

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Ricardo reference:
ED21132

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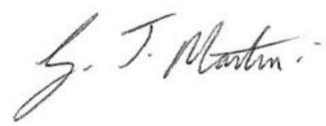

Date:
8st December 2025

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CONTENTS

EXECUTIVE SUMMARY

The River Wye Special Area of Conservation (SAC) holds international conservation status and supports notable species including native White-Clawed Crayfish, and Lamprey, Bullhead, European otter, and Atlantic Salmon. The river is failing to meet SAC and WFD water quality targets for phosphorus, which is affecting the ecological functioning of the river. This report aims to collate the existing evidence base, identify phosphorus concentration reductions (based on fair share principals) required to achieve SAC and WFD compliance, appraise a range of mitigation measures to reduce phosphorus loading, and provide recommendations for the Welsh Wye catchment to achieve SAC and WFD compliance that could be considered as part of an updated NMP.

On the Welsh side of the Wye catchment there are a total of 45 waterbodies with SAC targets and 34 waterbodies with a WFD target for phosphorus. In 2024, 58% of waterbodies with an SAC target failed for compliance (26 out of 45 waterbodies) and 35% of waterbodies with a WFD target did not achieve *'good status'* (12 out of 34 waterbodies). Failure to meet phosphorus targets has correlated with poor ecological health. Several published data sources attributed failing phosphorus targets to diffuse and point source pollution inputs from agriculture, wastewater and urban inputs.

SAGIS model outputs attributed sources of phosphorus in the failing waterbodies only to be primarily from agriculture (87%), followed by wastewater (7%), other (private sewerage systems, urban and industry) (2%) and intermittents (CSOs) (<1%). Significant geological and soil influences were thought to impact phosphorus loading from agriculture, including the impermeability of the mudstone geology, erodible soils, and steep topography.

To understand the sources of phosphorus from the agricultural sources, baseline phosphorus loading from individual farm types was modelled in Farmscoper V5. Extensive grazing contributed to the highest phosphorus load of 36%, believed to be due to a large area of the catchment having extensive livestock farms. This was followed by pigs and poultry farms contributing 32% of agricultural loading, believed to be due to significant manure production with higher phosphorus concentrations per tonnes compared to other farm types. Arable farms were contributing 21% of agricultural loading, believed to be due to high P index soils and soil erosion. P index is the measure of phosphorus concentration in agricultural soils. For wastewater, inputs were identified from the Permitted Discharges Register with 7% of total concentrations in the Welsh Wye attributed to final treated effluent from 73 Sewerage Treatment Works (STW). Inputs from other sources included registered private sewerage systems (PSS) identified using the Permitted Discharges Register and the Water Quality Exemptions register, highlighting a total of 107 PSS with a permit to discharge phosphorus to controlled waters.

To mitigate phosphorus loading from agriculture, over 120 individual mitigation measures derived from Farmscoper V5 were categorised into eight mitigation scenarios. The load reductions that could be achieved from implementing these measures were modelled for the whole of the Wye catchment: existing regulatory compliance (13%) maximum regulatory compliance (18%), best practice (32%), existing welsh agri-environment measures (39%), all possible agri-environment measures (44%), all possible mitigation measures (45%). Two further scenarios were developed by altering the baseline data used to model baseline loading from agriculture: all possible measures + low phosphorus index soils (47%) and all possible measures + 5% land use change (50%). Regulation delivered the highest cost-benefit, followed by best practice and welsh agri-environment schemes. When applied to all the failing waterbody catchments, the mitigation measure scenarios assessed are estimated to achieve *"fair share"* phosphorus concentration reductions required from agricultural sources in 76% of the failing waterbody catchments (25 out of 33). Individual measures were appraised and the top ten most effective measures recommended specific to farm type and fertiliser practices at the individual waterbody catchment scale, categorised by annual rainfall.

For wastewater measures, STW upgrades undertaken between 2020 and 2025 have reduced phosphorus loading by 8,974 kg phosphorus per year in the Welsh Wye across five STW. Planned STW upgrades between 2025 and 2030 at ten STW within failing waterbody catchments will achieve a total load reduction of 877 kg phosphorus per year. This will achieve their *"fair share"* concentration reductions, as approved by NRW for AMP8 investments. Backstop limits are also being implemented by DCWW at seven sites without a current phosphorus condition contained within the permit to prevent deterioration. For *"Other"* sources of phosphorus (from ST and urban sources), upgrading PSS can reduce phosphorus concentrations in discharge by up to 97% in failing waterbodies where PSS with a phosphorus permit to discharge to controlled waters is identified. However, upgrades may not

be economically feasible when compared to the potential monetary benefit for water quality, and PSS contribute less than 10% of nutrient loads in 37 out of 38 failing waterbodies. It is important to note that the number of total PSS is unknown and therefore phosphorus inputs from this source may be underestimated, which can lead to an overestimation of contributions from diffuse sources such as agriculture.

An action plan of high-level recommendations for the Welsh Wye that could be considered for the Wye Nutrient Management Plan and the Wye Catchment Plan has been provided. A monitoring framework describes potential monitoring components, including methods for reporting progress and impact, potential risks and mitigation strategies that could be considered with the Wye Nutrient Management Plan and Wye Catchment Plan.

Nitrate and ammonia risks were also assessed to see if there are any increasing concerns. WFD waterbodies all passed for ammonia in 2024, and since 2020 no waterbodies were observed to have increasing ammonia trends. One SAC waterbody failed for ammonia, however water quality sampling data from 2020 to 2024 at this site did not show a significant increasing trend overtime. Citizen science water quality sampling did show higher nitrate concentrations in some of the headwaters of the Upper Wye catchment. NRW sampling for nitrate showed a very small significant increasing trend in nitrate in one waterbody that was not sampled by Citizen Science, however all other waterbodies did not have significant increasing trends. Current regulations are in place specifically to reduce nitrate polluting the water environment. In addition, the measures recommended here for the agricultural sector which reduce sedimentation of watercourses and nutrient run off will likely reduce nitrate and ammonia inputs from agricultural sources, as well as phosphorus.

This evidence base and options appraisal draws together the existing evidence related to phosphorus pollution in the Welsh Wye and outlines a range of mitigation measures that could be implemented across the Welsh Wye catchment to reduce phosphorus concentrations from a range of sources. The mitigation measures presented here can be appraised for inclusion in the Wye Nutrient Management Plan to improve compliance with SAC and WFD targets, the ecological health of the river, safeguard wildlife, support resilient and sustainable agricultural practices, and improve the quality of our water supplies.

1. INTRODUCTION

The River Wye and the lower parts of it's main tributary, the River Lugg, hold international conservation status as a Special Area of Conservation (SAC) under the Habitats Directive. Environmental monitoring conducted by the Environment Agency (EA) and Natural Resources Wales (NRW) shows that water quality and ecosystem health are failing to meet the SAC or WFD target for some parts of the Wye catchment. This is primarily due to excessive nutrient levels, which has negatively impacted the ecological health of the SAC.

A Nutrient Management Board (NMB) was established in 2014, with an aim of achieving favourable condition status and to enable sustainable housing development in the Lugg catchment. However, a significant legal shift occurred in 2018 with the Dutch Nitrate Judgment, which reinforced the principle that internationally designated sites already exceeding environmental limits should not receive additional pollutants unless effective, measurable mitigation could be demonstrated. In response to this, Natural England (NE) advised in 2019 that the existing Nutrient Management Plan's (NMP) goal of achieving compliance by 2027 was no longer sufficient.

Following this ruling, NE and the EA revised the NMP in 2021, developing a Phosphate Action Plan aimed at defining concrete, legally compliant measures. However, by 2023, it became evident that the complexity of pollution sources (such as legacy phosphorus deposits and diffuse sources) made it unlikely that the plan could fully meet the stringent requirements of the Habitats Regulations. Consequently, the focus of the NMP shifted towards broader river restoration efforts. NE has recently conducted a high-level review of the plan to reflect this change and assess progress within the English portion of the Wye catchment. Following this an SAC compliance assessment was conducted in 2021 and 2024 by NRW, which showed that not all water body catchments achieved a pass for SAC targets.

As part of the 2023 NMP update, improvements to infrastructure at Dŵr Cymru Welsh Water's (DCWW) sewage treatment facilities were included, shifting regulatory attention towards managing diffuse pollution, which falls under the EA's jurisdiction. Following a Judicial Review, the EA has begun developing a Diffuse Water Pollution Plan to mitigate nutrient runoff from agricultural land.

In addition, Welsh Government have allocated funding to update the NMP using data collected from the Welsh catchment by NRW and citizen science groups. Since nutrient pollution remains the primary concern, the NMP will form a central focus of the broader Wye Catchment Plan, ensuring alignment between all related initiatives. The NMB members require the evidence base from both the Welsh and English sides of the Wye catchment to develop a whole catchment NMP, which brings forwards an aligned set of priority actions. This report will aim to collate and appraise the evidence base for Wales and undertake an options appraisal to recommend a range of mitigation measures that could be taken forward as part of the updated Wye NMP to achieve SAC compliance for the Welsh Wye catchment.

1.1 OBJECTIVES

The objectives of this report are to:

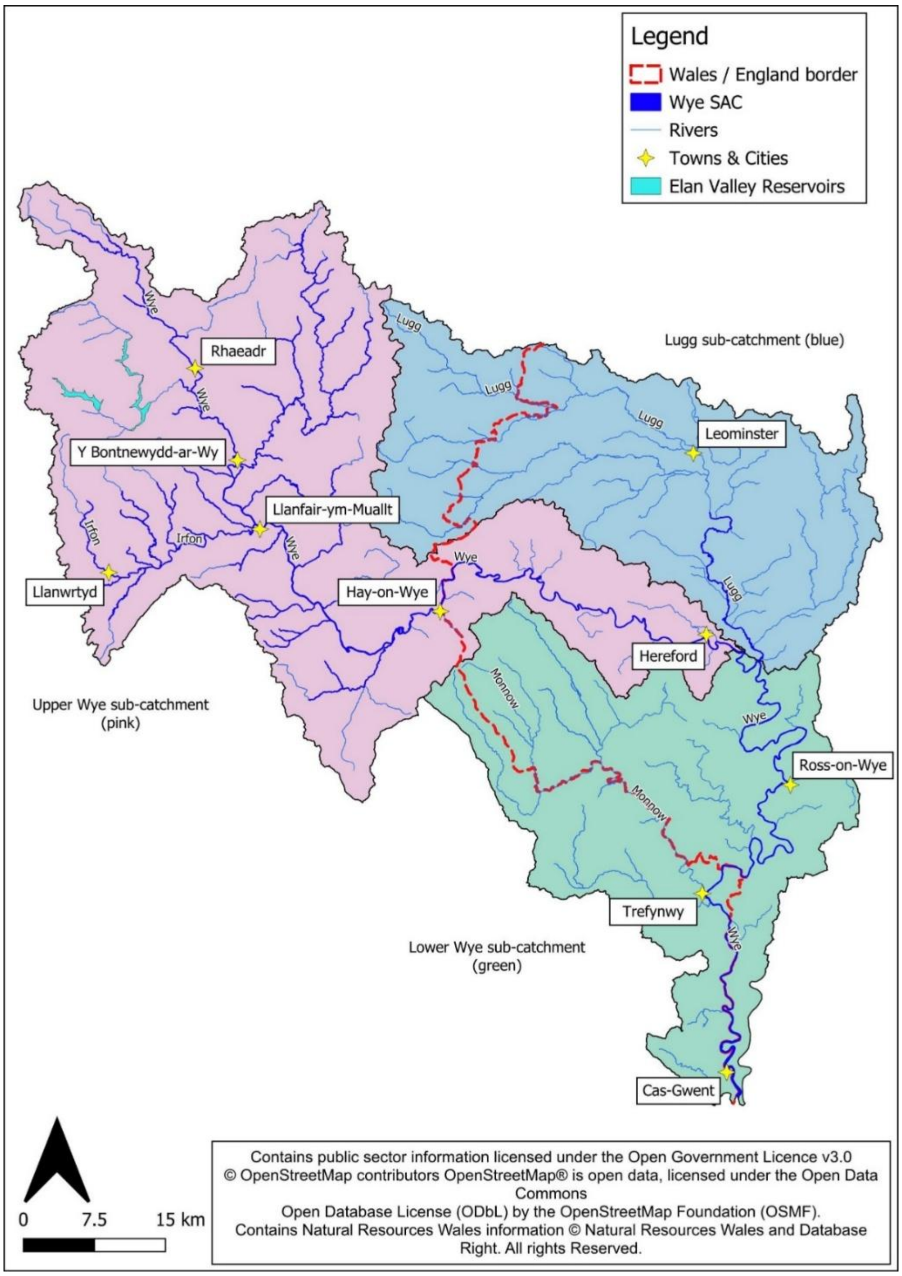
1. Draw together the Welsh catchment evidence base related to the sources and pathways of phosphorus in the Welsh part of the Wye catchment including NRW and Citizen Science data.
2. Summarise the main sources of phosphorus and concentration reductions required to achieve SAC and Water Framework Directive (WFD) targets in Wales.
3. Review the current projects being undertaken in the Welsh side of the Wye catchment to reduce phosphorus pollution.
4. Undertake an options appraisal of mitigation measures that can be implemented to reduce nutrient pollution in the Welsh Wye catchment and appraise the extent to which these measures can achieve phosphorus reductions.
5. Provide recommendations that can be considered as part of an updated NMP to restore the SAC to favourable conservation status, including a monitoring framework.

2. THE WYE CATCHMENT

The source of the River Wye originates on the eastern slopes of Plynlimon, which forms part of the Cambrian Mountains in Mid-Wales. This nationally important river flows 215km in a south-easterly direction from Wales into England, before flowing back into Wales at Monmouth, and then forming part of the Welsh and English border before flowing into the Severn Estuary in England. The River Wye and parts of its main tributary the River Lugg, are both designated a Site of Special Scientific Interest (SSSI) and form the River Wye SAC, with widespread habitats characterised by bryophyte-dominated vegetation and notable species including native White-Clawed Crayfish, and Lamprey, Bullhead, European otter, and Atlantic Salmon (Natural England, 2023; JNCC, 2025b). In addition, the River Wye forms part of the Wye Valley Area of Outstanding Natural Beauty (AONB).

The Wye catchment spans 4,017km^2 and can be sub divided into three main operational catchments; the Upper Wye, the Lugg and the Lower Wye (Figure 1).

Figure 1: Wye sub-catchments and the River Wye SAC



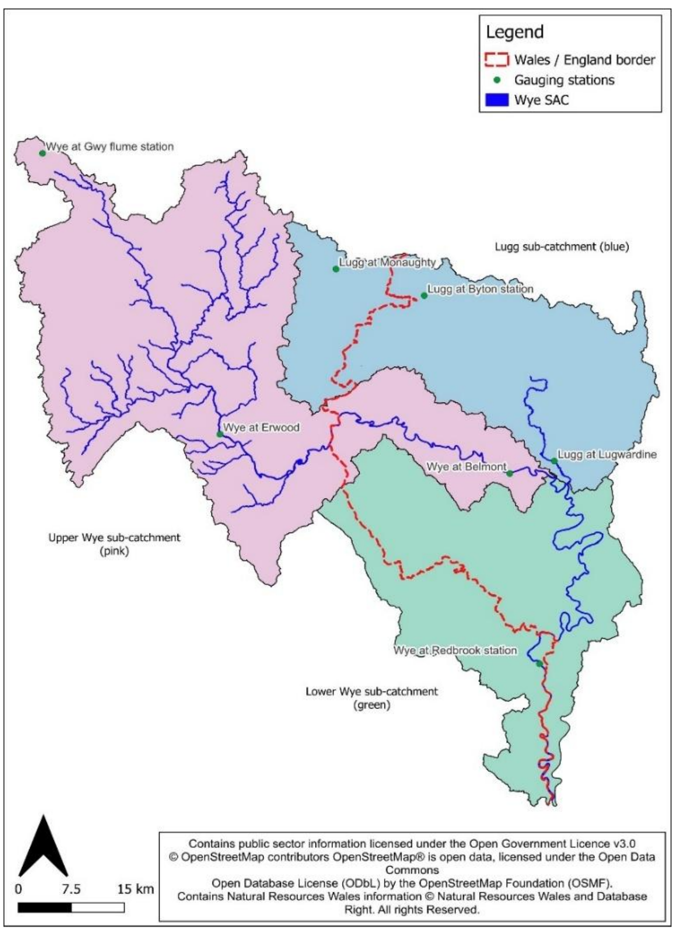
2.1 GEOLOGY, SOILS AND HYDROLOGY

The Upper Wye catchment in Wales is characterised mainly by Silurian and Ordovician mudstones, interspersed with some siltstones and sandstones (BGS, 2025). Soils at the source in the uplands are peaty and slowly permeable or wet (Soilscapes, 2025). Mean flow increases from 1.66m^3/s, with average river levels of 0.05 – 0.70m near the source (Wye at Gwy flume station, NGR: SN824853) to average river flows of 37.49m^3/s at Erwood in the lower part of the Upper Wye (Wye at Erwood NGR: SO075444) which represents the point at which the catchment changes from upland to lowland catchment, (NRFA, 2025).

In the Lugg catchment into England the bedrock geology changes to Devonian sandstones (BGS, 2025), overlaid with mainly freely draining loamy soils in the west and clayey loam soils in the east which can be suspectable to erosion and nutrient run-off (Soilscapes, 2025). Average river levels at the most upstream gauging station of the Lugg (Lugg at Monaughty (NGR: SO2391068450) range from 0.13m – 0.57m, flow is not measured at this gauging station. At Leominster average flow increases to 5.79m^3/s with an increased river level range of 0.76m – 2.60m (Lugg at Byton station, NGR: SO364646). At the last gauging station upstream of the River Lugg/River Wye confluence (Lugg at Lugwardine NGR: SO548405), flow rate increases to an average of 10.75m^3/s, with a decreased rainfall average of 882mm/yr and a river level range of 0.15m – 2.40m (NFRA, 2025). Close to Hereford, river levels range from 0.18m to 3.80m, with an average flow of 47.30m^3/s and rainfall decreases to 1,269mm/yr (station: Wye at Belmont, NGR: SO485387).

The Lower Wye in the south, sandstone lithology changes to Carboniferous limestone, this rock is more resistant to erosion and as a result gorges and caves are formed (BGS, 2025). The soil types are characterised by mainly freely draining loamy soils (Soilscapes, 2025). At the last station before the river meets the sea (Wye at Redbrook station, NGR: SO527110) average flow increases to 73.35m^3/s, with a decreased rainfall average of 1,054mm/yr, and a slight increase of river level, ranging 0.23m to 4.09m (NRFA, 2025).

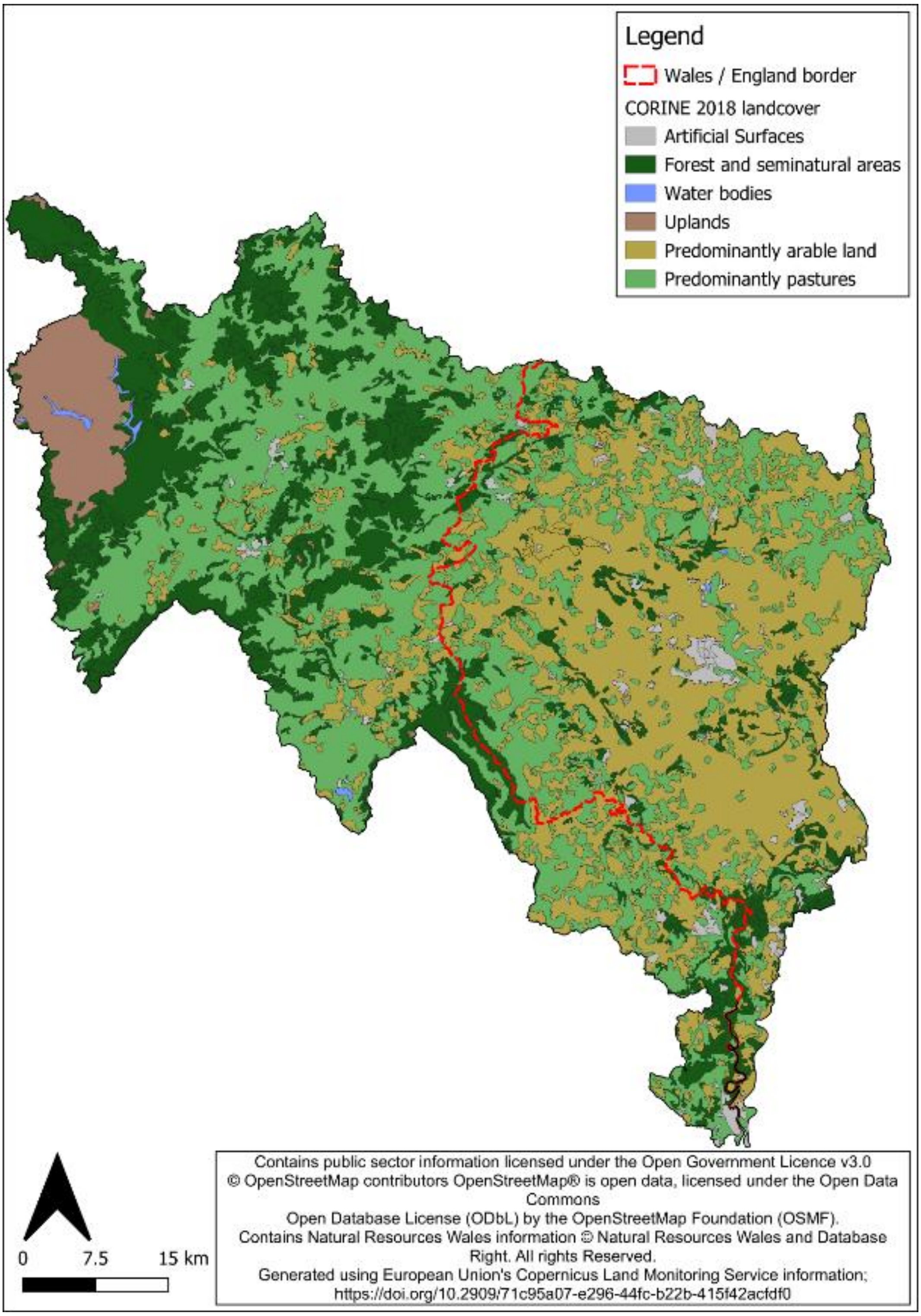
Figure 2: Wye flow gauging stations



2.2 LAND USE

In the Upper Wye catchment, land use is predominantly semi-natural (Figure 3), consisting of woodland and moorland, predominantly grazed by sheep. This area is sparsely populated with smaller settlements. Moving eastwards, land use changes from predominantly grassland to mixture of arable and dairy farms. The Lugg catchment has upland areas of sheep grazing in the higher reaches, which changes to more intensive arable land towards Leominster. In the lowlands of the Lower Wye, arable and poultry farms are the primary land use, with some industrial land uses in Hereford. The main towns of the Wye include Hereford, Monmouth, Leominster, Rhayader, Hay-on-Wye, Ross-on-Wye and Chepstow (Jarvie *et al.,* 2003; Bussi *et al.,* 2018) (See Figure 1).

Figure 3: Wye catchment CORINE 2018 landcovers



Agriculture is the major land use, with pastoral farming (sheep and beef) in the uplands, and more intensive arable/mixed farming (cereals, potatoes, hops, soft fruit, dairy, and poultry) on the fertile and highly productive soils in the lowlands. Poultry farming, in particular, has expanded rapidly in the region in recent years along with maize and potatoes (Withers *et al.,* 2022a). In the last ten years arable and grassland areas, and livestock numbers have remained the same; with the exception of poultry numbers, which are estimated to be nearing 30 million chickens (Herefordshire Council, 2024) across the Wye catchment (representing a 12% increase in the last five years) (Natural England, 2025).

2.3 WATER QUALITY

The following sections outline the water quality of the River Wye across England and Wales related to phosphorus.

2.3.1 Phosphorus and phosphate

Phosphorus is an essential element for all organisms and is often a limiting nutrient in freshwater, however elevated phosphorus can cause excessive plant and algal growth, which can reduce oxygen concentrations in the river and lead to reduced ecological status and fish kills (Hilton *et al.,* 2006). Phosphorus does not occur naturally in its elemental state due to its high reactivity, therefore, it readily forms other compounds under normal environmental conditions.

Many compounds containing phosphorus exist within waterbodies, with the ratio of forms dependent upon its source, environmental conditions and its location within the water column. Not all forms are available for algal, plant or cyanobacterial growth. The main compound typically of concern in relation to increased risks of cyanobacterial or algal growth is orthophosphate. Phosphate (any compound having one or more PO_4 units) and orthophosphate (phosphates with only one PO_4 unit) are an example of such compounds which are biologically available to algae, higher plants and cyanobacteria. Therefore, the higher the phosphate concentrations within a body of water, the higher are the risks of water quality deterioration as a result of an algal or cyanobacterial bloom. Inorganic phosphorous (phosphate) has been found to instigate and fuel cyanobacterial blooms, however, both nitrogen and phosphorus are essential in the establishment of cyanobacteria. Phosphorus may be accumulated on the sediment surface following senescence of an organism, be bound to redox-sensitive iron compounds or fixed in labile organic forms. As a result, the release of phosphorus into the water from the sediment may be triggered by various environmental conditions. Such releases may include the mineralisation of organic matter, the desorption and dissolution of phosphorus-bound in precipitates and inorganic materials and the diffusion of dissolved phosphorus from sediment pore waters (Moore *et al*., 1998), potentially resulting in continued eutrophication (Hou *et a*l., 2013).

An increase in cyanobacteria or algae within a river may deteriorate water quality through altering the water environment, for example, by increasing turbidity and decreasing available oxygen and sunlight penetration, which can reduce the ecological health of a river. Additionally, some cyanobacteria are capable of producing toxins which may be harmful to the health of both animals and humans, whereas other strains of cyanobacteria may produce compounds such as geosmin and 2-MIB (2-methylisoborneol) in response to favourable growing conditions, which can be challenging to treat for human consumption and increase treatment costs.

2.3.2 Water quality of the River Wye

Several organisations have published literature and research on the water quality issues in the River Wye SAC related to phosphorus (P), as well as the potential sources and pathways of phosphorus. The main findings and key points of various publications are outlined in Table 1.

Table 1 Published literature in relation to the whole Wye catchment.

Source	Water quality issues	Sources and pathways of phosphorus pollution
Tackling Phosphorus Pollution in Special Area of Conservation	• 67% of the River Wye water bodies failing to meet phosphorus targets. • Phosphorus pollution has also negatively impacted housing development, halting	Phosphorus inputs by each sector were attributed to: • Rural land use (72%), • STW (23%),

Source	Water quality issues	Sources and pathways of phosphorus pollution
(SAC) Rivers: information and evidence pack (Welsh Government, 2022a).	many schemes due to high phosphorus levels.	• Storm overflows (2%), • ST and urban run-off (3%).
Lancaster University Rephokus Report (English Side) (Withers *et al.,* 2022a).	Lancaster University undertook a three-phase study on the eastern half of the Wye catchment to investigate potential links between: • livestock manure, • the potential linkages between surplus phosphorus in soil from manure spreading and phosphorus concentration in the rivers and tributaries. The report highlights that there is a strong link between catchment phosphorus input pressures, manure phosphorus loadings to the land surface and build-up of soil phosphorus across the English part of the Wye.	Livestock farming has had a major impact on land use patterns and phosphorus cycling in the Wye catchment over the last 150 years, traditionally with cattle (dairy and beef) and sheep farming but more recently due to the rapid expansion of the poultry industry. An historic analysis of census-derived land use and livestock numbers indicates the Wye catchment has been in phosphorus surplus for the last 150 years. Historic applications of phosphorus indicate that more has been added to the land than crops can use. The soil phosphorus legacy is equivalent to 1.86 tonnes per hectare in the arable and productive grassland, which could take a decade to reduce if no phosphorus fertilisers are applied and all livestock manures are exported outside the catchment.
Lancaster University Rephokus Report Re-focusing Phosphorus use in the Wye Catchment (Withers *et al.*, 2022a).	• Analysis of long-term river P concentration data for the Wye catchment outlet at Redbrook suggests river P pollution may be gradually rising again, but more consistent and higher frequency water quality monitoring is required to confirm. • Annual P surplus of ca. 3000t (17kg P/ha), 60% above national average. • Clear evidence of positive links between annual P input pressure (and P surplus) and river P concentrations and loads exists at regional and catchment scales.	• High livestock numbers. • Livestock manure production. • Accumulation of soil P in agricultural soils. • Poorly-buffered and highly dispersible P-rich soils . • Steep slopes and moderate to high rainfall. • Inadequate water quality monitoring programs. • Lack of fine resolution census data. • Insufficient support for catchment stakeholders.
Lancaster University Soil Phosphorus Status and Water Quality in the River Wye Phase 1 (Withers *et al.*, 2022b).	• Orthophosphate concentrations in runoff are 0.1mg/l at mid soil P index 2, and 0.17mg/l at mid soil P Index 3. • Lower Wye soils release more P into solution than many other soils because they are poorly buffered and easily erodible.	• River flow is a key driver of phosphorus load. • Soil erosion is a driver of phosphorus loads to rivers (particulate P) which main be retained in river sediments. • Storm events increase phosphorus load from sewage and septic tanks (ST).
Lancaster University Soil Phosphorus	• The 2021 phosphorus surplus in six sub-catchments of the English Wye varied from 1.9kg P/ha in Yazor Brook to 16.2kg P/ha	• Maize areas have increased in the Welsh Wye, which increases risk of soil erosion.

Source	Water quality issues	Sources and pathways of phosphorus pollution
Status and Water Quality in the River Wye Phase 2 (Withers *et al.*, 2022c).	in Garren Brook, there is a wide variation in manure P production across the catchment. • Phosphorus sampling on the English Wye showed 55% of fields above P index 2.	• Poultry farms have increased across the whole Wye catchment which have a higher phosphorus content. • Manure production drives surplus phosphorus. • River phosphorus export was higher in sub-catchments with higher P surpluses.
Severn River Basin Management Plan summary and cross border catchments (England and Wales) (EA, 2022).	• Only 139 out of 740 waterbodies in the Severn River Basin achieved good status in 2022.	• Key drivers of poor status included invasive species, pollution from agricultural, rural areas, urban areas, sewage and industry. • The Wye and Usk foundation are working to eradicate invasive species in the Wye catchment. • NMB, DCWW and the Storm Overflow Taskforce are reducing phosphate pollution from sewage in the Wye catchment. • The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 have been introduced in Wales to reduce losses of pollutants from agriculture.
River Wye Special Area of Conservation 2023 growing season monitoring summary report (EA, 2023).	• One site on the main stem of the River Wye has exceeded its phosphate target in 2023, but this is due to one abnormally high reading in July 2023. The River Lugg failed at all five sites in 2022 and failed at three in 2023. •	• The River Lugg is known to have issues with eutrophication and efforts are ongoing to better understand and reduce nutrient pollution in the catchment.
River Wye Special Area of Conservation 2024 growing season monitoring summary report (EA, 2024)	• One site on the main stem of the River Wye has exceeded its phosphate target in 2024, due to one abnormally high reading in May 2024. • The River Lugg waterbodies all fail phosphate targets in 2024.	• None identified.

The previous research indicates that the Wye catchment experiences high livestock densities, phosphorus-rich soils, and annual phosphorus surpluses 60% above the national average, exacerbated by steep slopes and high rainfall. The research also indicates that phosphorus pollution in the River Wye primarily originates from diffuse agricultural sources (72%), including nutrient run off from livestock manure spreading and soil erosion, with additional contributions from sewage treatment works (23%), storm overflows (2%), and ST/urban runoff (3%).

4. EVIDENCE BASE IN WALES

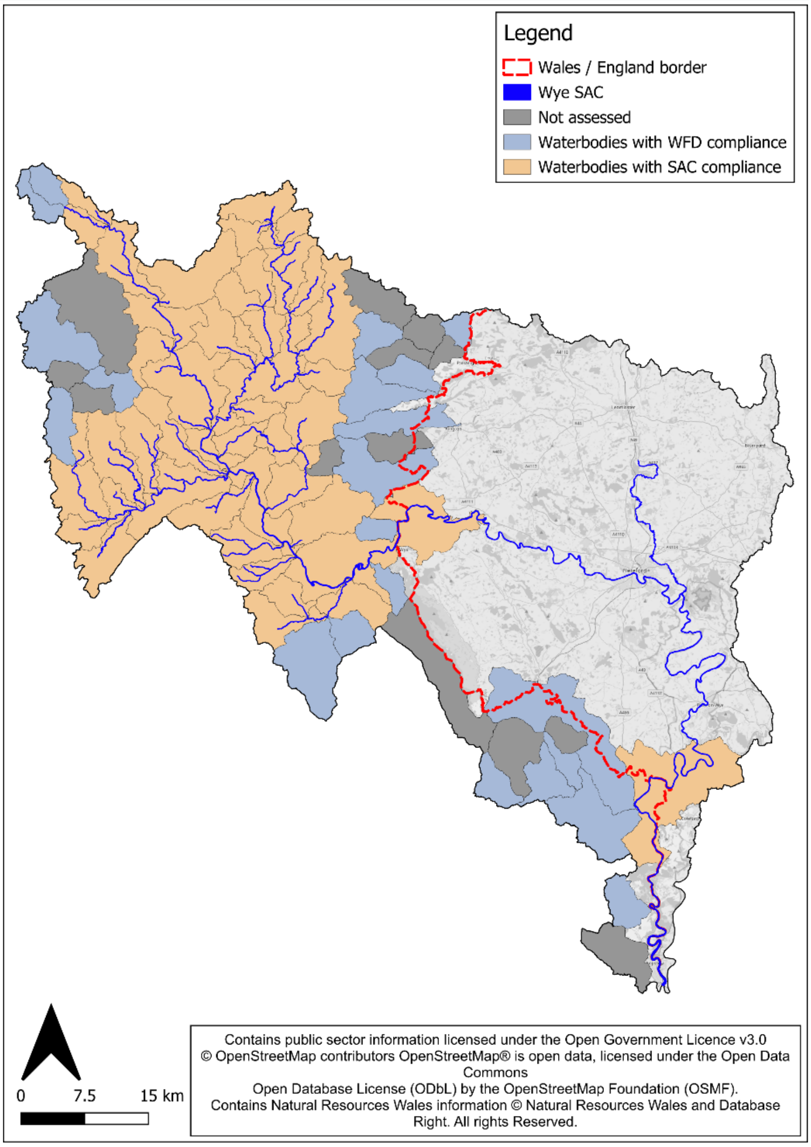
The following section aims to outline the current evidence underpinning the condition of the Wye waterbody catchment within Wales in relation to the concentration, sources and pathways of phosphorus.

4.1 WATER QUALITY

4.1.1 Official NRW compliance with targets

Achieving or maintaining SAC and WFD compliance for all water bodies in the Wye catchment is a key priority. WFD targets are the primary measure of river health in the UK, under The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (referred to as WFD Regulations 2017), which aims to achieve *"good"* status of all ground and surface water bodies. The River Wye is designated a SAC under the Conservation of Habitats and Species Regulations, 2017. Due to this designation the River Wye SAC has tighter phosphorus targets than WFD targets, known as common standards monitoring (CSM) targets, aimed at protecting the ecological health of the site by providing a simple measure of condition (JNCC, 2025a). Each water body is assigned a specific phosphorus target for SAC compliance. For all other waterbodies outside the SAC area WFD targets apply. In the Welsh part of the Wye catchment, there are 45 waterbodies with SAC targets with the remaining 34 waterbodies having WFD targets. Figure 4 highlights the waterbodies that are subject to SAC compliance targets or WFD compliance targets.

Figure 4: Summary map of waterbodies in the Welsh evidence base, including whether SAC or WFD targets apply



A compliance assessment of waterbodies against their SAC and WFD targets was conducted by NRW in 2021 and 2024. In 2021, 29 out of 45 waterbodies failed the SAC phosphorus targets, this reduced to 26 out of 45 in 2024. . In 2021 there were 11 out of the 34 waterbodies failing WFD targets, with five waterbodies not assessed. In 2024, the number of failing waterbodies increased to 12 out of 34 (due to *Gilwern Bk - source to conf R Arrow* being not assessed in 2021 and assessed in 2024).

Figure 5 and Figure 6 presents a spatial representation of the SAC and WFD compliance assessment results.

Figure 5 SAC phosphorus compliance assessment 2021 and 2024 comparison

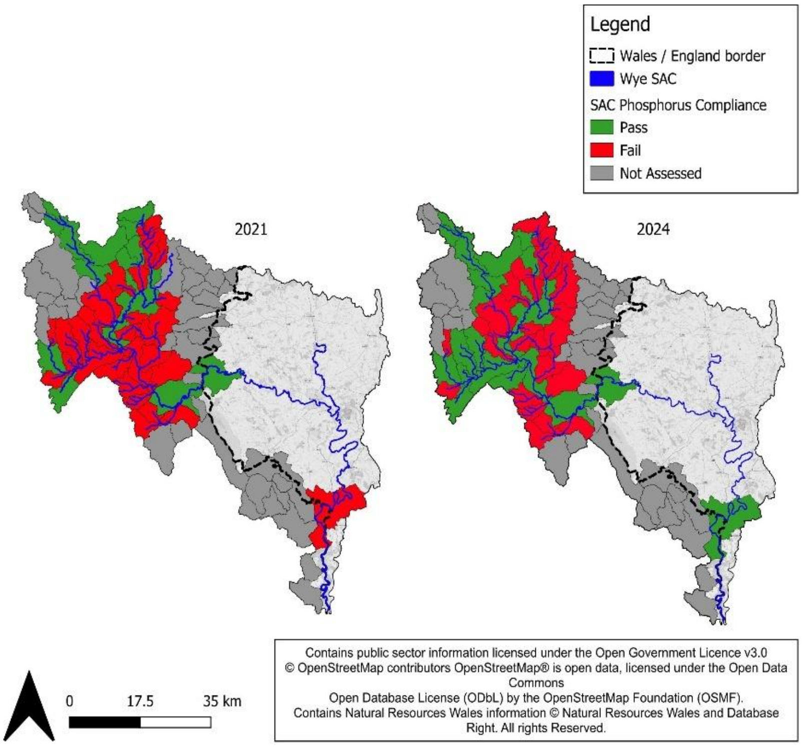
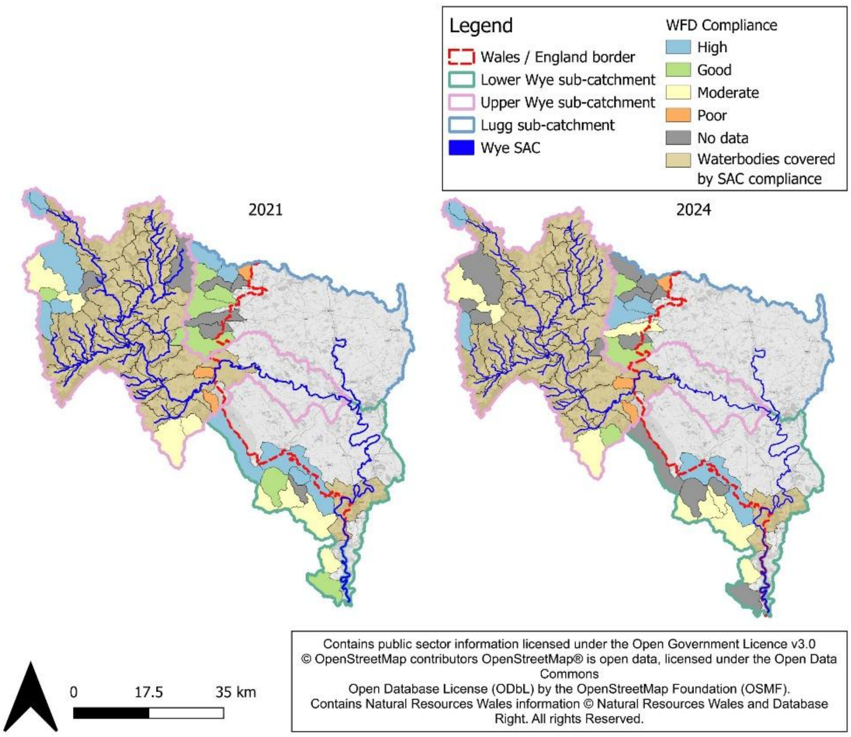


Figure 6: WFD phosphorus compliance for remaining waterbodies not covered by SAC compliance, 2021 and 2024 comparison



Water quality across the Welsh Wye has improved significantly since 2021, as demonstrated through the increases in compliance for phosphorus targets for WFD and SAC. NRW have advised that these improvements may have been driven through an increase in regulatory compliance visits on farms, support from Farming Connect to enhance the rural environment, and the Wye and Usk Foundations work improving habitat condition and riparian fencing. However, the average annual phosphorus concentration can be easily affected by sample outliers as outlined by NRW sensitivity testing, which can also lead to compliance changes (NRW, 2025c).

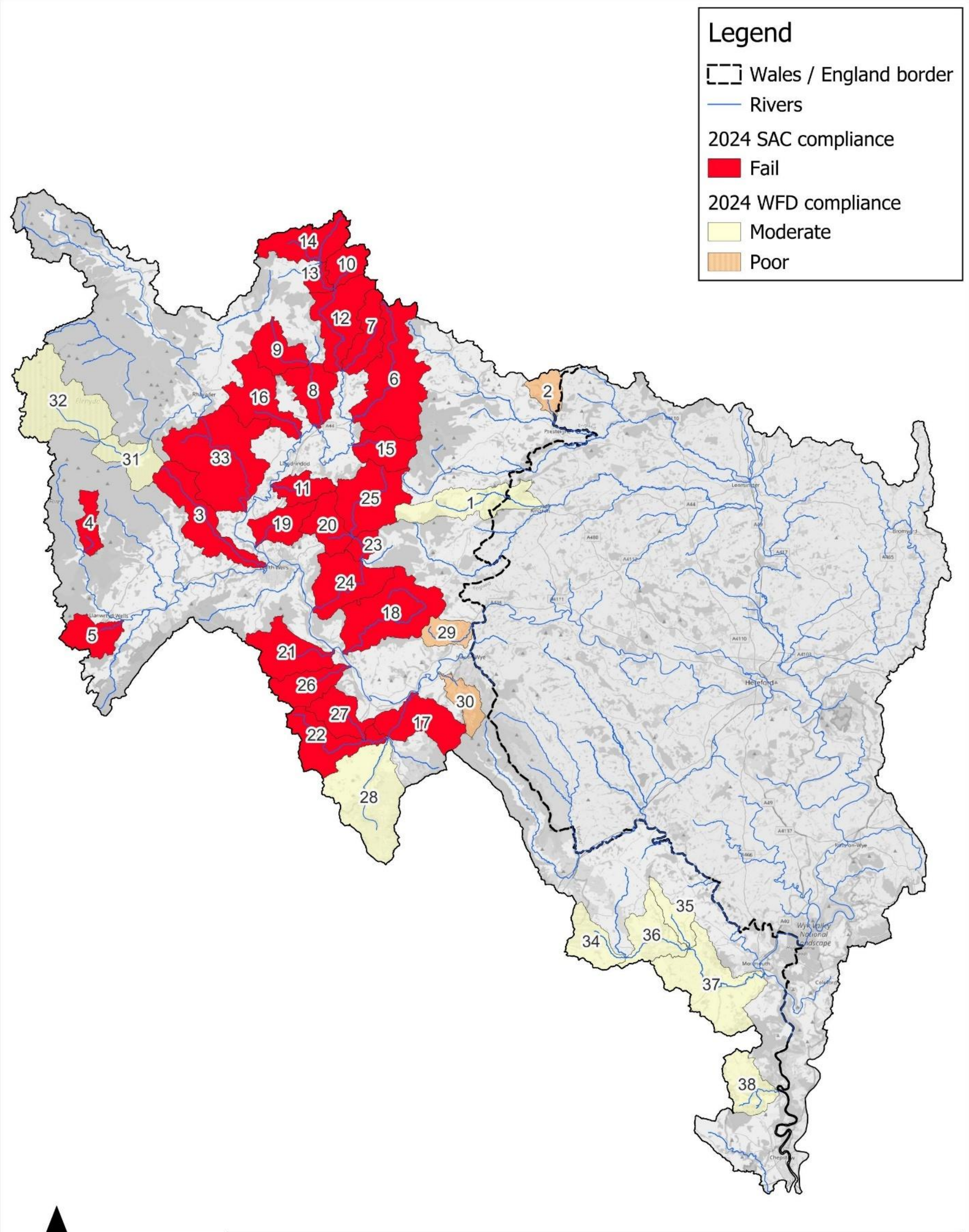
In total, for all waterbodies with a WFD or SAC assessment, there are 38 out of 79 waterbody catchments failing their phosphorus targets in 2024 (see Figure 7 and Table 2).

Table 2 Summary of SAC and WFD waterbodies failing phosphorus targets in 2024.

Wye sub-catchment	Operational catchment	Failing WB reference number	Waterbody name	SAC or WFD Target	2024 compliance
Lugg	Arrow, Lugg and Frome	1	*Gilwern Bk - source to conf R Arrow*	WFD	Moderate
	Lugg	2	*Norton Bk - source to conf R Lugg*	WFD	Poor
Upper Wye	Irfon	3	*Afon Chwefru - source to conf R Irfon*	SAC	Fail
		4	*Afon Gwesyn - source to conf R Irfon*	SAC	Fail
		5	*Cledan - source to conf R Irfon*	SAC	Fail
	Ithon	6	*Aran - source to conf R Ithon*	SAC	Fail
		7	*Camddwr Bk - source to conf R Ithon*	SAC	Fail
		8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	SAC	Fail
		9	*Clywedog Bk - source to conf Bachell Bk*	SAC	Fail
		10	*Gwenlas Bk - source to conf R Ithon*	SAC	Fail
		11	*Howey Bk - source to conf R Ithon*	SAC	Fail
		12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	SAC	Fail
		13	*Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	SAC	Fail
		14	*Ithon - source to conf Llaethdy Bk*	SAC	Fail
		15	*Mithil Bk - source to conf R Ithon*	SAC	Fail
		16	*Nantmel Dulas - source to conf R Ithon*	SAC	Fail
	Ithon to Hay	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	SAC	Fail
		18	*Bach Howey Bk - source to conf R Wye*	SAC	Fail
		19	*Builth Dulas Bk - source to conf R Wye*	SAC	Fail
		20	*Camnant Brook - source to confluence R Edw*	SAC	Fail
		21	*Clettwr Bk - source to conf R Wye*	SAC	Fail
		22	*Dulas Bk - source to conf Afon Llynfi*	SAC	Fail
		23	*Edw - conf Camnant Bk to conf Clas Bk*	SAC	Fail
		24	*Edw - conf Clas Bk to conf R Wye*	SAC	Fail
		25	*Edw - source to conf Colwyn Bk*	SAC	Fail
		26	*Scithwen Bk - source to conf R Wye*	SAC	Fail
		27	*Triffrwd - source to Dulas*	SAC	Fail
		28	*Afon Llynfi - source to conf Dulas Bk*	WFD	Moderate
		29	*Clyro Bk - source to conf R Wye*	WFD	Poor

Wye sub-catchment	Operational catchment	Failing WB reference number	Waterbody name	SAC or WFD Target	2024 compliance
		30	*Digedi Bk - source to conf R Wye*	WFD	Poor
	Wye source to Ithon	31	*Afon Claerwen - conf Afon Arban to Caban-coch*	WFD	Moderate
		32	*Afon Claerwen - source to conf Afon Arban*	WFD	Moderate
		33	*Wye - conf Afon Elan to conf R Ithon*	SAC	Fail
Lower Wye	Trothy	34	*Llanymynech Bk - source to conf R Trothy*	WFD	Moderate
		35	*Llymon Bk - source to conf R Trothy*	WFD	Moderate
		36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	WFD	Moderate
		37	*Trothy - conf Llymon Bk to conf R Wye*	WFD	Moderate
	Wye OC	38	*Tintern Bk - source to conf R Wye*	WFD	Moderate

Figure 7: Map of all waterbody catchments in Wales failing phosphorus compliance in 2024



4.1.2 Analysis of monitored data

Further analysis undertaken for this study uses the average concentration per waterbody, based on all available NRW monitored phosphate concentration data between 2020 and 2024 and is provided in Appendix A Additionally, a visual representation of phosphate concentration over time compared to their corresponding WFD or SAC target is presented for each waterbody in Appendix B. Overall, most failing waterbodies show average orthophosphate concentrations well above the target, some samples were very low but with numerous samples with concentrations substantially above the target indicating some temporal variation in P loading.Samples taken in four WFD waterbodies and two SAC waterbodies show that the majority of monitored samples were below the threshold and only exceeded the target on some occasions (see Appendix B). The waterbodies with concentrations of phosphorus below the target except for occasional samples are:

- 2. *Norton Bk - source to conf R Lugg* (WFD).
- 30. *Digedi Bk - source to conf R Wye* (WFD).
- 5. *Cledan - source to conf R Irfon* (SAC).
- 38. *Wye - conf Afon Elan to conf R Ithon* (SAC).

Additionally, all NRW reported concentrations at *Afon Claerwen - conf Afon Arban to Caban-coch* are below the target concentration of 0.028mg/l (the 2024 failure is a roll-forward from 2021 which used a 2017-2019 dataset).

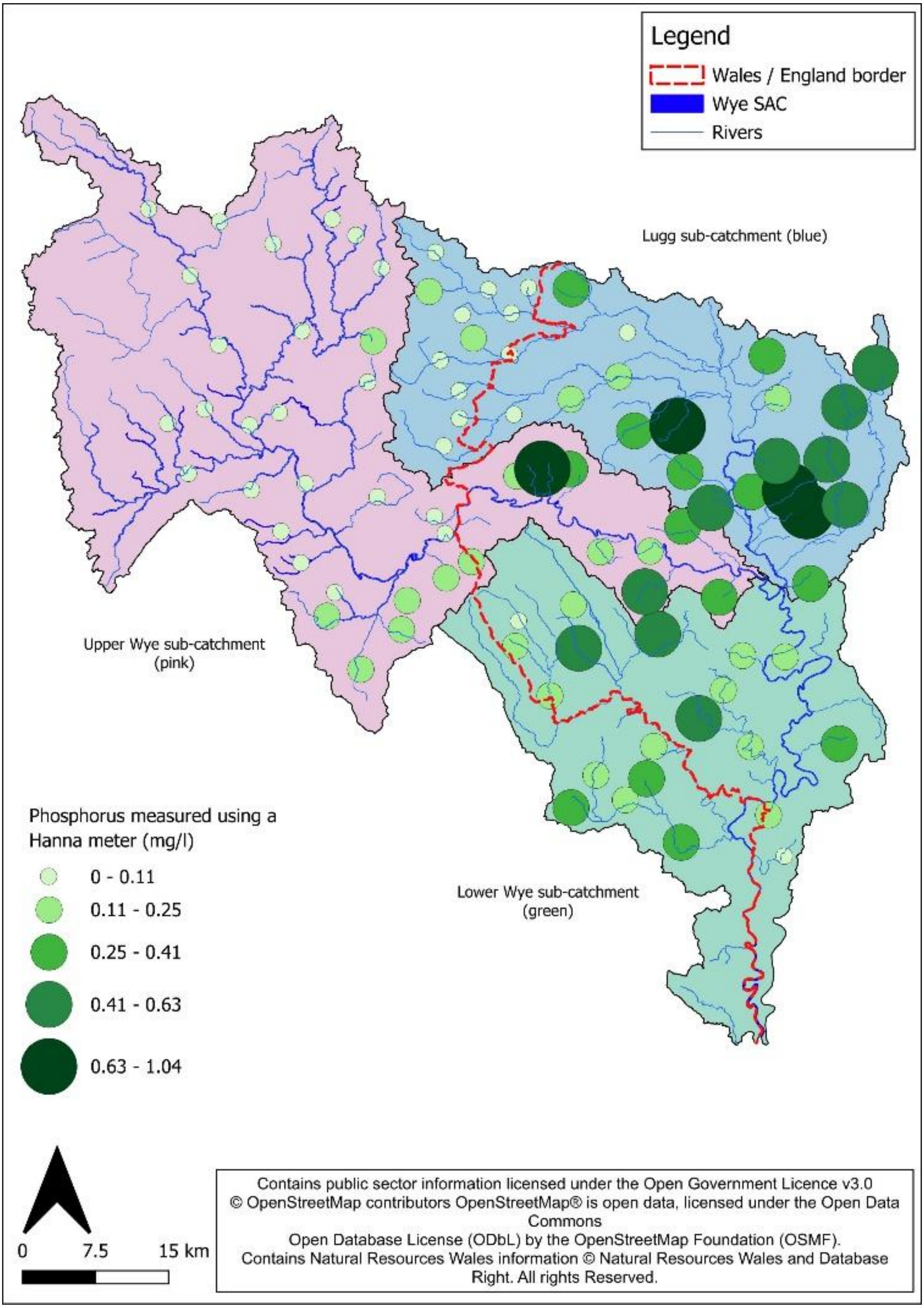
It should be noted that *Norton Bk*, *Clyro Bk*, *Llymon Bk* and *Afon Claerwen* present a limited number of samples, between seven and 14; while average number of samples range from 20 to 60 samples over the selected time period, with up to 100 samples in *Afon Llynfi - source to conf Dulas Bk* and *Llanymynech Bk - source to conf R Trothy* WFD water bodies and 79 at *Afon Llynfi - conf Dulas Bk to conf R Wye* SAC waterbody. WFD sampling frequency is typically quarterly and SAC monthly, higher frequencies are likely due to investigations and may not have been used in formal classification and status assessments.

Norton Bk historically had a higher number of samples above target before Norton STW was diverted to Presteigne in 2021.

4.1.3 Wye Alliance Citizen Science

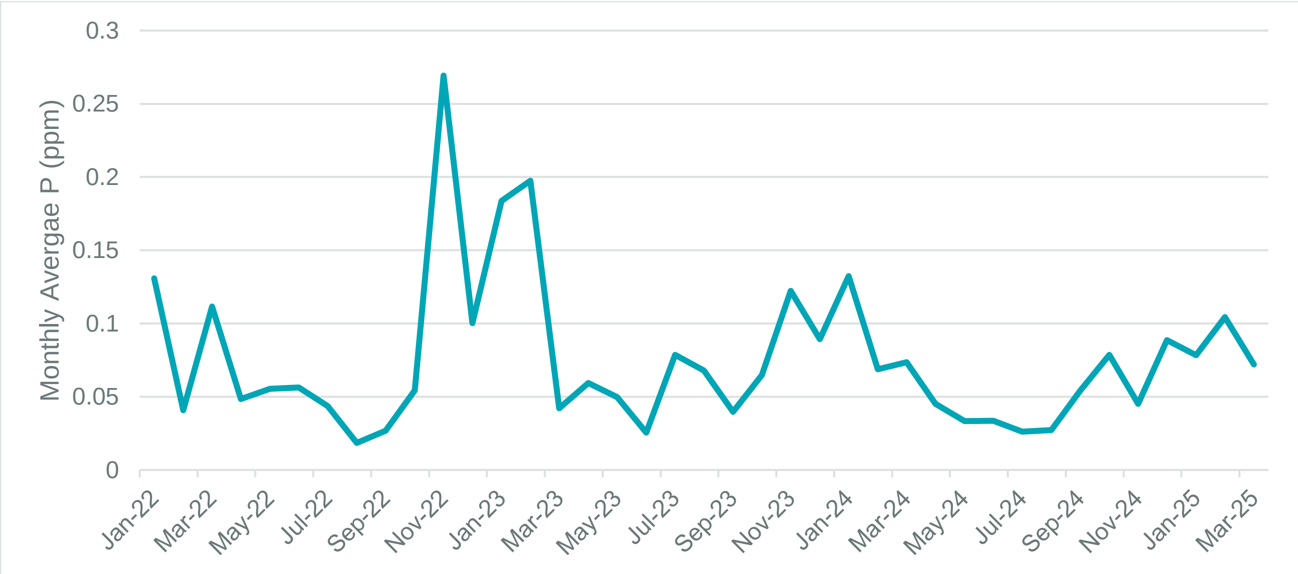
In addition to regulatory sampling, the Friends of the River Wye provide an array of water quality sampling data across the Wye catchment. The data has been collated from samples collected through a citizen science programme using Hanna phosphorus meters at various locations along the River Wye and its many tributaries. Figure 8 displays the sampling locations and concentrations of phosphorus measured across the catchment. The data show that in the upper reaches of the Upper Wye catchment have lower phosphorus concentrations than the lower Upper Wye catchment (between 0 – 0.11mg/l in the upper reaches compared to 0.62mg/l in the lower reaches). The Lugg catchment has high concentrations of phosphorus in the eastern part of the catchment (0.63 to 1.04mg/l). In the Lower Wye catchment there are several locations with concentrations between 0.25 and 0.63mg/l. The analysis shows that phosphorus concentrations are lower in Wales and in the uplands, whilst the lowlands and the majority of the English Wye catchment have higher phosphorus concentrations. Note that phosphorus concentrations are measured as orthophosphate by the Hannah metres used by Citizen Scientists whereas NRW measures as orthophosphate-as-P and therefore, there will be disparities in phosphorus concentrations in mg/L between the two datasets. As a molecule of orthophosphate (PO43-) weighs 3.06 times more than a molecule of just phosphorus (P), the Hannah results need to be divided by 3.06 for a direct comparison.

Figure 8: Phosphorus concentrations measured by Citizen Science in mg/l



Analysis of the mean phosphate concentrations within the River Wye at dedicated sampling locations indicated increases in mean phosphate concentrations during both the growing season (March to September inclusive) and out-of-growing seasons (October to February inclusive) (Figure 9). The moving average remained below 0.2ppm over the sampling period, except for one sample of 0.26ppm in November 2022.

Figure 9: The monthly average phosphate measurement across the River Wye and tributaries located in Wales from January 2022 to March 2025 (n=1,760 samples)



(Source: adapted from WyeViz, 2025).

4.1.4 Published literature

In addition to the water quality sampling and compliance assessments, there are several organisations who have published literature and research on the water quality issues in the River Wye SAC related to phosphorus, as well as the potential sources and pathways of phosphorus pollution. The main findings and key points of various publications which relate to the Welsh side of the Wye specifically are outlined in Table 3.

Table 3 Summary of published literature on the water quality issues as well as the key sources and pathways of phosphorus pollution identified by various organisations.

Source	Water quality issues	Sources and pathways of phosphorus pollution
NRW Welsh part of the Severn River Basin Management Plan (2021-2027) (NRW, 2022a).	• Widespread phosphorus breaches in River Wye SAC. • 33% of water bodies achieved good or better overall status in the Welsh section of the Wye catchment in 2015, increasing to 35% in 2021.	• Diffuse agricultural pollution from use of fertilizers and manure use. • Sewage discharges from treatment plants and combined sewer overflows (CSOs) releasing untreated or partially treated sewage containing phosphorus into the river during heavy rainfall events.
NRW Core Management Plans (NRW 2022b).	• White-clawed crayfish are a key species present in the system. Major decline in the distribution and abundance of the invasive white-clawed crayfish has been recorded in the River Wye, but are widespread and abundant in the River Lugg.	• In the Wye catchment, the most significant sources of diffuse pollution are from agriculture, which includes fertiliser runoff, livestock manure, silage effluent and soil erosion from ploughed land.

Source	Water quality issues	Sources and pathways of phosphorus pollution
	• The current unfavourable status of Bullhead results from the presence of adverse factors, in particular localised water quality failures. • The current unfavourable status of Atlantic salmon results from failure of the Management Target for adult run size, in particular the potential for flow depletion and localised water quality failures. • Pollution of rivers with toxic chemicals, such as PCBs, was one of the major factors identified in the widespread decline of otters during the last century. There should be no increase in pollutants potentially toxic to otters. • The present unfavourable status of *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation results from reduced water quality in some tributaries of the Wye e.g. parts of the Ithon and Llynfi sub-catchments, due mainly to diffuse pollution from agriculture.	• Potential agricultural pollution from Rhayader, upper catchment, poultry and arable farming, sheep-dips, livestock encroachment.
NRW Phosphate compliance review for SAC rivers in Wales, 2021 (NRW, 2021).	• Comparison of phosphorus concentrations in the Wye against targets indicate widespread failures, some of them large in magnitude. Fourteen water bodies passed their targets, 28 failed and three were unknown. • Water bodies achieving their phosphorus targets were located in the Upper Wye above Rhayader, about half of the Ithon, and two water bodies in the Irfon. • All of the middle Wye tributaries, the remaining Irfon and Ithon and the Llynfi failed their targets. • The largest failures were the Wye near Newbridge, the Cammarch, Clettwr Brook, Mithil Brook, lower Irfon, Garth Dulas and the three water bodies in the Llynfi catchment. Both consistent and episodic failures were identified.	Recent media interest has focussed strongly on poultry units as being the cause for concern in the Upper Wye, especially in the Ithon sub-catchment. However, the overall pattern of failures in the Wye does not support the hypothesis that poultry units are the main or even a particularly important reason for nutrient failures on the Wye. An investigation of nutrient sources in the Upper Wye is needed that takes into account all potential nutrient sources, including smaller local STW which may not have been included in previous work.
Phosphorus Source Apportionment Summary: Updating the SAGIS Upper Wye Model (DCWW, 2023).	• 67% of water bodies in the Upper Wye SAC fail to achieve targets, January 2021. • On balance, a kilogram of phosphorus discharged from a treatment works will have a relatively greater impact on the in-river concentration than the equivalent input from diffuse sources. The concentration and load apportionment are different because inputs from different sources tend to occur under differing river flow conditions.	DCWW Source Apportionment Geographic Information Systems (SAGIS) model data for the Upper Wye showed that effluent from STW accounts for 23% of the average daily load with rural land use contributing 72%, storm overflows contributing 2% and a further 3% from other sources including ST and urban run-off. At the assessment location (quantified at water quality monitoring station 50021 which, although situated in England, is less than 2km from the border with

Source	Water quality issues	Sources and pathways of phosphorus pollution
		Wales), the model shows that, under current conditions, approximately 67kg of phosphorus is discharged from the Welsh part of the upper River Wye catchment on a daily basis.

In summary, previous research and findings indicate the River Wye SAC faces widespread phosphorus pollution, with 67% of water bodies failing to meet targets in the Upper Wye historically. This has impacted water quality, aquatic ecosystems, and housing development. While some areas meet phosphorus targets, many tributaries show failures. Key species, such as white-clawed crayfish, bullhead and Atlantic salmon, as well as notable vegetation, such as *Ranunculion fluitantis* and *Callitricho-Batrachion*, are in decline partly due to water quality issues.

4.2 ECOLOGICAL IMPACTS

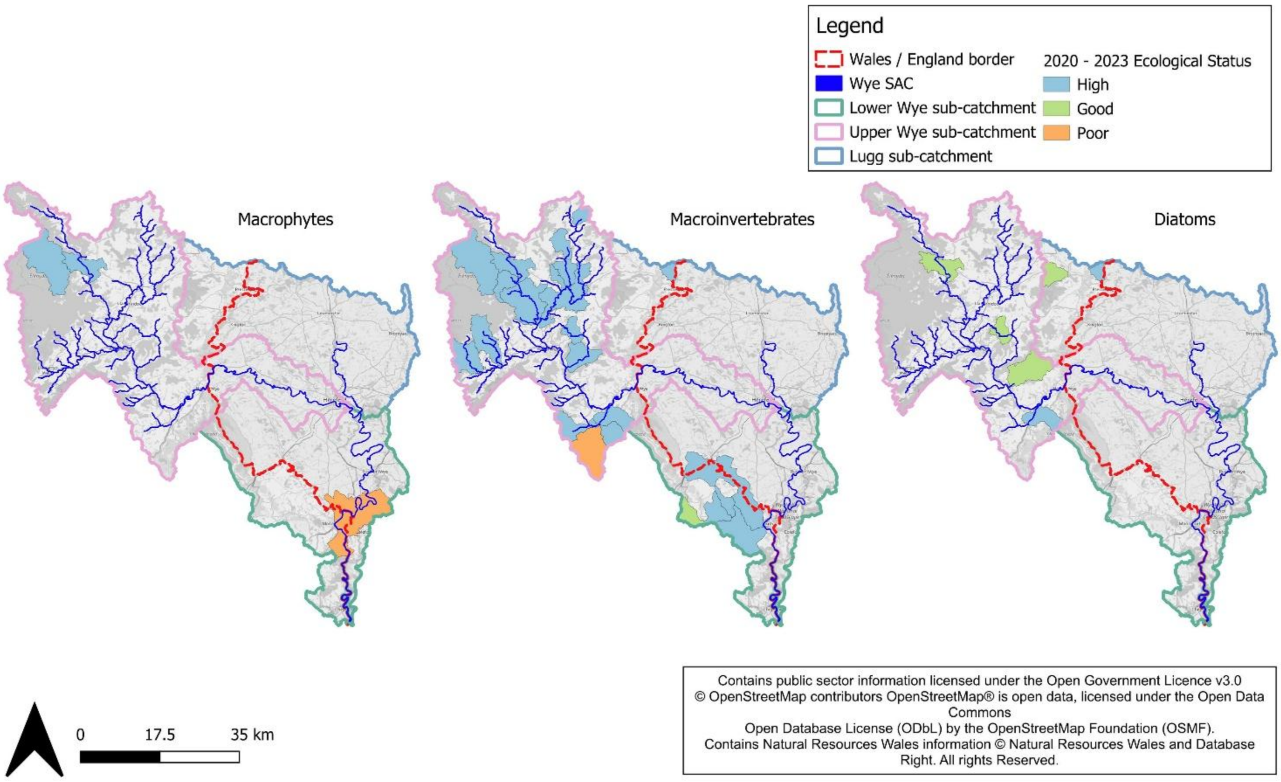
Excessive phosphorus loading in aquatic ecosystems can induce eutrophication, characterized by the proliferation of primary producers such as phytoplankton and macrophytes. This hyperproductive state often leads to harmful algal blooms (HABs), including toxin-producing cyanobacteria. The subsequent senescence and decomposition of these blooms result in increased biochemical oxygen demand (BOD), leading to hypoxic or anoxic conditions. These oxygen-depleted zones can cause significant mortality events in fish and benthic invertebrates, thereby disrupting trophic interactions and altering community structure. Additionally, the decline in water quality can impair ecosystem services, including potable water supply, recreational activities, and habitat provision for aquatic organisms. Effective management of phosphorus inputs is critical to mitigate these ecological impacts and maintain the integrity of aquatic ecosystems.

Due to the importance of the impact of phosphorus concentrations on aquatic organisms this section evaluates waterbody ecological classification based on UKTAG WFD guidelines and standard ecological assessment thresholds. The assessment uses the available 2020 to 2023 biological monitoring data collected from NRW data catalogue (NRW, 2025c). Data varies slightly from the routine WFD status classification from 2024 due to the addition of a larger open-source dataset and a slightly longer temporal dataset for phosphorus (2020 – 2024). These data have been included to provide a broader understanding of the influences on the status over time, and to include any data which may supplement the official WFD classification. WFD classification provides a standardised approach to assessing ecological status per water body utilising only predetermined monitoring data over a three year period and reported as an annual classification. NRW data was selected for classification and mapping over a series of years to provide a deeper understanding of the biological status over time. A detailed description of the methodology used to assess and classify monitoring data on diatoms, invertebrates and macrophytes in the Welsh Wye catchment, is provided in Appendix E.

Results from this assessment is presented in Figure 10 for macroinvertebrate, macrophyte and diatom data, respectively. Coverage of recent data over the catchment is limited and about half of the WFD waterbodies could not be assessed. However, a general assessment of the correspondence between ecology data and phosphorus concentration can be made from available data. Overall, WFD 2024 overall classifications match the ecological status classification performed in this study corresponding to invertebrates and macrophyte samples collected between 2020 and 2023. *Afon Llynfi - source to conf Dulas Bk* waterbody shows poor invertebrate ecological status, in line with its current Moderate WFD overall classification, while all other waterbodies covered align with good or high ecological status. The analysis showed that available macrophyte and diatom data is much reduced between 2020 and 2023. Diatom data do not show high correspondence with WFD 2024 water quality status. However, it should be noted that while both diatoms and green algae respond to nutrient loads, diatoms have a unique requirement for silica and can adapt to varying nutrient conditions, whereas green algae often respond more dramatically to nutrient enrichment. Abundance and growth of these two biological elements are closely related to P content in water and should be considered as key biological indicators of nutrient pollution.

Coherence between invertebrate, macrophyte and diatom SAC waterbody classification is low, with most ecological assessment results showing High or Good status, while the corresponding waterbodies have been reported as failing SAC P compliance.

Figure 10: Summary map of Welsh Wye waterbodies unofficial ecological status based on NRW invertebrate, macrophyte and diatom available monitoring data between 2020 and 2023



4.3 SOURCES AND PATHWAYS OF PHOSPHORUS POLLUTION

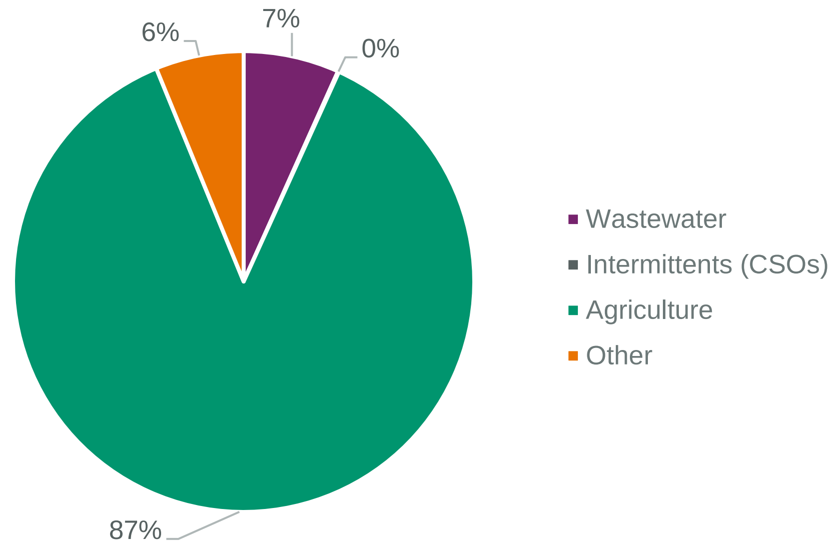
Source apportionment data has been produced for the catchment using SAGIS v3 modelling provided by NRW. DCWW produced SAGIS model outputs (based on 2016 to 2019 water quality monitoring) for the Welsh part of the Upper Wye, that was reviewed by NRW, and the EA produced SAGIS model outputs for the Welsh Lugg and Lower Wye. The data consists of modelled sector sources of phosphorus at the lowest boundary of each waterbody. The sector sources include STW, intermittent discharges (combined sewer overflows), rural land use (agriculture), and other (ST, urban and industrial discharges).

There are no sector contributions for highways.

The Upper Wye Welsh model showed that under current conditions effluent from sewage treatment works accounts for 23% of the average daily load (kg/day) with rural land use contributing 72%, storm overflows contributing 2% and a further 3% from other sources including ST, industry and urban runoff.

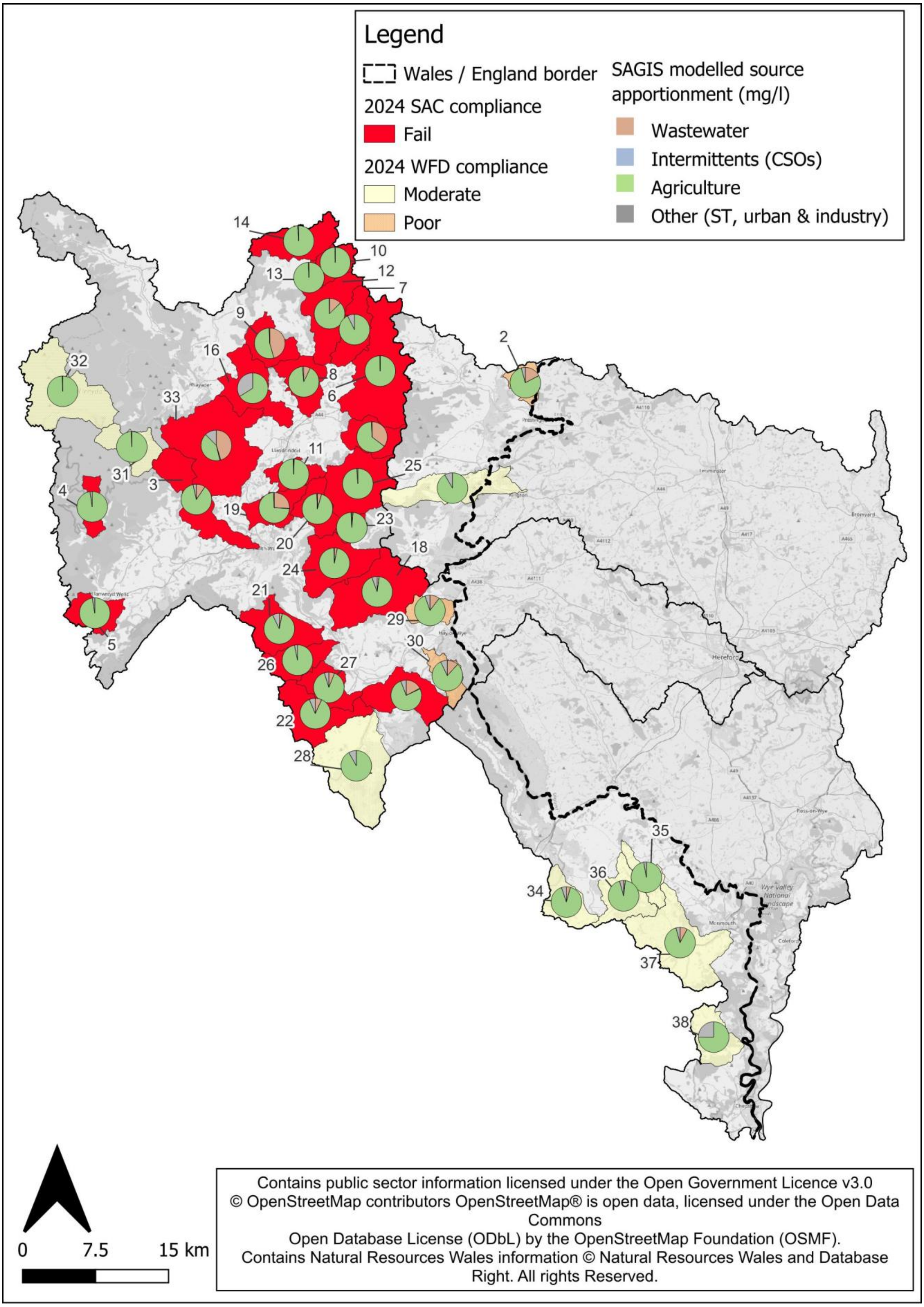
The model outputs were analysed looking only at those water bodies in the Welsh Wye failing phosphorus targets in 2024. The highest sector contribution is agriculture (87%), followed by sewage (7%), other (ST, urban and industry) (6%) and intermittent discharges (<1%) (Figure 11).

Figure 11: Total sector contributions of phosphorus concentration across all failing waterbodies in the Welsh Wye catchment (as derived from SAGIS).



Sector contributions of phosphorus concentration (as derived from SAGIS) in individual waterbody catchments is displayed in Figure 12 (see Appendix F for the full dataset and Appendix H for a detailed methodology of how percentage sector contributions have been calculated). Rural contributions are highest in all failing waterbody catchments, with wastewater having significant contributions in Clywedog Bk - source to conf Bachell Bk, Mithil Bk - source to conf R Ithon and Wye - conf Afon Elan to conf R Ithon of over 30%. Other contributions are limited to less than 10% of contributions in all failing waterbodies except *Nantmel Dulas - source to conf R Ithon*, *Wye - conf Afon Elan to conf R Ithon* and *Tintern Bk - source to conf R Wye*. CSOs have minimal contributions in all failing waterbodies.

Figure 12: Map of combined EA and DCWW SAGIS modelled source apportionment concentrations



4.3.1 Geological and soil influences

The variation in geology and soil types can influence how phosphorus is transported into the river. In the Upper Wye, the impermeability of the mudstone geology, combined with the erodibility of the peaty soils, steep topography of the Cambrian mountains and high rainfall in this area (2,320 – 2,418mm/yr) can lead to surface run-off and flash flooding in the Upper Wye catchment, driving nutrient inputs through mobilised sediment (Brandt *et al.,* 2004).

In the Lugg catchment the sandy soil types and underlaying sandstone are more permeable which reduces flash flooding, however, these soil types are more suspectable to erosion via overland flow if soils are bare and heavy rainfall occurs, which can carry phosphorus into the river via this pathway. Phosphorus inputs bound to sediment can be higher if heavy rainfall occurs during droughts or when high flows can cause bankside erosion (Petry *et al.,* 2002; Dupas *et al.,* 2024).

In the Lower Wye, the limestone geology is more resistant to erosion and as a result gorges and caves are formed, which can increase the occurrence of ground and surface water interaction at springs (BGS, 2025). Significant groundwater contributions to the Lower Wye can stabilise lower river flows (Jarvie *et al.,* 2003), however high river flow given the upstream contributions can increase bankside erosion.

4.3.2 Agriculture sources

The SAGIS model estimated that 87% of phosphorus loading originates from the agricultural sector across all waterbody catchments failing SAC or WFD targets (Environmental Information Data Centre, 2025). This has been attributed to an annual phosphorus surplus of 3,000t across the whole of the Wye Catchment (ranging from 1.9 to 17kgP/ha across the catchment); this is 55% higher than the national average and is primarily driven by livestock manure inputs to land (Withers *et al.,* 2022a). In the uplands of the Upper Wye and the furthest reaches of the Lugg catchment, sheep grazing and peatland degradation can exacerbate surface runoff and carry sediments and phosphorus into the river, however phosphorus concentrations in the soil are considered low (P index 1 or below) in this area due to low nutrient inputs from extensive grazing practices (Jarvie *et al.,* 2003; Wtihers *et al.,* 2022b). In the lowlands of the Wye catchment phosphorus loading is higher, with 55% of fields having above optimum phosphorus concentrations (Withers *et al.,* 2022b). Livestock manures have historically originated from cattle and sheep; however, poultry numbers have increased in the catchment in recent years. Poultry manure has a higher phosphorus concentration than cattle and sheep manure by around 60% on average, as derived from RB209 Nutrient Management Guide (AHDB, 2023) (see Table 4). Therefore, the increases in poultry production may have increased the concentration of phosphorus applied in livestock manures across the catchment, contributing to elevated phosphorus concentrations in the waterbodies.

Table 4 Phosphorus concentrations in fresh-weight livestock manures.

Livestock	Dry matter (%)	Total phosphorus (kg / tonne)	Available phosphorus (kg / tonne)
Cattle and sheep	25	3.2	1.9
Poultry	20	8.0	4.8

(Source: adapted from AHDB, 2023).

There is currently no regulatory limit on phosphorus applications to land in Wales, however there is existing guidance (Welsh Government, 2022c):

- Materials spread to land should benefit agriculture or ecological improvements - Environment Permitting Regulations (Defra, 2016),
- Phosphorus applications must be limited to crop offtake only and risks to the environment must be addressed when applied to P index 3 or above soils - Code of Good Agricultural Practice for the Protection of Water, Soil and Air for Wales (Welsh Assembly Government, 2011),
- Nutrient requirements to be considered when applying sludge - Sludge Use in Agriculture Regulations (Defra, 2018).

In the Welsh Wye, there is limited up-to-date data on phosphorus soil reserves (Welsh Government, 2022b). However, across the whole of the Wye catchment, the surplus phosphorus after crop uptake is 60% higher than the national average and has led to high legacy phosphorus reserves in the soil (Withers *et al.,* 2022a). The soils have limited phosphorus buffering capacity due to the high existing phosphorus reserves. Steep slopes and high rainfall can lead to soil erosion and sedimentation of watercourses, which can transport sediment-bound phosphorus into watercourses. During the springtime, soil erosion following livestock manure applications has been shown to be a major cause of phosphorus pollution in rivers from rural land (Bowes *et al.,* 2022). In addition, bankside erosion from high flows or livestock poaching (Scott *et al.,* 2023) can cause sediment and nutrient pollution. Therefore, the two major causes of phosphorus pollution from the agricultural sector can be attributed to excessive livestock manure inputs to land and soil erosion into watercourses.

To assess the contribution of diffuse phosphorus pollution from different farm types, Farmscoper Upscale V5 (ADAS, 2025) was used to model the estimated loads of phosphorus for the Wye catchment. See Appendix G for the full methodology.

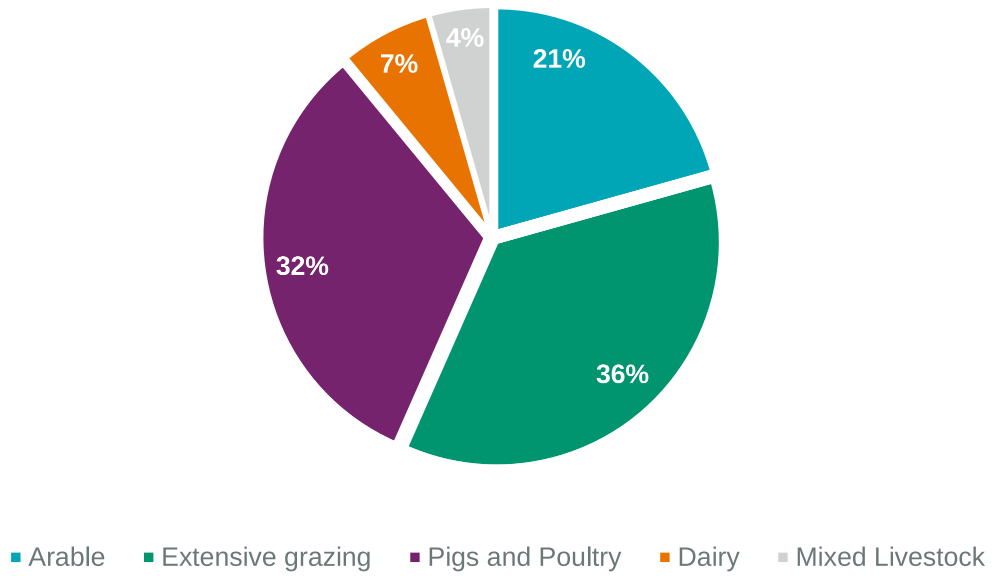
The farm type results (Table 5) show that extensive grazing farms are the most numerous, followed by arable, mixed livestock, dairy and pig and poultry. Pig and poultry farms have the highest stocking density in kg of nitrogen per hectare due to the high livestock numbers and higher phosphorus content in manure. The average area per farm for poultry has been increased based on the land area required to spread the livestock manure under the “170 kg N per ha” regulatory limit (which would include land on neighbouring farms). Therefore, this area does not represent the average area of individual poultry farms. The number of poultry in the catchment was increased to a total of 29.7 million poultry to represent the increase in poultry numbers since 2019 (Natural England, 2024).

Table 5 Farmscoper Create results modelled in Farmscoper Upscale V5 for farm types in the Wye catchment.

	Arable	Extensive Grazing	Pigs and Poultry	Dairy	Mixed Livestock
Number of farms	837	2,765	16	115	232
Stocking density (kg N per ha)	0	87	167	132	97
Average area per farm (ha)	105	72	974	169	106
Land use per farm type (ha)					
Cropping	67	4	566	31	41
Grassland	28	56	400	130	56
Woodland	10	4	6	6	7
Rough grazing	0	8	2	2	2
Livestock numbers per farm type (head)					
Cattle	0	46	0	244	65
Sheep	0	518	0	153	412
Pigs	0	0	548	0	21
Poultry	0	0	245,049	0	5,566

The total phosphorus loading per farm type across the Wye catchment is predominantly from extensive grazing and pigs and poultry farms (Figure 13).

Figure 13: Phosphorus loading per farm type



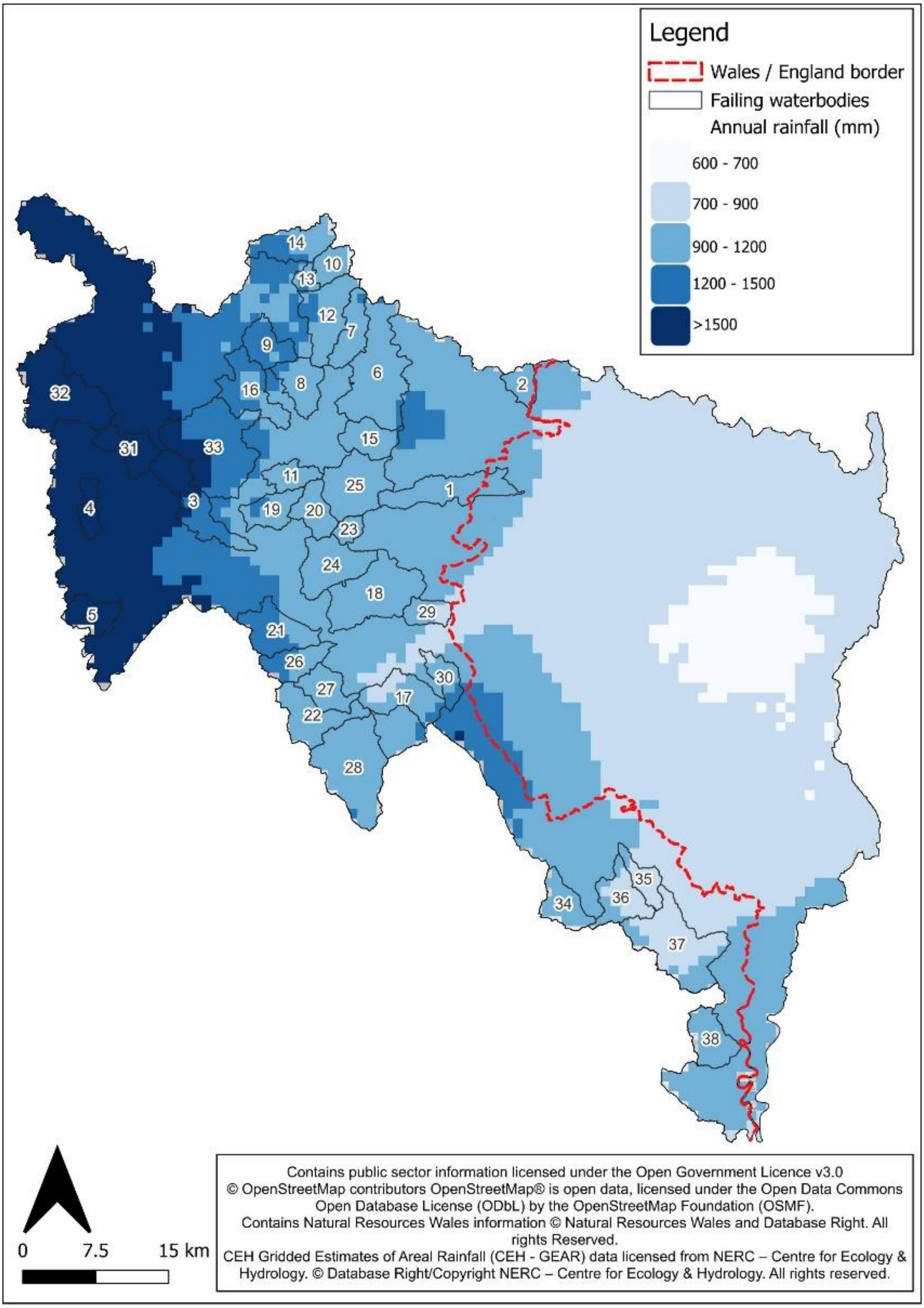
Extensive grazing farms are thought to be a large contributor of phosphorus loading from agriculture due to the large land area this farm type covers. Pig and poultry farms are few in the catchment, however the large livestock numbers on each farm, combined with a higher phosphorus content in manures contribute to the high phosphorus load from this farm type.

Table 6 shows the failing waterbody catchments categorised into rainfall bands and the baseline phosphorus load per ha on each of the farm types present within the individual waterbody catchments (refer to for the locations of waterbody catchments categorised by annual rainfall). The results show that the highest phosphorus load per ha is from pig and poultry farms in waterbody catchments with an annual rainfall of 1200-1500mm (which are located in the Upper Wye and Lower Wye sub-catchments). Dairy farms in waterbody catchments with an annual rainfall of 900-1200mm have the second highest phosphorus load per ha (2.24kg).

Table 6 Estimated current baseline phosphorus load per hectare from the different farm types with different annual rainfall quantities within the Wye catchment, as modelled in Farmscoper Upscale V5.

	Annual rainfall			
Rainfall	>1500mm	1200-1500mm	900-1200mm	700-900mm
Waterbody catchment reference	32, 31, 4, 5, upper 3, upper 33	Lower 3, lower 33, 16, 9, upper 14, upper 21, upper 26,	Lower 14, 13, 10, 12, 7, 6, 8, lower 16, 11, 19, 15, 25, 20, 23, 24, 1, 18, 29, 2, lower 21, lower 26, 22, 27, 28, lower 17, 30, 38	34, 35, 37,
Farm types	**Phosphorus baseline load per hectare (kg)**			
Extensive grazing	2.34	1.57	1.08	0.66
Dairy	3.48	2.24	2.24	0.99
Pigs and Poultry	-	2.45	1.69	1.02
Mixed Livestock	-	-	1.69	0.93
Arable	-	-	-	0.80

Figure 14: Annual rainfall across the failing waterbody catchments in the Wye catchment.



4.3.3 Wastewater Treatment Works sources

On the Welsh side of the Wye, the wastewater sector is inputting phosphorus mostly from final treated effluent, contributing to a total of 7% of concentrations in the failing waterbody catchments. Figure 15 highlights all STW from the Permitted Discharges to Controlled Waters with Conditions register (NRW, 2025d) on the Welsh side of the Wye. Table 7 shows all the failing waterbody catchments where the SAGIS outputs identified inputs from wastewater, and whether there are any STW located in the catchment (based on the Permitted Discharges to Controlled Waters with Conditions register (NRW, 2025d) and data provided by NRW and DCWW).

Figure 15: Map of all STW on the Welsh side of the Wye from the Permitted Discharges Register

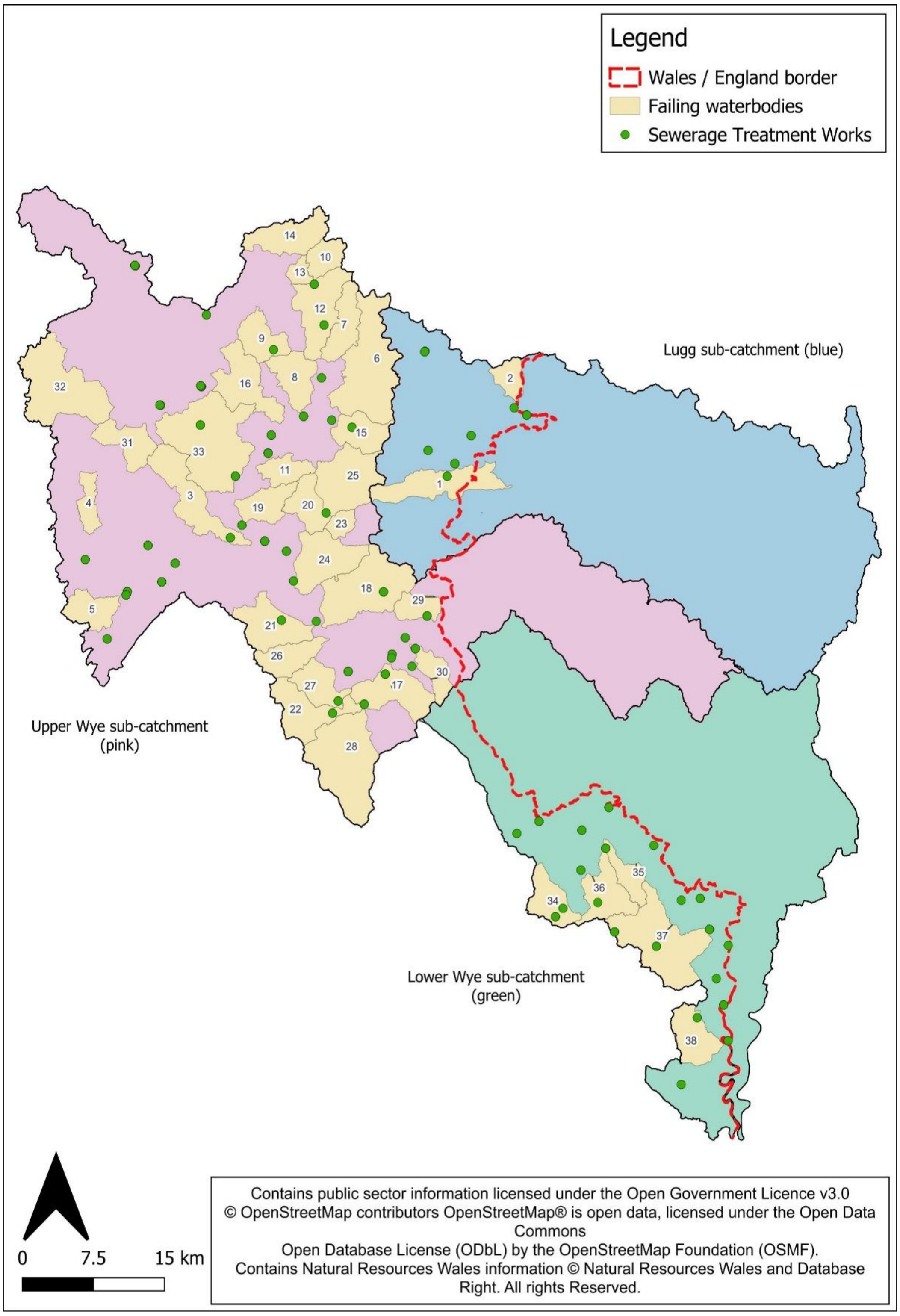


Table 7 Wastewater sources identified in the failing waterbody catchments where SAGIS outputs indicate a phosphorus load from the wastewater sector.

Failing waterbody catchment	WwTWs identified in the catchment
2 *Norton Bk - source to conf R Lugg*	None identified
3 *Afon Chwefru - source to conf R Irfon*	Cilmery STW
8 *Clywedog Bk - conf Bachell Bk to conf R Ithon*	None identified
9 *Clywedog Bk - source to conf Bachell Bk*	Abbey Cwm Hir STW
12 *Ithon - conf Gwenlas Bk to conf Camddwr Bk*	Llanbister STW Llanbadarn STW
15 *Mithil Bk - source to conf R Ithon*	Llandegley STW
17 *Afon Llynfi - conf Dulas Bk to conf R Wye*	Aberllynfi (Three Cocks) STW Velindre STW Talgarth STW
18 *Bach Howey Bk - source to conf R Wye*	Painscastle STW
19 *Builth Dulas Bk - source to conf R Wye*	Builth Road STW
20 *Camnant Brook - source to confluence R Edw*	Hundred House STW
21 Clettwr Bk - source to conf R Wye	Gwenddwr STW
22 *Dulas Bk - source to conf Afon Llynfi*	Llanfilo STW
23 *Edw - conf Camnant Bk to conf Clas Bk*	None identified
24 *Edw - conf Clas Bk to conf R Wye*	None identified
27 *Triffrwd - source to Dulas*	Llandefalle STW
29 *Clyro Bk - source to conf R Wye*	Clyro STW
30 *Digedi Bk - source to conf R Wye*	Llanigon STW
33 *Wye - conf Afon Elan to conf R Ithon*	Newbridge-On-Wye STW Llanwrthwl STW
34 *Llanymynech Bk - source to conf R Trothy*	Llanddewi Rhydderch STW Llanvapley STW
36 *Trothy - conf Llanymynach Bk to conf Llymon Bk*	Llantilio Crosenny STW Abergavenny
37 *Trothy - conf Llymon Bk to conf R Wye*	Dingestow STW Penrhos STW

4.3.4 Intermittent (CSO) sources

Within the failing waterbodies, CSO contributions of 1% are identified in waterbodies 11. *Howey Bk - source to conf R Ithon*, 17. *Afon Llynfi - conf Dulas Bk to conf R Wye* and 33. *Wye - conf Afon Elan to conf R Ithon.*

4.3.5 Other sources

"Other" sources of phosphorus inputs within the failing waterbodies includes private sewerage systems and industrial effluent. Other sources contribute a total of 6% of all phosphorus input into the Welsh side of the Wye according to SAGIS modelling outputs.

Private sewerage systems

Septic Tanks are private sewerage systems that serve small residential properties that cannot connect to a mains sewer network. ST with an Environmental Permit to Discharge, contribute a total of 23kg P/yr on the Welsh side of the Wye (see Figure 16). Package treatment plants (PTP) are larger private sewerage systems that serve larger residential properties or businesses that cannot connect to a mains sewer network. PTP with an Environmental Permit to Discharge (NRW, 2025d) or that are operating under the General Binding Rules, contribute a total of 1,565kg P/yr on the Welsh side of the Wye (see Figure 17). It should be noted that only private sewerage systems with a permit to discharge to controlled waters from the Permitted Discharges Register (NRW, 2025d) have been assessed, and additional private sewerage systems do operate within the catchment, however the details of these are unknown and unquantified within this report.

Figure 16: Map of all ST with a permit to discharge to controlled waters on the Welsh side of the Wye from the Permitted Discharges Register (NRW, 2025d)

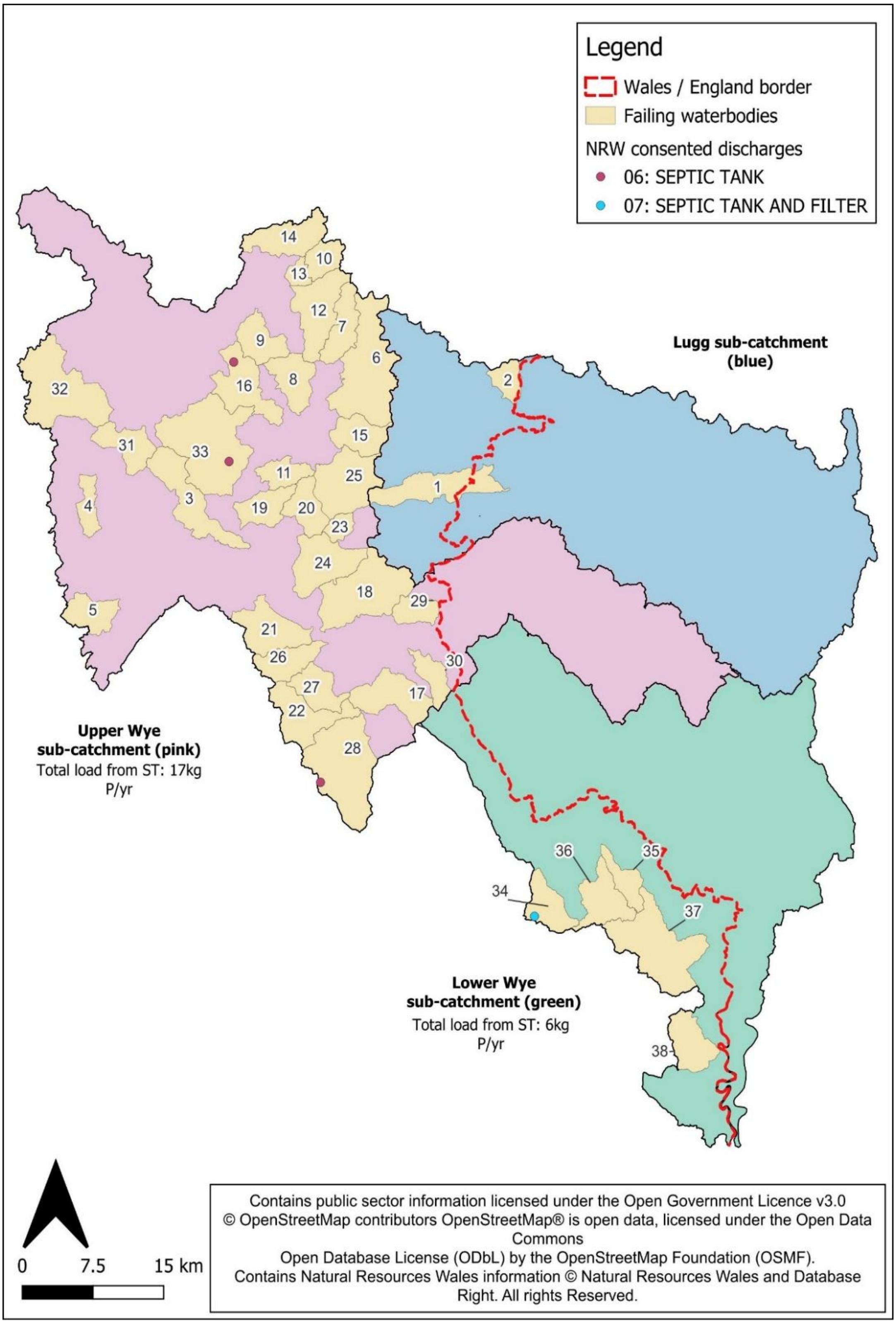
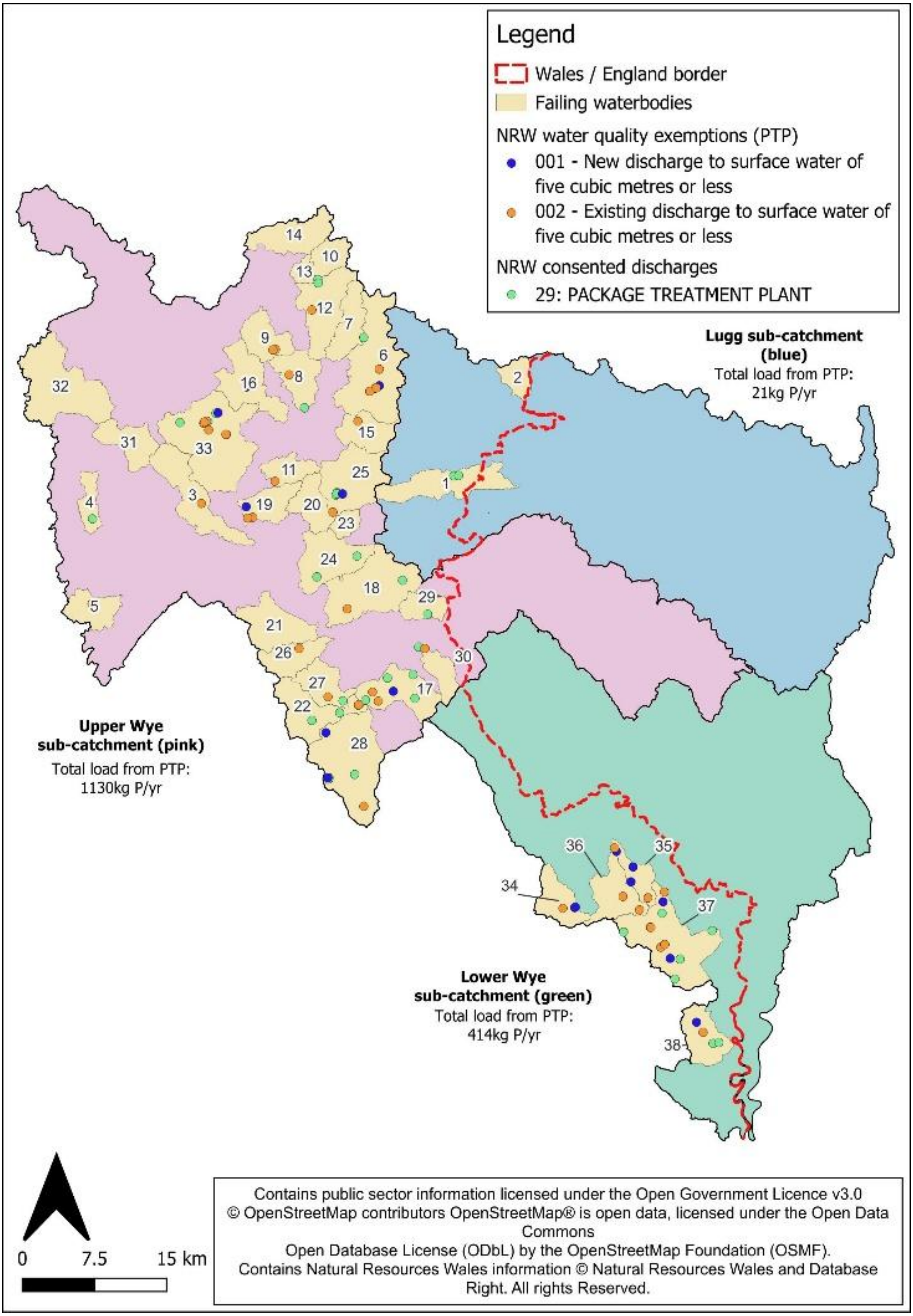


Figure 17: Map of all PTP on the Welsh side of the Wye from the Permitted Discharges Register (NRW, 2025b) and the Water Quality Exemptions Register (NRW, 2025c)



Industrial sources

SAGIS concentrations identify a total of 0.0079 mg/l of phosphorus in waterbody 16. *Nantmel Dulas - source to conf R Ithon and* in waterbody 33. *Wye - conf Afon Elan to conf R Ithon*. However, NRW advised that the discharge was a landfill and was modelled based on permitted flow and a generic phosphorus value. Therefore, industrial inputs modelled in SAGIS are highly unlikely to be realistic sources in the Wye catchment.

4.3.6 Phosphorus concentration reductions required

Phosphorus concentration reductions required for agricultural and other (ST and urban) inputs to meet SAC or WFD compliance for each failing waterbody is proportional to the sectors total percentage contribution derived from the SAGIS data (see Appendix H for full detailed on the methods used).

Table 8 provides the percentage contribution of phosphorus per sector. The reductions in phosphorus concentrations are provided as an exceedance of the target phosphorus concentration. The sector contribution therefore relates to the percentage reduction of the difference in actual phosphorus vs the target phosphorus concentration (the exceedance). Sectors will be required to reduce their concentration of phosphorus by the sector contribution to the exceedance of the target value. The wastewater sector already has regulated *"fair share"* phosphorus reduction targets set by NRW to be met by 2030 based on the SAGIS outputs and water quality data measured between 2017 and 2019.

Note that *Camnant Brook - source to confluence R Edw* and *Afon Claerwen - conf Afon Arban to Caban-coch* require 100% and 108% reductions in sector concentrations to meet the target. This is because the SAGIS model outputs were based on a 2016 to 2019 river water quality dataset and the in-river concentration from recent monitored data has been assessed after the SAGIS model has been produced. Therefore, the total phosphorus concentrations from the sectors as modelled in SAGIS may be higher than the exceedance above target from recent water quality monitoring.

Table 8 Percentage contribution of phosphorus concentration from each sector (derived from SAGIS).

Main catchment	Operational catchment	Water body name	Annual average P conc (mg/L)	Target P conc (mg/L)	P exceedance (mg/L)	Sector percentage contribution			
						Wastewater	CSO's	Rural	Other*
Lugg	Arrow Lugg and Frome	*1. Gilwern Bk - source to conf R Arrow*	-	0.046	-	0%	0%	92%	8%
	Lugg	*2. Norton Bk - source to conf R Lugg*	0.113	0.035	0.078	17%	0%	78%	4%
Upper Wye	Irfon	*3. Afon Chwefru - source to conf R Irfon*	0.015	0.010	0.005	9%	0%	87%	4%
		4. Afon Gwesyn - source to conf R Irfon	0.012	0.010	0.002	0%	0%	98%	2%
		5. Cledan - source to conf R Irfon	0.016	0.010	0.006	0%	0%	97%	3%
	Ithon	*6. Aran - source to conf R Ithon*	0.020	0.015	0.005	0%	0%	100%	0%
		7. Camddwr Bk - source to conf R Ithon	0.024	0.013	0.011	0%	0%	93%	7%
		8. Clywedog Bk - conf Bachell Bk to conf R Ithon	0.011	0.010	0.001	7%	0%	92%	1%
		9. Clywedog Bk - source to conf Bachell Bk	0.012	0.010	0.002	46%	0%	54%	1%
		10. Gwenlas Bk - source to conf R Ithon	0.033	0.010	0.023	0%	0%	100%	0%
		11. Howey Bk - source to conf R Ithon	0.044	0.015	0.029	0%	1%	99%	0%
		12. Ithon - conf Gwenlas Bk to conf Camddwr Bk	0.012	0.010	0.002	13%	0%	87%	0%
		13. Ithon - conf Llaethdy Bk to conf Gwenlas Bk	0.012	0.010	0.002	0%	0%	99%	1%
		14. Ithon - source to conf Llaethdy Bk	0.011	0.010	0.001	0%	0%	99%	1%
		15. Mithil Bk - source to conf R Ithon	0.042	0.015	0.027	35%	0%	64%	1%
		16. Nantmel Dulas - source to conf R Ithon	0.019	0.010	0.009	0%	0%	66%	34%
	Wye - Ithon to Hay	*17. Afon Llynfi - conf Dulas Bk to conf R Wye*	0.059	0.025	0.034	17%	1%	76%	6%
		18. Bach Howey Bk - source to conf R Wye	0.032	0.015	0.017	2%	0%	92%	6%
		19. Builth Dulas Bk - source to conf R Wye	0.018	0.015	0.003	26%	0%	73%	1%
		20. Camnant Brook - source to confluence R Edw	0.048	0.015	0.033	4%	0%	95%	1%
		21. Clettwr Bk - source to conf R Wye	0.022	0.015	0.007	3%	0%	90%	7%

Main catchment	Operational catchment	Water body name	Annual average P conc (mg/L)	Target P conc (mg/L)	P exceedance (mg/L)	Sector percentage contribution			
						Wastewater	CSO's	Rural	Other*
		22. Dulas Bk - source to conf Afon Llynfi	0.035	0.025	0.010	7%	0%	87%	6%
		23. Edw - conf Camnant Bk to conf Clas Bk	0.037	0.015	0.022	1%	0%	98%	1%
		24. Edw - conf Clas Bk to conf R Wye	0.016	0.015	0.001	3%	0%	96%	1%
		25. Edw - source to conf Colwyn Bk	0.023	0.015	0.008	0%	0%	99%	1%
		26. Scithwen Bk - source to conf R Wye	0.020	0.015	0.005	0%	0%	97%	3%
		27. Triffrwd - source to Dulas	0.033	0.015	0.018	6%	0%	89%	5%
		28. Afon Llynfi - source to conf Dulas Bk	0.076	0.052	0.024	0%	0%	92%	8%
		29. Clyro Bk - source to conf R Wye	0.076	0.062	0.014	10%	0%	84%	5%
		30. Digedi Bk - source to conf R Wye	0.083	0.064	0.019	12%	0%	81%	7%
	Wye source to Ithon	*31. Afon Claerwen - conf Afon Arban to Caban-coch*	0.040	0.028	0.012	0%	0%	99%	1%
		32. Afon Claerwen - source to conf Afon Arban	-	0.028	-	0%	0%	100%	0%
		33. Wye - conf Afon Elan to conf R Ithon	0.012	0.010	0.002	45%	1%	41%	12%
Lower Wye	Trothy	*34. Llanymynech Bk - source to conf R Trothy*	0.130	0.075	0.055	4%	0%	91%	5%
		35. Llymon Bk - source to conf R Trothy	0.093	0.085	0.008	0%	0%	97%	3%
		36. Trothy - conf Llanymynach Bk to conf Llymon Bk	0.089	0.079	0.010	2%	0%	94%	4%
		37. Trothy - conf Llymon Bk to conf R Wye	0.099	0.084	0.015	8%	0%	88%	4%
	Wye OC	*38. Tintern Bk - source to conf R Wye*	-	0.083	-	0%	0%	75%	25%

***Other sources include ST, urban and industrial discharges**

5. OPTIONS APPRAISAL

5.1 AGRICULTURAL MEASURES

5.1.1 Existing mitigation measures

Regulatory compliance, best practice and agri-environment schemes

The agricultural sector currently already has in place existing mitigation measures that are delivered as part of regulatory requirements, best practices or funded through agri-environment grants. In Wales, farmers and land managers must comply with The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 (Welsh Government, 2023a). These include:

- Storage of silage must be compliant with The Water Resources (Control of Pollution) (Silage, Slurry and Agriculture Fuel Oil) (Wales) Regulations 2010;
- Notifying NRW of the construction of any new substantially enlarged or reconstructed silo or slurry storage system;
- Controlling the spreading of nitrogen fertiliser at high risk times and high risk areas;
- Incorporating organic manures into bare soil or stubble;
- Closed periods for spreading manufactured nitrogen fertiliser.
- Risk maps for spreading or storage of organic manures;
- Storage of organic manure 10m away from field drains and watercourses;
- The individual hectare limit (250kg/ha) for the spreading of organic manure;
- Import/export of manure to ensure farm limits (170kg/ha) from livestock manures are met;
- Nutrient Management Planning and recording;
- Nutrient applications restricted to crop limits.
- Holding nitrogen limit: ‘the 170kg of nitrogen per ha from all livestock manures limit’.
- Closed periods for spreading nitrogen fertiliser (includes slurry and other organic manures);
- Storage capacity for slurry must be enough to prevent spreading in the closed period;
- The storage period for pigs and poultry must be six months, and other livestock types must be five months.

At the time of writing[1], farm inspections were completed in 2023 as part of a new Service Level Agreement across 596 farms in Wales (Welsh government, 2025a). Of the farms surveyed, 243 (40.8%) were compliant with all the current required regulations while 353 (59.2%) were not compliant with the regulations. Compliance failures were commonly attributed to silage clamp construction, nutrient management planning, capacity and construction of slurry stores, risk mapping for manure spreading and nitrogen limits. This suggests that common sources of phosphorus pollution in the River Wye from agricultural practices can be attributed to point source pollution from inappropriate slurry or silage storage, and diffuse pollution from the overapplication or inappropriate application of manures or artificial fertilisers.

In addition, Welsh Government provide rural grants and payments to farmers and land managers to improve agricultural infrastructure or sustainable land management practices, with a total of £60 million set aside for capital funding for 2024 to 2025 (Welsh Government, 2023b). These grants aim to reduce the environmental impact and improve the sustainability of the agricultural sector in Wales. Grants encourage best practice and cover a broad range of measures that directly impact the water environment including nutrient management, habitat creation, fencing, guttering, and slurry and silage storage and management (Welsh Government, 2025b).

Farmscoper Upscale and Evaluate V5 (ADAS, 2025) were used to estimate the impact of existing mitigation measures delivered as part of regulatory compliance, best practice or agri-environment scheme measures on

[1] Note: NRW advise that there were 847 Control of Agricultural Pollution Regulations inspections (November 2023 - March 2025) across Wales, of which 448 (53%) farms were noncompliant with one or more CoAPR requirements.

phosphorus loading from agriculture (See Appendix I for full methodology). The existing level of compliance (41%) was input into Farmscoper Evaluate V5 against the following relevant mitigation measures:

- Fertiliser spreader calibration
- Use a fertiliser recommendation system
- Integrate fertiliser and manure nutrient supply
- Do not apply manufactured fertiliser to high-risk areas
- Avoid spreading manufactured fertiliser to fields at high-risk times
- Do not apply P fertilisers to high P index soils
- Increase the capacity of farm slurry stores to improve timing of slurry applications
- Minimise the volume of dirty water produced (sent to dirty water store)
- Minimise the volume of dirty water produced (sent to slurry store)
- Site solid manure heaps away from watercourses/field drains
- Manure Spreader Calibration
- Do not apply manure to high-risk areas
- Do not spread slurry or poultry manure at high-risk times
- Do not spread FYM to fields at high-risk times
- Incorporate manure into the soil
- Capture of dirty water in a dirty water store

All other mitigation measures remained at the standard implementation level (derived from Farmscoper Evaluate V5 prior implementation values, which represent national average rates of mitigation measure implementation on farms). The results showed that, compared to baseline phosphorus loads (with no mitigation in place), the existing estimated uptake of mitigation measures and the current level of regulatory compliance reduced phosphorus loading by a total of 24,650kg, which represents a load reduction of 13% compared to the baseline load (with no mitigation measures in place) (Table 9).

Table 9 Estimated phosphorus load reduction achieved from existing mitigation measures across the Wye catchment as modelled in Farmscoper V5.

Mitigation scenario	Phosphorus load (kg/yr)	Phosphorus load reduction (kg/yr)	Phosphorus load reduction (%)
Baseline (no mitigation)	187,014	-	-
Existing mitigation measures	162,364	24,650	13

Table 10 presents the percentage contribution of phosphorus from the agricultural sector, each failing waterbody will need to reduce their concentration of phosphorus by their percentage contribution to the exceedance of the target (See Table 8) to achieve SAC and WFD compliance. The existing mitigation measures in eight waterbody catchments (highlighted in green) achieve the load reduction target from agriculture to meet compliance.

Table 10 Estimated phosphorus reduction (proportion of the exceedance of the target), required beyond current regulatory compliance and existing mitigation measures implemented in each failing waterbody catchment.

Main catchment	Operational Catchment	Water body name	Phosphorus concentration reduction of the exceedance of the target
Lugg	Arrow, Lugg and Frome	1. *Gilwern Bk - source to conf R Arrow*	92%
		2. *Norton Bk - source to conf R Lugg*	78%

Main catchment	Operational Catchment	Water body name	Phosphorus concentration reduction of the exceedance of the target
Upper Wye	Irfon	3. *Afon Chwefru - source to conf R Irfon*	87%
		4. *Afon Gwesyn - source to conf R Irfon*	98%
		5. *Cledan - source to conf R Irfon*	97%
	Ithon	6. *Aran - source to conf R Ithon*	100%
		7. *Camddwr Bk - source to conf R Ithon*	93%
		8. *Clywedog Bk - conf Bachell Bk to conf R Ithon*	92%
		9. *Clywedog Bk - source to conf Bachell Bk*	54%
		10. *Gwenlas Bk - source to conf R Ithon*	100%
		11. *Howey Bk - source to conf R Ithon*	99%
		12. *Ithon - conf Gwenlas Bk to conf Camddwr Bk*	87%
		13. *Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	99%
		14. *Ithon - source to conf Llaethdy Bk*	99%
		15. *Mithil Bk - source to conf R Ithon*	64%
		16. *Nantmel Dulas - source to conf R Ithon*	66%
	Wye – Ithon to Hay	17. *Afon Llynfi - conf Dulas Bk to conf R Wye*	76%
		18. *Bach Howey Bk - source to conf R Wye*	92%
		19. *Builth Dulas Bk - source to conf R Wye*	73%
		20. *Camnant Brook - source to confluence R Edw*	95%
		21. *Clettwr Bk - source to conf R Wye*	90%
		22. *Dulas Bk - source to conf Afon Llynfi*	87%
		23. *Edw - conf Camnant Bk to conf Clas Bk*	98%
		24. *Edw - conf Clas Bk to conf R Wye*	96%
		25. *Edw - source to conf Colwyn Bk*	99%
		26. *Scithwen Bk - source to conf R Wye*	97%
		27. *Triffrwd - source to Dulas*	89%
		28. *Afon Llynfi - source to conf Dulas Bk*	92%
		29. *Clyro Bk - source to conf R Wye*	84%
		30. *Digedi Bk - source to conf R Wye*	81%
	Wye source to Ithon	31. *Afon Claerwen - conf Afon Arban to Caban-coch*	99%
		32. *Afon Claerwen - source to conf Afon Arban*	100%
		33. *Wye - conf Afon Elan to conf R Ithon*	41%
Lower Wye	Trothy	34. *Llanymynech Bk - source to conf R Trothy*	91%
		35. *Llymon Bk - source to conf R Trothy*	97%
		36. *Trothy - conf Llanymynach Bk to conf Llymon Bk*	94%
		37. *Trothy - conf Llymon Bk to conf R Wye*	88%
	Wye OC	38. *Tintern Bk - source to conf R Wye*	75%

In addition to the uptake of mitigation measures as part of regulatory compliance, best practice or agri-environment measures on farms and other river restoration projects aiming at reducing phosphorus loading in the River Wye catchment have been delivered, which are detailed below.

Upper Wye Catchment Restoration Project

Launched in 2024, the £900,000 project aims to restore and enhance habitats in the Upper Wye catchment. The project will run until 2029, and activities will aim to reduce sediment, and pollutant loads to surface water and strengthen the river's resilience to extreme weather and rising temperatures caused by climate change (NRW, 2024a).

The project is being carried out as a collective effort involving farmers and landowners, and the support of local communities. Key partners include the Freshwater Habitats Trust (demonstration sites and funding for water troughs), Radnorshire Wildlife Trust's Wye Adapt to Climate Change project (completing farm visits), the Wye and Usk Foundation, the Floodplain Meadows Partnership, Swansea University and NRW.

Activities which are completed or in progress include:

- **Local farm and demonstration sites visit:** Visited local organisations and demonstration sites, engaging with farmers along the Ithon, Irfon, and Marteg rivers to explore collaborative efforts in improving river health (NRW, 2024a).
- **Surveys of river condition and migratory fish:** Conducted specialist surveys, including river condition assessments and acoustic monitoring for migratory shad, to guide targeted restoration efforts and enhance understanding of key species in the Wye catchment. Spring surveys confirmed significant shad spawning in the upper Wye near Newbridge and the first official record on the Ithon, helping guide future habitat improvements for this rare migratory species (NRW, 2024a; NRW, 2024c).
- **Surveys for Invasive Non-Native Species:** Surveyed Upper Wye tributaries for Himalayan Balsam, Japanese Knotweed and American Skunk Cabbage and identified areas for treatment, encouraging local involvement to help stop their spread. Planned work consisted of efforts focused on early action to halt their spread and protect river ecosystems (NRW, 2025f).
- **'Slow the Flow' project**: The restoration project visited the Stroud Valleys Natural Flood Management Project to learn natural flood management techniques and is now developing similar 'Slow the Flow' projects in the upper Wye forests to reduce runoff, improve water quality, and enhance habitats. A Slow the Flow project was completed on the Afon Bidno, adding deadwood and pleached willows to improve river habitats, slow water flow, and create a demonstration site for wider catchment benefits (NRW, 2024c).
- **Work with farming community:** Working closely with farmers in the Upper Wye catchment to co-design voluntary, tailored schemes that benefit both farm businesses and river health through nature-based solutions (NRW, 2024c) including:

    - Installation of fences along river corridors to create buffer zones.

    - Provide alternative drinking options to remove the need for livestock to enter watercourses.

    - Plant trees to increase shading of rivers and bank stability.

    - Install measures to reduce overland flow, increase infiltration, and reduce soil and nutrient run off.

    - Improve riparian and floodplain habitats.

    - Make improvements on or around farmyards to reduce diffuse pollution.

- **Introduced drone assistance:** Enhanced environmental monitoring, enabling capture of high-resolution imagery and tracking the impact of restoration efforts across the Upper Wye (NRW, 2024c). The drone was used to undertake surveys to monitor and measure landscape changes in the Slow the Flow work on the Afon Bidno and Tarenig Forest, using high-resolution optical and multispectral images for detailed analysis (NRW, 2025f).

- **Conducted stakeholder events**: The first stakeholder event was held in Llandrindod Wells and brought together over 50 participants to share project progress, strengthen partnerships, and explore collaborative ways to restore the Upper Wye catchment (NRW, 2024c).
- **Completed first farm scheme**: The scheme was completed on the River Irfon and succeeded in creating 1.6km of fenced buffer zones and wetland habitat to protect endangered species and support sustainable farming (NRW, 2025f).

Of the actions that impact water quality improvements on agricultural land, the estimated phosphorus load reductions achieved from each project is detailed in Table 11 (see Appendix I.2 for methodology).

Table 11 Upper Wye Restoration project actions and estimated phosphorus load reductions achieved.

Project	Project location	Action	Land area covered	Estimated phosphorous load reduction achieved (kg/yr)
Upper Wye Restoration Project: Work with the farming community	Focus areas around Afon Marteg *(outside of failing waterbody catchments)*	Watercourse fencing	2.7km (27ha of land influenced assuming a minimum of 100m adjacent to the fenced river is grazed by livestock)	2.7
		Riparian buffers	2.7km x 3m (0.81ha)	0.8
First farm scheme	1.6km of the River Irfon, south-west of Builth Wells (*(outside of failing waterbody catchments)*	Watercourse fencing	1.6km (16ha of land influenced assuming a minimum of 100m adjacent to the fenced river is grazed by livestock)	1.6
		Riparian buffers	0.96ha	0.10
		Floodplain wetland creation	16.00ha	1.55

The Wilder Lugg Project

The Wilder Lugg Project is a two-year initiative running from January 2024 to January 2026, focused on implementing natural flood management and habitat creation within the River Lugg (SSSI) catchment in Wales. Covering an area of 9,257 hectares in north-east Radnorshire, Powys, the project aims to empower the local rural community to collaboratively develop a long-term, sustainable vision for the river's health. By uniting farmers, conservationists, and other stakeholders, the project seeks to restore a clean and thriving River Lugg for future generations. It is funded by Radnorshire Wildlife Trust with a total grant of £180,000 (Radnorshire Wildlife Trust, n.d.).

Activities which are completed or in progress include (Westbury, 2025):

- Promoted regenerative and sustainable land management to improve soil and river health.
- Encouraging the following practices:
    - *In permanent pasture systems:*
        - Greater rest periods.

        - Increased grazing exclusion.
        - Increased herbage variety.
        - Diverse livestock stocking.

    - *In arable systems:*

        - Use of cover crops.
        - Companion planting.
        - Reduction of chemical inputs.
        - Creation of wildflower margins.

    - *Landscape-scale interventions:*

        - Restoration of woodland on steep upland hills to slow rainwater runoff.
        - Development of lowland wetlands to store and purify water, protecting farmland and towns.

- Raised awareness about the complexity of river pollution and the need for multi-stakeholder collaboration.

SAC Nutrients Project

Focuses on improving water quality through collaboration with various stakeholders.

Since its initiation in 2021, the SAC Rivers Water Quality Project in NRW (now the SAC Nutrients Project) has been addressing the water quality issues identified in nine SAC rivers, as listed under the EU Habitats Directive. This work is essential for enabling NRW to meet its statutory obligations regarding the sustainable management of natural resources, as well as its well-being duties under the Environment (Wales) Act.

The project has focused on identifying sources of pollution, developing targeted interventions, and working with stakeholders across sectors to improve ecological conditions in the affected catchments. It also aligns closely with the Welsh Government's priority to improve water quality across Wales.

This ongoing programme represents a critical step in securing the long-term health and biodiversity of some of Wales's most important riverine habitats (NRW, 2023a)

To address excess nutrients in the soil and SAC rivers of Wales, collaborative efforts between the housing development and the agriculture sector are essential. Key actions include:

1. **Support and training programmes**: Farming Connect provides advice, support, training, and on-farm events to improve water quality in failing SAC catchments.
2. **Rural Investment Schemes**: Offering 40% grants for infrastructure improvements in nutrient management and pollution prevention, continuing the support previously provided by the Rural Development Plan.
3. **Agricultural Representation**: Ensuring agricultural representation at all NMBs/Catchment Partnerships in Wales.
4. **Innovation**: Working with groups like the WLMF sub-group on agricultural pollution to encourage innovation and achieve measurable outcomes by September 2023.
5. **Farming Unions and Organizations**: Promoting good nutrient management practices, continuing collaboration with the WLMF sub-group, advocating for the Water Standard, and providing guidance on the Control of Agricultural Pollution Regulation.

Further mitigation activities and recommendations provided by various stakeholders have been included in Appendix I.

5.1.2 Future mitigation measures

Improvements to agricultural practices and infrastructure

Improving agricultural practices and farm infrastructure can reduce the phosphorus loads in the River Wye from the agricultural sector. Farmscoper mitigation measures were categorised into five mitigation scenarios to assess the impact of improving agricultural practices or infrastructure on phosphorus loading from agriculture, if all applicable measures were implemented on 100% of applicable land or farm types in the Wye catchment.

In addition, two further scenarios (all possible measures + P index 2 or below soils and all possible measures + 5% land use change) were assessed. Reducing the P index to optimal or below soils was modelled due to the high amount of legacy phosphorus in the soils, which is believed to be a major source of phosphorus pollution to the River Wye when soils erode in surface waters (Withers *et al.,* 2022b). Across Wales, a total of 43,000ha of trees needs to be planted to tackle the climate emergency (Welsh Government, 2024). The conversion of agricultural land to woodland could reduce the phosphorus load from the agricultural sector.

The mitigation scenario descriptions are outlined in Table 12 and the individual mitigation measures that have been modelled at the maximum implementation rate (100%) within each mitigation scenario are present in Table 13. The mitigation scenarios were modelled in Farmscoper Upscale and Evaluate V5 to assess the potential phosphorus load reduction that could be achieved. Appendix I.3 presents the full methodology.

Table 12 Mitigation measure scenarios.

Mitigation scenario	Description
Regulatory compliance	Measures that allow maximum regulatory compliance with The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021.
Best practice	Regulation + measures that can be implemented to ensure best practice.
Welsh agri-environment measures	Regulation + best practice + measures that can be implemented under current agri-environment schemes or grants in Wales.
All possible agri-environment measures	Regulation + best practices + Welsh agri-environment measures + all possible measures that can be implemented as part of an agri-environment schemes or grants.
All possible measures	All possible measures that can be implemented on farms to improve practices or infrastructure.
All possible measures + P index 2 or below soils	All possible measures that can be implemented on farms to improve practices or infrastructure with soils at P index 2 and below.
All possible measures + 5% land use change	Converting 5% of the existing agricultural land to woodland and all possible measures that can be implemented on farms to improve practices or infrastructure on the remaining farmland.

Table 13 Individual mitigation measures included within the mitigation measure scenarios above. “Yes” indicates that the mitigation measure is included in the mitigation scenario and has been modelled at the maximum level of implementation on all applicable land (100%). “No” indicates that this mitigation measure is not included in the mitigation scenario and has been modelled at the current level of implementation.

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Establish cover crops in the autumn	No	Yes	Yes	Yes	Yes
Early harvesting and establishment of crops in the autumn	No	Yes	Yes	Yes	Yes
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	No	Yes	Yes	Yes	Yes
Adopt reduced cultivation systems	No	No	No	Yes	Yes

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Cultivate compacted tillage soils	No	Yes	Yes	Yes	Yes
Cultivate and drill across the slope	No	No	No	Yes	Yes
Leave autumn seedbeds rough	No	Yes	Yes	Yes	Yes
Manage over-winter tramlines	No	Yes	Yes	Yes	Yes
Establish in-field grass buffer strips	No	No	No	Yes	Yes
Establish riparian buffer strips	No	Yes	Yes	Yes	Yes
Loosen compacted soil layers in grassland fields	No	Yes	Yes	Yes	Yes
Allow grassland field drainage systems to deteriorate	No	No	No	Yes	Yes
Ditch management on arable land	No	No	Yes	Yes	Yes
Ditch management on grassland	No	No	Yes	Yes	Yes
Improved livestock through breeding	No	No	No	No	Yes
Use plants with improved nitrogen use efficiency	No	No	Yes	Yes	Yes
Fertiliser spreader calibration	Yes	Yes	Yes	Yes	Yes
Use a fertiliser recommendation system	Yes	Yes	Yes	Yes	Yes
Integrate fertiliser and manure nutrient supply	Yes	Yes	Yes	Yes	Yes
Do not apply manufactured fertiliser to high-risk areas	Yes	Yes	Yes	Yes	Yes
Avoid spreading manufactured fertiliser to fields at high-risk times	Yes	Yes	Yes	Yes	Yes
Use manufactured fertiliser placement technologies	No	No	No	Yes	Yes
Use nitrification inhibitors	No	No	No	Yes	Yes
Replace urea fertiliser to grassland with another form	No	No	No	Yes	Yes
Replace urea fertiliser to arable land with another form	No	No	No	Yes	Yes
Incorporate a urease inhibitor into urea fertilisers for grassland	No	No	No	Yes	Yes
Incorporate a urease inhibitor into urea fertilisers for arable land	No	No	No	Yes	Yes
Use clover in place of fertiliser nitrogen	No	No	Yes	Yes	Yes
Do not apply P fertilisers to high P index soils	Yes	Yes	Yes	Yes	Yes
Reduce dietary N and P intakes: Dairy	No	No	No	Yes	Yes
Reduce dietary N and P intakes: Pigs	No	No	No	Yes	Yes
Reduce dietary N and P intakes: Poultry	No	No	No	Yes	Yes
Adopt phase feeding of livestock: Dairy	No	No	No	Yes	Yes
Adopt phase feeding of livestock: Pigs	No	No	No	Yes	Yes
Reduce the length of the grazing day/grazing season	No	No	No	Yes	Yes
Extend the grazing season for cattle	No	No	No	Yes	Yes
Reduce field stocking rates when soils are wet	No	Yes	Yes	Yes	Yes
Move feeders at regular intervals	No	Yes	Yes	Yes	Yes
Construct troughs with concrete base	No	No	No	Yes	Yes
Increase scraping frequency in dairy cow cubicle housing	No	No	Yes	Yes	Yes
Additional targeted bedding for straw-bedded cattle housing	No	No	No	Yes	Yes
Washing down of dairy cow collecting yards	No	No	No	Yes	Yes

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Frequent removal of slurry from beneath-slat storage in pig housing	No	No	No	Yes	Yes
Install air-scrubbers: mechanically ventilated pig housing	No	No	No	No	Yes
Install air-scrubbers: mechanically ventilated poultry housing	No	No	No	No	Yes
More frequent manure removal from laying hen housing with manure belt systems	No	No	No	No	Yes
In-house poultry manure drying	No	No	No	No	Yes
Increase the capacity of farm slurry stores to improve timing of slurry applications	Yes	Yes	Yes	Yes	Yes
Adopt batch storage of slurry	No	No	No	Yes	Yes
Install covers to slurry stores	No	No	Yes	Yes	Yes
Allow cattle slurry stores to develop a natural crust	No	No	No	Yes	Yes
Anaerobic digestion of livestock manures	No	No	No	Yes	Yes
Minimise the volume of dirty water produced (sent to dirty water store)	Yes	Yes	Yes	Yes	Yes
Minimise the volume of dirty water produced (sent to slurry store)	Yes	Yes	Yes	Yes	Yes
Compost solid manure	No	No	No	Yes	Yes
Site solid manure heaps away from watercourses/field drains	Yes	Yes	Yes	Yes	Yes
Store solid manure heaps on an impermeable base and collect effluent	No	No	No	Yes	Yes
Cover solid manure stores with sheeting	No	No	Yes	Yes	Yes
Use liquid/solid manure separation techniques	No	No	Yes	Yes	Yes
Use poultry litter additives	No	No	No	No	Yes
Manure Spreader Calibration	Yes	Yes	Yes	Yes	Yes
Do not apply manure to high-risk areas	Yes	Yes	Yes	Yes	Yes
Do not spread slurry or poultry manure at high-risk times	Yes	Yes	Yes	Yes	Yes
Use slurry band spreading application techniques	No	No	Yes	Yes	Yes
Use slurry injection application techniques	No	No	Yes	Yes	Yes
Do not spread FYM to fields at high-risk times	Yes	Yes	Yes	Yes	Yes
Incorporate manure into the soil	Yes	Yes	Yes	Yes	Yes
Fence off rivers and streams from livestock	No	Yes	Yes	Yes	Yes
Construct bridges for livestock crossing rivers/streams	No	No	No	Yes	Yes
Re-site gateways away from high-risk areas	No	No	No	Yes	Yes
Farm track management	No	No	No	Yes	Yes
Establish new hedges	No	No	Yes	Yes	Yes
Establish and maintain artificial wetlands - steading runoff	No	No	No	Yes	Yes
Irrigate crops to achieve maximum yield	No	No	No	Yes	Yes
Establish tree shelter belts around livestock housing	No	No	Yes	Yes	Yes
Calibration of sprayer	No	No	No	Yes	Yes
Fill/Mix/Clean sprayer in field	No	No	No	Yes	Yes
Avoid PPP application at high risk timings	No	No	No	Yes	Yes

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Drift reduction methods	No	No	No	Yes	Yes
PPP substitution	No	No	No	Yes	Yes
Construct bunded impermeable PPP filling/mixing/cleaning area	No	No	No	Yes	Yes
Treatment of PPP washings through disposal, activated carbon or biobeds	No	No	No	Yes	Yes
Protection of in-field trees	No	No	No	No	Yes
Management of woodland edges	No	No	Yes	Yes	Yes
Management of in-field ponds	No	No	Yes	Yes	Yes
Management of arable field corners	No	No	No	No	Yes
Plant areas of farm with wild bird seed / nectar flower mixtures	No	No	Yes	Yes	Yes
Beetle banks	No	No	No	No	Yes
Uncropped cultivated margins	No	No	No	No	Yes
Skylark plots	No	No	No	No	Yes
Uncropped cultivated areas	No	No	Yes	Yes	Yes
Unfertilised cereal headlands	No	No	Yes	Yes	Yes
Unharvested cereal headlands	No	No	Yes	Yes	Yes
Undersown spring cereals	No	Yes	Yes	Yes	Yes
Management of grassland field corners	No	No	No	No	Yes
Leave residual levels of non-aggressive weeds in crops	No	No	Yes	Yes	Yes
Use correctly-inflated low ground pressure tyres on machinery	No	Yes	Yes	Yes	Yes
Locate out-wintered stock away from watercourses	No	Yes	Yes	Yes	Yes
Use dry-cleaning techniques to remove solid waste from yards prior to cleaning	No	No	No	No	Yes
Capture of dirty water in a dirty water store	Yes	Yes	Yes	Yes	Yes
Irrigation/water supply equipment is maintained and leaks repaired	No	No	No	No	Yes
Avoid irrigating at high risk times	No	No	No	No	Yes
Use efficient irrigation techniques (boom trickle, self closing nozzles)	No	No	No	No	Yes
Use high sugar grasses	No	No	No	No	Yes
Monitor and amend soil pH status for grassland	No	No	No	No	Yes
Increased use of maize silage	No	No	No	No	Yes
Improved crop health	No	No	No	No	Yes
Better health planning: dairy	No	No	No	No	Yes
Better health planning: beef	No	No	No	No	Yes
Better health planning: sheep	No	No	No	No	Yes
Improve livestock through genetic modification	No	No	No	No	Yes
Slurry acidification during storage	No	No	No	No	Yes
Slurry acidification at spreading	No	No	No	No	Yes
Install covers to slurry stores and burn off methane	No	No	Yes	Yes	Yes

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Use feed additives to reduce enteric methane emissions	No	No	No	No	Yes

The results show that the mitigation scenarios could achieve a phosphorus load reduction of between 18% and 50% compared to the estimated baseline load modelled in Farmscoper for the whole of the Wye catchment (Table 14). These load reductions are the theoretical maximum that can be achieved if the mitigation measures in each scenario are implemented on 100% of all applicable land or farm types.

The load reduction percentages that could be achieved from each mitigation scenario from Table 14 were applied to the current estimated agricultural load (calculated from SAGIS) for each failing waterbody catchment. The results are displayed in Appendix I. A cost benefit analysis was completed for each failing waterbody catchment for the mitigation measure scenario that is required to meet the load reduction target (or the maximum that can be achieved from *all possible measures + 5% land use change* if the target cannot be met). See Appendix I for a detailed methodology. Table 15 shows that the agricultural sector can achieve the load reductions required to contribute to achieving SAC/WFD compliance in 25 out of the 38 failing waterbody catchments. Three waterbody catchments could not be assessed as water quality monitoring is not undertaken in these catchments. The load reduction required from agriculture in 10 catchments cannot be met.

The results show that regulatory compliance has the highest cost benefit of 2.78, which means that £1 of investment in mitigation measures for the agricultural sector would equate to £2.78 worth of benefits from reduced fertiliser costs to agriculture and reduced pollution to the environment. Best practice and Welsh agri-environment schemes can achieve higher benefits than the cost, however the other mitigation scenarios would have higher costs than benefits.

The total cost of implementing the mitigation measures as part of the Regulatory compliance, Best practice and Welsh agri-environment measures scenarios can partly be offset by current rural grants and payments offered by Welsh Government. The new Sustainable Farming Scheme set to be launched in 2026 (Welsh Government, 2025c) can partly offset the cost associated with the *"All possible agri-environment"* measures *and "All possible measures"* scenarios. However, the extent of this offset cost will be determined by the eligibility and uptake of grants on individual farms, as well as the additional grants available to farmers in 2026, which at the time of writing are still being developed. In Wales, farmers and landowners may be eligible to apply for a Woodland Creation Grant which could contribute towards the implementation costs (Welsh Government, 2024).

Table 14 Estimated costs per year and cost benefits for each mitigation scenario for the whole of the Wye catchment.

Mitigation scenario	Phosphorus load (kg/yr)	Phosphorus load reduction* (kg/yr)	Phosphorus load reduction relative to baseline (%)	Total cost (£/yr)	Agricultural benefit[1] (£/yr)	Environmental benefit[2] (water quality[3]) (£/yr)	Total benefits[4] (£/yr)	Benefit cost ratio[5]	Total benefits per kg load reduction[6] (£/yr)
Baseline (no mitigation)	187,014	-	-	-	-	-	-	-	-
Regulation	153,426	33,587	18	£17,631,582	£33,587	£49,023,932 (£1,695,492)	£49,057,520	2.78	£1,461
Best practice	126,478	60,536	32	£39,025,896	£60,536	£66,293,254 (£3,055,855)	£66,353,790	1.70	£1,096
Welsh agri-environment measures	114,910	72,104	39	£92,577,042	£72,104	£103,432,014 (£3,639,786)	£103,504,117	1.12	£1,435
All possible agri-environment measures	105,100	81,914	44	£134,350,454	£81,914	£122,175,435 (£4,135,019)	£122,257,349	0.91	£1,493
All possible measures	101,949	85,065	45	£174,578,993	£85,065	£154,342,113 (£4,294,060)	£154,427,178	0.88	£1,815
All possible measures + P index 2 or below soils	99,854	87,160	47	£175,610,359	£87,160	£154,342,113 (£4,399,840)	£154,429,273	0.88	£1,772
All possible measures + 5% land use change	93,815	93,199	50	£209,762,813	£93,199	£186,008,785 (£4,704,694)	£186,101,984	0.89	£1,997

*Phosphorus load reduction that can be achieved from measures, modelled in Farmscoper.

[1]Agricultural benefit: value of phosphorus fertiliser saved from reduced losses to environment based on 2025 fertiliser price of triple super phosphate at £460 per tonne containing 46% phosphorus (Redman, 2025).

[2]Environmental benefit:

[3]Water quality benefit: Monetary value of economic damage from phosphorus on drinking water quality, fishing, bathing water quality and eutrophication based on £50.48 / kg (2025 value) (ADAS, 2025).

[4]$Total\ benefit\ (£) = agricultural\ benefit\ (£) + environmental\ benefit\ (£)$

[5]$Benefit\ cost\ ratio\ = total\ benefits\ (£) \div total\ cost\ (£)$

[6]$Total\ benefits\ per\ kg\ load\ reduction\ (£)\ = total\ benefits\ (£)\ \div\ load\ reduction\ achieved\ \ (kg)$

Table 15 Agricultural contribution of phosphorus concentration (%) as derived from SAGIS, the recommended mitigation measure to achieve water quality targets (or the maximum that can be achieved from mitigation scenarios assessed) and the cost benefit of each mitigation scenario in each failing waterbody catchment. Green indicates that sector concentration reductions to meet water quality targets can be achieved from mitigation scenarios assessed.

Sub-catchment	Operational catchment	Water body name	Target	Agricultural contribution of phosphorus concentration	Mitigation recommended	Phosphorus load reduction achieved from mitigation (kg P/yr)*	Cost (£/yr)	Benefit (£/yr)	Benefit / Cost Ratio
Lugg	Arrow, Lugg and Frome	1. *Gilwern Bk - source to conf R Arrow*	WFD	92%	-	-	-	-	-
		2. *Norton Bk - source to conf R Lugg*	WFD	78%	All possible measures + 5% land use change	283	£637,341	£565,733	0.89
Upper Wye	Irfon	3. *Afon Chwefru - source to conf R Irfon*	SAC	87%	Welsh agri-environment measures	159	£204,127	£228,379	1.12
		4. *Afon Gwesyn - source to conf R Irfon*	SAC	98%	Welsh agri-environment measures	64	£81,680	£91,384	1.12
		5. *Cledan - source to conf R Irfon*	SAC	97%	All possible measures + P index 2 or below soils	160	£321,962	£283,289	0.88
	Ithon	6. *Aran - source to conf R Ithon*	SAC	100%	Best practice	192	£123,647	£210,422	1.70
		7. *Camddwr Bk - source to conf R Ithon*	SAC	93%	All possible measures + 5% land use change	156	£351,123	£311,673	0.89
		8. *Clywedog Bk - conf Bachell Bk to conf R Ithon*	SAC	92%	Existing regulation and measures	55	£30,526	£79,521	2.61
		9. *Clywedog Bk - source to conf Bachell Bk*	SAC	54%	Best practice	17	£10,643	£18,112	1.70
		10. *Gwenlas Bk - source to conf R Ithon*	SAC	100%	All possible measures + 5% land use change	144	£323,913	£287,520	0.89
		11. *Howey Bk - source to conf R Ithon*	SAC	99%	All possible measures + 5% land use change	196	£440,907	£391,370	0.89
		12. *Ithon - conf Gwenlas Bk to conf Camddwr Bk*	SAC	87%	Best practice	83	£53,489	£91,028	1.70
		13. *Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	SAC	99%	Best practice	128	£82,344	£140,133	1.70
		14. *Ithon - source to conf Llaethdy Bk*	SAC	99%	Existing regulation and measures	26	£14,107	£36,749	2.61

Sub-catchment	Operational catchment	Water body name	Target	Agricultural contribution of phosphorus concentration	Mitigation recommended	Phosphorus load reduction achieved from mitigation (kg P/yr)*	Cost (£/yr)	Benefit (£/yr)	Benefit / Cost Ratio
		15. Mithil Bk - source to conf R Ithon	SAC	64%	All possible measures + 5% land use change	204	£458,413	£406,909	0.89
		16. Nantmel Dulas - source to conf R Ithon	SAC	66%	All possible measures + 5% land use change	155	£348,009	£308,909	0.89
	Wye – Ithon to Hay	*17. Afon Llynfi - conf Dulas Bk to conf R Wye*	SAC	76%	All possible measures + 5% land use change	1,664	£3,745,583	£3,324,753	0.89
		18. Bach Howey Bk - source to conf R Wye	SAC	92%	All possible measures + 5% land use change	664	£1,493,769	£1,325,938	0.89
		19. Builth Dulas Bk - source to conf R Wye	SAC	73%	Regulation	36	£18,748	£52,200	2.78
		20. Camnant Brook - source to confluence R Edw	SAC	95%	All possible measures + 5% land use change	352	£791,320	£702,412	0.89
		21. Clettwr Bk - source to conf R Wye	SAC	90%	Welsh agri-environment measures	202	£259,372	£290,189	1.12
		22. Dulas Bk - source to conf Afon Llynfi	SAC	87%	Best practice	152	£98,165	£167,058	1.70
		23. Edw - conf Camnant Bk to conf Clas Bk	SAC	98%	All possible measures + 5% land use change	965	£2,170,925	£1,927,013	0.89
		24. Edw - conf Clas Bk to conf R Wye	SAC	96%	Existing regulation and measures	163	£89,949	£234,319	2.61
		25. Edw - source to conf Colwyn Bk	SAC	99%	Welsh agri-environment measures	285	£366,512	£410,057	1.12
		26. Scithwen Bk - source to conf R Wye	SAC	97%	Best practice	104	£66,951	£113,938	1.70
		27. Triffrwd - source to Dulas	SAC	89%	All possible measures + 5% land use change	132	£297,292	£263,890	0.89
		28. Afon Llynfi - source to conf Dulas Bk	WFD	92%	Best practice	695	£448,064	£762,517	1.70
		29. Clyro Bk - source to conf R Wye	WFD	84%	Best practice	185	£119,434	£203,253	1.70
		30. Digedi Bk - source to conf R Wye	WFD	81%	Best practice	218	£140,512	£239,123	1.70

Sub-catchment	Operational catchment	Water body name	Target	Agricultural contribution of phosphorus concentration	Mitigation recommended	Phosphorus load reduction achieved from mitigation (kg P/yr)*	Cost (£/yr)	Benefit (£/yr)	Benefit / Cost Ratio
	Wye source to Ithon	*31. Afon Claerwen - conf Afon Arban to Caban-coch*	WFD	99%	Best practice	1,115	£719,041	£1,223,664	1.70
		32. Afon Claerwen - source to conf Afon Arban	WFD	100%	-	-	-	-	-
		33. Wye - conf Afon Elan to conf R Ithon	SAC	41%	Best practice	785	£411,869	£1,146,755	2.78
Lower Wye	Trothy	*34. Llanymynech Bk - source to conf R Trothy*	WFD	91%	Regulation	559	£916,278	£1,269,862	0.89
		35. Llymon Bk - source to conf R Trothy	WFD	97%	All possible agri-environment measures	84	£46,701	£121,656	2.61
		36. Trothy - conf Llanymynech Bk to conf Llymon Bk	WFD	94%	Existing regulation and measures	268	£147,913	£385,315	2.61
		37. Trothy - conf Llymon Bk to conf R Wye	WFD	88%	Existing regulation and measures	972	£510,116	£1,420,301	2.78
	Wye OC	*38. Tintern Bk - source to conf R Wye*	WFD	75%	-	-	-	-	-

* Phosphorus load reduction that can be achieved from measures, modelled in Farmscoper.

Phosphorus concentration reductions required from the agricultural sector to achieve water quality targets can be achieved in 25 out of 38 waterbody catchments assessed, with three not assessed due to limited water quality monitoring data. The remaining 10 waterbody catchments would require all possible mitigation measures plus land use change to meet their *"fair share"* target.

"Regulation", "best practice" and *"welsh agri-environment measures"* mitigation scenarios are existing delivery mechanisms that can theoretically achieve a maximum phosphorus load reduction of up to 39% from the agricultural sector if all measures within each mitigation scenario are implemented on all applicable land. These mitigation scenarios deliver more environmental and agricultural benefits than the costs. However, *"all possible measures"*, *"all possible measures plus low P index"* and *"all possible measures plus 5% land use change"* all deliver less environmental and agricultural benefits than the cost. It may not be economically feasible to implement mitigation scenarios that cost more than the benefits gained, and land use change may impact food production and agricultural productivity. Improving compliance with regulation, implementing best practices where possible, and increasing the uptake of Welsh agri-environment scheme measures will deliver more benefits than the cost, as well as improving water quality in the failing waterbody catchments.

Evaluation of individual measures

The impact of implementing individual mitigation measures across the whole of the Wye catchment on each farm type was modelled in Farmscoper Upscale and Evaluate V5 and categorised into rainfall bands to understand which specific mitigation measures would be most effective to reduce phosphorus loading in individual waterbody catchments (see Appendix I for full methodology). Table 16 shows the annual rainfall across the waterbody catchments. The following sections outline the most effective individual mitigation measures to reduce agricultural phosphorus loading for each waterbody catchment, categorised by rainfall.

Table 16 Waterbody catchments categorised by annual rainfall.

	Waterbody catchments categorised by annual rainfall			
Rainfall	>1500mm	1200-1500mm	900-1200mm	700-900mm
Waterbody catchment reference	32, 31, 4, 5, upper 3, upper 33	Lower 3, lower 33, 16, 9, upper 14, upper 21, upper 26,	Lower 14, 13, 10, 12, 7, 6, 8, lower 16, 11, 19, 15, 25, 20, 23, 24, 1, 18, 29, 2, lower 21, lower 26, 22, 27, 28, lower 17, 30, 38	34, 35, 37, lower 29, upper 17

Most effective measures for farms in >1500mm rainfall areas

Land use is predominantly upland or lowland grassland (as assessed from CORINE and ESRI satellite datasets), and Farmscoper Upscale V5 create results show that there are 37 extensive grazing and two dairy farms in the Upper Wye catchment in the areas with more than 1500mm annual rainfall.

The following failing waterbody catchments are within the >1500mm annual rainfall area within the Wye catchment (refer to Figure 14 for location of water body catchments that corresponds to the reference numbers below):

- 32. *Afon Claerwen - source to conf Afon Arban.*
- 31. *Afon Claerwen - conf Afon Arban to Caban-coch.*
- 4. *Afon Gwesyn - source to conf R Irfon.*
- 5. *Cledan - source to conf R Irfon.*
- Upper catchment of 3. *Afon Chwefru - source to conf R Irfon.*
- Upper catchment of 33. *Wye - conf Afon Elan to conf R Ithon.*

Within the above waterbodies the top ten most effective individual mitigation measures to implement on each farm type depending on their fertiliser practices and land use is provided in Table 17.

Table 17 Top ten mitigation measures that can be implemented on the different farm types within the failing waterbodies in the Upper Wye catchment in areas with >1500mm rainfall per year, and the respective load reduction that can be achieved relative to the baseline.

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Extensive Grazing (no fertiliser applied)		
Reduce the length of the grazing day/grazing season	7.86	0.18
Loosen compacted soil layers in grassland fields	7.15	0.17
Management of grassland field corners	6.92	0.16
Establish riparian buffer strips	6.44	0.15
Do not spread Farmyard Manure (FYM) to fields at high-risk times	6.30	0.15
Establish new hedges	6.04	0.14
Construct troughs with concrete base	6.04	0.14
Fence off rivers and streams from livestock	6.04	0.14

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Use dry-cleaning techniques to remove solid waste from yards prior to cleaning	6.00	0.14
Establish and maintain artificial wetlands - steading runoff	5.96	0.14
Extensive Grazing (fertiliser applied)		
Reduce the length of the grazing day/grazing season	7.86	0.18
Allow grassland field drainage systems to deteriorate	7.17	0.17
Loosen compacted soil layers in grassland fields	7.15	0.17
Do not apply P fertilisers to high P index soils	7.06	0.17
Management of grassland field corners	6.92	0.16
Integrate fertiliser and manure nutrient supply	6.46	0.15
Avoid spreading manufactured fertiliser to fields at high-risk times	6.46	0.15
Establish riparian buffer strips	6.44	0.15
Do not spread FYM to fields at high-risk times	6.30	0.15
Establish new hedges	6.04	0.14
Dairy (on grassland, fertiliser applied)		
Use slurry injection application techniques	17.10	0.60
Establish riparian buffer strips	13.92	0.48
Do not apply P fertilisers to high P index soils	12.24	0.43
Loosen compacted soil layers in grassland fields	12.22	0.43
Increase the capacity of farm slurry stores to improve timing of slurry applications	12.04	0.42
Minimise the volume of dirty water produced (sent to slurry store)	12.04	0.42
Management of grassland field corners	11.95	0.42
Reduce the length of the grazing day/grazing season	11.86	0.41
Fence off rivers and streams from livestock	11.73	0.41
Integrate fertiliser and manure nutrient supply	11.72	0.41

Most effective measures for farms in 1200-1500mm rainfall areas

Land use is predominantly upland or lowland grassland and Farmscoper Upscale V5 create results show that there are 127 extensive grazing, 6 dairy farms and 1 pig and poultry farm in the Wye catchment in the areas with 1200 to 1500mm annual rainfall.

The following failing waterbody catchments are within the 1200-1500mm annual rainfall area within the Upper Wye catchment (refer to Figure 14 for location of water body catchments that corresponds to the reference numbers below)

- Lower catchment of 3. *Afon Chwefru - source to conf R Irfon.*
- Lower catchment of 33. *Wye - conf Afon Elan to conf R Ithon.*
- Upper catchment of 16. *Nantmel Dulas - source to conf R Ithon.*
- 9. *Clywedog Bk - source to conf Bachell Bk.*
- Upper catchment of 14. *Ithon - source to conf Llaethdy Bk*.
- Upper catchment of 21. *Clettwr Bk - source to conf R Wye.*
- Upper catchment of 26. *Scithwen Bk - source to conf R Wye.*

Within the above waterbodies the top most effective individual mitigation measures to implement on each farm type depending on their fertiliser practices and land use is provided in Table 18.

Table 18 Top ten mitigation measures that can be implemented on the different farm types within the failing waterbodies in the Upper Wye catchment in areas with 1200-1500mm rainfall per year, and the respective load reduction that can be achieved relative to the baseline.

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Extensive Grazing (no fertilisers)		
Reduce the length of the grazing day/grazing season	7.98	0.13
Loosen compacted soil layers in grassland fields	7.35	0.12
Management of grassland field corners	7.05	0.11
Do not spread FYM to fields at high-risk times	6.64	0.10
Fence off rivers and streams from livestock	6.38	0.10
Establish riparian buffer strips	6.32	0.10
Construct troughs with concrete base	6.28	0.10
Use dry-cleaning techniques to remove solid waste from yards prior to cleaning	6.22	0.10
Establish new hedges	6.18	0.10
Establish and maintain artificial wetlands - steading runoff	6.18	0.10
Extensive Grazing (fertilisers applied)		
Reduce the length of the grazing day/grazing season	7.98	0.13
Allow grassland field drainage systems to deteriorate	7.39	0.12
Loosen compacted soil layers in grassland fields	7.35	0.12
Do not apply P fertilisers to high P index soils	7.15	0.11
Management of grassland field corners	7.05	0.11
Integrate fertiliser and manure nutrient supply	6.73	0.11
Avoid spreading manufactured fertiliser to fields at high-risk times	6.73	0.11
Do not spread FYM to fields at high-risk times	6.64	0.10
Fence off rivers and streams from livestock	6.38	0.10
Establish riparian buffer strips	6.32	0.10
Dairy (grassland, fertilisers applied)		
Use slurry injection application techniques	18.83	0.42
Establish riparian buffer strips	12.94	0.29
Loosen compacted soil layers in grassland fields	12.38	0.28
Increase the capacity of farm slurry stores to improve timing of slurry applications	12.35	0.28
Minimise the volume of dirty water produced (sent to slurry store)	12.35	0.28
Do not apply P fertilisers to high P index soils	12.25	0.27
Fence off rivers and streams from livestock	12.09	0.27
Management of grassland field corners	12.02	0.27
Do not spread FYM to fields at high-risk times	11.89	0.27
Integrate fertiliser and manure nutrient supply	11.88	0.27
Dairy (maize and cereals, fertilisers applied)		
Establish cover crops in the autumn	21.2	0.48
Use slurry injection application techniques	18.8	0.42
Early harvesting and establishment of crops in the autumn	14.4	0.32
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	14.4	0.32
Uncropped cultivated areas	13.3	0.30
Establish riparian buffer strips	12.9	0.29

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Adopt reduced cultivation systems	12.5	0.28
Allow grassland field drainage systems to deteriorate	12.5	0.28
Plant areas of farm with wild bird seed / nectar flower mixtures	12.4	0.28
Loosen compacted soil layers in grassland fields	12.4	0.28
Pigs and Poultry (grassland, fertilisers applied)		
Establish riparian buffer strips	11.75	0.29
Plant areas of farm with wild bird seed / nectar flower mixtures	10.14	0.25
Do not apply P fertilisers to high P index soils	8.83	0.22
Incorporate manure into the soil	8.82	0.22
Do not spread slurry or poultry manure at high-risk times	8.72	0.21
Integrate fertiliser and manure nutrient supply	8.57	0.21
Store solid manure heaps on an impermeable base and collect effluent	8.06	0.20
Use correctly-inflated low ground pressure tyres on machinery	7.87	0.19
Avoid spreading manufactured fertiliser to fields at high-risk times	7.76	0.19
Loosen compacted soil layers in grassland fields	7.66	0.19
Pigs and Poultry (arable land)		
Uncropped cultivated areas	13.49	0.33
Establish cover crops in the autumn	12.32	0.30
Undersown spring cereals	11.94	0.29
Establish riparian buffer strips	11.75	0.29
Adopt reduced cultivation systems	10.27	0.25
Plant areas of farm with wild bird seed / nectar flower mixtures	10.14	0.25
Cultivate compacted tillage soils	8.99	0.22
Establish in-field grass buffer strips	8.94	0.22
Do not apply P fertilisers to high P index soils	8.83	0.22
Incorporate manure into the soil	8.82	0.22

Most effective measures for farms in 900-1200mm rainfall areas

Land use is predominantly upland or lowland grassland, with some arable land. Farmscoper Upscale V5 create results show that there are 47 extensive grazing, two dairy, one pig and poultry and one mixed livestock farm in the Wye catchment in the areas with 900-1200mm annual rainfall.

The following failing waterbody catchments are within the 900-1200mm annual rainfall area within the Upper Wye catchment (refer to Figure 14 for location of water body catchments that corresponds to the reference numbers below):

- Lower catchment of 16. *Nantmel Dulas - source to conf R Ithon.*
- Lower catchment of 14*. Ithon - source to conf Llaethdy Bk.*
- 13. *Ithon - conf Llaethdy Bk to conf Gwenlas Bk.*
- 10. *Gwenlas Bk - source to conf R Ithon.*
- 12. *Ithon – conf Gwenlas Bk to conf Camddwr Bk.*
- 7. *Camddwr Bk - source to conf R Ithon.*
- 6. *Aran - source to conf R Ithon.*
- 15. *Mithil Bk - source to conf R Ithon.*
- 25. *Edw - source to conf Colwyn Bk.*

- 20. *Camnant Brook - source to confluence R Edw.*
- 11. *Howey Bk - source to conf R Ithon.*
- 19. *Builth Dulas Bk - source to conf R Wye.*
- 23. *Edw - conf Camnant Bk to conf Clas Bk.*
- 24. *Edw - conf Clas Bk to conf R Wye.*
- 18. *Bach Howey Bk - source to conf R Wye.*
- 1. *Gilwern Bk - source to conf R Arrow.*
- 2. *Norton Bk - source to conf R Lugg.*
- Upper catchment of 29. *Clyro Bk - source to conf R Wye.*
- 22. *Dulas Bk - source to conf Afon Llynfi.*
- Lower catchment of 21. *Clettwr Bk - source to conf R Wye.*
- Lower catchment of 26. *Scithwen Bk - source to conf R Wye.*
- 27. *Triffrwd - source to Dulas.*
- 28. *Afon Llynfi - source to conf Dulas Bk.*
- Lower catchment of 17. *Afon Llynfi - conf Dulas Bk to conf R Wye.*
- 30. *Digedi Bk - source to conf R Wye.*
- 34. *Llanymynech Bk - source to conf R Trothy.*
- 38. *Tintern Bk - source to conf R Wye.*

Within the above waterbodies the top ten most effective individual mitigation measures to implement on each farm type depending on their fertiliser practices and land use is provided in Table 19.

Table 19 Top ten mitigation measures that can be implemented on the different farm types within the failing waterbodies in the Upper Wye catchment in areas with 900-1200mm rainfall per year, and the respective load reduction that can be achieved relative to the baseline.

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Extensive Grazing (no fertilisers)		
Reduce the length of the grazing day/grazing season	8.12	0.09
Allow grassland field drainage systems to deteriorate	7.68	0.08
Loosen compacted soil layers in grassland fields	7.65	0.08
Management of grassland field corners	7.26	0.08
Do not spread FYM to fields at high-risk times	7.10	0.08
Fence off rivers and streams from livestock	6.91	0.07
Construct troughs with concrete base	6.66	0.07
Establish riparian buffer strips	6.64	0.07
Use dry-cleaning techniques to remove solid waste from yards prior to cleaning	6.57	0.07
Establish and maintain artificial wetlands - steading runoff	6.52	0.07
Extensive Grazing (fertilisers applied)		
Reduce the length of the grazing day/grazing season	8.12	0.09
Allow grassland field drainage systems to deteriorate	7.68	0.08
Loosen compacted soil layers in grassland fields	7.65	0.08
Do not apply P fertilisers to high P index soils	7.36	0.08
Management of grassland field corners	7.26	0.08
Integrate fertiliser and manure nutrient supply	7.11	0.08
Avoid spreading manufactured fertiliser to fields at high-risk times	7.11	0.08

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Do not spread FYM to fields at high-risk times	7.10	0.08
Fence off rivers and streams from livestock	6.91	0.07
Construct troughs with concrete base	6.66	0.07
Dairy (grassland, fertilisers applied)		
Use slurry injection application techniques	21.02	0.47
Establish riparian buffer strips	13.81	0.31
Increase the capacity of farm slurry stores to improve timing of slurry applications	13.41	0.30
Minimise the volume of dirty water produced (sent to slurry store)	13.41	0.30
Allow grassland field drainage systems to deteriorate	13.32	0.30
Fence off rivers and streams from livestock	13.30	0.30
Loosen compacted soil layers in grassland fields	13.26	0.30
Do not apply P fertilisers to high P index soils	13.04	0.29
Do not spread FYM to fields at high-risk times	12.87	0.29
Management of grassland field corners	12.82	0.29
Dairy (maize and cereals, fertilisers applied)		
Establish cover crops in the autumn	21.81	0.49
Use slurry injection application techniques	21.02	0.47
Early harvesting and establishment of crops in the autumn	15.19	0.34
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	15.18	0.34
Uncropped cultivated areas	14.15	0.32
Establish riparian buffer strips	13.81	0.31
Increase the capacity of farm slurry stores to improve timing of slurry applications	13.41	0.30
Minimise the volume of dirty water produced (sent to slurry store)	13.41	0.30
Adopt reduced cultivation systems	13.38	0.30
Plant areas of farm with wild bird seed / nectar flower mixtures	13.32	0.30
Pigs and Poultry (grassland, fertilisers applied)		
Establish riparian buffer strips	12.48	0.21
Do not apply P fertilisers to high P index soils	9.14	0.15
Do not spread slurry or poultry manure at high-risk times	9.11	0.15
Integrate fertiliser and manure nutrient supply	9.05	0.15
Incorporate manure into the soil	9.01	0.15
Store solid manure heaps on an impermeable base and collect effluent	8.71	0.15
Use correctly-inflated low ground pressure tyres on machinery	8.29	0.14
Avoid spreading manufactured fertiliser to fields at high-risk times	8.17	0.14
Loosen compacted soil layers in grassland fields	8.00	0.14
Allow grassland field drainage systems to deteriorate	7.97	0.14
Pigs and Poultry (arable land)		
Uncropped cultivated areas	13.87	0.23
Establish cover crops in the autumn	12.61	0.21
Establish riparian buffer strips	12.48	0.21
Undersown spring cereals	12.24	0.21
Adopt reduced cultivation systems	10.90	0.18
Plant areas of farm with wild bird seed / nectar flower mixtures	10.67	0.18

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Cultivate compacted tillage soils	9.56	0.16
Establish in-field grass buffer strips	9.48	0.16
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	9.15	0.15
Do not apply P fertilisers to high P index soils	9.14	0.15
Mixed Livestock (arable, fertilisers applied)		
Establish cover crops in the autumn	10.94	0.19
Uncropped cultivated areas	9.77	0.17
Establish riparian buffer strips	8.82	0.15
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	8.46	0.14
Adopt reduced cultivation systems	8.28	0.14
Plant areas of farm with wild bird seed / nectar flower mixtures	8.28	0.14
Early harvesting and establishment of crops in the autumn	8.20	0.14
Cultivate compacted tillage soils	8.20	0.14
Do not apply P fertilisers to high P index soils	8.14	0.14
Establish in-field grass buffer strips	8.03	0.14
Mixed Livestock (grassland, fertilisers applied)		
Establish riparian buffer strips	10.94	0.19
Do not apply P fertilisers to high P index soils	8.82	0.15
Reduce the length of the grazing day/grazing season	8.46	0.14
Integrate fertiliser and manure nutrient supply	8.28	0.14
Avoid spreading manufactured fertiliser to fields at high-risk times	8.28	0.14
Allow grassland field drainage systems to deteriorate	8.26	0.14
Do not spread slurry or poultry manure at high-risk times	8.20	0.14
Loosen compacted soil layers in grassland fields	8.20	0.14
Use slurry injection application techniques	8.14	0.14
Do not spread FYM to fields at high-risk times	8.03	0.14

Most effective measures for farms in 700-900mm rainfall areas

Land use is predominantly upland or lowland grassland, with some arable land. Farmscoper Upscale V5 create results show that there are 47 extensive grazing, 2 dairy, 1 pig and poultry and 1 mixed livestock farm in the Wye catchment in the areas with 700-900mm annual rainfall.

The following failing waterbody catchments are within the 700-900mm annual rainfall area within the Lower Wye catchment (refer to Figure 14 for location of water body catchments that corresponds to the reference numbers below):

- Lower catchment of 29. *Clyro Bk - source to conf R Wye.*
- Upper catchment of 17. *Afon Llynfi - conf Dulas Bk to conf R Wye.*
- 35. *Llymon Bk - source to conf R Trothy.*
- 36. *Trothy - conf Llanymynach Bk to conf Llymon Bk.*
- 37. *Trothy - conf Llymon Bk to conf R Wye.*

Within the above waterbodies the top ten most effective individual mitigation measures to implement on each farm type depending on their fertiliser practices and land use is provided in Table 20.

Table 20 Top ten mitigation measures that can be implemented on the different farm types within the failing waterbodies in the Lower Wye catchment in areas with 700-900mm rainfall per year, and the respective load reduction that can be achieved relative to the baseline.

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Extensive Grazing (no fertilisers)		
Reduce the length of the grazing day/grazing season	8.74	0.06
Loosen compacted soil layers in grassland fields	8.50	0.06
Allow grassland field drainage systems to deteriorate	8.34	0.05
Fence off rivers and streams from livestock	8.07	0.05
Do not spread FYM to fields at high-risk times	8.05	0.05
Management of grassland field corners	7.84	0.05
Construct troughs with concrete base	7.53	0.05
Use dry-cleaning techniques to remove solid waste from yards prior to cleaning	7.37	0.05
Move feeders at regular intervals	7.30	0.05
Establish and maintain artificial wetlands - steading runoff	7.30	0.05
Extensive Grazing (fertilisers applied)		
Reduce the length of the grazing day/grazing season	8.74	0.06
Loosen compacted soil layers in grassland fields	8.50	0.06
Allow grassland field drainage systems to deteriorate	8.34	0.05
Fence off rivers and streams from livestock	8.07	0.05
Do not spread FYM to fields at high-risk times	8.05	0.05
Do not apply P fertilisers to high P index soils	7.92	0.05
Integrate fertiliser and manure nutrient supply	7.91	0.05
Avoid spreading manufactured fertiliser to fields at high-risk times	7.91	0.05
Management of grassland field corners	7.84	0.05
Construct troughs with concrete base	7.53	0.05
Dairy (grassland, fertilisers applied)		
Establish riparian buffer strips	29.27	0.29
Fence off rivers and streams from livestock	27.26	0.27
Reduce the length of the grazing day/grazing season	24.77	0.25
Loosen compacted soil layers in grassland fields	24.64	0.25
Use slurry injection application techniques	24.38	0.24
Construct bridges for livestock crossing rivers/streams	23.21	0.23
Construct troughs with concrete base	23.11	0.23
Do not spread slurry or poultry manure at high-risk times	22.93	0.23
Establish new hedges	22.81	0.23
Move feeders at regular intervals	22.74	0.23
Dairy (maize and cereals, fertilisers applied)		
Establish cover crops in the autumn	43.39	0.43
Establish riparian buffer strips	29.27	0.29
Early harvesting and establishment of crops in the autumn	28.89	0.29
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	28.69	0.29
Adopt reduced cultivation systems	28.15	0.28
Fence off rivers and streams from livestock	27.26	0.27

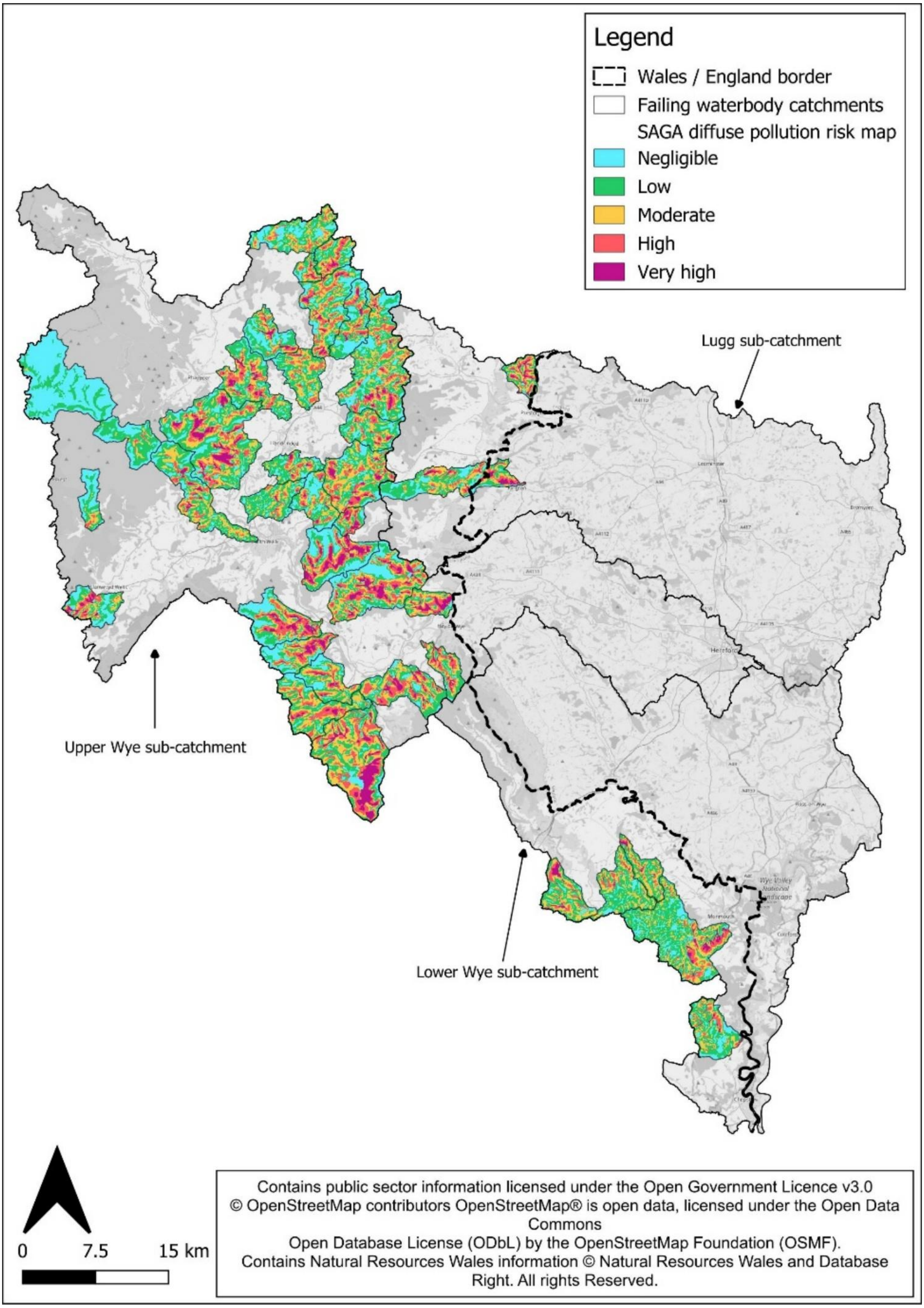
Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Uncropped cultivated areas	26.56	0.26
Plant areas of farm with wild bird seed / nectar flower mixtures	25.97	0.26
Cultivate compacted tillage soils	25.39	0.25
Establish in-field grass buffer strips	25.30	0.25
Pigs and Poultry (grassland, fertilisers applied)		
Establish riparian buffer strips	12.24	0.13
Do not spread slurry or poultry manure at high-risk times	9.71	0.10
Integrate fertiliser and manure nutrient supply	9.69	0.10
Do not apply P fertilisers to high P index soils	9.48	0.10
Incorporate manure into the soil	9.43	0.10
Store solid manure heaps on an impermeable base and collect effluent	9.31	0.10
Avoid spreading manufactured fertiliser to fields at high-risk times	8.65	0.09
Use correctly-inflated low ground pressure tyres on machinery	8.53	0.09
Loosen compacted soil layers in grassland fields	8.40	0.09
Allow grassland field drainage systems to deteriorate	8.33	0.09
Pigs and Poultry (arable land)		
Uncropped cultivated areas	14.22	0.15
Establish cover crops in the autumn	12.95	0.13
Undersown spring cereals	12.58	0.13
Establish riparian buffer strips	12.24	0.13
Plant areas of farm with wild bird seed / nectar flower mixtures	10.75	0.11
Adopt reduced cultivation systems	10.60	0.11
Do not spread slurry or poultry manure at high-risk times	9.71	0.10
Cultivate compacted tillage soils	9.69	0.10
Integrate fertiliser and manure nutrient supply	9.69	0.10
Establish in-field grass buffer strips	9.53	0.10
Mixed Livestock (arable, fertilisers applied)		
Establish cover crops in the autumn	17.21	0.16
Uncropped cultivated areas	12.30	0.11
Establish riparian buffer strips	10.81	0.10
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	10.80	0.10
Plant areas of farm with wild bird seed / nectar flower mixtures	9.94	0.09
Adopt reduced cultivation systems	9.72	0.09
Early harvesting and establishment of crops in the autumn	9.35	0.09
Do not apply P fertilisers to high P index soils	9.19	0.09
Cultivate compacted tillage soils	9.02	0.08
Establish in-field grass buffer strips	8.95	0.08
Establish riparian buffer strips	10.81	0.10
Do not apply P fertilisers to high P index soils	9.19	0.09
Reduce the length of the grazing day/grazing season	8.83	0.08
Integrate fertiliser and manure nutrient supply	8.81	0.08
Avoid spreading manufactured fertiliser to fields at high-risk times	8.81	0.08

Top ten measures per farm type	Load reduction (%)	Load reduction per ha (kg)
Do not spread slurry or poultry manure at high-risk times	8.80	0.08
Use slurry injection application techniques	8.76	0.08
Loosen compacted soil layers in grassland fields	8.71	0.08
Allow grassland field drainage systems to deteriorate	8.66	0.08
Fence off rivers and streams from livestock	8.62	0.08
Arable (fertilisers applied)		
Establish cover crops in the autumn	18.77	0.15
Uncropped cultivated areas	13.16	0.10
Establish riparian buffer strips	10.25	0.08
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	9.27	0.07
Plant areas of farm with wild bird seed / nectar flower mixtures	8.42	0.07
Adopt reduced cultivation systems	8.33	0.07
Cultivate compacted tillage soils	6.96	0.06
Do not apply P fertilisers to high P index soils	6.87	0.05
Establish in-field grass buffer strips	6.87	0.05
Early harvesting and establishment of crops in the autumn	6.87	0.05

Locations of mitigation measures

Mitigation measures should first be targeted at the highest risk areas of soil and nutrient run-off, to maximise the impact of measures to reduce diffuse pollution from agriculture to the water environment. Using the SAGA GIS diffuse risk map model, a diffuse pollution risk map was created for the whole Wye catchment and then clipped to the failing waterbodies to highlight high priorities areas within the Welsh Wye catchment (see Figure 18). The model calculates the highest risk areas for soil erosion and surface water connectivity based on soil type, slope and land cover. The dark purple areas on the map indicate the areas of highest risk for sediment and soil-bound run-off, therefore these are the areas that should be prioritised for implementing mitigation measures that aim to intercept sediment and nutrient run-off or reduce nutrients applied to land.

Figure 18: SAGA diffuse pollution risk map for failing waterbody catchments



5.2 WASTEWATER MEASURES

Phosphorus removal schemes have been identified under plans that were based on relevant environmental needs using the best available data at the time of the price review (PR24) in readiness from AMP8 (2020 – 2025). DCWW works with their environmental regulators, NRW and the EA, to develop an investment programme to protect and restore environmental failures which could be as a result of operations. Most of the schemes listed below were agreed for investment to meet the requirements of the WFD and SAC compliance.

The Upper and Lower Wye had the highest number of scheme commitments of all SAC catchments in DCWW's operating area between 2020-2025. These also included additional drivers such as monitoring, storm overflow investigation and schemes to prepare for growth. DCWW introduced accelerated funding of £60 million that was committed at the First Minister's Phosphorus Summit in 2022; this meant these schemes (i.e. Monmouth STW) that would have been due for 2030 was brought forward for completion in 2025.

In February 2023, NRW published details of a proposed review of existing environmental permits against the revised water quality targets for SAC rivers. This work was done as an appropriate measure under Article 6(2) of the Habitats Directive in Wales and was completed in June 2024. It resulted in tighter phosphorus limits being placed on STW Environmental Permits for 31 assets that discharge to a SAC river with over 20m^3 per day dry weather flow (NRW, 2024d).

DCWW produced a Phosphorus Reduction programme for all SAC rivers with the aim of reducing their '*fair share'* by 2032. This consisted of 17 STW that will receive new tighter phosphorus limits. In addition, 14 backstop limits of 5mg/l phosphorus were introduced to prevent deterioration of the River Wye.

There is currently no proposal to review the environmental permits for the majority of smaller STW (those with flows less than 20m^3 per day that did not require a phosphorus limit in order to achieve 'fair share'). Therefore, the discharges from these STW will remain without phosphorus limits on their permits and development proposals connecting to such a works will need to demonstrate nutrient neutrality. If future development results in 20m^3 DWF being met, a backstop condition in the permit would also be needed.

5.2.1 Mitigation measures undertaken to date

AMP7 STW upgrades

AMP7 upgrades consisted of 11 STW, six of which are located in England and have therefore not been considered. There is one STW located in the Lower Wye, one in the Lugg and three in the Upper Wye sub-catchments (see Figure 19). No AMP7 upgrades were located within the failing waterbodies. The total load reduction achieved from AMP7 STW upgrades in the Welsh Wye was 8,975kg P/yr (see Table 21 for more detail).

Figure 19: AMP7 STW upgrades in Wales

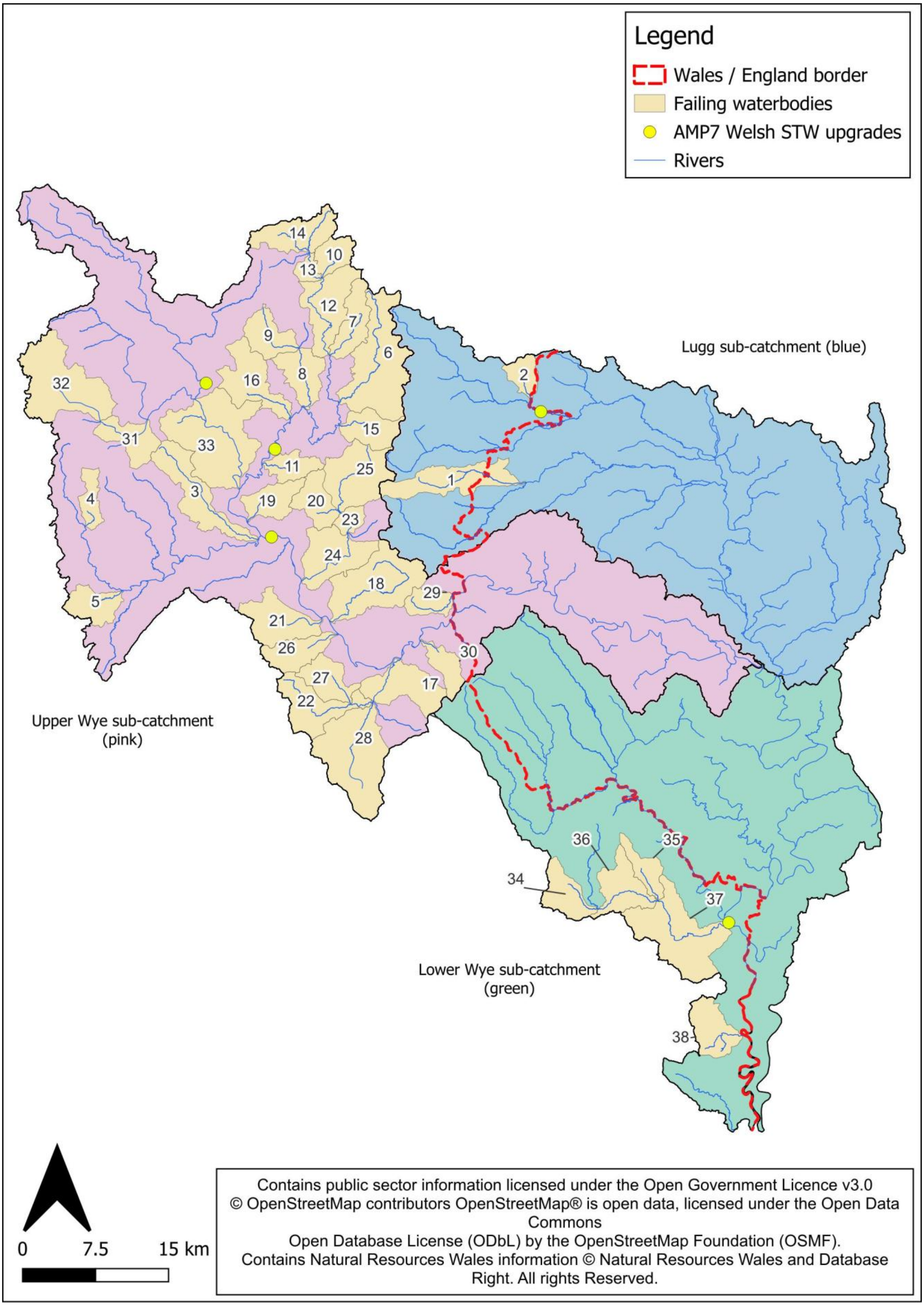


Table 21 Load reductions achieved from AMP7 sewerage treatment works upgrades

Sub-Catchment	Water body catchment	Sewage treatment works	Current load (kg P/yr)	New load (kg P/yr)	Load reduction achieved (kg P/yr)
Lower Wye	*Wye - conf Walford Bk to Bigsweir Br*	Monmouth Redbrook Road	6,495	2,598	3,894
Lugg	*Lugg - conf Norton Bk to conf R Arrow*	Presteigne	2,602	520	2,081
Upper Wye	*Wye - conf R Irfon to Scithwen Bk*	Builth Wells	3,703	1,851	1,850
	Ithon - conf Camddwr Bk to conf R Wye	Llandrindod Wells STW Park Lane	1,022	654	368
	Wye - conf to conf Afon Marteg to conf Afon Elan	Rhayader	1,956	1,174	782

5.2.2 Future mitigation measures

Planned AMP8 STW upgrades

In DCWW's current investment cycle (AMP8: 2025-30), they are investing more than £120 million on sites to improve the Wye. This includes more than £55m on further projects to remove phosphorous, more than £55 million targeted on storm overflows and a further £10m on improving final treated effluent before it is returned to the river. This includes the following improvements:

- **Storm overflows –** sites that were identified from DCWW's Storm Overflow Assessment Framework investigation 2020 – 2025, 12 sites will receive schemes in the Wye catchment for 2025 - 2030.
- **Phosphorous –** there will be a larger number of sites in the Wye catchment that will receive investment over the coming five years. However, the overall cost of the work will be lower. After prioritising the larger sites in AMP7, DCWW now see a variation of schemes to meet new tighter P limits along with work to maintain backstop limits etc. The work will also support reductions in ammonia, BOD and suspended solids.

To calculate the load reduction that can be achieved from planned AMP8 STW upgrades in the Upper Wye catchment, data was shared on NRW and DCWW's asset management programme investment. Using the 2030 proposed permit limit, and the current permitted limit and dry weather flow from the Permitted Discharges Register (NRW, 2025d), the current and proposed loads were calculated and compared to indicate the potential load reduction achieved from the STW upgrades. To calculate the current and proposed loads, the Dry Weather Flow of the works was multiplied by 1.25 to convert it to a permitted average and then the following equation was used:

$$Phosphorus\ load\ (kg) = flow\ (m3)\ \times\ 1{,}000\ \times\ concentration\ (mg/l)\ /\ 1{,}000{,}000\ \times\ 365$$

Further detail on the current and 2030 permit limits are highlighted in Appendix J.

In the Upper Wye catchment, there are 12 STW upgrades planned for completion in 2030 and two STW upgrades planned for completion in 2032, ten of which are located within the failing waterbody catchments (See Figure 20). Four of the upgrades achieve a 20% reduction in phosphorus load, two achieve a 30%

reduction, two achieve a 40% reduction, two achieve a 60% reduction, one achieves an 80% reduction, one achieves an 84% reduction, one achieves an 88% reduction, and one achieves a 90% reduction. All AMP8 upgrades contribute to a total reduction of 1,790kg P/yr in the Upper Wye sub-catchment and a load reduction of 877kg P/yr in the failing waterbody catchments (calculated based on current and future maximum permitted loads, this approach is relatively conservative and reflects the maximum possible load, under normal operation loads ae likely to be lower).

The planned permit reduction limits for all ten STW within the failing waterbody catchments will achieve their fair share targets based on SAGIS modelling and fair share methodologies agreed between DCWW and NRW to inform AMP8 investments. Table 22 details the reduction achieved from AMP8 upgrades in the Upper Wye catchment.

Figure 20: AMP8 STW upgrades

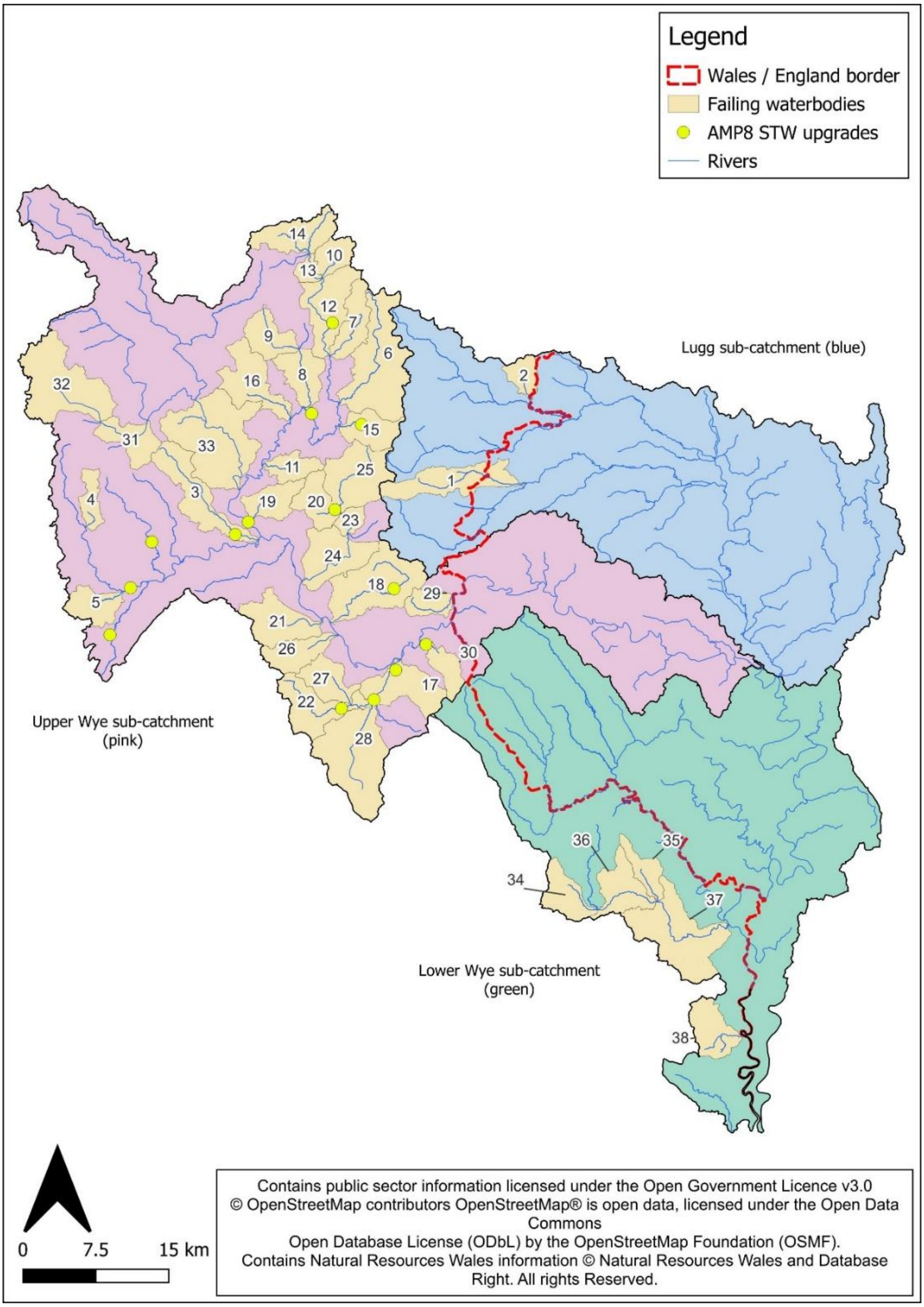


Table 22

Estimated load reduction achieved from AMP8 sewerage treatment work upgrades in the Upper Wye sub-catchment for failing waterbodies compared to sector load reduction targets.

Water body catchment	Sewerage treatment works	Load reduction achieved (kg P/yr)	Percentage load reduction achieved
17. *Afon Llynfi - conf Dulas Bk to conf R Wye*	Aberllynfi (Three Cocks) STW	45	30%

Water body catchment	Sewerage treatment works	Load reduction achieved (kg P/yr)	Percentage load reduction achieved
	Talgarth STW	671	87%
12. *Ithon - conf Gwenlas Bk to conf Camddwr Bk*	Llanbister STW	7	20%
19. *Builth Dulas Bk - source to conf R Wye*	Builth Road STW	24	40%
20. *Camnant Brook - source to confluence R Edw*	Hundred House STW	2	20%
3. *Afon Chwefru - source to conf R Irfon*	Cilmery STW	10	20%
30. *Digedi Bk - source to conf R Wye*	Llanigon STW	66	90%
18. *Bach Howey Bk - source to conf R Wye*	Painscastle STW	10	30%
15. *Mithil Bk - source to conf R Ithon*	Llandegley STW	24	80%
22. *Dulas Bk - source to conf Afon Llynfi*	Llanfilo STW	18	60%

In addition to the above measures planned for AMP8, DCWW are also implementing P permit limits through introducing a 5mg/l backstop limit on seven sites in the Wye catchment, without a current phosphorus condition contained within the permit to prevent deterioration (see Figure 21). Two of these sites are located within failing waterbodies (see Table 23). Additionally, storm overflow improvements have been undertaken at 12 sites (see Figure 22). The impact of these upgrades cannot be quantified as no baseline monitoring of phosphorus concentrations in final treated effluent has been undertaken and these sites do not currently have phosphorus permits. Note the sites and number of sites are subject to change

Table 23 P backstop limits (5mg/l) for STWs in failing waterbodies, to reduce phosphorus concentration in final treated effluent.

Sub-catchment	Operational catchment	STW	Permit number
Upper Wye	Wye source to Ithon	Newbridge-on-Wye	AW1004401
	Wye Ithon to Hay	Clyro	AW1000901

Figure 21: DCWW AMP8 backstop limits

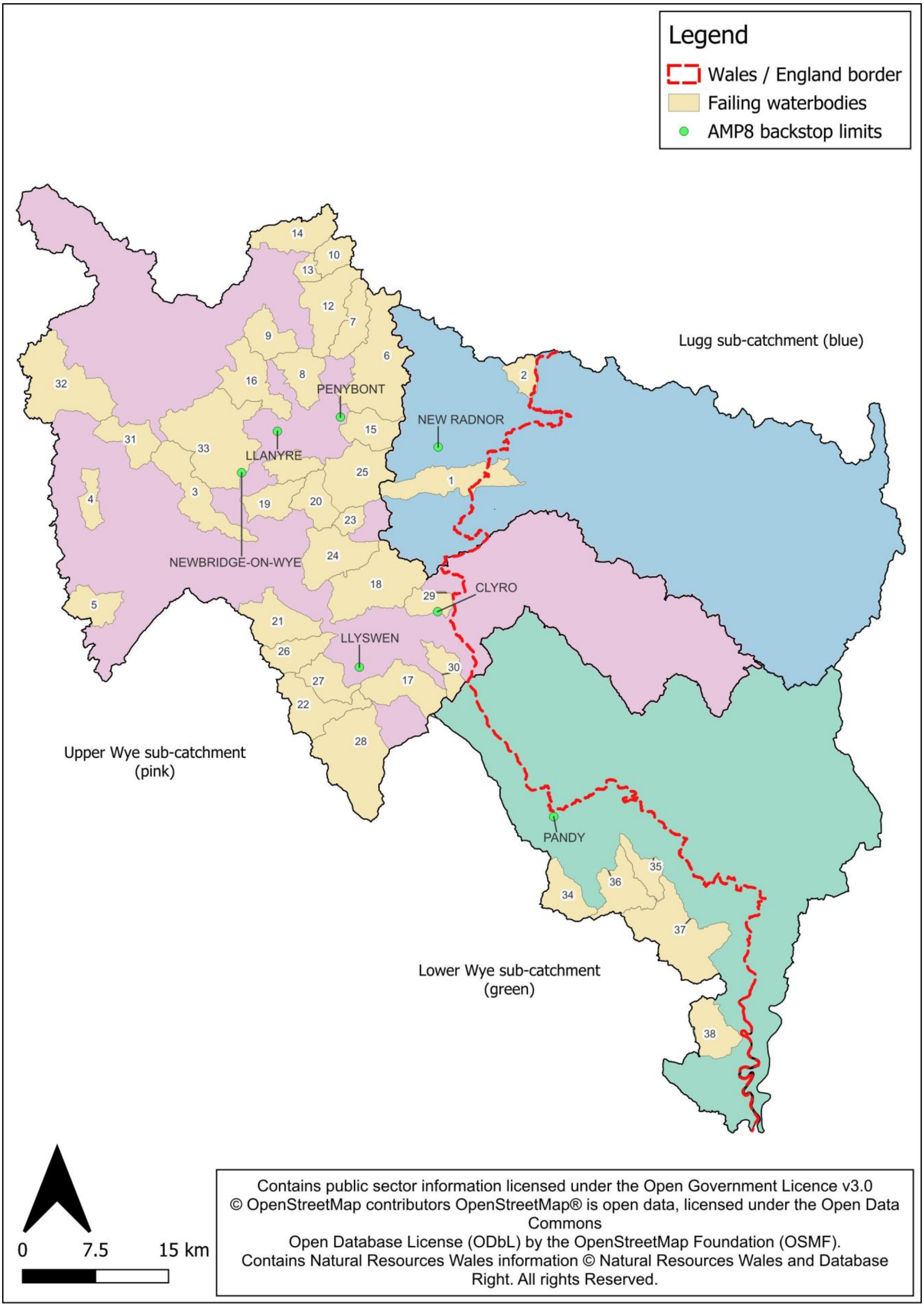
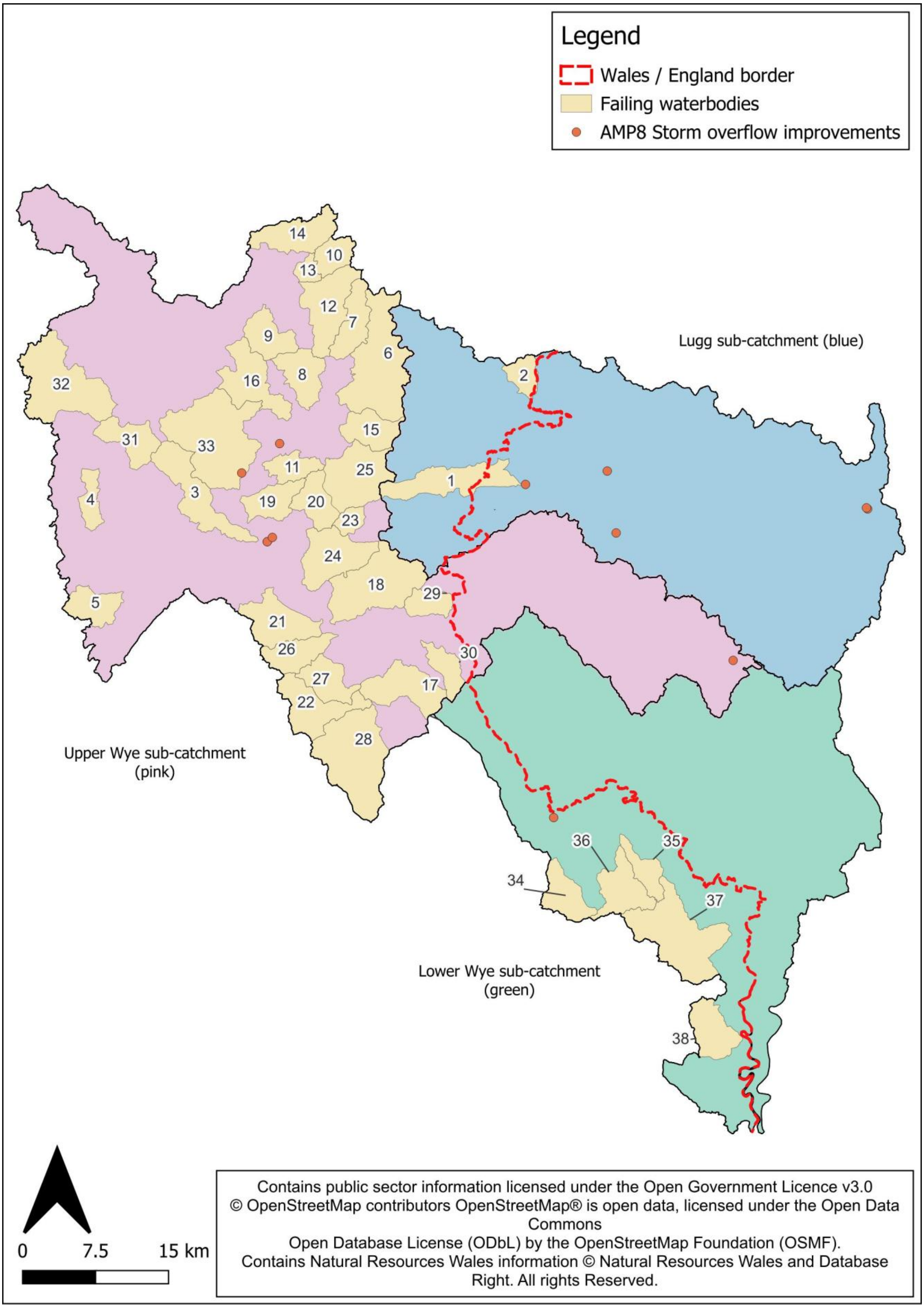


Figure 22: DCWW AMP8 storm overflow improvements



5.3 OTHER MEASURES

5.3.1 Mitigation measures undertaken to date

There is no current record of ST or package treatment plan upgrades that will reduce the phosphorus load from *"Other"* sources.

5.3.2 Potential mitigation measures

Private sewerage system upgrades

Older private sewerage systems (PSS) are likely to leak and discharge phosphorus into surface waters and heavily rely on regular maintenance to ensure no additional nutrients are entering the catchment. However, newer systems provide manufacturer guarantees of nutrients in the effluent, some as low as 0.4mg total phosphorus per litre (GRAF, 2023). To assess the potential load reduction that can be achieved from PSS upgrades, open-source data was collated from the Permitted Discharges Register (NRW, 2025d) and the Water Quality Exemptions register (NRW, 2025b), then plotted on QGIS 3.38.3 (QGIS Development Team, 2025). This helped to identify all PSS (ST and PTP) with an Environmental Permit to Discharge or operating under the General Binding Rules within the Wye catchment. ST that discharge into groundwater were excluded due to minimal connectivity to groundwater within the Upper Wye catchment (see Section 4.3.1).

Three ST were identified in the Upper Wye sub-catchment and one ST was identified in the Lower Wye sub-catchment, contributing a total of 23kg P/yr (See Figure 16). A total of 103 PTP were identified, 73 of which are located in the Upper Wye sub-catchment contributing 1,112 kg P/yr. Two are located in the Lugg sub-catchment, contributing a total of 21kg P/yr and, 28 are located in the Lower Wye sub-catchment contributing a total of 414kg P/yr. In total PTP contribute 1,565kg P/yr in the Wye catchment (see Figure 17)

The total phosphorus load from PSS was calculated using default PTP and ST concentrations obtained from the Wales Nutrient Budget Calculator (Herefordshire Council, 2019), and flow rates were obtained from the Permitted Discharges Register (NRW, 2025d) and the Water Quality Exemptions Register (NRW, 2025b). The load reduction that can be achieved from upgrades in each failing waterbody where registered PSS are located in, is provided in Table 24 and is calculated based on assumptions detailed in Appendix K (see Appendix K for further detail on load calculations of individual PSS). The results show that upgrading PSS within the catchment can reduce phosphorus inputs by 96 to 97%.

Upgrading PSS at individual properties has been estimated to cost around £4,500 per unit for a 3 to 4 bedroom house (Neilberg, 2025). The monetary benefit of reducing phosphorus loads to watercourses from agricultural sources has been estimated to be £50.48 per kilogram of phosphorus (calculated to 2025 values using Bank of England, 2025) (Defra, 2025). Although this value has been attributed to agricultural sources of phosphorus, the value represents the economic benefit from reducing phosphorus pollution per kilogram for drinking water quality, fishing, bathing water quality and eutrophication reduction (Defra, 2025). Using this value, a cost benefit analysis of PSS upgrades compared to the monetary benefits of phosphorus reduction has been completed to assess economic feasibility. The results displayed in Table 24 show that is it not cost beneficial to upgrade PSS when the cost is compared to the potential monetary benefit from phosphorus reductions.

It is important to note, that although PSS systems contribute less than 10% of nutrient loads in the failing waterbodies, temporal variations in nutrient loading may significantly increase in-stream nutrient concentrations particularly in low flow periods. In addition, although only PSS with a permit to discharge to controlled waters is assessed here, there is an uncertain number of additional systems operating within the catchment that do not require registration due to their size. Underestimating the number of ST can lead to an overestimation of contribution from diffuse sources, such as agriculture (Withers *et al.,* 2012).

Table 24 Estimated load reduction using modelled SAGIS contributions and cost-benefit analysis of upgrading PSS systems

Sub Catchment	Operational Catchment	Ref	Failing WB name	Number of PSS	SAGIS percentage contribution from ST	Total current load (kg)	Total upgraded load (kg)	Total load reduction (kg P/yr)	Total estimated cost	Total water quality benefit	Cost benefit ratio
Lugg	Arrow Lugg Frome	1	*Gilwern Bk - source to conf R Arrow*	2	6.3%	21	1	20	£9,000	£1,022	0.11
Upper Wye	Irfon	3	*Afon Chwefru - source to conf R Irfon*	1	1.4%	18	1	17	£4,500	£857	0.19
		4	*Afon Gwesyn - source to conf R Irfon*	1	2.3%	10	0	10	£4,500	£496	0.11
		5	*Cledan - source to conf R Irfon*	2	2.6%	35	1	34	£9,000	£1,715	0.19
		6	*Aran - source to conf R Ithon*	8	0.4%	134	5	128	£36,000	£6,486	0.18
		8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	2	1.4%	45	2	43	£9,000	£2,179	0.24
		9	*Clywedog Bk - source to conf Bachell Bk*	2	0.6%	35	1	34	£9,000	£1,715	0.19
		11	*Howey Bk - source to conf R Ithon*	1	0.3%	18	1	17	£4,500	£857	0.19
		12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	4	0.3%	54	2	52	£18,000	£2,613	0.15
		15	*Mithil Bk - source to conf R Ithon*	1	0.6%	18	1	17	£4,500	£857	0.19
		16	*Nantmel Dulas - source to conf R Ithon*	2	1.6%	22	1	21	£9,000	£1,064	0.12
	Wye Ithon to Hay	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	7	4.8%	143	5	138	£31,500	£6,960	0.22

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Sub Catchment	Operational Catchment	Ref	Failing WB name	Number of PSS	SAGIS percentage contribution from ST	Total current load (kg)	Total upgraded load (kg)	Total load reduction (kg P/yr)	Total estimated cost	Total water quality benefit	Cost benefit ratio
		18	*Bach Howey Bk - source to conf R Wye*	2	5.7%	21	1	20	£9,000	£1,002	0.11
		19	*Builth Dulas Bk - source to conf R Wye*	4	0.8%	71	3	68	£18,000	£3,429	0.19
		22	*Dulas Bk - source to conf Afon Llynfi*	5	6.3%	93	3	89	£22,500	£4,503	0.20
		24	*Edw - conf Clas Bk to conf R Wye*	2	0.5%	8	0	8	£9,000	£413	0.05
		25	*Edw - source to conf Colwyn Bk*	7	1.1%	74	3	71	£31,500	£3,605	0.11
		26	*Scithwen Bk - source to conf R Wye*	1	3.1%	18	1	17	£4,500	£857	0.19
		27	*Triffrwd - source to Dulas*	2	4.7%	48	2	46	£9,000	£2,344	0.26
		28	*Afon Llynfi - source to conf Dulas Bk*	7	7.2%	96	4	92	£31,500	£4,662	0.15
		29	*Clyro Bk - source to conf R Wye*	2	5.3%	24	1	23	£9,000	£1,167	0.13
		30	*Digedi Bk - source to conf R Wye*	2	7.2%	26	1	25	£9,000	£1,270	0.14
	Wye Source to Ithon	33	*Wye - conf Afon Elan to conf R Ithon*	11	0.9%	136	5	130	£49,500	£6,569	0.13
Lower Wye	Trothy	34	*Llanymynech Bk - source to conf R Trothy*	4	5.1%	59	2	57	£18,000	£2,882	0.16
		35	*Llymon Bk - source to conf R Trothy*	5	2.8%	89	4	85	£22,500	£4,287	0.19

Sub Catchment	Operational Catchment	Ref	Failing WB name	Number of PSS	SAGIS percentage contribution from ST	Total current load (kg)	Total upgraded load (kg)	Total load reduction (kg P/yr)	Total estimated cost	Total water quality benefit	Cost benefit ratio
		36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	2	4.3%	35	1	34	£9,000	£1,715	0.19
		37	*Trothy - conf Llymon Bk to conf R Wye*	14	3.7%	190	8	183	£63,000	£9,225	0.15
	Wye OP Catchment	38	*Tintern Bk - source to conf R Wye*	4	24.9%	47	2	45	£18,000	£2,262	0.13

5.4 LEGISLATIVE MEASURES: WATER PROTECTION ZONES

A Water Protection Zone (WPZ) is a statutory designation under Section 93 of the Water Resources Act 1991 which can be applied to a river or it's catchment area to prohibit or regulate polluting activities that could cause harm to water quality and the water environment (Gov, 2025a). A WPZ can be created if it is necessary to stop polluting substances causing environmental harm. Although significant progress has been and will be made to reduce phosphorus pollution in the Wye, the mitigation measures appraised here are not enough to achieve SAC and WFD compliance for all failing waterbodies in the Wye catchment. Therefore, a WPZ may need to be considered by the Welsh Ministers if NRW apply for one in the Welsh part of the Wye catchment.

A WPZ can set rules to ban or restrict activities that may damage the water environment, require sectors to implement actions that aim to protect the water environment, and make it a criminal offence to breach the rules imposed (Gov, 2025a). The following sections outline controls which could be imposed on the sectors

The River Dee WPZ is currently the only one of its kind in the UK, whereby consents are required to carry out controlled activities at industrial or research and development sites, storage or distribution centres and for sites which store or treat water, surface water, effluent or sewage. Inorganic fertilisers are included in the list of controlled substances (which could contain phosphorus) alongside dangerous, medicinal, cosmetic, toxic, corrosive, harmful and irritant substances. Retail, construction and agricultural sites are exempt, and orders do not apply for activities permitted under the Environmental Permitting Regulations 2010. The following sections describe potential controls that could be applied to each sector to reduce diffuse and point source pollution in the River Wye.

5.4.1 Agricultural controls

The following mitigation measures assessed in this report that currently apply to the agricultural sector under The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021, Silage, Slurry and Agricultural Fuel Oil (SSAFO) Regulations 2010 and The Environmental Permitting (England and Wales) Regulations 2016 are:

- Fertiliser spreader calibration,
- Use a fertiliser recommendation system,
- Integrate fertiliser and manure nutrient supply,
- Do not apply manufactured fertiliser to high-risk areas,
- Avoid spreading manufactured fertiliser to fields at high-risk times,
- Do not apply P fertilisers to high P index soils,
- Increase the capacity of farm slurry stores to improve timing of slurry applications,
- Minimise the volume of dirty water produced (sent to dirty water store),
- Minimise the volume of dirty water produced (sent to slurry store),
- Site solid manure heaps away from watercourses/field drains,
- Manure Spreader Calibration,
- Do not apply manure to high-risk areas,
- Do not spread slurry or poultry manure at high-risk times,
- Do not spread FYM to fields at high-risk times,
- Incorporate manure into the soil,
- Capture of dirty water in a dirty water store.

The above measures ensure that farmers:

- Maintain up to date risk maps for inorganic and organic fertiliser applications (slope, locations of watercourses, land drains, boreholes, wells, springs, manure heaps),
- Observe buffer zones for watercourses, boreholes, wells or springs,
- Apply manures using techniques that reduce risks of nutrient run-off or leaching (low trajectory slurry spreading, incorporation of manures, closed periods, nitrogen limits, nutrient records),
- Store manures in a way that reduces risks of nutrient run-off or leaching (field heap site, slurry, manure and silage store construction,
- Observe permits for intensive poultry or pig units to prevent pollution.

The existing level of compliance with the current legislation is 40.8% (Welsh government, 2025a). Improving the level of compliance was estimated to reduce phosphorus loading from agriculture by 13% across the Wye catchment). It is recommended that compliance with existing regulation is improved before NRW introduce increased controls as part of a WPZ.

5.4.2 Wastewater controls

Further legislative controls have already been introduced to reduce phosphorus concentrations from the wastewater sector. The Water (Special Measures) Act 2025 has been introduced to support the Environment Act 2021 to reduce sewage pollution by 50% by 2030 and reduce phosphorus concentrations in final treated effluent by 50% by 2028 and 80% by 2038 (Gov, 2025b). Significant investment has been planned for AMP8 in the Wye catchment to meet wastewater's fair share target. Therefore, further legislative controls in the Wye catchment are not required.

5.4.3 Urban controls

Septic tanks and package treatment plants at residential properties that cannot connect to a main sewer, are not within 500m of an protect site (including SAC), and with discharge less than or equal to $5m^3$/day to a watercourse or $2m^3$/day to groundwaters are eligible for free registration which means they will be exempt from the Environmental Permitting Regulations 2016 (NRW, 2025g). However, these exemptions do not apply for any properties discharging near or to SAC sites. NRW have provided ST or PTP owners with maintenance guidance, which includes ensuring annual maintenance and emptying (NRW, 2025b). For larger ST and PTP the Environmental Permitting Regulations 2016 apply, which states they must have environmental permits and not cause pollution to surface or groundwater (Gov, 2025c). Therefore, further legislative controls in the Wye catchment are not required.

6. KNOWLEDGE GAPS

The following knowledge gaps, identified from the analysis, are outlined below.

There is a lack of water quality monitoring data collected by NRW in the following waterbodies, therefore WFD compliance cannot be assessed:

- 32. Afon Claerwen - source to conf Afon Arban.
- 38. *Tintern Bk - source to conf R Wye.*

There is a lack of monitored data on the sources and pathways of phosphorus pollution to the River Wye from agricultural sources. Phosphorus loading from agricultural sources and the percentage load reductions achieved from mitigation measures has been quantified using Farmscoper modelling (V5). Farmscoper is an environmental decision support tool used to assess diffuse agricultural pollution and quantify the impacts of mitigation measures, using data derived from Defra’s June Agricultural Survey (ADAS, 2025). The model is based on a wide range of peer reviewed research, field trials and national datasets, and standard practices and implementation rates for the Wye catchment have been used at the Wye catchment scale (ADAS, 2025). However, the percentage load reductions have been modelled at the Wye catchment scale and applied to the waterbody catchment scale, as there is a lack of open-source data available on farming practices at the waterbody scale. This provides an estimated load reduction percentage from the mitigation measures; however, this will be not entirely reflective of real-world impacts for each waterbody catchment.

7. ACTION PLAN

The following sections outline:

- The progress on the Phosphate Action Plan 2021 to date,
- A Catchment Wide Action Plan, which outlines the main findings from the options appraisal that should be considered in the Wye Nutrient Management Plan and the Wye Catchment Plan.
- A monitoring framework that can be used if the actions are taken forward as part of the Wye Nutrient Management Plan and the Wye Catchment Plan.

7.1 PHOSPHATE ACTION PLAN 2021 PROGRESS TO DATE

The River Wye SAC Nutrient Management Plan Phosphate Action Plan was outlined by NRW, NE and EA as part of the previous Wye Nutrient Management Plan completed in 2021 (Herefordshire Council, 2021). Table 25 outlines the main actions identified, the progress completed to date and the estimated load reduction achieved from on-the-ground measures.

Table 25 Actions outlined in the Phosphate Action Plan 2021, including the progress to date and estimated phosphorus reductions achieved from actions.

Action	Detail	Progress	Phosphorus reduction achieved	End date
Investigations				
Investigate inputs from septic tanks		23kg P/yr input from septic tanks, 1,565kg P/yr from package treatment plants identified in this report (Section 0).	None	No end date
Investigate inputs from industry		Eight industrial sites identified in Welsh Wye in this report, none present in 2024 failing waterbodies (Section 0).	None	No end date
Investigations based on geography (hot spots)		Sediment risk mapping completed in this report (Section 0).	None	No end date
Certainty from voluntary actions (agri-environment measures)	TAG to consider how much certainty can be attributed to voluntary actions.	Farmscoper modelling completed for this report suggests voluntary actions (agri-environment measures) can reduce phosphorus loading from agriculture by up to 44%.	None	No end date
Legacy phosphorus	Consider outcomes of RePhokUS project.	Project outcomes used to inform Farmscoper modelling and mitigation actions in this report.	None	No end date
Water protection zone	EA to lead thinking on whether a water protection zone is required.	Water protection zone considered in this report for failing waterbodies where load reduction targets cannot be met from agriculture.	None	No end date
Desk study into Phosphate treatment of Farm wastes	Project to establish innovative approaches to reducing phosphate losses from agriculture.	Outcomes paper produced.	None	2025
Evidence review	Review existing evidence and define further work.	Completed in this report (Section 3).	None	No end date
Farmscoper runs	Consider if Farmscoper re-runs add value.	Completed in this report (Section 5.1.2).	None	No end date
Review and map all know data	Review and map all known data (WQ, ecological, agriculture data, permitted discharges, biosolid notifications).	WQ, ecological, permitted discharges, land cover and sediment risk mapping completed in this report (Section 4).	None	No end date

Action	Detail	Progress	Phosphorus reduction achieved	End date
Catchment Sensitive Farming review	Project to increase understanding of the successes, shortcomings of CSF, and future opportunities. Quantify reductions from CSF, list measures that reduce P, rank certainty, forecast future reductions from CSF.	Current Welsh agri-environment schemes, all potential agri-environment measures that could be included in new agri-environment schemes and all possible measures assessed in this report.	None	No end date
Groundwater / surface water abstractions	Assess potential to effect base flow and dilution of discharges.		None	No end date
Citizen science	Six citizen science projects in the Wye catchment.	Citizen science data included in the evidence base of this report.	None	No end date
Identify highways as diffuse pollution pathways	Consider potential interventions.	Local authorities to update.	None	No end date
Monitoring				
RBMP working group to agree target across Wales and England	Being discussed as part of River Basin Management Plan review.	NRW/ EA/ NE to report to TAG.	None	2021
Agree monitoring requirements across England and Wales		SAC and WFD compliance monitoring completed.	None	No end date
Wastewater actions				
STW improvements	Upgrade 12 STW in Wales to reduce phosphorus concentration in final treated effluent.	Four upgrades in AMP7. Five upgrades in AMP8 (see Section 5.2).	AMP7: 5,080kg AMP8: 1,834kg **Total: 6,914kg**[1]	2027
DCWW Storm Overflow Assessment Framework (SOAF)	CSO spill monitoring at Event Duration Monitor Sites to target CSO upgrades.	Monitoring undertaken at 42 CSOs in South East Wales by DCWW (see Section 0).	None	2025
Agriculture actions				
Farming Connect: review of catchments and priorities	Targeted pollution prevention.	Four farming connect farms in the Welsh Wye catchment, Farming Connect to report outcomes to TAG.	None	2021
NRW targeted farm inspection programme	Dairy project, poultry/pig farm visits. Ithon opportunity catchment partnership programme.	NRW to report to TAG.	None	2022

Action	Detail	Progress	Phosphorus reduction achieved	End date
Sub-catchment actions				
River restoration work along all main rivers and tributaries	River restoration to reduce pollution risks and improve ecological resilience.	River restoration completed through Upper Wye Restoration Project (2.7km Afon Marteg, 1.6km River Irfon, Wye and Usk Foundation (WUF) Habitat Restoration project aims to improve riparian zones) (see Section 0).	6.74kg	No end date
Identify point sources of all main rivers	Identify point sources from DCWW, private works, septic tanks, CSO, agricultural units, anerobic digestion plants.	DCWW, septic tanks, package treatment plants and industrial sites identified in this report (see Section 5.3.3 and 5.3.4).	None	No end date
Natural flood management	Encourage natural flood management in all main rivers.	Integrated Wetlands and Woodlands for Water projects by WUF completed.	None	No end date
Groundwater pollution sources	Identify sources discharging into ground.		None	No end date
Target sub-catchment work based on phosphate evidence report	Target sub-catchment work based on phosphate evidence report taking into account wider evidence.	Sub-catchment projects identified and being undertaken.	None	No end date
Influence farming practices	Use catchment officers to influence farming practices.		None	No end date
Ditch blocking and wetland restoration		Integrated Wetlands and Woodlands for Water projects by WUF completed.	None	No end date

[1]See Appendix J for full list of STWs included in Phosphate Action Plan actions.

The NMP actions mainly focus on investigative actions, most of which have been completed through the production of this report. There has also been significant progress on actions for the Wastewater sector through AMP7 and planned AMP8 upgrades (Section 4.2), and river restoration projects at the sub-catchment scale on agricultural land (Section 4.1.1).

7.2 WELSH WYE CATCHMENT RECOMMENDATIONS

Catchment wide recommendations that could be considered in the updated Wye NMP have been outlined in Table 26. Monitoring metrics and measures of success for each of these recommendations have been outlined in Section 6.3.1.

Table 26 Welsh Wye Catchment recommendations 2024.

Sector / source	Recommendation	Effectiveness
Agriculture	Increase level of regulatory compliance.	Achieving 100% regulatory compliance will reduce phosphorus loads from agriculture by 18% across the Welsh Wye.
	Encourage uptake of best practice measures and existing agri-environment schemes in Wales.	Sector phosphorus concentration reductions can be achieved to meet SAC compliance in 22 out of 38 failing waterbodies.
	Collaborate with NRW, DCWW, Wye and Usk to track mitigation measures delivered through regulation, best practices, agri-environment schemes and other catchment projects.	Enables mitigation measures to be monitored and quantified.
Wastewater	Reduce phosphorus concentrations in final treated effluent in-line with AMP8 investment programme.	Fair share targets can be achieved.
Other	Engage with PSS owners to raise awareness about nutrient pollution, identify funding opportunities to support PSS upgrades.	A phosphorus concentration reduction of 97% can be achieved from the PSS.

7.3 PROPOSED MONITORING FRAMEWORK

The below sections detail a proposed monitoring framework which Herefordshire Council can use to provide regular progress updates for the delivery of the updated Wye NMP.

7.3.1 Scope

This monitoring framework outlines how Herefordshire Council will track and evaluate the implementation of the actions taken forward in the updated NMP.

7.3.2 Objectives

The objective of a monitoring framework are:

1. To track the implementation of the mitigation actions recommended in the updated Wye NMP,
2. To track progress to achieving SAC and WFD compliance in failing waterbody catchments,
3. To identify any risks or gaps to achieving SAC and WFD compliance.

7.3.3 Monitoring

Table 27 outlines the key monitoring components and potential metrics and measures of success that could be used in the updated Wye NMP.

Table 27 Monitoring components required to track and assess progress of mitigation measures taken forward into the updated NMP.

Monitoring component	Owner	Methods	Potential metrics / measures of success
Water quality sampling	NRW	Compliance monitoring for orthophosphate. Citizen science water quality sampling.	Phosphorus concentration (mg/l).
Agricultural regulatory compliance	NRW	Compliance inspections on farms.	Percentage or number of farms compliant with regulations.
Agricultural mitigation measures uptake	NRW, Herefordshire Council	Compliance inspections Agri-environment scheme uptake. NRW funded interventions (e.g., Upper Wye Restoration Project).	Type and area (hectares) of mitigation measures implemented. Percentage or number of farms implementing mitigation measures.
Delivery of AMP8 wastewater upgrades	DCWW	Upgrades to treatment process at STWs.	Number of STW upgrades. Upgrade type. Phosphorus concentration (mg/l)
PSS regulatory compliance	NRW	Compliance inspections at residential properties.	Percentage or number of PSS inspected. Percentage or number of PSS owners compliant with regulations.

7.3.4 Reporting and evaluation

If the recommendations are bought forward into the updated Wye NMP, the progress of delivering the recommendations should be reported to the NMB annually, including phosphorus concentration reductions from sources where it is possible to quantify. Annual reviews and evaluation will allow the progress of the implementation of any recommendations to be tracked.

7.3.5 Risks and mitigation

Risks that could impact the delivering of a monitoring framework and potential mitigation strategies to address the risks have been identified in Table 28.

Table 28 Potential risks and mitigation opportunities that could impact the monitoring framework.

Risk	Potential mitigation
Insufficient data on mitigation measure implementation for agriculture	Collaborate with NRW, DCWW, NGOs (including Wye and Usk Foundation), Citizen Science, catchment partnerships, farm cluster groups and local landowners to collect and collate mitigation measures on farms.
Limited capacity to complete farm inspections	Target high risks areas outlined in Section 4.1.2.3 to have the largest impact.
Limited funding to implement mitigation measures for agriculture	Encourage uptake of agri-environment schemes.
Limited funding to implement PSS upgrades.	PSS found to be non-compliant and causing pollution should be upgraded at the expense of the polluter.

8. AMMONIA AND NITRATE MANAGEMENT: CURRENT STRATEGIES AND FUTURE NEEDS

Ammonia concentrations across the Welsh Wye catchment have achieved WFD good status (Figure 24), however one waterbody catchment has failed for ammonia in the most recent SAC compliance assessment (Figure 23) (NRW, 2024d). The failing waterbody was 11. *Howey Bk - source to conf R Ithon*. Analysis of NRW's water quality sampling data did not show a statistically significant increasing trend over time at sampling site Howey Brook At Confl River Ithon (slope -0.00004 mg/L per day, R^2 = 0.01, p value = 0.47).

Nitrate (N) is not assessed as part of SAC or WFD compliance, however it is monitored. Statistical analysis of NRW's nitrate-as-N sampling data shows only one monitoring site to have a statistically significant trend at Llangorse Lake (slope = -0.0002 per day, p value = 0.04) in waterbody 28. *Afon Llynfi - source to conf Dulas Bk*. This equates to a decrease of 0.073 mg/L per year at the site.

Citizen science data shows that in the Wye catchment nitrate concentrations are higher on the English side and in a few limited source waterbody catchments (Figure 25).

Figure 23: Ammonia SAC compliance assessment, 2021 and 2024 comparison

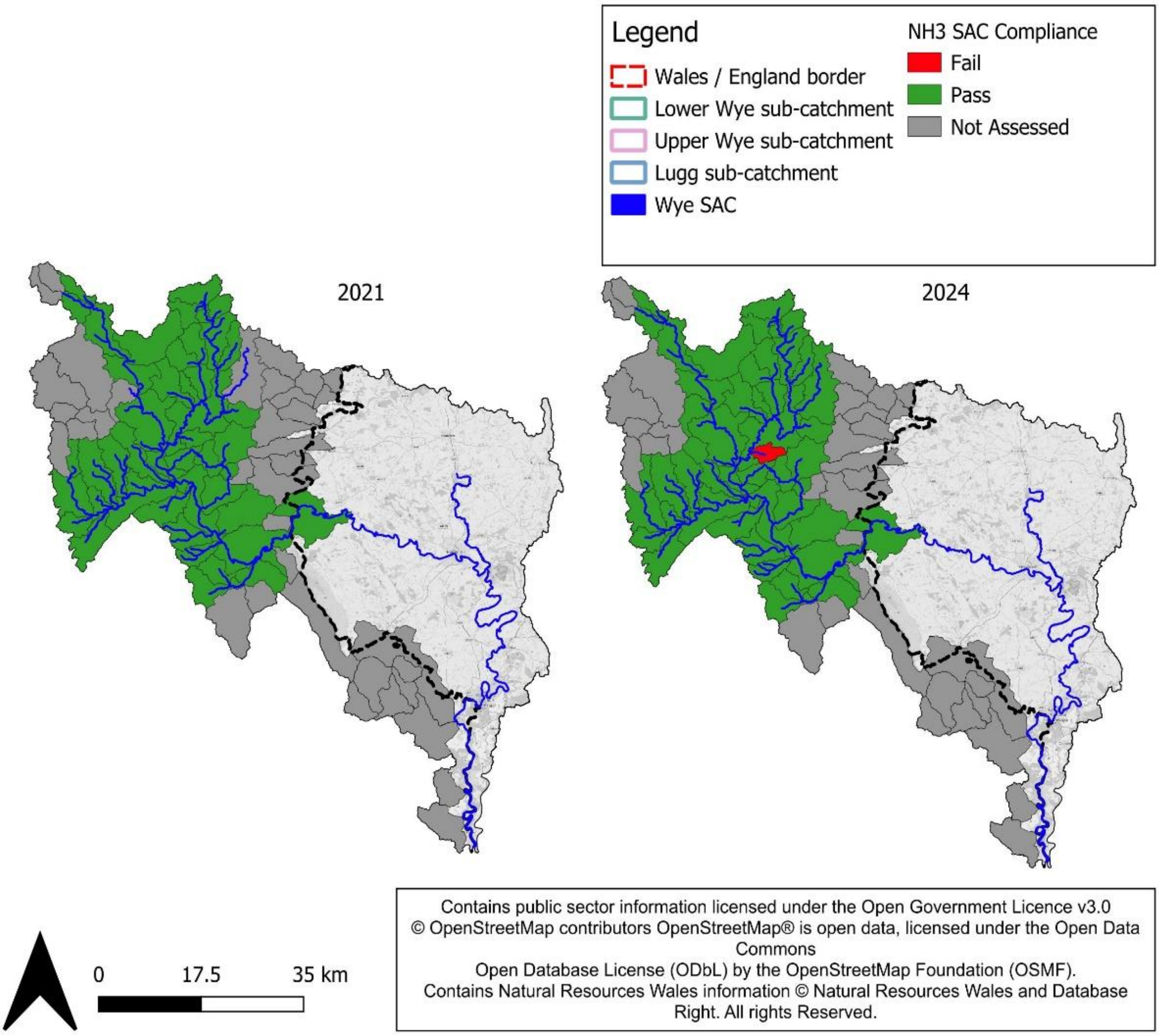


Figure 24: Ammonia WFD compliance assessment, 2021 and 2024 comparison

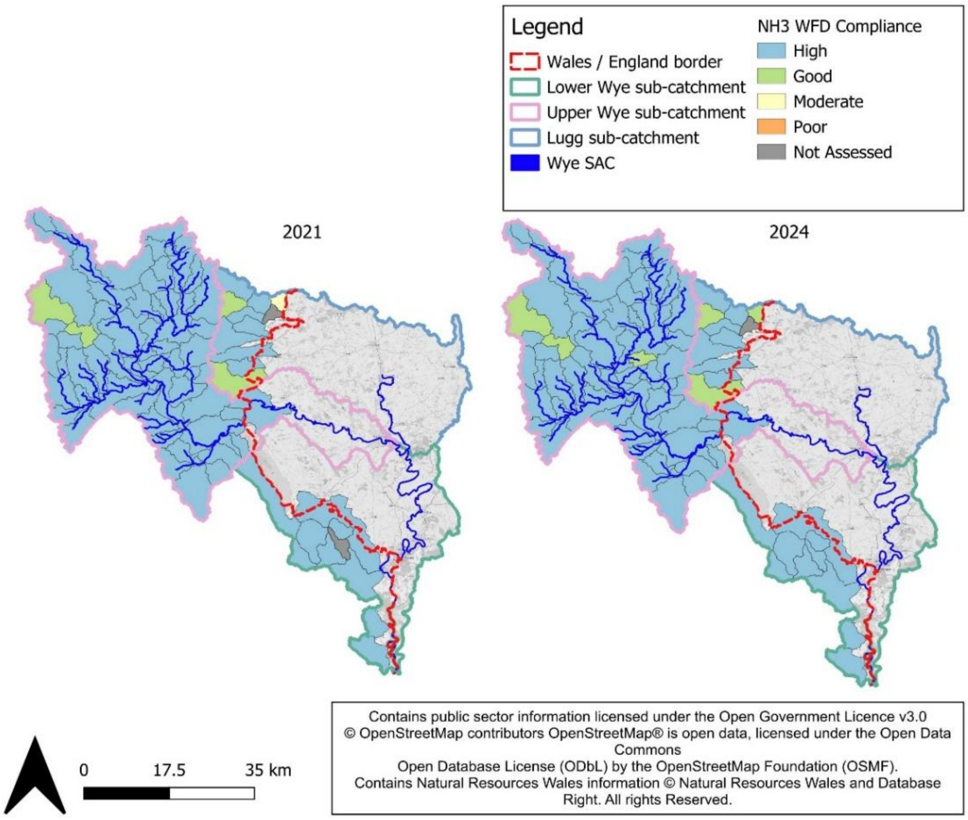
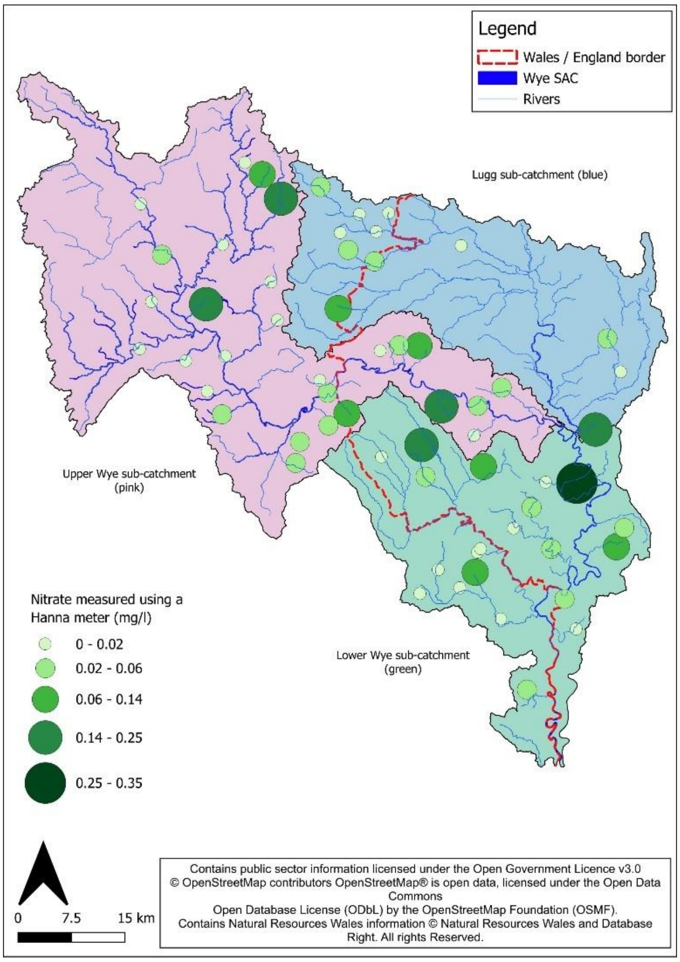


Figure 25: Average Nitrate measured by Citizen Science in mg/l



Nitrogen-containing compounds serve as a source of nutrition for algae and cyanobacteria. Nitrate is stable in aerobic water and is used by plants and cyanobacteria to grow (Litchman *et al.,* 2003; Welsh Government, 2022). Nitrite is typically an intermediate product during ammonium oxidation to nitrate; therefore, nitrite does not remain in solution for long periods and is often not considered to be the most important specie of nitrogen. Nitrite is commonly considered alongside the concentration of nitrate when determining the concentration of total oxidised nitrogen (TON) which can be important when considering nutrient ratios (Litchman *et al.,* 2003; Welsh Government, 2022). Ammonium is also bioavailable to plant and cyanobacteria and may also fuel cyanobacterial growth resulting in toxin production (Litchman *et al.,* 2003; Welsh Government, 2022). Nitrogen is more soluble in water during periods of lower water temperatures whereas warmer water temperatures help remove the nitrogen from the water.

River sediments may act as a sink for nitrogen, with nitrogen being released from the sediment to the water under varying conditions e.g., low pH, anaerobic conditions and sediment disturbance (Welsh Government, 2022). Anthropogenic sources of N contribute towards the N load within a river, e.g., nitrogen is frequently applied to the land as fertiliser in the form of Ammonium Nitrate; however, excess fertiliser is prone to run-off during periods of heavy rainfall, making agricultural processes among the worst N polluters within the UK (Galloway *et al.,* 2008). In non-polluted areas, much of the combined atmospheric nitrogen is in the form of Ammonia a significant amount of which originated from the decomposition of terrestrial organic matter. The main source of entry for N into a water course is through organic waste (fish, bird, mammal) and via run-off from fertilised land during a period of heavy rainfall (Grey *et al*., 2002). When a river water level is lower during the summer season, nitrogen may be released from the peripheral sediment into the water during episodes of heavy rainfall. Plant uptake within exposed sediment during the summer period can significantly reduce sediment N during periods of growth through removal and assimilation of N-fractions during the growing phase but is returned to the river following plant senescence and decay (Welsh Government, 2022).

The whole of Wales is designated a Nitrate Vulnerable Zone (NVZ), introduced under the Water Resources (Control of Agricultural Pollution) (Wales) Regulations in 2021. NVZs aim to improve nutrient management on farms (Gov, 2025d). This includes limiting nitrogen applications from livestock manures to 170kg N per ha on average across the whole farm, with individual fields not receiving more than 250 kg N per ha from all organic manures, ensuring nutrient applications are planned for crop need, risk mapping the farm to reduce nutrient leaching or run-off, storing manure in suitable concrete stores or temporary field heaps and enforcing *“closed periods”* during the month months when nitrate must not be spread in fertilisers or manures (Gov, 2025d). These actions limit the risk of nitrate polluting ground and surface waters.

In addition to nitrate and ammonia monitoring, the EA and NRW are collaborating with partners and stakeholders to tackle water quality issues in the River Wye as part of the River Severn River Basin Management Plan Gov, (2022*)*. This includes increasing farm visits to provide targeted advice, and conducting detailed investigations into the management of poultry manure.

The mitigation measures assessed for the agricultural sector in this report that encourage improvements to soil health and nutrient management will have a positive impact on reducing nitrate and ammonia run-off to surface water. It is expected that if the recommendations are taken forward into the updated NMP, ammonia and nitrate trends will not increase overtime and the management of phosphorus will also support the management of nitrate and ammonia.

9. CONCLUSION

This report has demonstrated that phosphorus remains the principal nutrient pressure in the Welsh Wye, driving non-compliance with WFD or SAC targets as well as effecting the ecological health of individual waterbodies. The evidence presented demonstrated that the agricultural sector is the largest source of phosphorus concentration within failing waterbodies, followed by wastewater final treated effluent discharges and urban private sewerage. Extensive modelling and scenario analysis indicated that substantial reductions in agricultural phosphorus loading can be achieved through targeted regulatory compliance, best practice and agri-environment interventions, supported by planned upgrades to WwTW. Upgrades to PSS can reduce phosphorus concentrations from these sources by 97%, however it may not be cost beneficial when compared to the monetary benefit gained from water quality improvement.

The mitigation measures appraised here can deliver contribute to achieving SAC and WFD compliance in 25 failing waterbody catchments, with the remaining catchments expected to make significant progress towards compliance (a minimum of 71%). Not all mitigation measures assessed are cost beneficial (including *"all possible measures"* and land use change for agricultural concentration reductions, and PSS upgrades for other source reductions).

It is recommended that the evidence base and options appraisal presented here for Wales is compared to the Environment Agency's Diffuse Water Pollution Plan to bring together cross border initiatives and inform potential recommendations for a future Wye Nutrient Management Plan and Wye Catchment Plan. Through collective implementation of mitigation measures on both sides of the border, the River Wye's internationally important habitats and species can be safeguarded, and the quality of the water environment will be improved.

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APPENDIX A SAC AND WFD COMPLIANCE

Table 29 Comparison of SAC compliance for 2021 and 2024 at the water body scale for the Wye Catchment.

Wye sub-catchment	Water body name	Threshold (mg/l)	2021 Assessment		2024 Assessment	
			SAC Compliance	Average annual P concentration (mg/l)	SAC Compliance	Average annual P concentration (mg/l)
Upper Wye	*Afon Cammarch - source to conf R Irfon*	0.010	Fail	0.046	Pass	0.007
	Afon Chwefru - source to conf R Irfon	0.010	Fail	0.022	Fail	0.015
	Afon Garth Dulas - source to conf R Irfon	0.010	Fail	0.015	Pass	0.004
	Afon Gwesyn - source to conf R Irfon[1]	0.010	Fail	0.012	Fail	0.012
	Cledan - source to conf R Irfon	0.010	Fail	0.018	Fail	0.016
	Irfon - conf Afon Gwesyn to conf Cledan	0.010	Pass	0.008	Pass	0.004
	Irfon - conf Cledan to conf R Wye	0.010	Fail	0.024	Pass	0.005
	Tirabad Dulas - source to conf R Irfon	0.010	Pass	0.008	Pass	0.005
	Aran - source to conf R Ithon	0.015	N/A	N/A	Fail	0.020
	Bachell Bk - source to conf Clywedog Bk	0.010	Pass	0.004	Pass	0.003
	Camddwr Bk - source to conf R Ithon	0.013	Fail	0.020	Fail	0.024
	Clywedog Bk - conf Bachell Bk to conf R Ithon	0.010	Fail	0.015	Fail	0.011
	Clywedog Bk - source to conf Bachell Bk	0.010	Pass	0.009	Fail	0.012
	Gwenlas Bk - source to conf R Ithon	0.010	Fail	0.024	Fail	0.033
	Howey Bk - source to conf R Ithon	0.015	Fail	0.025	Fail	0.044
	Ithon - conf Camddwr Bk to conf R Wye	0.025	Pass	0.017	Pass	0.020
	Ithon - conf Gwenlas Bk to conf Camddwr Bk	0.010	Fail	0.013	Fail	0.012
	Ithon - conf Llaethdy Bk to conf Gwenlas Bk	0.010	Fail	0.013	Fail	0.012
	Ithon - source to conf Llaethdy Bk	0.010	Pass	0.008	Fail	0.011
	Llaethdy Bk - source to conf R Ithon	0.010	Pass	0.007	Pass	0.006
	Mithil Bk - source to conf R Ithon	0.015	Fail	0.040	Fail	0.042
	Nantmel Dulas - source to conf R Ithon	0.010	Fail	0.021	Fail	0.019
	Afon Llynfi - conf Dulas Bk to conf R Wye	0.025	Fail	0.077	Fail	0.059
	Bach Howey Bk - source to conf R Wye	0.015	Fail	0.029	Fail	0.032
	Builth Dulas Bk - source to conf R Wye	0.015	Fail	0.016	Fail	0.018

Wye sub-catchment	Water body name	Threshold (mg/l)	2021 Assessment		2024 Assessment	
			SAC Compliance	Average annual P concentration (mg/l)	SAC Compliance	Average annual P concentration (mg/l)
	Camnant Brook - source to confluence R Edw	0.015	Fail	0.024	Fail	0.048
	Clettwr Bk - source to conf R Wye	0.015	Fail	0.041	Fail	0.022
	Duhonw - source to conf R Wye	0.015	Fail	0.015	Pass	0.008
	Dulas Bk - source to conf Afon Llynfi	0.025	Fail	0.074	Fail	0.035
	Edw - conf Camnant Bk to conf Clas Bk	0.015	Fail	0.020	Fail	0.037
	Edw - conf Clas Bk to conf R Wye	0.015	Fail	0.020	Fail	0.016
	Edw - source to conf Colwyn Bk	0.015	Fail	0.030	Fail	0.023
	Scithwen Bk - source to conf R Wye	0.015	Fail	0.019	Fail	0.020
	Triffrwd - source to Dulas	0.015	Fail	0.070	Fail	0.033
	Wye - conf R Irfon to Scithwen Bk	0.016	Fail	0.023	Pass	0.007
	Wye (Avon Gwy) - conf R Ithon to conf R Irfon	0.015	Pass	0.008	Pass	0.008
	R Wye - conf Walford Bk to Bigsweir Br	0.039	Fail	0.052	Pass	0.034
	Wye - Scithwen Bk to Brewardine Br	0.020	Pass	0.019	Pass	0.007
	Afon Bidno - source to conf R Wye	0.010	Pass	0.001	Pass	0.002
	Afon Elan - Caban-coch Rsvr to conf R Wye	0.010	N/A	N/A	Pass	0.002
	Afon Marteg - source to conf R Wye	0.013	Pass	0.007	Pass	0.007
	Wye - conf Afon Bidno to conf Afon Marteg	0.010	Pass	0.002	Pass	0.002
	Wye - conf Afon Elan to conf R Ithon	0.010	Fail	0.037	Fail	0.012
	Wye - conf Afon Tarenig to conf Afon Bidno	0.010	Pass	0.002	Pass	0.002
	Wye - conf to conf Afon Marteg to conf Afon Elan	0.020	Pass	0.011	Pass	0.012

[1]Note this waterbody catchment was not assessed in 2024, the result is 2021 rolled forward.

Table 30 Comparison of WFD phosphorus compliance in 2021 and 2024 for the remaining catchment waterbodies not covered by SAC compliance

Wye sub-catchment	Waterbody name	WFD 2021 compliance	WFD 2024 compliance
Lugg	*Arrow - source to conf Gladestry Bk*	Good	Good
	Bleddfa Bk - source to conf R Lugg	Good	Good

Wye sub-catchment	Waterbody name	WFD 2021 compliance	WFD 2024 compliance
	Cascob Bk - source to conf R Lugg	N/A	N/A
	Gilwern Bk - source to conf R Arrow	N/A	Moderate
	Gladestry Bk - source to conf R Arrow	N/A	N/A
	Hindwell Bk - source to conf Knobley Bk	Good	High
	Knobley Bk - source to conf Hindwell Bk	Good	High
	Lugg - conf Bleddfa Bk to conf Cascob Bk	High	N/A
	Lugg - conf Cascob Bk to conf Norton Bk	N/A	N/A
	Lugg Bk - source to conf Bleddfa Bk	High	N/A
	Norton Bk - source to conf R Lugg	Poor	Poor
Upper Wye	*Irfon - source to conf Afon Gwesyn*	High	High
	Afon Llynfi - source to conf Dulas Bk	Moderate	Moderate
	Clas Bk - source to conf R Edw	Good	N/A
	Clyro Bk - source to conf R Wye	Poor	Poor
	Digedi Bk - source to conf R Wye	Poor	Poor
	Ennig - source to conf Afon Llynfi	Moderate	Good
	Afon Arban - source to conf Afon Claerwen	Good	N/A
	Afon Claerwen - conf Afon Arban to Caban-coch	Moderate	Moderate
	Afon Claerwen - source to conf Afon Arban	Moderate	Moderate
	Afon Elan - source to Pont ar Elan	High	N/A
	Afon Tarenig - source to conf R Wye	High	High
	Rhiwnant - source to conf Afon Claerwen	High	N/A
	Wye - source to conf Afon Tarenig	High	High
Lower Wye	*Afon Honddu - source to conf R Monnow*	High	N/A
	Monnow - conf Afon Honddu to conf R Wye	High	High
	Norton Bk - source to conf R Monnow	High	N/A
	Llanymynech Bk - source to conf R Trothy	Moderate	Moderate
	Llymon Bk - source to conf R Trothy	N/A	Moderate
	Trothy - conf Llanymynach Bk to conf Llymon Bk	Moderate	Moderate
	Trothy - conf Llymon Bk to conf R Wye	Moderate	Moderate
	Trothy - source to conf Llanymynech Bk	Good	N/A

Wye sub-catchment	Waterbody name	WFD 2021 compliance	WFD 2024 compliance
	Mounton Bk - source to R Severn Estuary	Good	N/A
	Tintern Bk - source to conf R Wye	Moderate	Moderate

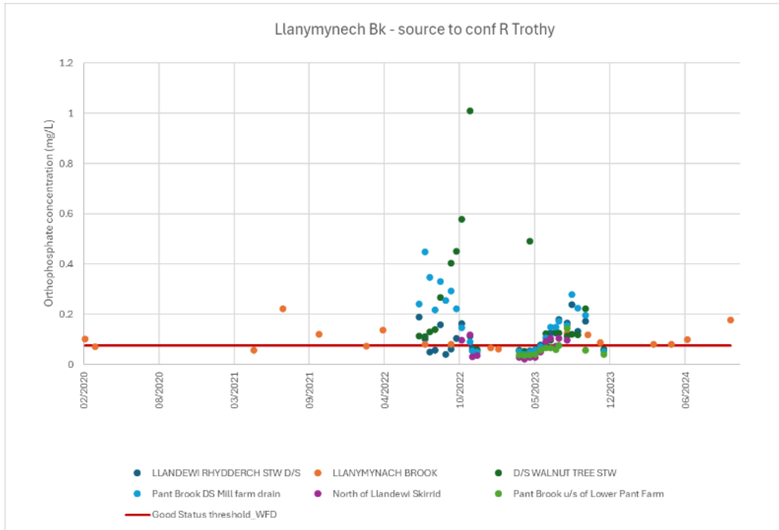
Table 31 Summary of target P concentration and average concentration for SAC and WFD failing waterbodies in 2024 (based on official NRW assessments for SAC using 2020-2023 data and monitored water quality data collected between 2020 and 2024 for WFD).

Main catchment	Operational catchment	Reference number	Water body name	SAC or WFD Target	2024 compliance	Target concentration (µg/l)	Average P concentration (µg/l)
River Lugg	Arrow Lugg and Frome	1	*Gilwern Bk - source to conf R Arrow*	WFD	Moderate	-	-
	Lugg	2	*Norton Bk - source to conf R Lugg*	WFD	Poor	35	97
River Wye	Irfon	3	*Afon Chwefru - source to conf R Irfon*	SAC	Fail	10	15
		4	*Afon Gwesyn - source to conf R Irfon*	SAC	Fail	10	12
		5	*Cledan - source to conf R Irfon*	SAC	Fail	10	16
	Ithon	6	*Aran - source to conf R Ithon*	SAC	Fail	15	20
		7	*Camddwr Bk - source to conf R Ithon*	SAC	Fail	13	24
		8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	SAC	Fail	10	11
		9	*Clywedog Bk - source to conf Bachell Bk*	SAC	Fail	10	12
		10	*Gwenlas Bk - source to conf R Ithon*	SAC	Fail	10	33
		11	*Howey Bk - source to conf R Ithon*	SAC	Fail	15	44
		12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	SAC	Fail	10	13
		13	*Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	SAC	Fail	10	12
		14	*Ithon - source to conf Llaethdy Bk*	SAC	Fail	10	11
		15	*Mithil Bk - source to conf R Ithon*	SAC	Fail	15	42
		16	*Nantmel Dulas - source to conf R Ithon*	SAC	Fail	10	19
	Wye - Ithon to Hay	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	SAC	Fail	25	59
		18	*Bach Howey Bk - source to conf R Wye*	SAC	Fail	15	32
		19	*Builth Dulas Bk - source to conf R Wye*	SAC	Fail	15	18
		20	*Camnant Brook - source to confluence R Edw*	SAC	Fail	15	48

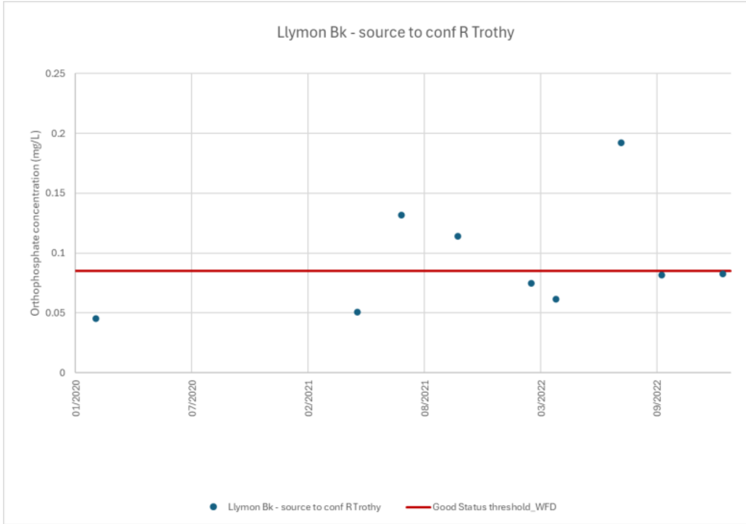
Main catchment	Operational catchment	Reference number	Water body name	SAC or WFD Target	2024 compliance	Target concentration (µg/l)	Average P concentration (µg/l)
		21	*Clettwr Bk - source to conf R Wye*	SAC	Fail	15	22
		22	*Dulas Bk - source to conf Afon Llynfi*	SAC	Fail	25	35
		23	*Edw - conf Camnant Bk to conf Clas Bk*	SAC	Fail	15	37
		24	*Edw - conf Clas Bk to conf R Wye*	SAC	Fail	15	16
		25	*Edw - source to conf Colwyn Bk*	SAC	Fail	15	23
		26	*Scithwen Bk - source to conf R Wye*	SAC	Fail	15	20
		27	*Triffrwd - source to Dulas*	SAC	Fail	15	33
		28	*Afon Llynfi - source to conf Dulas Bk*	WFD	Moderate	52	76
		29	*Clyro Bk - source to conf R Wye*	WFD	Poor	62	71
		30	*Digedi Bk - source to conf R Wye*	WFD	Poor	64	36
	Wye source to Irthon	31	*Afon Claerwen - conf Afon Arban to Caban-coch*	WFD	Moderate	28	4
		32	*Afon Claerwen - source to conf Afon Arban*	WFD	Moderate	-	-
		33	*Wye - conf Afon Elan to conf R Ithon*	SAC	Fail	10	13
	Trothy	34	*Llanymynech Bk - source to conf R Trothy*	WFD	Moderate	75	130
		35	*Llymon Bk - source to conf R Trothy*	WFD	Moderate	85	93
		36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	WFD	Moderate	79	90
		37	*Trothy - conf Llymon Bk to conf R Wye*	WFD	Moderate	84	99
	Wye OC	38	*Tintern Bk - source to conf R Wye*	WFD	Moderate	-	-

APPENDIX B TIME SERIES IN NON-COMPLIANT WATERBODIES

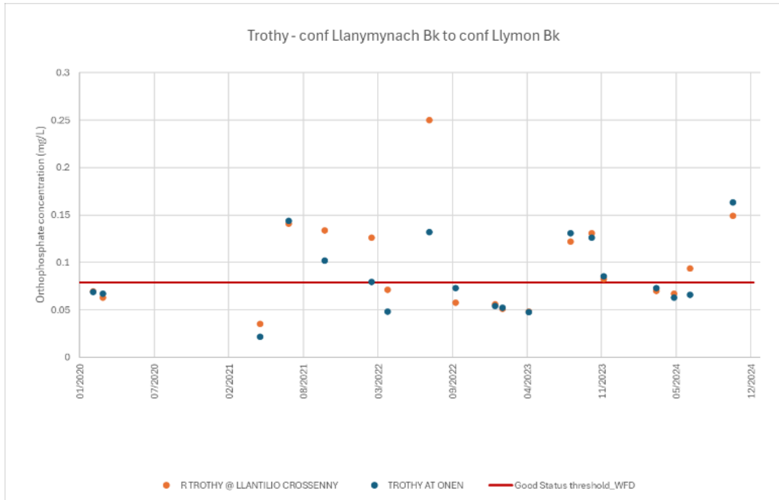
Figure 26: Phosphorus concentration over time, covering 2020-2024 data in WFD non-compliance waterbodies



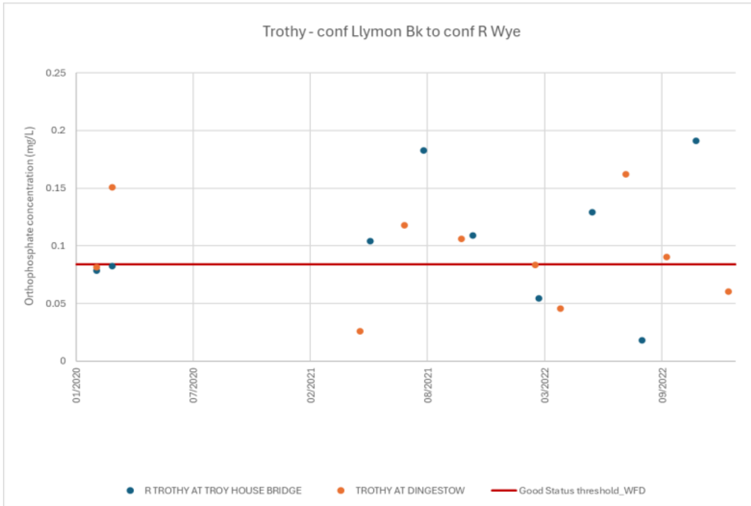
Llanymynech Bk - source to conf R Trothy
Orthophosphate concentration (mg/L)
LLANDEWI RHYDDERCH STW D/S
LLANYMYNACH BROOK
D/S WALNUT TREE STW
Pant Brook DS Mill farm drain
North of Llandewi Skirrid
Pant Brook u/s of Lower Pant Farm
Good Status threshold_WFD



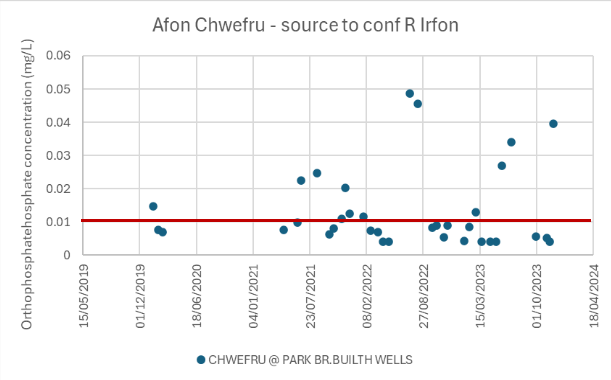
Llymon Bk - source to conf R Trothy
Orthophosphate concentration (mg/L)
Llymon Bk - source to conf R Trothy
Good Status threshold_WFD

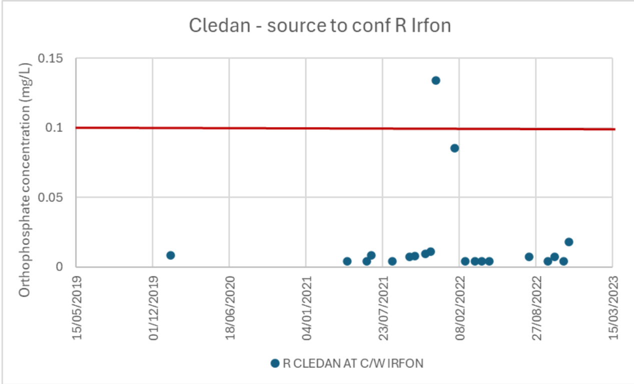


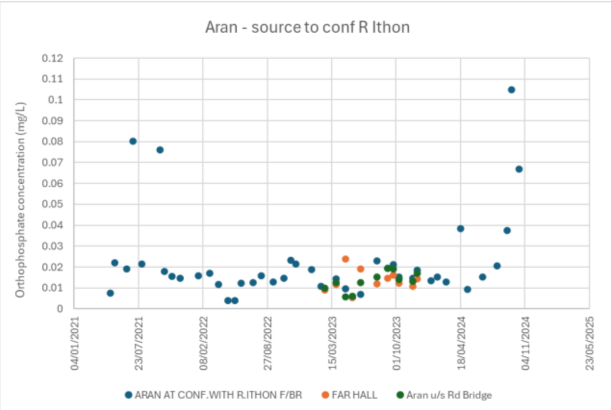
Trothy - conf Llanymynach Bk to conf Llymon Bk
Orthophosphate concentration (mg/L)
R TROTHY @ LLANTILIO CROSSENNY
TROTHY AT ONEN
Good Status threshold_WFD

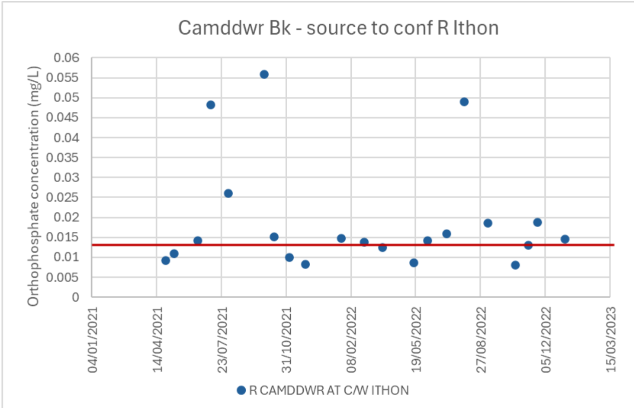


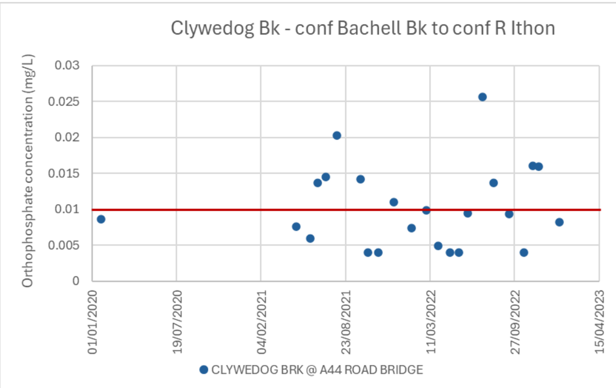
Trothy - conf Llymon Bk to conf R Wye
Orthophosphate concentration (mg/L)
R TROTHY AT TROY HOUSE BRIDGE
TROTHY AT DINGESTOW
Good Status threshold_WFD

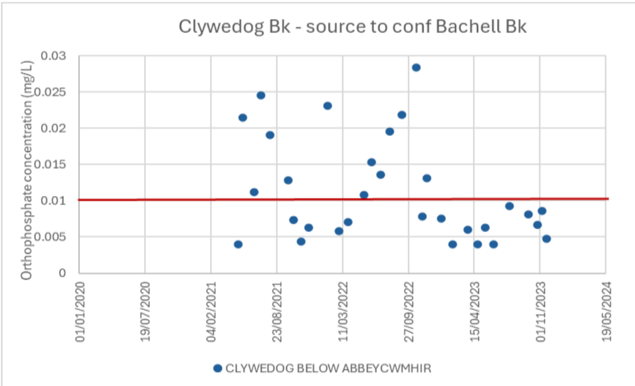

Afon Chwefru - source to conf R Irfon
Orthophosphatehosphate concentration (mg/L)
0.06
0.05
0.04
0.03
0.02
0.01
0
15/05/2019
01/12/2019
18/06/2020
04/01/2021
23/07/2021
08/02/2022
27/08/2022
15/03/2023
01/10/2023
18/04/2024
CHWEFRU @ PARK BR.BUILTH WELLS

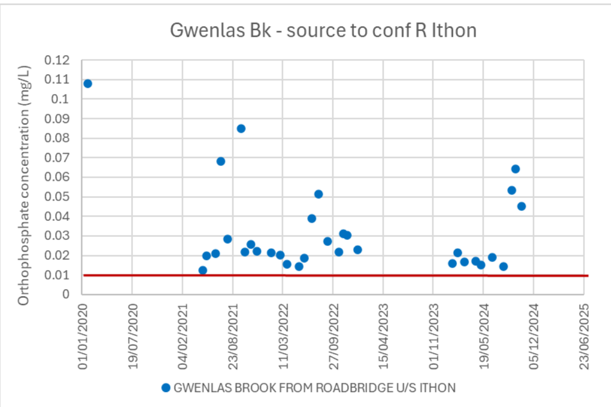

Cledan - source to conf R Irfon
Orthophosphate concentration (mg/L)
0.15
0.1
0.05
0
15/05/2019
01/12/2019
18/06/2020
04/01/2021
23/07/2021
08/02/2022
27/08/2022
15/03/2023
R CLEDAN AT C/W IRFON

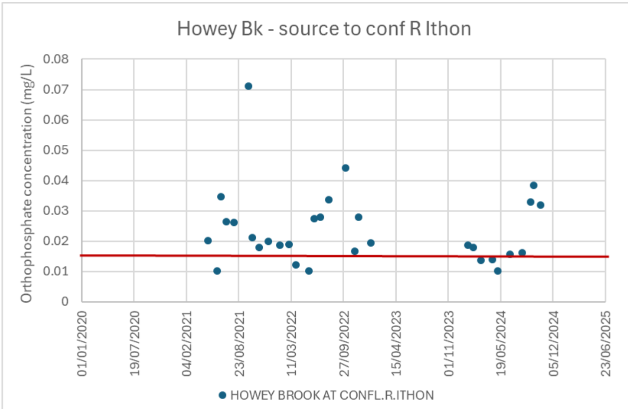

Aran - source to conf R Ithon
Orthophosphate concentration (mg/L)
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
04/01/2021
23/07/2021
08/02/2022
27/08/2022
15/03/2023
01/10/2023
18/04/2024
04/11/2024
23/05/2025
ARAN AT CONF.WITH R.ITHON F/BR
FAR HALL
Aran u/s Rd Bridge

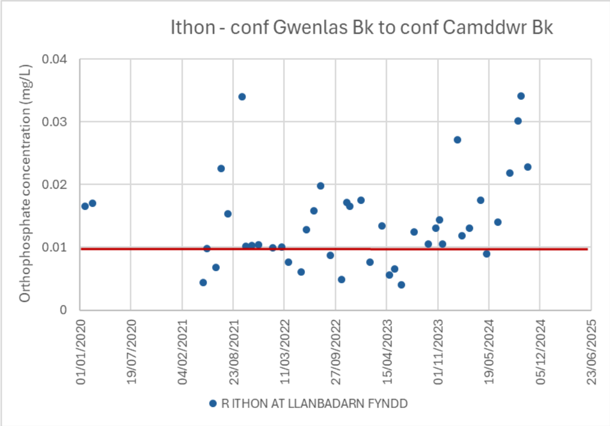

Camddwr Bk - source to conf R Ithon
Orthophosphate concentration (mg/L)
0.06
0.055
0.05
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
04/01/2021
14/04/2021
23/07/2021
31/10/2021
08/02/2022
19/05/2022
27/08/2022
05/12/2022
15/03/2023
R CAMDDWR AT C/W ITHON

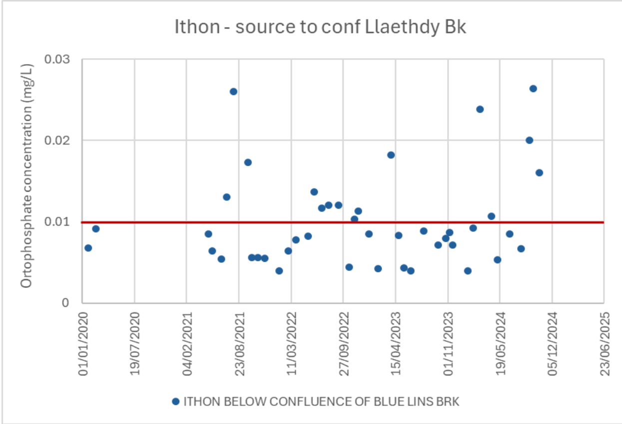

Clywedog Bk - conf Bachell Bk to conf R Ithon
Orthophosphate concentration (mg/L)
0.03
0.025
0.02
0.015
0.01
0.005
0
01/01/2020
19/07/2020
04/02/2021
23/08/2021
11/03/2022
27/09/2022
15/04/2023
CLYWEDOG BRK @ A44 ROAD BRIDGE

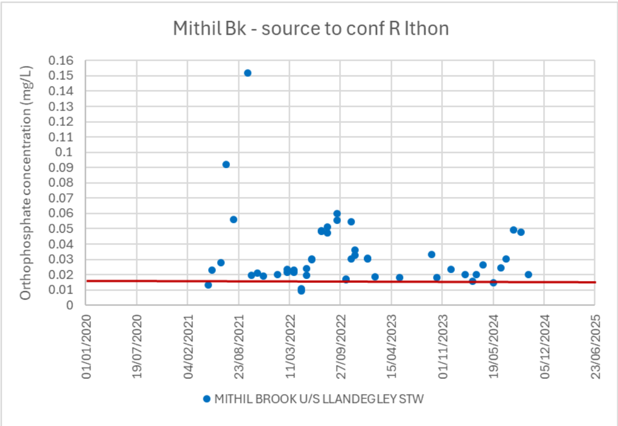

Clywedog Bk - source to conf Bachell Bk
Orthophosphate concentration (mg/L)
0.03
0.025
0.02
0.015
0.01
0.005
0
01/01/2020
19/07/2020
04/02/2021
23/08/2021
11/03/2022
27/09/2022
15/04/2023
01/11/2023
19/05/2024
CLYWEDOG BELOW ABBEYCWMHIR

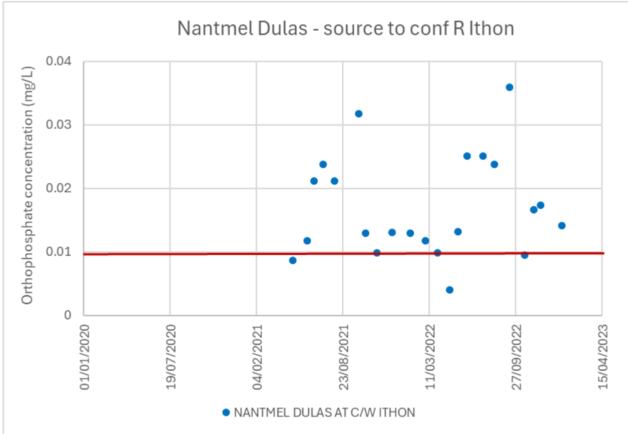

Gwenlas Bk - source to conf R Ithon
Orthophosphate concentration (mg/L)
0.12
0.11
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
01/01/2020
19/07/2020
04/02/2021
23/08/2021
11/03/2022
27/09/2022
15/04/2023
01/11/2023
19/05/2024
05/12/2024
23/06/2025
GWENLAS BROOK FROM ROADBRIDGE U/S ITHON

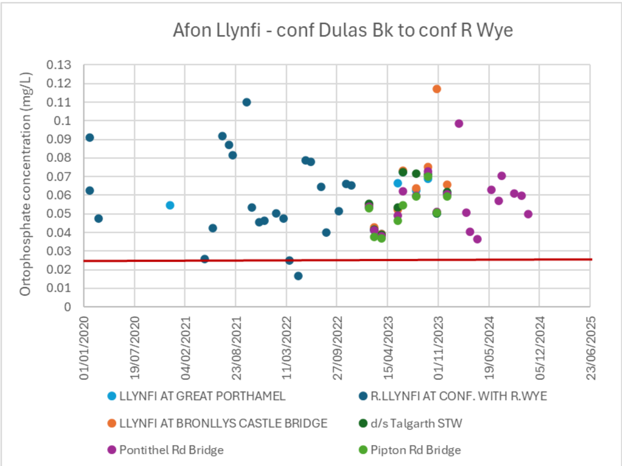

Howey Bk - source to conf R Ithon
Orthophosphate concentration (mg/L)
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
01/01/2020
19/07/2020
04/02/2021
23/08/2021
11/03/2022
27/09/2022
15/04/2023
01/11/2023
19/05/2024
05/12/2024
23/06/2025
HOWEY BROOK AT CONFL.R.ITHON

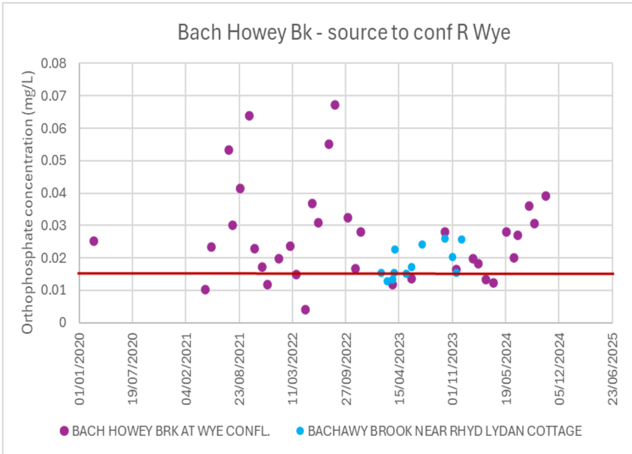

Ithon - conf Gwenlas Bk to conf Camddwr Bk
Orthophosphate concentration (mg/L)
R ITHON AT LLANBADARN FYNDD

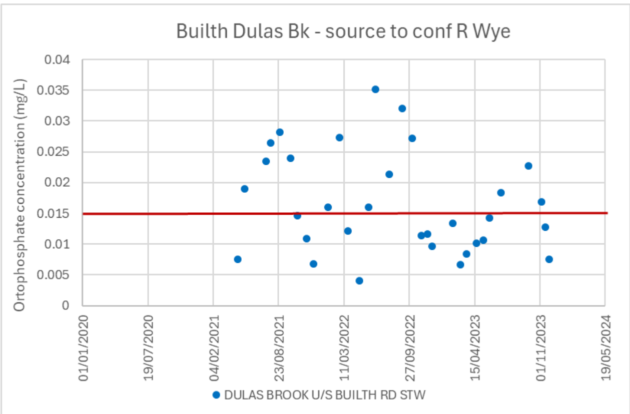

Ithon - source to conf Llaethdy Bk
Orthophosphate concentration (mg/L)
ITHON BELOW CONFLUENCE OF BLUE LINS BRK

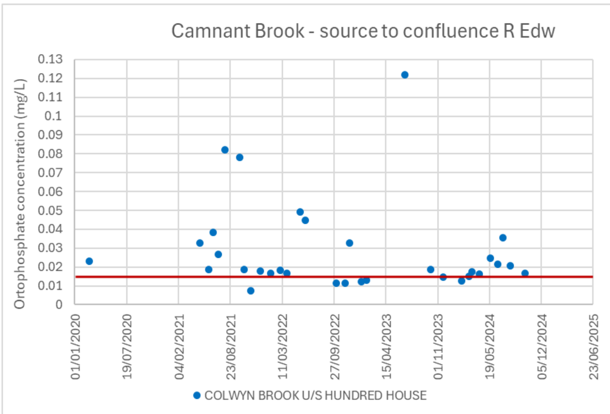

Mithil Bk - source to conf R Ithon
Orthophosphate concentration (mg/L)
MITHIL BROOK U/S LLANDEGLEY STW

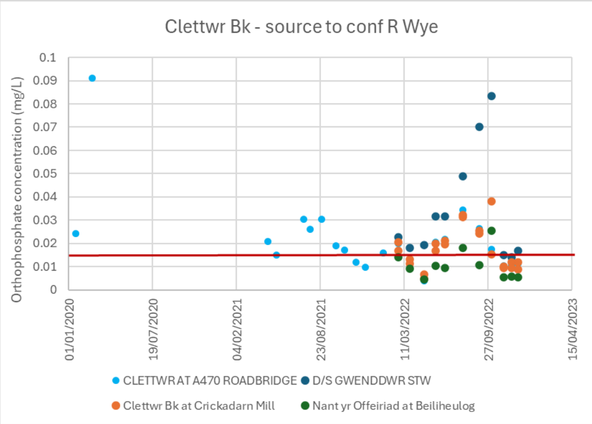

Nantmel Dulas - source to conf R Ithon
Orthophosphate concentration (mg/L)
NANTMEL DULAS AT C/W ITHON

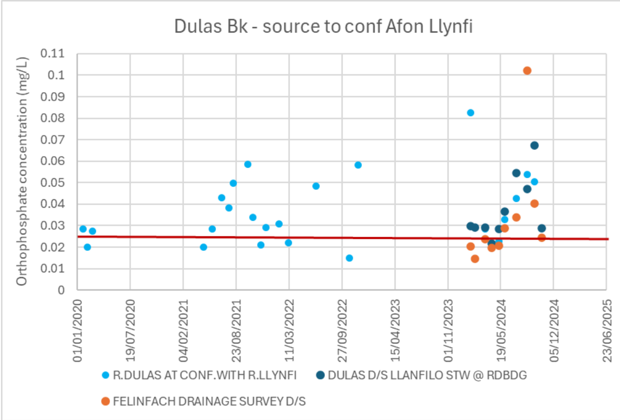

Afon Llynfi - conf Dulas Bk to conf R Wye
Orthophosphate concentration (mg/L)
LLYNFI AT GREAT PORTHAMEL
R.LLYNFI AT CONF. WITH R.WYE
LLYNFI AT BRONLLYS CASTLE BRIDGE
d/s Talgarth STW
Pontithel Rd Bridge
Pipton Rd Bridge

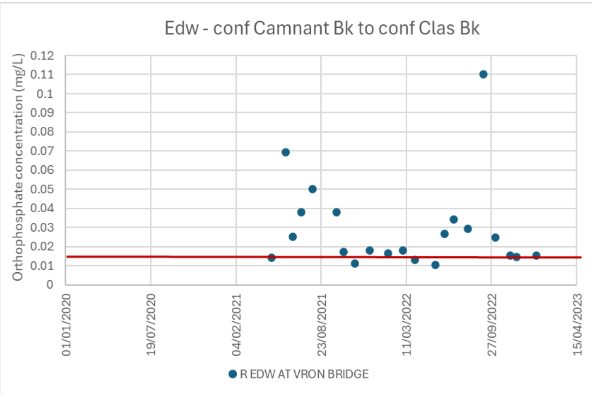

Bach Howey Bk - source to conf R Wye
Orthophosphate concentration (mg/L)
BACH HOWEY BRK AT WYE CONFL.
BACHAWY BROOK NEAR RHYD LYDAN COTTAGE

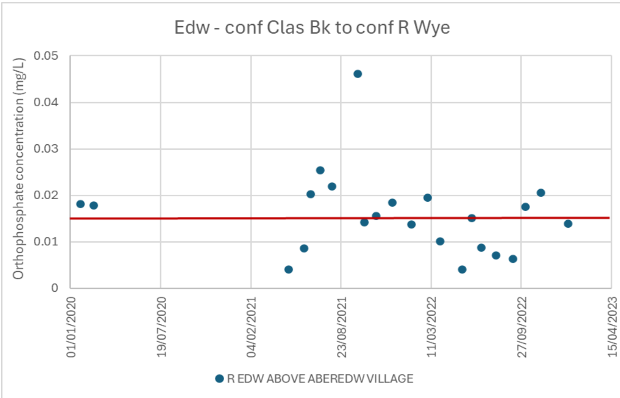

Builth Dulas Bk - source to conf R Wye
Ortophosphate concentration (mg/L)
DULAS BROOK U/S BUILTH RD STW

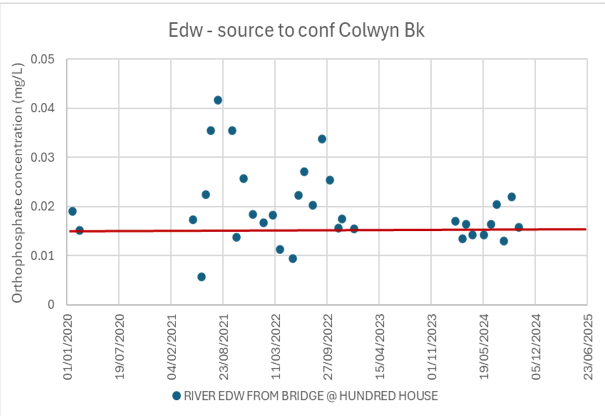

Camnant Brook - source to confluence R Edw
Ortophosphate concentration (mg/L)
COLWYN BROOK U/S HUNDRED HOUSE

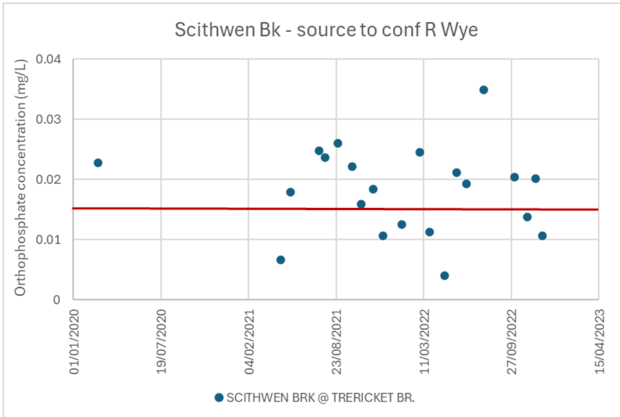

Clettwr Bk - source to conf R Wye
Orthophosphate concentration (mg/L)
CLETTWR AT A470 ROADBRIDGE
D/S GWENDDWR STW
Clettwr Bk at Crickadarn Mill
Nant yr Offeiriad at Beiliheulog

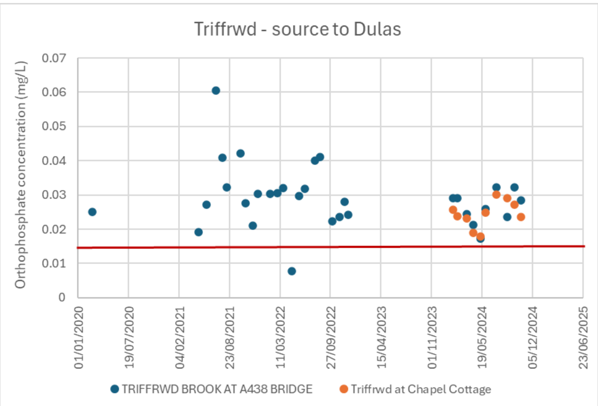

Dulas Bk - source to conf Afon Llynfi
Orthophosphate concentration (mg/L)
R.DULAS AT CONF.WITH R.LLYNFI
DULAS D/S LLANFILO STW @ RDBDG
FELINFACH DRAINAGE SURVEY D/S

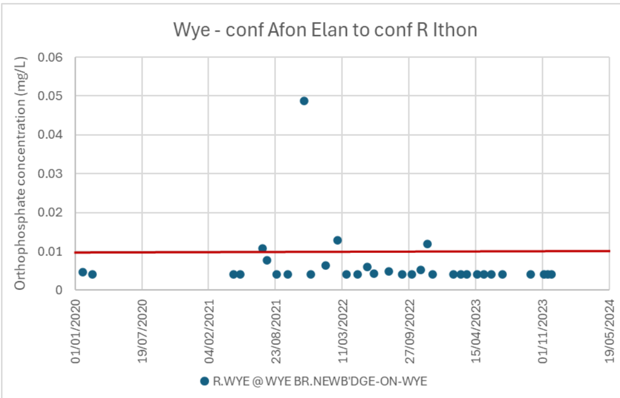

Edw - conf Camnant Bk to conf Clas Bk
Orthophosphate concentration (mg/L)
R EDW AT VRON BRIDGE


Edw - conf Clas Bk to conf R Wye
Orthophosphate concentration (mg/L)
R EDW ABOVE ABEREDW VILLAGE


Edw - source to conf Colwyn Bk
Orthophosphate concentration (mg/L)
RIVER EDW FROM BRIDGE @ HUNDRED HOUSE


Scithwen Bk - source to conf R Wye
Orthophosphate concentration (mg/L)
SCITHWEN BRK @ TRERICKET BR.


Triffrwd - source to Dulas
Orthophosphate concentration (mg/L)
TRIFFRWD BROOK AT A438 BRIDGE
Triffrwd at Chapel Cottage


Wye - conf Afon Elan to conf R Ithon
Orthophosphate concentration (mg/L)
R.WYE @ WYE BR.NEWB'DGE-ON-WYE

APPENDIX C CITIZEN SCIENCE

Friends of the River Wye have sampled the water at 24 locations along the river's length using a Hanna meter over a period of five years to help identify locations along the river/tributaries that may not be achieving set targets for concentrations of orthophosphate (OP). Of the 24 locations sampled by Friends of the Wye, 12 sites recorded a mean phosphate concentration below that of the designated target (highlighted green, Table 32). Of the 24 sites, 12 recorded a mean phosphate concentration greater than their respective target orthophosphate concentration (highlighted in red), with the *Afon Cammarch source to confluence with the River Irfon* recorded the highest mean phosphate concentration (0.21ppm) relative to its target (0.03ppm), suggesting an increased risk of water quality deterioration at this site relative to all other sites sampled.

Table 32 Average phosphate concentrations relative to phosphate targets (ppm) (WFD) (data from March 2020 – March 2025) (WyeViz: WyeViz (Wye Alliance Citizen Science dashboard) | Tableau Public)

Water body	Samples	Target (OP (ppm))	Phosphate (Hanna meter, ppm)	Actual/ Target
Afon Cammarch - source to conf R Irfon	8	0.03	0.21	6.9
Afon Chwefru - source to conf R Irfon	9	0.03	0.01	0.2
Afon Garth Dulas - source to conf R Irfon	13	0.03	0.00	0.0
Afon Llynfi - conf Dulas Bk to conf R Wye	472	0.08	0.17	2.2
Aran - source to conf R Ithon	118	0.05	0.07	1.5
Bach Howey Bk - source to conf R Wye	22	0.05	0.04	0.9
Builth Dulas Bk - source to conf R Wye	32	0.05	0.02	0.3
Camddwr Bk - source to conf R Ithon	21	0.04	0.04	1.1
Clettwr Bk - source to conf R Wye	46	0.05	0.05	1.2
Clywedog Bk - source to conf Bachell Bk	15	0.03	0.01	0.2
Duhonw - source to conf R Wye	86	0.05	0.08	1.8
Dulas Bk - source to conf Afon Llynfi	67	0.08	0.16	2.0
Edw - source to conf Colwyn Bk	21	0.05	0.08	1.7
Irfon - conf Cledan to conf R Wye	255	0.03	0.03	0.9
Ithon - conf Camddwr Bk to conf R Wye	384	0.08	0.04	0.5
Ithon - conf Gwenlas Bk to conf Camddwr Bk	186	0.03	0.06	1.8
Scithwen Bk - source to conf R Wye	52	0.05	0.04	0.9
Triffrwd - source to Dulas	37	0.05	0.05	1.2
Wye - conf Afon Bidno to conf Afon Marteg	25	0.03	0.02	0.6
Wye - conf R Irfon to Scithwen Bk	87	0.05	0.11	2.2
Wye - conf to conf Afon Marteg to conf Afon Elan	160	0.06	0.04	0.7
Wye - conf Walford Bk to Bigsweir Br	598	0.12	0.13	1.1

Water body	Samples	Target (OP (ppm))	Phosphate (Hanna meter, ppm)	Actual/ Target
Wye - Scithwen Bk to Brewardine Br	836	0.06	0.05	0.8
Wye (Avon Gwy) - conf R Ithon to conf R Irfon	77	0.05	0.04	0.9

APPENDIX D DETAILED DESCRIPTION OF PUBLISHED DATA

This Appendix includes a detailed description of the main findings on water quality issues, pollution sources and mitigation measures reported in published reports.

D.1 NRW WELSH PART OF THE SEVERN RIVER BASIN MANAGEMENT PLAN (2021-2027)

The River Wye faces significant phosphorus pollution challenges, primarily due to diffuse agricultural pollution and sewage discharges. Agricultural activities, including the use of fertilizers and manure, contribute to high levels of phosphorus entering the river. Additionally, sewage discharges from treatment plants and CSOs exacerbate the problem, releasing untreated or partially treated sewage containing phosphorus into the river during heavy rainfall events. The widespread phosphorus breaches in the River Wye SAC highlight the need for targeted actions to address this issue.

In addition to phosphorus, other nutrients such as nitrates and ammonia also contribute to water quality issues in the River Wye. Sewage discharges are a major source of these nutrients, with sewage containing high levels of nitrates and ammonia. CSOs further contribute to nutrient pollution, releasing untreated or partially treated sewage into the river during heavy rainfall events. Poor land management practices in rural areas also exacerbate nutrient pollution through soil erosion and runoff.

To mitigate phosphorus and overall nutrient pollution, several measures have been implemented. The Wye and Usk Foundation has undertaken riverine habitat restoration work, and the SAC Nutrients Project focuses on improving water quality through collaboration with various stakeholders. Nutrient Management Plans are being developed and implemented to reduce nutrient loading from agricultural sources. The Water Industry Investment Programme, including DCWW's 2020-25 business plan (AMP7), allocates significant funds for environmental improvements, such as reducing the impacts of high spilling CSOs. The Storm Overflow Roadmap, developed by a taskforce including NRW, Welsh Government, Ofwat, DCWW, and Hafren Dyfrdwy, aims to investigate and improve the management of storm overflows. NRW also works with the agricultural sector on sustainable land management, to co-produce a strategic approach to tackle agricultural pollution. This includes regulation, voluntary actions, advice, guidance, skills development, and investment in innovation. Additionally, enhanced monitoring and investigations, as part of the UK Chemicals Investigation Programme (UKCIP), are conducted to understand pollution sources better; and public awareness campaigns aim to reduce nutrient pollution from misconnections and harmful substance disposal. Overall, future plans emphasize nature-based solutions and local actions within Opportunity Catchments to further reduce phosphorus pollution.

D.2 RIVER POLLUTION SUMMIT EVIDENCE PACK

The River Wye faces significant phosphorus pollution challenges, with around 67% of its water bodies failing to meet the tightened phosphorus targets. The main sources of phosphorus pollution include sewage treatment works (23%), rural land use (72%), storm overflows (2%), and other sources such as ST and urban run-off (3%). This pollution has also negatively impacted housing development, halting many schemes due to high phosphorus levels.

To address these issues, NRW and DCWW have implemented a model to understand phosphorus sources and explore improvement strategies. Additionally, regulations like the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 aim to tackle nutrient pollution, with £44.5 million made available between 2018 and 2021 to support farmers in reducing farm pollution through capital infrastructure improvements. Local authorities are also working on measures to address phosphorus pollution, including planning conditions to permit development only after phosphate treatment works are completed.

Moreover, training and guidance are provided through an HRA training program for planners and ecologists, and the revised guidance from NRW helps local planning authorities screen specific development types and consider phosphorus reduction technology for private treatment works.

RBMPs take an holistic approach to managing waters within the wider ecosystem, identifying Opportunity Catchments for the third cycle of River Basin Planning (2021-2027) to deliver long-term benefits for waterbodies, habitats, and species. NRW leads several projects, including a River Restoration Programme to reduce diffuse pollution and improve water quality, and The Dairy Project, which aims to reduce agricultural pollution by visiting dairy farms and offering compliance advice.

D.3 LANCASTER UNIVERSITY REPHOKUS REPORT (UK AND WHOLE CATCHMENT)

The Wye catchment has a high risk of agricultural P loss due to high P input pressure, poorly-buffered and highly dispersible P-rich soils, steep slopes and moderate to high rainfall.

Farming in the Wye catchment generates an annual P surplus (i.e. unused P) of ca. 3000t (17kg P/ha). This P surplus is nearly 60% greater than the national average and is driven by the large amounts of livestock manure produced in the catchment.

Analysis of long-term river P concentration data for the Wye catchment outlet at Redbrook suggests river P pollution may be gradually rising again, but more consistent and higher frequency water quality monitoring is required to confirm. Clear evidence of positive links between annual P input pressure (and P surplus) and river P concentrations and loads exists at regional and catchment scales and this should drive a greater emphasis on reducing the P input pressure in the Wye catchment.

EA/NRW water quality monitoring programmes are not considered adequate to capture river quality impacts of short-term or small area changes in agricultural practice. Similarly, the general provision of up-to-date census data is not at a sufficiently fine resolution to accurately quantify spatially distributed P input pressure in catchments. These are both generic problems confounding provision of robust evidence of cause and effect.

Water quality in the Wye catchment, and many other livestock-dominated catchments, will not greatly improve without reducing the agricultural P surplus and drawing-down P-rich soils to at least the agronomic optimum. This will take many years.

A combination of reducing the number of livestock and processing of livestock manures to recover renewable fertilisers that can substitute for imported P products is needed to effectively reduce the P surplus.

Catchment stakeholders have a nascent capacity to change practice but require a firmer evidence base and on-the-ground support to implement both incremental and transformative change in practices to improve river water quality. Experience in Northern Ireland suggests support schemes have a measurable impact on behavioural change.

The Wye catchment faces a significant risk of phosphorus loss from agriculture due to high P input pressures, poorly buffered and highly dispersible P-rich soils, steep slopes, and moderate to high rainfall.

D.4 NRW CORE MANAGEMENT PLAN

River SACs designated under the Habitats Regulations 2017 overlap river water bodies designated under Water Framework Directive Regulations. Water quality targets and standards for SAC rivers are set via agreement at a UK-level and presented to and revised by the CSM guidance through the Joint Nature Conservation Committee (JNCC) (JNCC, 2025a). In 2009, Welsh Ministers decided that where SAC and SPA conservation objectives are more stringent than ‘Good Ecological Status’ (GES) as defined in the WFD, they (and the standards they contain) are the objectives referred to in Article 4(1c) of the WFD. In relation to Phosphorus, the process for Phosphorus standards includes an alignment procedure to ensure standards are never less stringent than WFD Phosphorus standards for the same water body; if WFD standards are more stringent than CSM standards, the WFD standards applies therefore.

Reactive Phosphorus - The process also includes an alignment procedure to ensure that standards are never less stringent than the WFD phosphorus standard for the same water body. If the WFD standard is more stringent than the CSM standard then the WFD standard applies.

Six out of 45 WFD water bodies in the Wye are classified as at risk of acidification however, to comply with CSM guidance, acid standards have been applied for all relevant water bodies in the catchment.

D.5 NRW PRIORITY IMPROVEMENT PLANS (PIPS)

Prioritised Improvement Plans (PIPs) are prioritised, costed actions plans that are produced for each SAC and SPA in Wales to help maintain or improve condition status of designated habitats and species features of the site. PIPs are not formal consultation documents and should be used to indicate the priority of conservation management issues at designated sites to support collaboration and discussion of future management decisions. First produced as part of the NRW LIFE Natura 2000 Programme, the aim is to provide a current reflection of NRW-hosted Actions Database Safle.

The purpose of RBMPs is to protect and improve the water environment for the wider benefits to people and wildlife. It includes a summary of measures needed to achieve WFD Regulation objectives together with the predicted environmental outcomes.

APPENDIX E ECOLOGY DATA ASSESSMENT

Diatoms

The ecological status of diatoms was assessed using the Average of two replicated Trophic Diatom Index (TDI) calculations, i.e. TDI3 and TDI4 data. TDI values are indicative of the ecological health of the water body, with values ranging from 20 to 50 generally considered to represent good ecological status. Specifically:

- **TDI > 20**: Indicates good ecological status.
- **TDI > 50**: Indicates high ecological status.

Macroinvertebrates

The classification of macroinvertebrates was based on the WHPT (Walley, Hawkes, Paisley, Trigg) scoring system, which has replaced the BMWP (Biological Monitoring Working Party) scoring system under the WFD for RBMP. The WHPT system provides updated taxon scores related to susceptibility to pollution, with the most susceptible families scoring the highest. The methodology includes:

- **Taxon Scores**: Scores are adjusted based on the total abundance of individuals found within each family. Pollution-tolerant families have their scores adjusted down when high abundance is present, and up when low abundance is present. Conversely, families susceptible to pollution have their scores adjusted up when high abundance is present, and down when low abundance is present.
- **Indices Derived**:
    - **ASPT (Average Score Per Taxon)**: Calculated by dividing the BMWP or WHPT score by the NST (Number of Scoring Taxa). ASPT scores are considered less sensitive to differences in sampling effort and provide a more reliable means of assessing biological quality.
        - **ASPT > 5**: Indicative of reasonably good water quality.
        - **ASPT > 6**: Indicative of exceptionally good quality.
        - **ASPT < 5**: Indicative of poor water quality.

The NRW macroinvertebrate dataset also includes 'wfd_awic_eqr' and corresponding 'wfd_awic_status_class' data. The WFD-AWICS method generates EQRs via type-specific reference conditions based on a mixture of chemical (dissolved organic carbon, DOC) and geographical factors. This method is primarily designed to respond to anthropogenic acidification and has been calibrated against pH and ANC environmental gradients. It can also be applicable to nutrient load impacts, such as eutrophication, which can result in water pH changes and related acidification. However, this index was not used in this study since not all sites were assessed and we used WHPT_ASTP data as approximate values for a more complete dataset.

Macrophytes

The ecological status of macrophytes was assessed using RMNI (River Macrophyte Nutrient Index). RMNI focuses on nutrient levels in rivers, particularly nitrogen and phosphorus. It is useful for assessing nutrient enrichment and its impact on macrophyte communities. The following classes were used in the assessment:

- **High Ecological Status**: RMNI scores typically below 5, indicating low nutrient levels and a healthy macrophyte community.
- **Good Ecological Status**: RMNI scores between 5 and 6, suggesting moderate nutrient levels and a relatively healthy ecosystem.
- **Moderate Ecological Status**: RMNI scores between 6 and 7, indicating higher nutrient levels and some ecological stress.
- **Poor Ecological Status**: RMNI scores between 7 and 8, reflecting significant nutrient enrichment and ecological degradation.
- **Bad Ecological Status**: RMNI scores above 8, indicating very high nutrient levels and severe ecological stress.

APPENDIX F SAGIS MODEL OUTPUTS

Table 33 details the SAGIS outputs of phosphorus concentration from each sector in mg/L and Table 34 provides the percentage contribution from each sector calculated from the SAGIS outputs for all failing waterbodies.

Table 33 SAGIS modelling data for all failing waterbodies in mg/L.

Main catchment	Operational catchment	Reference number	Water body name	Target	Wastewater (mg/l)	Intermittents (CSOs) (mg/l)	Other (mg/l)	Rural (mg/l)
Lugg	Arrow Lugg and Frome	1	*Gilwern Bk - source to conf R Arrow*	WFD	0.000	<0.000	0.006	0.064
	Lugg	2	*Norton Bk - source to conf R Lugg*	WFD	0.018	<0.000	0.004	0.083
Upper Wye	Irfon	3	*Afon Chwefru - source to conf R Irfon*	SAC	0.002	<0.000	0.001	0.015
		4	*Afon Gwesyn - source to conf R Irfon*	SAC	0.000	0.000	<0.000	0.013
		5	*Cledan - source to conf R Irfon*	SAC	0.000	0.000	<0.000	0.012
	Ithon	6	*Aran - source to conf R Ithon*	SAC	0.000	0.000	<0.000	0.025
		7	*Camddwr Bk - source to conf R Ithon*	SAC	0.000	0.000	0.001	0.015
		8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	SAC	0.001	0.000	<0.000	0.013
		9	*Clywedog Bk - source to conf Bachell Bk*	SAC	0.004	0.000	<0.000	0.005
		10	*Gwenlas Bk - source to conf R Ithon*	SAC	0.000	0.000	<0.000	0.026
		11	*Howey Bk - source to conf R Ithon*	SAC	0.000	<0.000	<0.000	0.046
		12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	SAC	0.002	<0.000	0.000	0.011
		13	*Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	SAC	0.000	0.000	<0.000	0.006
		14	*Ithon - source to conf Llaethdy Bk*	SAC	0.000	0.000	<0.000	0.009
		15	*Mithil Bk - source to conf R Ithon*	SAC	0.012	<0.000	<0.000	0.021
		16	*Nantmel Dulas - source to conf R Ithon*	SAC	0.000	0.000	0.007	0.014
	Wye - Ithon to Hay	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	SAC	0.013	<0.000	0.004	0.058
		18	*Bach Howey Bk - source to conf R Wye*	SAC	0.001	<0.000	0.002	0.028

Main catchment	Operational catchment	Reference number	Water body name	Target	Wastewater (mg/l)	Intermittents (CSOs) (mg/l)	Other (mg/l)	Rural (mg/l)
		19	*Builth Dulas Bk - source to conf R Wye*	SAC	0.006	<0.000	<0.000	0.018
		20	*Camnant Brook - source to confluence R Edw*	SAC	0.001	<0.000	<0.000	0.031
		21	*Clettwr Bk - source to conf R Wye*	SAC	0.001	<0.000	0.003	0.031
		22	*Dulas Bk - source to conf Afon Llynfi*	SAC	0.004	<0.000	0.004	0.054
		23	*Edw - conf Camnant Bk to conf Clas Bk*	SAC	0.000	<0.000	<0.000	0.025
		24	*Edw - conf Clas Bk to conf R Wye*	SAC	0.001	<0.000	<0.000	0.022
		25	*Edw - source to conf Colwyn Bk*	SAC	0.000	0.000	<0.000	0.017
		26	*Scithwen Bk - source to conf R Wye*	SAC	0.000	0.000	0.001	0.019
		27	*Triffrwd - source to Dulas*	SAC	0.003	0.000	0.002	0.042
		28	*Afon Llynfi - source to conf Dulas Bk*	WFD	0.000	<0.000	0.012	0.134
		29	*Clyro Bk - source to conf R Wye*	WFD	0.017	<0.000	0.009	0.138
		30	*Digedi Bk - source to conf R Wye*	WFD	0.021	<0.000	0.013	0.147
	Wye source to Ithon	31	*Afon Claerwen - conf Afon Arban to Caban-coch*	WFD	0.000	0.000	<0.000	0.011
		32	*Afon Claerwen - source to conf Afon Arban*	WFD	0.000	0.000	0.000	0.011
		33	*Wye - conf Afon Elan to conf R Ithon*	SAC	0.003	<0.000	0.001	0.003
Lower Wye	Trothy	34	*Llanymynech Bk - source to conf R Trothy*	WFD	0.007	<0.000	0.008	0.145
		35	*Llymon Bk - source to conf R Trothy*	WFD	0.000	<0.000	0.002	0.081
		36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	WFD	0.002	<0.000	0.004	0.087
		37	*Trothy - conf Llymon Bk to conf R Wye*	WFD	0.009	<0.000	0.005	0.106
	Wye OC	38	*Tintern Bk - source to conf R Wye*	WFD	0.000	0.000	0.027	0.081

Table 34 Percentage contribution of phosphorus concentration from each sector (derived from SAGIS).

Main catchment	Operational catchment	Water body name	Wastewater	Intermittents (CSOs)	Agriculture	Other
Lugg	Arrow Lugg and Frome	*1 Gilwern Bk - source to conf R Arrow*	0%	0%	92%	8%
	Lugg	*2 Norton Bk - source to conf R Lugg*	17%	0%	78%	4%
Upper Wye	Irfon	*3 Afon Chwefru - source to conf R Irfon*	9%	0%	87%	4%
		4 Afon Gwesyn - source to conf R Irfon	0%	0%	98%	2%
		5 Cledan - source to conf R Irfon	0%	0%	97%	3%
	Ithon	*6 Aran - source to conf R Ithon*	0%	0%	100%	0%
		7 Camddwr Bk - source to conf R Ithon	0%	0%	93%	7%
		8 Clywedog Bk - conf Bachell Bk to conf R Ithon	7%	0%	92%	1%
		9 Clywedog Bk - source to conf Bachell Bk	46%	0%	54%	1%
		10 Gwenlas Bk - source to conf R Ithon	0%	0%	100%	0%
		11 Howey Bk - source to conf R Ithon	0%	1%	99%	0%
		12 Ithon - conf Gwenlas Bk to conf Camddwr Bk	13%	0%	87%	0%
		13 Ithon - conf Llaethdy Bk to conf Gwenlas Bk	0%	0%	99%	1%
		14 Ithon - source to conf Llaethdy Bk	0%	0%	99%	1%
		15 Mithil Bk - source to conf R Ithon	35%	0%	64%	1%
		16 Nantmel Dulas - source to conf R Ithon	0%	0%	66%	34%
	Wye - Ithon to Hay	*17 Afon Llynfi - conf Dulas Bk to conf R Wye*	17%	1%	76%	6%
		18 Bach Howey Bk - source to conf R Wye	2%	0%	92%	6%
		19 Builth Dulas Bk - source to conf R Wye	26%	0%	73%	1%
		20 Camnant Brook - source to confluence R Edw	4%	0%	95%	1%
		21 Clettwr Bk - source to conf R Wye	3%	0%	90%	7%
		22 Dulas Bk - source to conf Afon Llynfi	7%	0%	87%	6%
		23 Edw - conf Camnant Bk to conf Clas Bk	1%	0%	98%	1%
		24 Edw - conf Clas Bk to conf R Wye	3%	0%	96%	1%
		25Edw - source to conf Colwyn Bk	0%	0%	99%	1%
		26 Scithwen Bk - source to conf R Wye	0%	0%	97%	3%

Main catchment	Operational catchment	Water body name	Wastewater	Intermittents (CSOs)	Agriculture	Other
		27 Triffrwd - source to Dulas	6%	0%	89%	5%
		28 Afon Llynfi - source to conf Dulas Bk	0%	0%	92%	8%
		29 Clyro Bk - source to conf R Wye	10%	0%	84%	5%
		30 Digedi Bk - source to conf R Wye	12%	0%	81%	7%
	Wye source to Ithon	*31 Afon Claerwen - conf Afon Arban to Caban-coch*	0%	0%	99%	1%
		32 Afon Claerwen - source to conf Afon Arban	0%	0%	100%	0%
		33 Wye - conf Afon Elan to conf R Ithon	45%	1%	41%	12%
Lower Wye	Trothy	*34 Llanymynech Bk - source to conf R Trothy*	4%	0%	91%	5%
		35 Llymon Bk - source to conf R Trothy	0%	0%	97%	3%
		36 Trothy - conf Llanymynach Bk to conf Llymon Bk	2%	0%	94%	4%
		37 Trothy - conf Llymon Bk to conf R Wye	8%	0%	88%	4%
	Wye OC	*38 Tintern Bk - source to conf R Wye*	0%	0%	75%	25%

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APPENDIX G FARMSCOPER MODELLING

The baseline phosphorus load from agriculture was modelled in Farmscoper Upscale V5 for the Wye catchment.

Livestock numbers were increased to represent the increase in poultry numbers (as outlined by Natural England, 2024) and the land areas were increased to represent the land that the poultry farms would need to spread manure on and achieved a nitrogen limit of below 170 kg N per ha as per regulatory requirements (Table 35 and Table 36).

Table 35 Changes to poultry numbers in Farmscoper Upscale V5

	Layers (Caged)	Layers (Uncaged)	Pullet	Broilers	Turkeys	Breeding Birds	Other Poultry	TOTAL
Default	214,725	319,798	305,918	1,687,751	71,843	186,347	44,826	2,831,209
New	2,254,621	3,357,881	3,212,143	17,721,382	754,351	1,956,644	470,674	29,727,696

Table 36 Changes to poultry farm land areas in Farmscoper Upscale V5

Cropping	Default area (ha)	New area (ha)
Permanent Pasture	23	300
Rotational Grassland	9	100
Rough Grazing	2	2
Winter Wheat	16	350
Winter Barley	2	125
Spring Barley	1	75
Winter OSR	5	5
Maize	0	0
Potatoes	2	2
Sugar Beet	1	1
Peas	0	0
Beans	1	1
Fodder Crops	1	1
Other Crops	2	2
Vegetables (Brassica)	0	0
Vegetables (Other)	0	0
Orchards	4	4
Soft Fruit	1	1
Bare Fallow	1	1
Land for outdoor pigs	1	1
Set Aside	0	0
Woodland	6	6

APPENDIX H SECTOR SHARE AND PHOSPHORUS CONCENTRATION REDUCTIONS

The following sections outline the methodology used to identify current and target in-river phosphorus concentration and phosphorus concentration reductions required by each sector

H.1 CURRENT AND TARGET PHOSPHORUS CONCENTRATION

The average annual phosphorus concentration and target concentrations for each waterbody was identified from the most recent compliance assessment (NRW 2025c). The monitoring point locations are presented in Figure 27. The phosphorus concentration and target phosphorus concentrations for each waterbody identified from the compliance assessment is detailed in Table 37.

Figure 27: Welsh Wye NRFA flow gauges

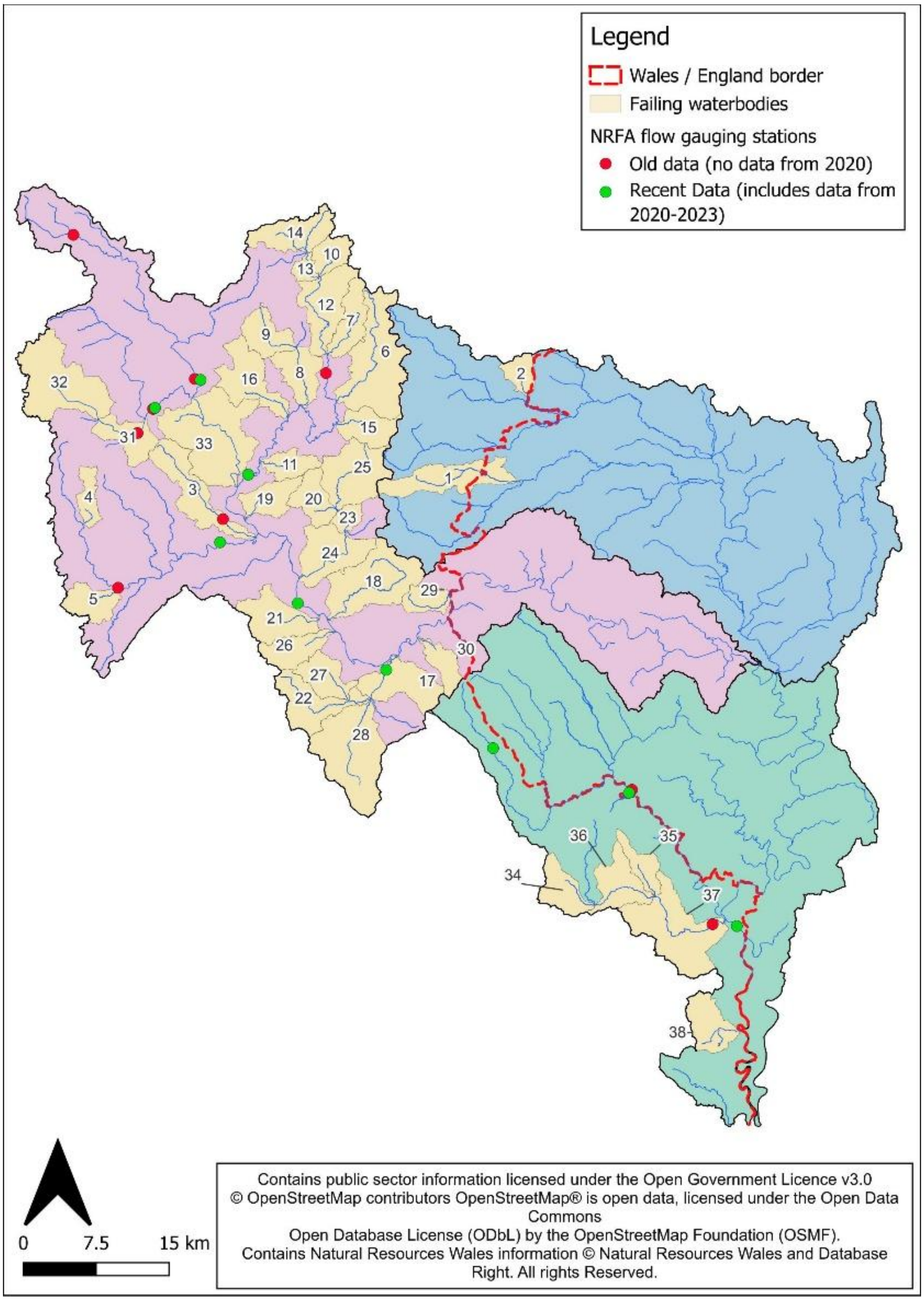


Table 37 Estimated current and target in-river phosphorus concentration per failing waterbody.

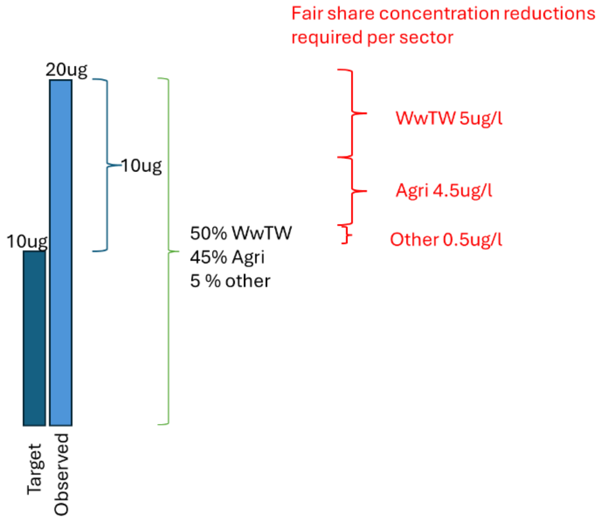
Main catchment	Ref	Water body name	Average annual P concentration (mg/l)	Target concentration (mg/l)
Lugg	1	*Gilwern Bk - source to conf R Arrow*	-	0.05
	2	*Norton Bk - source to conf R Lugg*	0.11	0.04
Upper Wye	3	*Afon Chwefru - source to conf R Irfon*	0.02	0.01
	4	*Afon Gwesyn - source to conf R Irfon*	0.01	0.01
	5	*Cledan - source to conf R Irfon*	0.02	0.01
	6	*Aran - source to conf R Ithon*	0.02	0.02
	7	*Camddwr Bk - source to conf R Ithon*	0.02	0.01
	8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	0.01	0.01
	9	*Clywedog Bk - source to conf Bachell Bk*	0.01	0.01
	10	*Gwenlas Bk - source to conf R Ithon*	0.03	0.01
	11	*Howey Bk - source to conf R Ithon*	0.04	0.02
	12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	0.01	0.01
	13	*Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	0.01	0.01
	14	*Ithon - source to conf Llaethdy Bk*	0.01	0.01
	15	*Mithil Bk - source to conf R Ithon*	0.04	0.02
	16	*Nantmel Dulas - source to conf R Ithon*	0.02	0.01
	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	0.06	0.03
	18	*Bach Howey Bk - source to conf R Wye*	0.03	0.02
	19	*Builth Dulas Bk - source to conf R Wye*	0.02	0.02
	20	*Camnant Brook - source to confluence R Edw*	0.05	0.02
	21	*Clettwr Bk - source to conf R Wye*	0.02	0.02
	22	*Dulas Bk - source to conf Afon Llynfi*	0.03	0.03
	23	*Edw - conf Camnant Bk to conf Clas Bk*	0.04	0.02
	24	*Edw - conf Clas Bk to conf R Wye*	0.02	0.02
	25	*Edw - source to conf Colwyn Bk*	0.02	0.02

Main catchment	Ref	Water body name	Average annual P concentration (mg/l)	Target concentration (mg/l)
	26	*Scithwen Bk - source to conf R Wye*	0.02	0.02
	27	*Triffrwd - source to Dulas*	0.03	0.02
	28	*Afon Llynfi - source to conf Dulas Bk*	0.08	0.05
	29	*Clyro Bk - source to conf R Wye*	0.08	0.06
	30	*Digedi Bk - source to conf R Wye*	0.08	0.06
	31	*Afon Claerwen - conf Afon Arban to Caban-coch*	0.04	0.03
	32	*Afon Claerwen - source to conf Afon Arban*	0.00	0.03
	33	*Wye - conf Afon Elan to conf R Ithon*	0.01	0.01
Lower Wye	34	*Llanymynech Bk - source to conf R Trothy*	0.13	0.08
	35	*Llymon Bk - source to conf R Trothy*	0.09	0.09
	36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	0.09	0.08
	37	*Trothy - conf Llymon Bk to conf R Wye*	0.10	0.08
	38	*Tintern Bk - source to conf R Wye*	-	0.08

H.2 SECTOR PERCENTAGE CONCENTRATION REDUCTION TARGETS

Sector percentage concentration reduction targets were calculated using the following guidance provided by NRW:

Figure 28 Example of fair share methodology provided by NRW.



The following steps were followed to calculate the percentage reductions each sector would need to achieve their "fair share" reduction of phosphorus concentration to achieve SAC and WFD compliance in failing waterbodies, using the SAGIS outputs:

Step 1: Calculate phosphorus exceedance above the target concentration compared to monitored concentration:

$$Exceedance\ (mg/L) = monitored\ concentration\ (mg/L) - target\ concentration\ (mg/L)$$

Step 2: Calculate the percentage contribution of phosphorus concentration attributed to each sector:

$$Phosphorus\ contribution\ from\ each\ sector\ (\%) = (sector\ concentration\ (mg/L)\ /\ total\ concentration\ (mg/L)) \times 100$$

Step 3: Calculate concentration reduction required by each sector to achieve target:

$$Concentration\ reduction\ required\ by\ each\ sector = sector\ concentration\ (mg/L) * percentage\ contribution\ from\ sector\ (\%)$$

Step 4: Calculate sector concentration at target:

$$Sector\ concentration\ at\ target\ (mg/L) = sector\ concentration\ (mg/L) - concentration\ reduction\ required\ by\ sector\ (mg/L)$$

Step 5: Calculate concentration reduction required by each sector as a percentage decrease from the current concentration:

$$Concentration\ reduction\ required\ by\ each\ sector\ (\%) = ((Sector\ concentration\ (mg/L) - sector\ concentration\ at\ target\ (mg/L))\ /\ sector\ concentration\ (mg/L)) \times 100$$

APPENDIX I AGRICULTURE MITIGATION MEASURES

I.1 EXISTING MITIGATION MEASURES

Farmscoper Upscale and Evaluate V5 were used to estimate the impact of existing mitigation measures delivered as part of regulatory compliance, best practice or agri-environment scheme measures on phosphorus loading from agriculture. The mitigation measures that can be implemented under The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 were selected and set to a standard current implementation rate of 41% in Farmscoper Evaluate V5 (as derived from Service Level Agreement Inspections) (Welsh government, 2025a). These mitigation measures were:

- Fertiliser spreader calibration.
- Use a fertiliser recommendation system.
- Integrate fertiliser and manure nutrient supply.
- Do not apply manufactured fertiliser to high-risk areas.
- Avoid spreading manufactured fertiliser to fields at high-risk times.
- Do not apply P fertilisers to high P index soils.
- Increase the capacity of farm slurry stores to improve timing of slurry applications.
- Minimise the volume of dirty water produced (sent to dirty water store).
- Minimise the volume of dirty water produced (sent to slurry store).
- Site solid manure heaps away from watercourses/field drains.
- Manure Spreader Calibration.
- Do not apply manure to high-risk areas.
- Do not spread slurry or poultry manure at high-risk times.
- Do not spread FYM to fields at high-risk times.
- Incorporate manure into the soil.
- Capture of dirty water in a dirty water store.

All other mitigation measures remained at the standard implementation level to estimate current uptake of best practices or agri-environment measures (derived from Farmscoper Evaluate V5 prior implementation values, which represent national average rates of mitigation measure implementation on farms). The current uptake of measures input into Farmscoper Evaluate V5 is provided in Table 38.

Table 38 Estimated current level of uptake of mitigation measures input into Farmscoper Evaluate V5.

Method Name	Current uptake of measures on farms (%)
Establish cover crops in the autumn	2
Early harvesting and establishment of crops in the autumn	50
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	2
Adopt reduced cultivation systems	25
Cultivate compacted tillage soils	25
Cultivate and drill across the slope	25
Leave autumn seedbeds rough	10
Manage over-winter tramlines	10
Establish in-field grass buffer strips	10
Establish riparian buffer strips	10
Loosen compacted soil layers in grassland fields	50
Allow grassland field drainage systems to deteriorate	2
Ditch management on arable land	50
Ditch management on grassland	25
Improved livestock through breeding	10

Method Name	Current uptake of measures on farms (%)
Use plants with improved nitrogen use efficiency	0
Fertiliser spreader calibration	41
Use a fertiliser recommendation system	41
Integrate fertiliser and manure nutrient supply	41
Do not apply manufactured fertiliser to high-risk areas	41
Avoid spreading manufactured fertiliser to fields at high-risk times	41
Use manufactured fertiliser placement technologies	10
Use nitrification inhibitors	0
Replace urea fertiliser to grassland with another form	0
Replace urea fertiliser to arable land with another form	0
Incorporate a urease inhibitor into urea fertilisers for grassland	0
Incorporate a urease inhibitor into urea fertilisers for arable land	0
Use clover in place of fertiliser nitrogen	10
Do not apply P fertilisers to high P index soils	41
Reduce dietary N and P intakes: Dairy	10
Reduce dietary N and P intakes: Pigs	80
Reduce dietary N and P intakes: Poultry	80
Adopt phase feeding of livestock: Dairy	80
Adopt phase feeding of livestock: Pigs	80
Reduce the length of the grazing day/grazing season	10
Extend the grazing season for cattle	10
Reduce field stocking rates when soils are wet	80
Move feeders at regular intervals	50
Construct troughs with concrete base	2
Increase scraping frequency in dairy cow cubicle housing	10
Additional targeted bedding for straw-bedded cattle housing	10
Washing down of dairy cow collecting yards	25
Frequent removal of slurry from beneath-slat storage in pig housing	2
Install air-scrubbers: mechanically ventilated pig housing	2
Install air-scrubbers: mechanically ventilated poultry housing	2
More frequent manure removal from laying hen housing with manure belt systems	10
In-house poultry manure drying	10
Increase the capacity of farm slurry stores to improve timing of slurry applications	41
Adopt batch storage of slurry	0
Install covers to slurry stores	10
Allow cattle slurry stores to develop a natural crust	80
Anaerobic digestion of livestock manures	0
Minimise the volume of dirty water produced (sent to dirty water store)	41
Minimise the volume of dirty water produced (sent to slurry store)	41
Compost solid manure	2
Site solid manure heaps away from watercourses/field drains	41
Store solid manure heaps on an impermeable base and collect effluent	10
Cover solid manure stores with sheeting	2
Use liquid/solid manure separation techniques	2
Use poultry litter additives	0

Method Name	Current uptake of measures on farms (%)
Manure Spreader Calibration	41
Do not apply manure to high-risk areas	41
Do not spread slurry or poultry manure at high-risk times	41
Use slurry band spreading application techniques	2
Use slurry injection application techniques	0
Do not spread FYM to fields at high-risk times	41
Incorporate manure into the soil	41
Fence off rivers and streams from livestock	25
Construct bridges for livestock crossing rivers/streams	80
Re-site gateways away from high-risk areas	25
Farm track management	25
Establish new hedges	2
Establish and maintain artificial wetlands - steading runoff	2
Irrigate crops to achieve maximum yield	2
Establish tree shelter belts around livestock housing	10
Calibration of sprayer	50
Fill/Mix/Clean sprayer in field	25
Avoid PPP application at high risk timings	10
Drift reduction methods	25
PPP substitution	0
Construct bunded impermeable PPP filling/mixing/cleaning area	2
Treatment of PPP washings through disposal, activated carbon or biobeds	50
Protection of in-field trees	0
Management of woodland edges	2
Management of in-field ponds	2
Management of arable field corners	2
Plant areas of farm with wild bird seed / nectar flower mixtures	2
Beetle banks	2
Uncropped cultivated margins	2
Skylark plots	2
Uncropped cultivated areas	2
Unfertilised cereal headlands	2
Unharvested cereal headlands	2
Undersown spring cereals	2
Management of grassland field corners	2
Leave residual levels of non-aggressive weeds in crops	2
Use correctly-inflated low ground pressure tyres on machinery	25
Locate out-wintered stock away from watercourses	10
Use dry-cleaning techniques to remove solid waste from yards prior to cleaning	0
Capture of dirty water in a dirty water store	41
Irrigation/water supply equipment is maintained and leaks repaired	10
Avoid irrigating at high risk times	2
Use efficient irrigation techniques (boom trickle, self closing nozzles)	0
Use high sugar grasses	10
Monitor and amend soil pH status for grassland	0

Method Name	Current uptake of measures on farms (%)
Increased use of maize silage	0
Improved crop health	0
Better health planning: dairy	0
Better health planning: beef	0
Better health planning: sheep	0
Improve livestock through genetic modification	0
Slurry acidification during storage	0
Slurry acidification at spreading	0
Install covers to slurry stores and burn off methane	0
Use feed additives to reduce enteric methane emissions	0

The mitigation measures were modelled in Farmscoper Upscale V5 as a “set”, this estimates the load from agriculture if all the mitigation measures are implemented at the above level on all applicable land.

I.2 OTHER ACTIONS

The actions completed by other projects (detailed in section 5.1.1) were matched to the Farmscoper Mitigation Measures list. The locations of the projects were matched to the rainfall bands and the farm types were cross referenced with CORINE 2018 and ESRI satellite, to select the load reduction per ha (kg phosphorus) for the farm type and rainfall band. The method from estimating land area influenced is provided in Table 39.

Table 39 Method and results for calculating estimated phosphorus reduction achieved from other projects.

Project	Area influenced	Action	Estimated land area (ha)	Method	Phosphorus load reduction per ha from measures (kg)	Total estimated phosphorus load reduction achieved[1] (kg)
First farm scheme	1.6 km of the River Irfon, south-west of Builth Wells.	Watercourse fencing	16.00	Assuming minimum of 100m of land adjacent to the river is grazed by livestock.	0.10	1.61
		Riparian buffer	0.96	Assuming riparian buffer is minimum 6m wide.	0.10	0.10
		Floodplain wetland creation	16.00	Assuming minimum of 100m of land adjacent to the river is grazed by livestock.	0.10	1.55

[1] Total estimated phosphorous load reduction achieved (kg) = Estimated land area (ha) x Phosphorus load reduction per ha from measures (kg)

In addition, the following mitigation measures were delivered or recommended by catchment stakeholders.

Table 40 Mitigation measures delivered or recommended from various stakeholders.

Mitigation measures delivered or recommended	Source
• The Wye and Usk Foundation have delivered riverine habitat restoration work. • SAC Nutrients Project improved water quality through collaboration with various stakeholders. • Nutrient Management Plans were developed and implemented to reduce nutrient loading from agriculture. • The Water Industry Investment Programme allocated significant funds to reduce the impacts of high spilling CSOs.	NRW Welsh part of the Severn River Basin Management Plan (2021-2027)

Mitigation measures delivered or recommended	Source
• The Storm Overflow Roadmap, developed by a taskforce including NRW, Welsh Government, Ofwat, DCWW, and Hafren Dyfrdwy, aims to investigate and improve the management of storm overflows. • NRW have created a SAC Nutrients Project to focus on water quality issues in designated rivers (Wye) and marine sites; working with Welsh Government, Planning Authorities, Land Managers and Water Companies to determine the best way to address the situation – locally, there is an NMB for the Wye SAC, used to identify and deliver actions to deliver water quality improvements in the SACs. *Note: NRW have advised The Oversight Group no longer meets in 2025 and their structure will be reviewed under the Ministerial Summit.* • NRW works with the agricultural sector to tackle agricultural pollution including: regulation, voluntary actions, advice, guidance, skills development, and investment in innovation, particularly through the Wales Land Management Forum (WLMF) • Enhanced monitoring and investigations, as part of the UK Chemicals Investigation Programme (UKCIP), are conducted to understand pollution sources. • Public awareness campaigns aim to reduce nutrient pollution from misconnections and harmful substance disposal. • Future plans emphasize nature-based solutions and local actions within Opportunity Catchments to further reduce phosphorus pollution.	
• Regulations like the Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 aim to tackle nutrient pollution, with £44.5 million made available between 2018 and 2021 to support farmers in reducing farm pollution through capital infrastructure improvements. • Local authorities are also working on measures to address phosphorus pollution, including planning conditions to permit development only after phosphate treatment works are completed. • Training and guidance are provided through a HRA training program for planners and ecologists, and the revised guidance from NRW helps local planning authorities screen specific development types and consider phosphorus reduction technology for private treatment works. • RBMPs take a holistic approach to managing waters within the wider ecosystem, identifying Opportunity Catchments for the third cycle of River Basin Planning (2021-2027) to deliver long-term benefits for waterbodies, habitats, and species. • NRW leads several projects, including a River Restoration Programme to reduce diffuse pollution and improve water quality, and The Dairy Project (note this has ended at the time of writing), which aims to reduce agricultural pollution by visiting dairy farms and offering compliance advice.	River Pollution Summit Evidence Pack
• Long-term improvement requires reducing P-rich soils to agronomic optimum. • Need for processing livestock manures to recover renewable fertilisers.	Lancaster University RephoKUs report
• Flow regime, water quality and physical habitat should be maintained in, or restored as far as possible to, a near-natural state, in order to support the coherence of ecosystem structure and function across the whole area of the SAC. • The relatively demanding water quality and spawning substrate quality requirements mean that reduction in diffuse pollution and siltation impacts is a high priority.	NRW Core Management Plans

Mitigation measures delivered or recommended	Source
• Measures to address these problems include the establishment of buffer zones on reaches adjacent to intensively managed livestock grazing or arable land. Tree management, especially coppicing and pollarding to increase light levels to the channel, is also often carried out. Liming has also been carried out in some of the acidified headwaters. • The Wye and Usk Foundation through their pHISH project have carried out much of this work in recent years. Other work has included removal of weirs and construction of fish passes to ease artificial barriers to salmon migration, reduction in exploitation pressure through buying out net fisheries in the estuary and the introduction of 'catch and release' byelaws. • In general, management for other SAC features is expected to result in favourable habitat for bullhead, through improvements in water quality and flow regime and maintenance of suitable physical habitat; • Factors that are important to the favourable conservation status of *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation include flow, substrate quality and water quality, which in turn influence species composition and abundance. Favourable management for this feature is therefore largely dependent on ensuring that sufficient depth, velocity and duration of flow and sufficiently low phosphate levels are maintained within the natural range of the vegetation. • To reduce agricultural runoff, preventative measures can include surfacing of tracks and gateways, moving feeding areas, and separating clean and dirty water in farmyards. Farm operations should avoid ploughing land which is vulnerable to soil erosion or leaving such areas without crop cover during the winter. • [For sea lamprey]: the potential impact of flow depletion resulting from a small number of major abstraction licences, if they were to be fully utilised, was highlighted in the Review of Consents process. As a result of this process, flow targets have been set which are considered likely to significantly reduce or remove the potential impacts on SAC features. The species is likely to benefit from positive management for the other SAC features, which could see further improvement in condition.	
• Ongoing projects (at the time of publication, 2022): River Restoration Plan 2020 + Salmon for tomorrow; Wye NMB; Wye Catchment Partnership; WFD work / Diffuse pollution farm visits; Water company and non-water company discharge compliance; Central Monmouthshire Opportunity Catchment work. • NRW and DCWW have implemented a programme of water quality modelling to develop an improved understanding of the sources of phosphorus within the catchment, and to explore approaches for improving water quality. In this instance, the form of phosphorus that was modelled was 'orthophosphate'. • £9.5million from the Welsh Government to improve water quality in Wales in 2021-2022, including £802,000 for water quality improvement plans led by NRW to tackle areas affected by increased pollutant levels, such as phosphate.	First Minister's Special Area of Conservation Rivers Summit
• NRW and DCWW have implemented a programme of water quality modelling to develop an improved understanding of the sources of phosphorus within the catchment, and to explore approaches for improving water quality.	Phosphorus Source Apportionment Summary: Updating the SAGIS Upper Wye Model

I.3 FUTURE MITIGATION MEASURES

I.3.1 Mitigation scenarios

Farmscoper mitigation measures were categorised into five mitigation scenarios (Table 41) to assess the impact of improving agricultural practices or infrastructure on phosphorus loading from the agricultural sector, if all applicable measures were implemented on 100% of applicable land or farm types in the Wye catchment.

Table 41 Mitigation measure scenarios.

Mitigation scenario	Description
Regulation	Measures that allow maximum regulatory compliance with The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021.
Best practice	Regulation + measures that can be implemented to ensure best practice.
Welsh agri-environment measures	Regulation + best practice + measures that can be implemented under current agri-environment schemes or grants in Wales.
All possible agri-environment measures	Regulation + best practices + Welsh agri-environment measures + all possible measures that can be implemented as part of an agri-environment schemes or grants.
All possible measures	All possible measures that can be implemented on farms to improve practices or infrastructure.

Table 42 provides the level of implementation of each mitigation measure included in each of the five mitigation scenarios that were modelled in Farmscoper Upscale and Evaluate V5.

Table 42 The level of implementation (%) of each mitigation measure included in each mitigation scenario.

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Establish cover crops in the autumn	2	100	100	100	100
Early harvesting and establishment of crops in the autumn	50	100	100	100	100
Cultivate land for crops in spring rather than autumn, retaining over-winter stubbles	2	100	100	100	100
Adopt reduced cultivation systems	25	25	25	100	100
Cultivate compacted tillage soils	25	100	100	100	100
Cultivate and drill across the slope	25	25	25	100	100
Leave autumn seedbeds rough	10	100	100	100	100
Manage over-winter tramlines	10	100	100	100	100
Establish in-field grass buffer strips	10	10	10	100	100
Establish riparian buffer strips	10	100	100	100	100
Loosen compacted soil layers in grassland fields	50	100	100	100	100
Allow grassland field drainage systems to deteriorate	2	2	2	100	100
Ditch management on arable land	50	50	100	100	100
Ditch management on grassland	25	25	100	100	100
Improved livestock through breeding	10	10	10	10	100

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Use plants with improved nitrogen use efficiency	0	0	100	100	100
Fertiliser spreader calibration	100	100	100	100	100
Use a fertiliser recommendation system	100	100	100	100	100
Integrate fertiliser and manure nutrient supply	100	100	100	100	100
Do not apply manufactured fertiliser to high-risk areas	100	100	100	100	100
Avoid spreading manufactured fertiliser to fields at high-risk times	100	100	100	100	100
Use manufactured fertiliser placement technologies	10	10	10	100	100
Use nitrification inhibitors	0	0	0	100	100
Replace urea fertiliser to grassland with another form	0	0	0	100	100
Replace urea fertiliser to arable land with another form	0	0	0	100	100
Incorporate a urease inhibitor into urea fertilisers for grassland	0	0	0	100	100
Incorporate a urease inhibitor into urea fertilisers for arable land	0	0	0	100	100
Use clover in place of fertiliser nitrogen	10	10	100	100	100
Do not apply P fertilisers to high P index soils	100	100	100	100	100
Reduce dietary N and P intakes: Dairy	10	10	10	100	100
Reduce dietary N and P intakes: Pigs	80	80	80	100	100
Reduce dietary N and P intakes: Poultry	80	80	80	100	100
Adopt phase feeding of livestock: Dairy	80	80	80	100	100
Adopt phase feeding of livestock: Pigs	80	80	80	100	100
Reduce the length of the grazing day/grazing season	10	10	10	100	100
Extend the grazing season for cattle	10	10	10	100	100
Reduce field stocking rates when soils are wet	80	100	100	100	100
Move feeders at regular intervals	50	100	100	100	100
Construct troughs with concrete base	2	2	2	100	100
Increase scraping frequency in dairy cow cubicle housing	10	10	100	100	100
Additional targeted bedding for straw-bedded cattle housing	10	10	10	100	100
Washing down of dairy cow collecting yards	25	25	25	100	100
Frequent removal of slurry from beneath-slat storage in pig housing	2	2	2	100	100
Install air-scrubbers: mechanically ventilated pig housing	2	2	2	2	100
Install air-scrubbers: mechanically ventilated poultry housing	2	2	2	2	100
More frequent manure removal from laying hen housing with manure belt systems	10	10	10	10	100
In-house poultry manure drying	10	10	10	10	100
Increase the capacity of farm slurry stores to improve timing of slurry applications	100	100	100	100	100
Adopt batch storage of slurry	0	0	0	100	100
Install covers to slurry stores	10	10	100	100	100

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Allow cattle slurry stores to develop a natural crust	80	80	80	100	100
Anaerobic digestion of livestock manures	0	0	0	100	100
Minimise the volume of dirty water produced (sent to dirty water store)	100	100	100	100	100
Minimise the volume of dirty water produced (sent to slurry store)	100	100	100	100	100
Compost solid manure	2	2	2	100	100
Site solid manure heaps away from watercourses/field drains	100	100	100	100	100
Store solid manure heaps on an impermeable base and collect effluent	10	10	10	100	100
Cover solid manure stores with sheeting	2	2	100	100	100
Use liquid/solid manure separation techniques	2	2	100	100	100
Use poultry litter additives	0	0	0	0	100
Manure Spreader Calibration	100	100	100	100	100
Do not apply manure to high-risk areas	100	100	100	100	100
Do not spread slurry or poultry manure at high-risk times	100	100	100	100	100
Use slurry band spreading application techniques	2	2	100	100	100
Use slurry injection application techniques	0	0	100	100	100
Do not spread FYM to fields at high-risk times	100	100	100	100	100
Incorporate manure into the soil	100	100	100	100	100
Fence off rivers and streams from livestock	25	100	100	100	100
Construct bridges for livestock crossing rivers/streams	80	80	80	100	100
Re-site gateways away from high-risk areas	25	25	25	100	100
Farm track management	25	25	25	100	100
Establish new hedges	2	2	100	100	100
Establish and maintain artificial wetlands - steading runoff	2	2	2	100	100
Irrigate crops to achieve maximum yield	2	2	2	100	100
Establish tree shelter belts around livestock housing	10	10	100	100	100
Calibration of sprayer	50	50	50	100	100
Fill/Mix/Clean sprayer in field	25	25	25	100	100
Avoid Plant Protection Products application at high risk timings	10	10	10	100	100
Drift reduction methods	25	25	25	100	100
PPP substitution	0	0	0	100	100
Construct bunded impermeable PPP filling/mixing/cleaning area	2	2	2	100	100
Treatment of PPP washings through disposal, activated carbon or biobeds	50	50	50	100	100
Protection of in-field trees	0	0	0	0	100
Management of woodland edges	2	2	100	100	100
Management of in-field ponds	2	2	100	100	100

Method Name	Regulation	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures
Management of arable field corners	2	2	2	2	100
Plant areas of farm with wild bird seed / nectar flower mixtures	2	2	100	100	100
Beetle banks	2	2	2	2	100
Uncropped cultivated margins	2	2	2	2	100
Skylark plots	2	2	2	2	100
Uncropped cultivated areas	2	2	100	100	100
Unfertilised cereal headlands	2	2	100	100	100
Unharvested cereal headlands	2	2	100	100	100
Undersown spring cereals	2	100	100	100	100
Management of grassland field corners	2	2	2	2	100
Leave residual levels of non-aggressive weeds in crops	2	2	100	100	100
Use correctly-inflated low ground pressure tyres on machinery	25	100	100	100	100
Locate out-wintered stock away from watercourses	10	100	100	100	100
Use dry-cleaning techniques to remove solid waste from yards prior to cleaning	0	0	0	0	100
Capture of dirty water in a dirty water store	100	100	100	100	100
Irrigation/water supply equipment is maintained and leaks repaired	10	10	10	10	100
Avoid irrigating at high risk times	2	2	2	2	100
Use efficient irrigation techniques (boom trickle, self closing nozzles)	0	0	0	0	100
Use high sugar grasses	10	10	10	10	100
Monitor and amend soil pH status for grassland	0	0	0	0	100
Increased use of maize silage	0	0	0	0	100
Improved crop health	0	0	0	0	100
Better health planning: dairy	0	0	0	0	100
Better health planning: beef	0	0	0	0	100
Better health planning: sheep	0	0	0	0	100
Improve livestock through genetic modification	0	0	0	0	100
Slurry acidification during storage	0	0	0	0	100
Slurry acidification at spreading	0	0	0	0	100
Install covers to slurry stores and burn off methane	0	0	100	100	100
Use feed additives to reduce enteric methane emissions	0	0	0	0	100

I.3.2 P index 2 or below soils

To model the impact of P index 2 or below soils the Farmscoper Upscale V5 create results for each farm type were modified to have 100% of the soils at P index 2 or below. The baseline results were deducted from the baseline results with soils at the at 30% P index 2 or below, 55% at P index 3 and 15% at P index 4 to provide the likely load reduction achieved by farming at optimal or below P indexes (Table 43).

Table 43 Baseline phosphorus load modelled in Farmscoper Upscale V5 for the Wye catchment under current or optimal P indexes.

	Baseline phosphorus load (kg)
Current P index	187,014
All soils at P index 2 or below	184,918
Load reduction achieved*	2,096

* *Load reduction achieved (kg) = Current P index phosphorus load - All soils at P index 2 or below phosphorus load.*

The load reduction achieved was deducted from the *"all possible measures"* phosphorus load with the current P index soils to provide a total estimated load from the agricultural sector where soils were at optimal or below P index with all possible mitigation measures in place (a total phosphorus load of 99,854kg and load reduction of 87,160kg relative to the baseline load of 187,014kg).

I.3.3 Land use change

The impact of land use change was estimated by reducing the farmed area in the Wye catchment modelled in Farmscoper Upscale V5 by 5% (which represents a total reduction of farmland by 21,882ha across the whole of the Wye catchment) and replacing this with woodland, with the different mitigation scenarios in place on the remaining agricultural land.

The farmed area for the whole of the Wye catchment was calculated by multiplying each farm type within each soil type and climate (rainfall) zone by the average area (hectares) per farm type using the results provided from Farmscoper Upscale V5 and the following formula:

$$Farmed\ area\ (ha) = Farm\ count\ \times Area\ per\ farm\ (ha)$$

This area was reduced by 5% to calculate how much land area in hectares could be converted to woodland:

$$Farmland\ reduced\ by\ 5\%\ (ha) = Farm\ area\ \times 0.95$$

The phosphorus load from each farm type calculated in Farmscoper Upscale V5 was converted to kg phosphorus per hectare by:

$$Phosphorus\ load\ per\ ha\ (kg) = Phosphorus\ load\ per\ farm\ (kg)\ \div Area\ per\ farm\ (ha)$$

The total phosphorus load from the remaining agricultural land in production was calculated by:

$$Total\ phosphorus\ load\ (kg) = Farmland\ reduced\ by\ 5\%\ (ha) \times Phosphorus\ load\ per\ ha$$

The total phosphorus load from agriculture from the 5% of converted agricultural land before it was converted to woodland was calculated by:

$$Total\ phosphorus\ load\ (kg) = 5\%\ \text{of farmed area}\ (ha) \times Phosphorus\ load\ per\ ha$$

This was completed for each of the phosphorus loads modelled for each of the five mitigation scenarios (regulation, best practice, Welsh agri-environment measures, all possible agri-environment measures and all possible measures).

The phosphorus load from one hectare of woodland was modelled for each soil type and climate (rainfall) zone combination in Farmscoper Create V5 (Table 44). The soil types include freely draining (FreeDrain), Drained for Arable only (DrainedAr) and Drained for Arable and Grassland (DrainedArGr).

Table 44 Phosphorus load from one hectare of woodland across the different climate and soil types in the Wye catchment.

Rainfall (mm)	Soil type	Phosphorus load per ha (kg)
600 to 700	FreeDrain	0.001
	DrainedAr	0.002
	DrainedArGr	0.001
700 to 900	FreeDrain	0.002
	DrainedAr	0.004
	DrainedArGr	0.002
900 to 1200	FreeDrain	0.008
	DrainedAr	0.011
	DrainedArGr	0.008
1200 to 1500	FreeDrain	0.023
	DrainedAr	0.024
	DrainedArGr	0.016
Over 1500	FreeDrain	0.060
	DrainedAr	0.056
	DrainedArGr	0.038

The phosphorus load from woodland per ha was then calculated by multiplying the woodland phosphorus load per ha by the land area converted to woodland (5% of farmland) for each farm type respective to the corresponding rainfall and soil type.

The phosphorus load reduction achieved from converting 5% of the agricultural land to woodland was calculated by:

$$Phosphorus\ load\ reduction\ achieved\ (kg) = \text{Phosphorus load from 5\% of agricultural land before coversion to woodland (kg)} - \text{Phosphorus load from woodland (kg)}$$

The new phosphorus load from the agricultural sector was then calculated by:

$$Agricultural\ phosphorus\ load\ (kg) = \text{Phosphorus load from all farmland (kg)} - \text{Phosphorus load reduction achieved (kg)}$$

Table 45 Extract of results

Farm	Climate (rainfall) (mm)	Soil	Farm Count	Area per Farm (ha)	Phosphorus per farm (kg)	Total farmed area (ha)	Total phosphorus (kg)	Phosphorus per ha (kg)	Farmland reduced by 5% (ha)	Total phosphorus from farmland reduced by 5% (kg)	Phosphorus load from agriculture before conversion to woodland (kg)	Woodland area (ha)	Phosphorus load from woodland (ha)	Load reduction achieved (kg P)	New load from agriculture with 5% land use change to woodland
Arable	600to700	FreeDrain	34	105.8	5	3,597	172	0.05	3,417	164	9	180	0.12	8	164
Arable	600to700	DrainedAr	69	105.8	27	7,300	1,880	0.26	6,935	1,786	94	365	0.79	93	1,787
Arable	600to700	DrainedArGr	4	105.8	47	423	190	0.45	402	180	9	21	0.02	9	180
Arable	700to900	FreeDrain	55	105.8	15	5,819	799	0.14	5,528	759	40	291	0.65	39	760
Arable	700to900	FreeDrain	241	105.8	15	25,498	3,502	0.14	24,223	3,327	175	1,275	2.86	172	3,330
Arable	700to900	DrainedAr	22	105.8	61	2,328	1,336	0.57	2,211	1,270	67	116	0.42	66	1,270
Arable	700to900	DrainedAr	170	105.8	61	17,986	10,326	0.57	17,087	9,810	516	899	3.26	513	9,813
Arable	700to900	DrainedArGr	19	105.8	84	2,010	1,602	0.80	1,910	1,522	80	101	0.20	80	1,522
Arable	700to900	DrainedArGr	24	105.8	84	2,539	2,024	0.80	2,412	1,922	101	127	0.25	101	1,923
Arable	900to1200	FreeDrain	83	105.8	26	8,781	2,158	0.25	8,342	2,050	108	439	3.56	104	2,054
Arable	900to1200	FreeDrain	12	105.8	26	1,270	312	0.25	1,206	296	16	63	0.52	15	297
Arable	900to1200	DrainedAr	46	105.8	116	4,867	5,320	1.09	4,623	5,054	266	243	2.57	263	5,057

The results for each farm type and the corresponding soil type and rainfall zone were then summed.

The results show that converting 5% of the agricultural land to woodland and implementing the different mitigation scenarios on the remaining agricultural land could achieve a phosphorus load reduction of between 13,309kg and 64,786kg of phosphorus, which represents a load reduction of between 22% and 50% compared to the baseline (Table 46). Land use change by 5% of the farmed area would reduce the phosphorus load from agriculture by a further 4% compared to no land use change when each mitigation scenario is implemented on the remaining farmed land.

Table 46 The phosphorus load reduction that could be achieved from implementing a range of mitigation scenarios, if all applicable mitigation measures are implemented on all applicable land and farm types across the Wye catchment.

Mitigation scenario	Phosphorus load (kg)	Phosphorus load reduction (kg)	Phosphorus load reduction (%)
Baseline (no mitigation)	187,014	-	-
Regulation	145,292	13,309	22
Best practice	118,343	40,258	37
Welsh agri-environment measures	106,776	51,825	43
All possible agri-environment measures	96,965	61,636	48
All possible measures	93,815	64,786	50

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I.3.4 Waterbody catchment load reductions

The load reductions achieved from each mitigation scenario (Table 47) were applied to the current agricultural load to assess whether the load reduction that could be achieved from each mitigation scenario. Table 47 displays the results.

Table 47 Current phosphorus load, load reduction target, and the load reductions that can be achieved from each mitigation measure scenario in the failing waterbodies. Green cells indicate that the target load reduction can be met from the mitigation measure scenario

Main catchment	Ref	Water body name	Phosphorus load (kg)	Load reduction target (kg)	Load reduction achieved (kg)						
					Regulatory compliance	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures	All possible measures + P index 2 or below soils	All possible measures + 5% land use change
Lugg	1	Gilwern Bk - source to conf R Arrow	No data	No data	-	-	-	-	-	-	-
	2	Norton Bk - source to conf R Lugg	568	392	102	184	219	249	258	265	283
Upper Wye	3	Afon Chwefru - source to conf R Irfon	412	153	74	133	159	181	188	192	205
	4	Afon Gwesyn - source to conf R Irfon	165	59	30	53	64	72	75	77	82
	5	Cledan - source to conf R Irfon	343	158	62	111	132	150	156	160	171
	6	Aran - source to conf R Ithon	593	151	106	192	228	260	270	276	295
	7	Camddwr Bk - source to conf R Ithon	313	147	56	101	121	137	142	146	156
	8	Clywedog Bk - conf Bachell Bk to conf R Ithon	419	37	75	136	162	184	191	195	209
	9	Clywedog Bk - source to conf Bachell Bk	51	15	9	17	20	22	23	24	25
	10	Gwenlas Bk - source to conf R Ithon	289	204	52	93	111	126	131	135	144
	11	Howey Bk - source to conf R Ithon	393	261	71	127	152	172	179	183	196
	12	Ithon - conf Gwenlas Bk to conf Camddwr Bk	256	52	46	83	99	112	117	119	128
	13	Ithon - conf Llaethdy Bk to conf Gwenlas Bk	395	75	71	128	152	173	179	184	197
	14	Ithon - source to conf Llaethdy Bk	194	14	35	63	75	85	88	90	96
	15	Mithil Bk - source to conf R Ithon	409	268	73	132	158	179	186	190	204
	16	Nantmel Dulas - source to conf R Ithon	310	157	56	100	120	136	141	145	155
	17	Afon Llynfi - conf Dulas Bk to conf R Wye	3,339	1,935	600	1,081	1,288	1,463	1,519	1,556	1,664
	18	Bach Howey Bk - source to conf R Wye	1,332	716	239	431	513	583	606	621	664

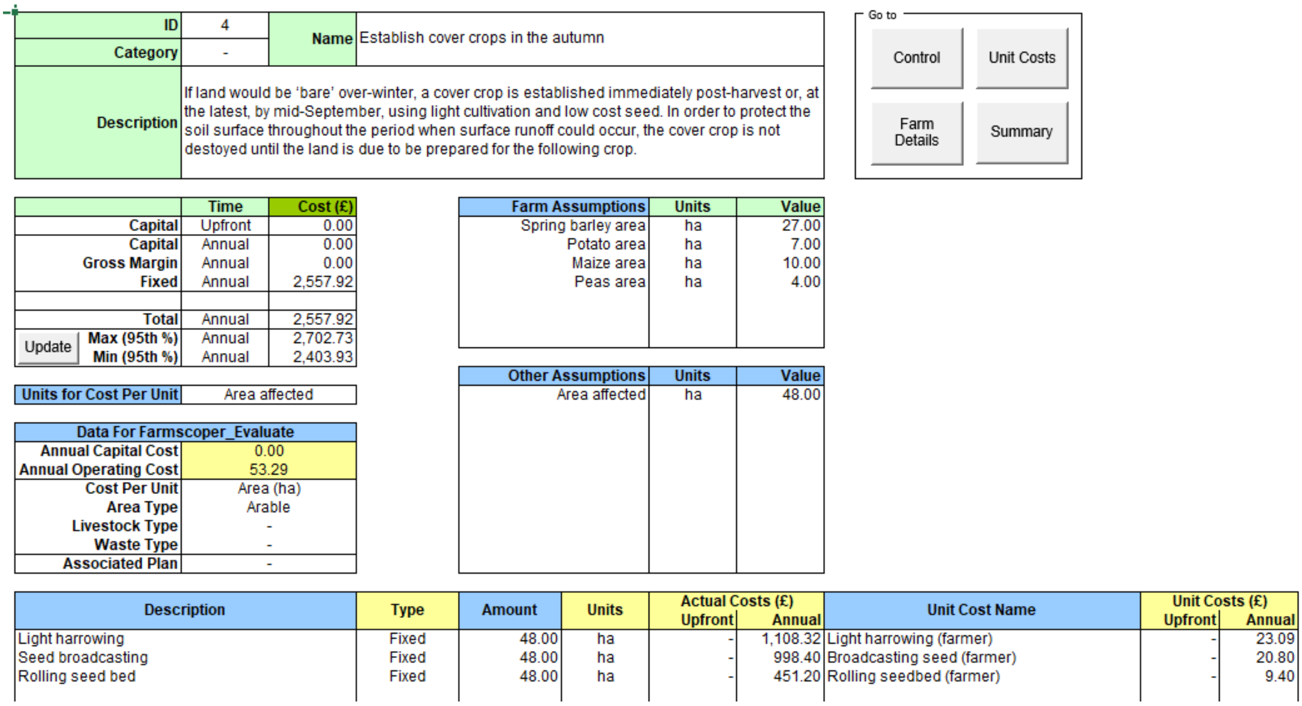
Main catchment	Ref	Water body name	Phosphorus load (kg)	Load reduction target (kg)	Load reduction achieved (kg)						
					Regulatory compliance	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures	All possible measures + P index 2 or below soils	All possible measures + 5% land use change
	19	Builth Dulas Bk - source to conf R Wye	199	34	36	64	77	87	90	93	99
	20	Camnant Brook - source to confluence R Edw	706	491	127	228	272	309	321	329	352
	21	Clettwr Bk - source to conf R Wye	524	180	94	170	202	229	238	244	261
	22	Dulas Bk - source to conf Afon Llynfi	470	132	84	152	181	206	214	219	234
	23	Edw - conf Camnant Bk to conf Clas Bk	1,935	1,146	348	627	746	848	880	902	965
	24	Edw - conf Clas Bk to conf R Wye	1,235	60	222	400	476	541	562	575	615
	25	Edw - source to conf Colwyn Bk	740	266	133	240	285	324	337	345	369
	26	Scithwen Bk - source to conf R Wye	321	80	58	104	124	141	146	150	160
	27	Triffrwd - source to Dulas	265	146	48	86	102	116	121	124	132
	28	Afon Llynfi - source to conf Dulas Bk	2,147	677	386	695	828	940	977	1,001	1,070
	29	Clyro Bk - source to conf R Wye	572	106	103	185	221	251	260	267	285
	30	Digedi Bk - source to conf R Wye	673	157	121	218	260	295	306	314	336
	31	Afon Claerwen - conf Afon Arban to Caban-coch	3,446	1,101	619	1,115	1,328	1,509	1,567	1,606	1,717
	32	Afon Claerwen - source to conf Afon Arban	No data	No data	-	-	-	-	-	-	-
	33	Wye - conf Afon Elan to conf R Ithon	4,369	769	785	1,414	1,684	1,913	1,987	2,036	2,177
Lower Wye	34	Llanymynech Bk - source to conf R Trothy	1,275	537	229	413	492	559	580	594	636
	35	Llymon Bk - source to conf R Trothy	641	54	115	207	247	281	292	299	319
	36	Trothy - conf Llanymynach Bk to conf Llymon Bk	2,030	228	365	657	783	889	923	946	1,012
	37	Trothy - conf Llymon Bk to conf R Wye	5,411	805	972	1,751	2,086	2,370	2,461	2,522	2,696
	38	Tintern Bk - source to conf R Wye	No data	No data	-	-	-	-	-	-	-

I.3.5 Cost benefit analysis

I.3.5.1 Costs of implementing mitigation measures

Farmscoper Cost V5 provides annualised capital and operational cost per unit per year for each mitigation measure (see example in Figure 29). The annual unit costs are used to calculate total operational and capital costs per year from mitigation measures modelled in Farmscoper Evaluate V5 across all applicable land and farm types.

Figure 29 Extract from Farmscoper Cost V5 showing estimated costs for establishing cover crops in the autumn, note highlighted yellow cells provide annualised capital and operational costs for each mitigation measure which is used by Farmscoper Evaluate V5 to calculate total cost per of implementing the measure per year.



The cost of implementing the mitigation measure scenarios was modelled in Farmscoper Evaluate V5 using the default 2021 cost values from Farmscoper Cost V5. The results were converted to 2025 price year based on a 24% cost increase (Bank of England, 2025) and are presented in Table 48.

Table 48 Estimated costs of implementing the mitigation scenarios (2025 values).

Mitigation scenario	Annualised capital cost (£/yr)	Annualised operational cost (£/yr)	Total annualised cost (£/yr)
Existing measures	£8,164,614	£5,460,770	£13,625,384
Regulatory compliance	£10,384,135	£7,247,447	£17,631,582
Best practice	£20,169,382	£18,856,514	£39,025,896
Welsh agri-environment measures	£53,829,510	£38,747,532	£92,577,042
All possible agri-environment measures	£81,520,746	£52,829,708	£134,350,454
All possible measures	£96,804,156	£77,774,836	£174,578,993
All possible measures + P index 2 or below soils	£96,804,156	£78,806,202	£175,610,359

Table 49 displays the estimate cost for the *"All possible measures + 5% land use change"* mitigation scenario. This was calculated by reducing the *"All possible measures"* costs by 5% to represent 5% less agricultural land that the measures would be implemented on. The total cost of broadleaved woodland establishment and maintenance was estimated to be £17,883 over 100 years in 2023 (Forestry Research, 2023). This equates to £18,777 over 100 years in 2025 values, based on a 5% cost increase (Bank of England, 2025). This equates to an estimated annualised capital and operational cost of £188 per ha per year for land use change to woodland. This value was multiplied by the total hectares that would be converted to woodland (21,882ha) to obtain a total annual capital and operational cost for 5% land use change to woodland across the whole of the Wye catchment.

Table 49 Estimated total cost of implementing all possible measures and 5% land use change.

Mitigation scenario	Total cost (£/yr)
All possible measures + 5% land use change	£209,762,813

The total costs for each mitigation measure scenario (Table 50) were divided by the total phosphorus load reduction achieved for all farms across the Wye as modelled in Farmscoper Evaluate V5. This provided a total cost per kg phosphorus load reduction achieved. The cost per kg was multiplied by the load reductions achieved in each waterbody catchment to provide a total estimated cost of implementing measures within the mitigation scenarios at the waterbody scale (Table 51).

Table 50 Load reductions, total cost and cost per kg phosphorus load reduction achieved from each mitigation scenario across the whole of the Wye catchment.

Mitigation scenario	Load reduction achieved (kg/yr)	Total cost (£/yr)	Cost per kg (£/yr)
Existing measures	24,650	£13,625,384	£553
Regulatory compliance	33,587	£17,631,582	£525
Best practice	60,536	£39,025,896	£645
Welsh agri-environment measures	72,104	£92,577,042	£1,284
All possible agri-environment measures	81,914	£134,350,454	£1,640
All possible measures	85,065	£174,578,993	£2,052
All possible measures + P index 2 or below soils	87,160	£175,610,359	£2,015
All possible measures + 5% land use change	93,199	£209,762,813	£2,251

Table 51 Total estimated cost of implementing each mitigation scenario in each waterbody catchment (based on the cost effectiveness of the phosphorus load reduction that could be achieved).

Main catchment	Ref	Water body name	Total cost (£/yr)						
			Regulatory compliance	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures	All possible measures + P index 2 or below soils	All possible measures + 5% land use change
Lugg	1	*Gilwern Bk - source to conf R Arrow*	-	-	-	-	-	-	-
	2	*Norton Bk - source to conf R Lugg*	£53,572	£118,576	£281,285	£408,209	£530,439	£533,573	£637,341
Upper Wye	3	*Afon Chwefru - source to conf R Irfon*	£38,877	£86,050	£204,127	£296,235	£384,936	£387,210	£462,514
	4	*Afon Gwesyn - source to conf R Irfon*	£15,556	£34,432	£81,680	£118,536	£154,029	£154,939	£185,071
	5	*Cledan - source to conf R Irfon*	£32,326	£71,550	£169,730	£246,317	£320,071	£321,962	£384,577
	6	*Aran - source to conf R Ithon*	£55,863	£123,647	£293,315	£425,666	£553,124	£556,391	£664,598
	7	*Camddwr Bk - source to conf R Ithon*	£29,514	£65,326	£154,965	£224,890	£292,229	£293,955	£351,123
	8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	£39,502	£87,433	£207,409	£300,998	£391,126	£393,436	£469,951
	9	*Clywedog Bk - source to conf Bachell Bk*	£4,808	£10,643	£25,246	£36,638	£47,609	£47,890	£57,204
	10	*Gwenlas Bk - source to conf R Ithon*	£27,226	£60,263	£142,956	£207,462	£269,583	£271,175	£323,913
	11	*Howey Bk - source to conf R Ithon*	£37,060	£82,030	£194,591	£282,396	£366,953	£369,121	£440,907
	12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	£24,166	£53,489	£126,886	£184,141	£239,278	£240,692	£287,501
	13	*Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	£37,202	£82,344	£195,335	£283,476	£368,358	£370,534	£442,595
	14	*Ithon - source to conf Llaethdy Bk*	£18,255	£40,406	£95,851	£139,101	£180,752	£181,820	£217,180
	15	*Mithil Bk - source to conf R Ithon*	£38,532	£85,287	£202,317	£293,608	£381,523	£383,777	£458,413
	16	*Nantmel Dulas - source to conf R Ithon*	£29,252	£64,746	£153,591	£222,896	£289,637	£291,348	£348,009
	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	£314,834	£696,857	£1,653,081	£2,398,999	£3,117,331	£3,135,747	£3,745,583
	18	*Bach Howey Bk - source to conf R Wye*	£125,559	£277,912	£659,262	£956,740	£1,243,217	£1,250,561	£1,493,769
	19	*Builth Dulas Bk - source to conf R Wye*	£18,748	£41,498	£98,441	£142,860	£185,636	£186,733	£223,049
	20	*Camnant Brook - source to confluence R Edw*	£66,514	£147,223	£349,242	£506,831	£658,591	£662,482	£791,320
	21	*Clettwr Bk - source to conf R Wye*	£49,398	£109,339	£259,372	£376,409	£489,117	£492,006	£587,691
	22	*Dulas Bk - source to conf Afon Llynfi*	£44,350	£98,165	£232,867	£337,943	£439,134	£441,728	£527,634
	23	*Edw - conf Camnant Bk to conf Clas Bk*	£182,477	£403,896	£958,119	£1,390,450	£1,806,792	£1,817,466	£2,170,925

Main catchment	Ref	Water body name	Total cost (£/yr)						
	24	*Edw - conf Clas Bk to conf R Wye*	£116,397	£257,633	£611,157	£886,928	£1,152,501	£1,159,310	£1,384,771
	25	*Edw - source to conf Colwyn Bk*	£69,803	£154,503	£366,512	£531,892	£691,156	£695,240	£830,449
	26	*Scithwen Bk - source to conf R Wye*	£30,248	£66,951	£158,822	£230,487	£299,501	£301,271	£359,861
	27	*Triffrwd - source to Dulas*	£24,989	£55,311	£131,207	£190,412	£247,427	£248,889	£297,292
	28	*Afon Llynfi - source to conf Dulas Bk*	£202,432	£448,064	£1,062,896	£1,542,505	£2,004,378	£2,016,219	£2,408,330
	29	*Clyro Bk - source to conf R Wye*	£53,959	£119,434	£283,321	£411,164	£534,279	£537,435	£641,955
	30	*Digedi Bk - source to conf R Wye*	£63,482	£140,512	£333,321	£483,725	£628,566	£632,280	£755,245
	31	*Afon Claerwen - conf Afon Arban to Caban-coch*	£324,857	£719,041	£1,705,705	£2,475,368	£3,216,567	£3,235,569	£3,864,818
	32	*Afon Claerwen - source to conf Afon Arban*	-	-	-	-	-	-	-
	33	*Wye - conf Afon Elan to conf R Ithon*	£411,869	£911,634	£2,162,574	£3,138,389	£4,078,116	£4,102,209	£4,900,001
Lower Wye	34	*Llanymynech Bk - source to conf R Trothy*	£120,248	£266,159	£631,381	£916,278	£1,190,639	£1,197,673	£1,430,595
	35	*Llymon Bk - source to conf R Trothy*	£60,432	£133,760	£317,305	£460,482	£598,364	£601,899	£718,955
	36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	£191,403	£423,652	£1,004,986	£1,458,464	£1,895,172	£1,906,368	£2,277,116
	37	*Trothy - conf Llymon Bk to conf R Wye*	£510,116	£1,129,095	£2,678,433	£3,887,019	£5,050,909	£5,080,748	£6,068,845
	38	*Tintern Bk - source to conf R Wye*	-	-	-	-	-	-	-

I.3.5.2 Monetary benefits

Agricultural benefit

The cost benefit to the agricultural sector from implementing the mitigation scenarios was calculated based on the value of phosphorus fertiliser. The value of phosphorus to agriculture was based on the value of triple superphosphate fertiliser (46% phosphorus) at £460 per tonne (46p per kg) (AHDB, 2025), which equates to a cost of £1 per kg of phosphorus. This was calculated using the following formula

$$Phosphorus\ cost\ to\ agriculture\ (£/kg)\ =\ phosphorus\ per\ kg\ (0.46)\ /\ cost\ per\ kg\ (£0.46)$$

The agricultural benefit (reduced fertiliser costs) was calculated by multiplying the phosphorus cost to agriculture by the load reductions achieved in the waterbody catchments (Table 52).

Table 52 Agricultural benefit (£/yr) that could be achieved from fertiliser savings from reduced phosphorus losses in the failing waterbodies.

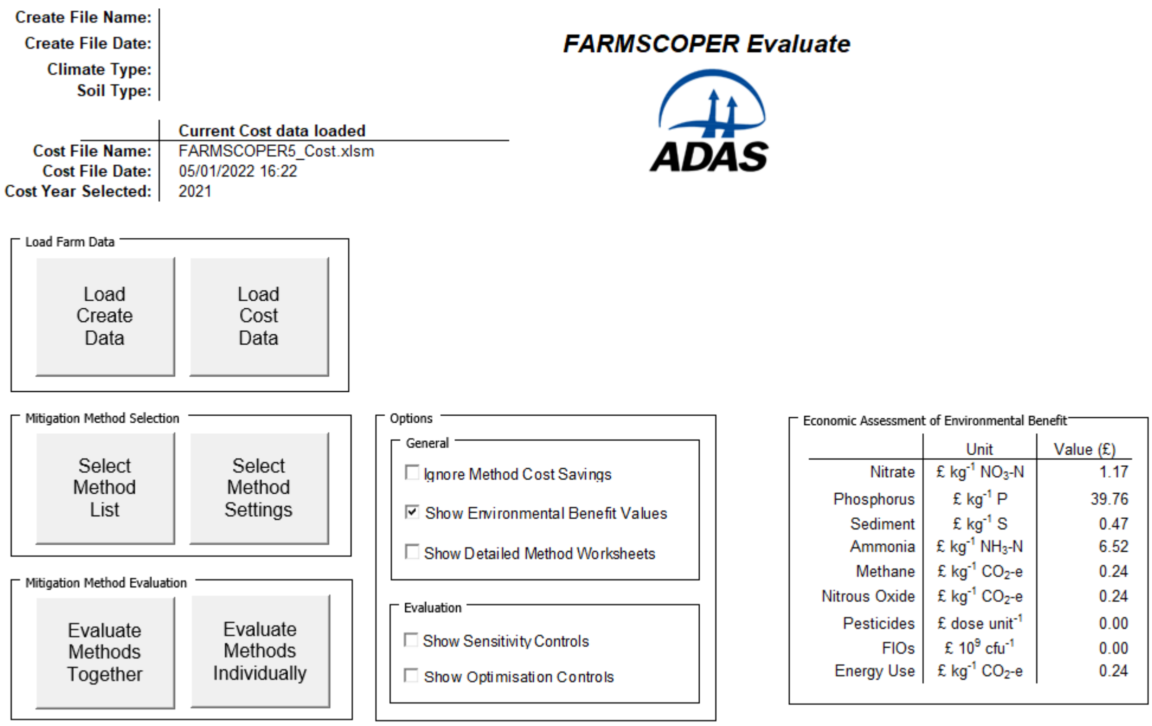
Main catchment	Ref	Water body name	Agricultural benefit (£/yr)						
			Regulatory compliance	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures	All possible measures + P index 2 or below soils	All possible measures + 5% land use change
Lugg	1	*Gilwern Bk - source to conf R Arrow*	-	-	-	-	-	-	-
	2	*Norton Bk - source to conf R Lugg*	£102	£184	£219	£249	£258	£265	£283
Upper Wye	3	*Afon Chwefru - source to conf R Irfon*	£74	£133	£159	£181	£188	£192	£205
	4	*Afon Gwesyn - source to conf R Irfon*	£30	£53	£64	£72	£75	£77	£82
	5	*Cledan - source to conf R Irfon*	£62	£111	£132	£150	£156	£160	£171
	6	*Aran - source to conf R Ithon*	£106	£192	£228	£260	£270	£276	£295
	7	*Camddwr Bk - source to conf R Ithon*	£56	£101	£121	£137	£142	£146	£156
	8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	£75	£136	£162	£184	£191	£195	£209
	9	*Clywedog Bk - source to conf Bachell Bk*	£9	£17	£20	£22	£23	£24	£25
	10	*Gwenlas Bk - source to conf R Ithon*	£52	£93	£111	£126	£131	£135	£144
	11	*Howey Bk - source to conf R Ithon*	£71	£127	£152	£172	£179	£183	£196
	12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	£46	£83	£99	£112	£117	£119	£128
	13	*Ithon - conf Llaethdy Bk to conf Gwenlas Bk*	£71	£128	£152	£173	£179	£184	£197
	14	*Ithon - source to conf Llaethdy Bk*	£35	£63	£75	£85	£88	£90	£96
	15	*Mithil Bk - source to conf R Ithon*	£73	£132	£158	£179	£186	£190	£204
	16	*Nantmel Dulas - source to conf R Ithon*	£56	£100	£120	£136	£141	£145	£155
	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	£600	£1,081	£1,288	£1,463	£1,519	£1,556	£1,664
	18	*Bach Howey Bk - source to conf R Wye*	£239	£431	£513	£583	£606	£621	£664
	19	*Builth Dulas Bk - source to conf R Wye*	£36	£64	£77	£87	£90	£93	£99
	20	*Camnant Brook - source to confluence R Edw*	£127	£228	£272	£309	£321	£329	£352
	21	*Clettwr Bk - source to conf R Wye*	£94	£170	£202	£229	£238	£244	£261
	22	*Dulas Bk - source to conf Afon Llynfi*	£84	£152	£181	£206	£214	£219	£234
	23	*Edw - conf Camnant Bk to conf Clas Bk*	£348	£627	£746	£848	£880	£902	£965

Main catchment	Ref	Water body name	Agricultural benefit (£/yr)						
			Regulatory compliance	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures	All possible measures + P index 2 or below soils	All possible measures + 5% land use change
	24	*Edw - conf Clas Bk to conf R Wye*	£222	£400	£476	£541	£562	£575	£615
	25	*Edw - source to conf Colwyn Bk*	£133	£240	£285	£324	£337	£345	£369
	26	*Scithwen Bk - source to conf R Wye*	£58	£104	£124	£141	£146	£150	£160
	27	*Triffrwd - source to Dulas*	£48	£86	£102	£116	£121	£124	£132
	28	*Afon Llynfi - source to conf Dulas Bk*	£386	£695	£828	£940	£977	£1,001	£1,070
	29	*Clyro Bk - source to conf R Wye*	£103	£185	£221	£251	£260	£267	£285
	30	*Digedi Bk - source to conf R Wye*	£121	£218	£260	£295	£306	£314	£336
	31	*Afon Claerwen - conf Afon Arban to Caban-coch*	£619	£1,115	£1,328	£1,509	£1,567	£1,606	£1,717
	32	*Afon Claerwen - source to conf Afon Arban*	-	-	-	-	-	-	-
	33	*Wye - conf Afon Elan to conf R Ithon*	£785	£1,414	£1,684	£1,913	£1,987	£2,036	£2,177
Lower Wye	34	*Llanymynech Bk - source to conf R Trothy*	£229	£413	£492	£559	£580	£594	£636
	35	*Llymon Bk - source to conf R Trothy*	£115	£207	£247	£281	£292	£299	£319
	36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	£365	£657	£783	£889	£923	£946	£1,012
	37	*Trothy - conf Llymon Bk to conf R Wye*	£972	£1,751	£2,086	£2,370	£2,461	£2,522	£2,696
	38	*Tintern Bk - source to conf R Wye*	-	-	-	-	-	-	-

Environmental benefit

The environmental benefit of the mitigation measures to reduce nitrate, phosphorus, sediment, ammonia, methane, nitrous oxide, pesticides, faecal indicator organisms (FIOs) and carbon losses to the environment is calculated by Farmscoper Evaluate V5 using standard values (Figure 30).

Figure 30 Standard cost values for environmental benefits used in Farmscoper Evaluate V5, based on 2021 values.



The environmental benefit calculated by Farmscoper Evaluate V5 using 2021 values was calculated to 2025 based on a 24% cost increase (Bank of England, 2025) (Table 53). The environmental benefit per kg phosphorus load reduction achieved was calculated by:

$$Environmental\ benefit\ per\ kg\ phosphorus\ (£/yr) = Environmental\ benefit\ (2025)\ (£/yr)\ \div\ Phosphorus\ load\ reduction\ (kg/yr)$$

Table 53 Environmental benefit modelled in Farmscoper Evaluate V5 and equivalent values.

Mitigation scenario	Phosphorus load reduction (kg/yr)	Environmental benefit (£/yr)	Environmental benefit (2025) (£/yr)	Environmental benefit per kg phosphorus (£/yr)
Existing measures	24,650	£28,584,702	£35,445,030	£1,439
Regulatory compliance	33,587	£39,535,429	£49,023,932	£1,461
Best practice	60,536	£53,462,301	£66,293,254	£1,096
Welsh agri-environment measures	72,104	£83,412,914	£103,432,014	£1,435
All possible agri-environment measures	81,914	£98,528,577	£122,175,435	£1,493
All possible measures	85,065	£124,469,446	£154,342,113	£1,815
All possible measures + P index 2 or below soils	87,160	£124,469,446	£154,342,113	£1,772
All possible measures + 5% land use change	93,199	£118,245,974	£186,008,785	£1,997

The environmental benefit per kg phosphorus was multiplied by the load reductions achieved in each failing waterbody catchment to calculate an estimated environmental benefit from the mitigation scenarios in each waterbody catchment (Table 54).

Table 54 Environmental benefit from the phosphorus load reductions that could be achieved for each mitigation scenario in the failing waterbody catchments.

Main catchment	Ref	`Water body name	Environmental benefit (£/yr)						
			Regulatory compliance	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures	All possible measures + P index 2 or below soils	All possible measures + 5% land use change
Lugg	1	Gilwern Bk - source to conf R Arrow	-	-	-	-	-	-	-
	2	Norton Bk - source to conf R Lugg	£149,056	£201,609	£314,486	£371,465	£469,210	£469,216	£565,450
Upper Wye	3	Afon Chwefru - source to conf R Irfon	£108,169	£146,306	£228,220	£269,570	£340,503	£340,507	£410,344
	4	Afon Gwesyn - source to conf R Irfon	£43,283	£58,543	£91,320	£107,866	£136,249	£136,251	£164,196
	5	Cledan - source to conf R Irfon	£89,942	£121,652	£189,763	£224,145	£283,125	£283,129	£341,197
	6	Aran - source to conf R Ithon	£155,430	£210,231	£327,935	£387,352	£489,276	£489,283	£589,632
	7	Camddwr Bk - source to conf R Ithon	£82,118	£111,070	£173,256	£204,647	£258,497	£258,500	£311,517
	8	Clywedog Bk - conf Bachell Bk to conf R Ithon	£109,908	£148,659	£231,890	£273,905	£345,978	£345,982	£416,942
	9	Clywedog Bk - source to conf Bachell Bk	£13,378	£18,095	£28,226	£33,340	£42,113	£42,114	£50,751
	10	Gwenlas Bk - source to conf R Ithon	£75,754	£102,463	£159,830	£188,788	£238,465	£238,468	£287,376
	11	Howey Bk - source to conf R Ithon	£103,116	£139,471	£217,559	£256,977	£324,596	£324,600	£391,174
	12	Ithon - conf Gwenlas Bk to conf Camddwr Bk	£67,238	£90,945	£141,863	£167,566	£211,658	£211,661	£255,072
	13	Ithon - conf Llaethdy Bk to conf Gwenlas Bk	£103,510	£140,005	£218,391	£257,960	£325,838	£325,842	£392,671
	14	Ithon - source to conf Llaethdy Bk	£50,792	£68,700	£107,164	£126,581	£159,888	£159,890	£192,683
	15	Mithil Bk - source to conf R Ithon	£107,210	£145,009	£226,197	£267,180	£337,483	£337,488	£406,705
	16	Nantmel Dulas - source to conf R Ithon	£81,389	£110,085	£171,720	£202,832	£256,204	£256,208	£308,755
	17	Afon Llynfi - conf Dulas Bk to conf R Wye	£875,985	£1,184,832	£1,848,198	£2,183,061	£2,757,495	£2,757,532	£3,323,089
	18	Bach Howey Bk - source to conf R Wye	£349,350	£472,520	£737,076	£870,622	£1,099,711	£1,099,726	£1,325,275
	19	Builth Dulas Bk - source to conf R Wye	£52,165	£70,557	£110,060	£130,001	£164,208	£164,211	£197,889
	20	Camnant Brook - source to confluence R Edw	£185,067	£250,316	£390,464	£461,210	£582,569	£582,577	£702,061
	21	Clettwr Bk - source to conf R Wye	£137,444	£185,903	£289,987	£342,527	£432,657	£432,663	£521,400

Main catchment	Ref	`Water body name	Environmental benefit (£/yr)						
			Regulatory compliance	Best practice	Welsh agri-environment measures	All possible agri-environment measures	All possible measures	All possible measures + P index 2 or below soils	All possible measures + 5% land use change
	22	Dulas Bk - source to conf Afon Llynfi	£123,399	£166,905	£260,353	£307,524	£388,444	£388,449	£468,118
	23	Edw - conf Camnant Bk to conf Clas Bk	£507,717	£686,724	£1,071,208	£1,265,293	£1,598,233	£1,598,254	£1,926,049
	24	Edw - conf Clas Bk to conf R Wye	£323,858	£438,041	£683,293	£807,095	£1,019,467	£1,019,481	£1,228,572
	25	Edw - source to conf Colwyn Bk	£194,218	£262,694	£409,772	£484,016	£611,376	£611,384	£736,776
	26	Scithwen Bk - source to conf R Wye	£84,161	£113,834	£177,568	£209,740	£264,930	£264,933	£319,270
	27	Triffrwd - source to Dulas	£69,528	£94,042	£146,694	£173,273	£218,866	£218,869	£263,758
	28	Afon Llynfi - source to conf Dulas Bk	£563,240	£761,822	£1,188,352	£1,403,662	£1,773,010	£1,773,034	£2,136,675
	29	Clyro Bk - source to conf R Wye	£150,135	£203,068	£316,762	£374,154	£472,606	£472,613	£569,543
	30	Digedi Bk - source to conf R Wye	£176,630	£238,905	£372,663	£440,184	£556,010	£556,018	£670,055
	31	Afon Claerwen - conf Afon Arban to Caban-coch	£903,870	£1,222,549	£1,907,033	£2,252,556	£2,845,275	£2,845,314	£3,428,874
	32	Afon Claerwen - source to conf Afon Arban	-	-	-	-	-	-	-
	33	Wye - conf Afon Elan to conf R Ithon	£1,145,970	£1,550,006	£2,417,827	£2,855,897	£3,607,376	£3,607,425	£4,347,290
Lower Wye	34	Llanymynech Bk - source to conf R Trothy	£334,575	£452,537	£705,904	£833,802	£1,053,203	£1,053,217	£1,269,227
	35	Llymon Bk - source to conf R Trothy	£168,143	£227,425	£354,757	£419,033	£529,294	£529,301	£637,858
	36	Trothy - conf Llanymynach Bk to conf Llymon Bk	£532,552	£720,315	£1,123,607	£1,327,186	£1,676,411	£1,676,434	£2,020,262
	37	Trothy - conf Llymon Bk to conf R Wye	£1,419,329	£1,919,744	£2,994,575	£3,537,142	£4,467,878	£4,467,938	£5,384,291
	38	Tintern Bk - source to conf R Wye	-	-	-	-	-	-	-

The agricultural and environmental monetary benefits were summed to calculate a total benefit (£/yr) for each failing waterbody catchment.

I.3.5.3 Cost benefit

A cost benefit analysis was completed using the Benefit-Cost Ratio (BCR) method:

$$Cost\ benefit\ (£)\ =\ benefit\ (£)\ /\ cost\ (£)$$

The total benefits (to the environment and farmers) that could be achieved from each mitigation scenario were divided by the total estimated cost of delivering the interventions in each mitigation scenario at the Wye catchment (Table 55).

Table 55 Benefit-cost ratio of each mitigation scenario.

Mitigation scenario	Phosphorus load (kg/yr)	Total cost (£/yr)	Total benefits (£/yr)	BCR
Existing measures	162,364	£13,625,384	£35,469,680	2.60
Regulatory compliance	153,426	£17,631,582	£49,057,520	2.78
Best practice	126,478	£39,025,896	£66,353,790	1.70
Welsh agri-environment measures	114,910	£92,577,042	£103,504,117	1.12
All possible agri-environment measures	105,100	£134,350,454	£122,257,349	0.91
All possible measures	101,949	£174,578,993	£154,427,178	0.88
All possible measures + P index 2 or below soils	99,854	£175,610,359	£154,429,273	0.88
All possible measures + 5% land use change	93,815	£209,762,813	£186,101,984	0.89

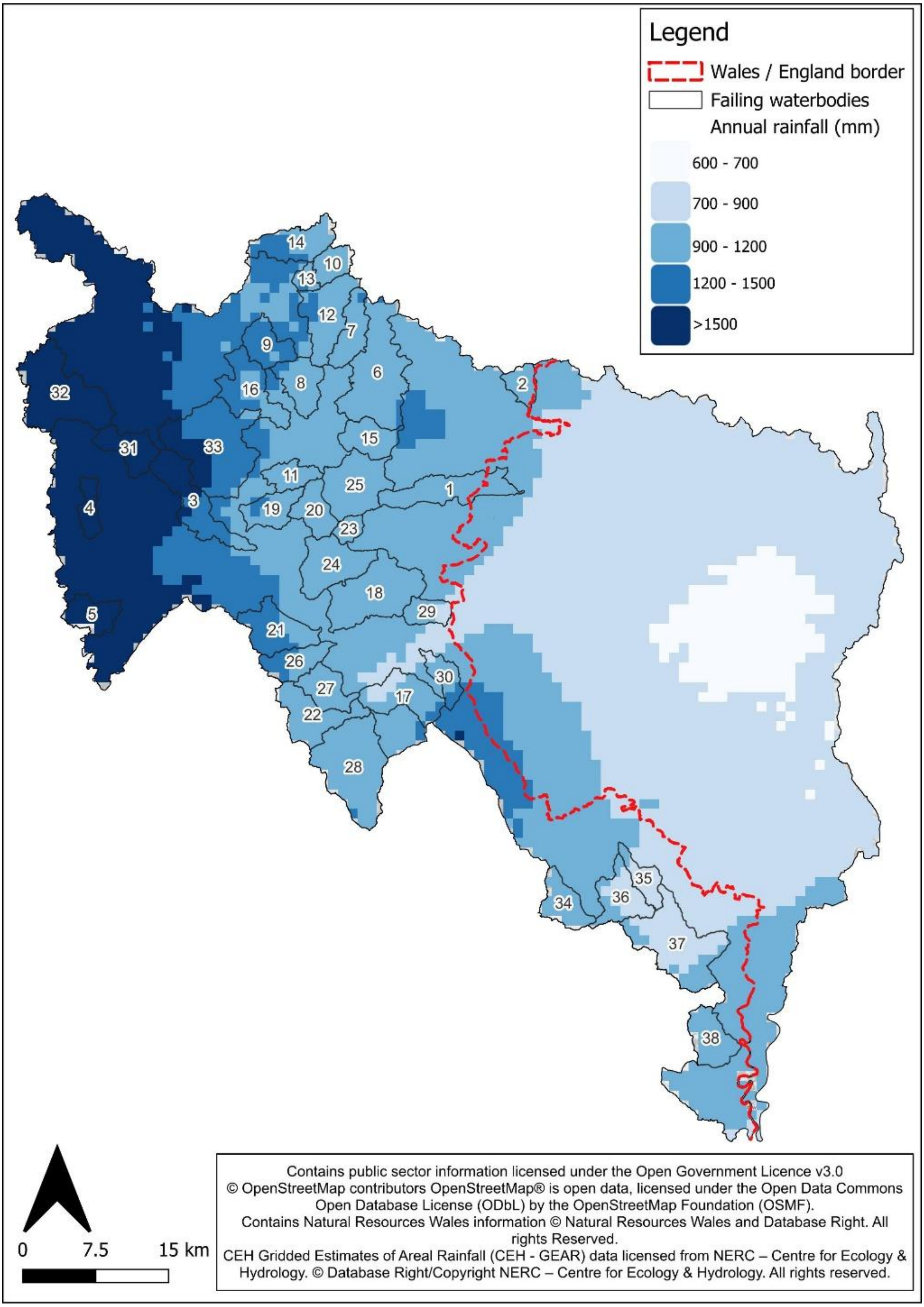
I.4 INDIVIDUAL MEASURES

The impact of individual measures was modelled in Farmscoper Upscale V5. The results provided the load from each farm type within each rainfall band with the individual measure implemented on 100% of applicable land.

The percentage difference between the load with the measure implemented at 100% relative to the baseline load was calculated. The phosphorus load reduction achieved per hectare was calculated by deducting the percentage difference in phosphorus load achieved from baseline phosphorus export per ha for each farm type in the applicable rainfall and soil type categories. This provided an estimated load reduction per hectare from each farm type within each rainfall area and soil type that was ranked high to low.

The failing water bodies were categorised into rainfall areas (Figure 31) and the land use was assessed using CORINE 2018 and ESRI satellite within each failing waterbody.

Figure 31: Water bodies categorised by rainfall bands.



The analysis produced four mitigation categories that included the rainfall, most likely land use and farm types within each failing waterbody catchment Table 56.

Table 56 Mitigation measure categories which include farms categorised by rainfall band, farm types and practices present and the applicable failing waterbodies these farm types are located in.

Mitigation measures category	Annual rainfall (mm)	Land use	Farm type / practices	Applicable failing waterbody catchments
1	>1500mm	Upland Grassland	Extensive Grazing (no fertiliser applied) Extensive Grazing (fertiliser applied) Dairy (grassland)	*Upper Afon Chwefru - source to conf R Irfon* *Afon Claerwen - conf Afon Arban to Caban-coch* *Afon Claerwen - source to conf Afon Arban* *Afon Gwesyn - source to conf R Irfon* *Afon Llynfi - conf Dulas Bk to conf R Wye* *Cledan - source to conf R Irfon*
2	1200-1500mm	Upland Grassland	Extensive Grazing (no fertiliser applied) Extensive Grazing (fertiliser applied) Dairy (grassland) Dairy (maize, cereals) Pigs and Poultry (grassland) Pigs and Poultry (arable)	*Lower Afon Chwefru – source to conf R Irfon* *Clywedog Bk - source to conf Bachell Bk* *Ithon - conf Llaethdy Bk to conf Gwenlas Bk* *Ithon - source to conf Llaethdy Bk* *Nantmel Dulas - source to conf R Ithon* *Wye - conf Afon Elan to conf R Ithon* *Ithon - conf Llaethdy Bk to conf Gwenlas Bk* *Ithon - source to conf Llaethdy Bk*
3	900-1200mm	Upland Grassland Arable	Extensive Grazing (no fertiliser applied) Extensive Grazing (fertiliser applied) Dairy (grassland) Dairy (maize, cereals) Pigs and Poultry (grassland) Pigs and Poultry (arable) Mixed Livestock (grassland) Mixed Livestock (arable)	*Afon Llynfi - source to conf Dulas Bk* *Aran - source to conf R Ithon* *Bach Howey Bk - source to conf R Wye* *Builth Dulas Bk - source to conf R Wye* *Camddwr Bk - source to conf R Ithon* *Camnant Brook - source to confluence R Edw* *Clettwr Bk - source to conf R Wye* *Clyro Bk - source to conf R Wye* *Clywedog Bk - conf Bachell Bk to conf R Ithon* *Digedi Bk - source to conf R Wye* *Dulas Bk - source to conf Afon Llynfi* *Edw - conf Camnant Bk to conf Clas Bk* *Edw - conf Clas Bk to conf R Wye* *Edw - source to conf Colwyn Bk* *Gilwern Bk - source to conf R Arrow* *Gwenlas Bk - source to conf R Ithon* *Howey Bk - source to conf R Ithon* *Ithon - conf Gwenlas Bk to conf Camddwr Bk* *Llanymynech Bk - source to conf R Trothy* *Mithil Bk - source to conf R Ithon*

Mitigation measures category	Annual rainfall (mm)	Land use	Farm type / practices	Applicable failing waterbody catchments
				Norton Bk - source to conf R Lugg *Scithwen Bk - source to conf R Wye* *Tintern Bk - source to conf R Wye* *Triffrwd - source to Dulas* *Ithon - conf Llaethdy Bk to conf Gwenlas Bk* *Ithon - source to conf Llaethdy Bk*
4	700-900mm	Grassland, arable	Extensive Grazing (no fertiliser applied) Extensive Grazing (fertiliser applied) Dairy (grassland) Dairy (maize, cereals) Pigs and Poultry (grassland) Pigs and Poultry (arable) Mixed Livestock (grassland) Mixed Livestock (arable) Arable	Llymon Bk - source to conf R Trothy Trothy - conf Llanymynach Bk to conf Llymon Bk Trothy - conf Llymon Bk to conf R Wye

The Farmscoper results were then filtered by farm type and rainfall band on drained soils to provide a list of tailored measures and the load reductions that can be achieved per ha within the failing waterbodies on different farm types.

The mitigation practices were then screened based on whether the measure reduced phosphorus loading to surface water. Measures were then categorised for each farm type based on whether there is grassland only on the farm or grassland and arable, as well as whether fertilisers are applied for extensive grazing (to match the 26 farm types in Table 56 above). This provided a tailored list of measures that would be most applicable to a farm based on the rainfall, farm type, land use and fertiliser practices.

For each farm type in the table above within the respective rainfall category, the measures were ranked high to low and the top ten measures were selected. These measures are presented in Section 4.1.2.2. The full list of mitigation measures and the farm type and failing waterbodies they are applicable to has been provided in a separate Excel Workbook.

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APPENDIX J STW UPGRADE CALCULATIONS

Table 57 STW upgrades completed from Phosphate Action Plan (PAP) Recommendations.

STW	Phosphorus load reduction (kg/yr)	Delivery period
Aberllynfi (Three Cocks) STW	45	AMP8
Beulah STW	49	AMP8
Builth Wells STW	1,850	AMP7
Crossgates STW	336	AMP8
Dingestow STW	No upgrade	
Llandewi Ystradenny STW	No upgrade	
Llandrindod Wells STW	368	AMP7
Llangammarch Wells STW	No upgrade	
Llanwrtyd Wells STW	523	AMP8
Presteigne STW	2,081	AMP7
Rhayader STW	782	AMP7
Talgarth STW	671	AMP8
Total achieved from PAP actions	6,914	

Table 58 Estimated load reductions achieved from AMP8 STW upgrades in the Upper Wye sub-catchment

STW Name	WB Name	WB ID	Failing WB	Current Permit (mg/l)	Permitted average dry weather flow (m^3/d)	2030 Permit (mg/l)	Permitted average current load (kg/yr)	Proposed 2030 load (kg/yr)	Load reduction (kg/yr)	% load reduction
Aberllynfi (Three Cocks) STW	17. Afon Llynfi - conf Dulas Bk to conf R Wye	GB109055036950	Yes	5	82.50	3.5	150.56	105.47	45.10	30
Talgarth STW	17. Afon Llynfi - conf Dulas Bk to conf R Wye	GB109055036950	Yes	2	1051.25	0.25	767.41	95.99	671.42	87

STW Name	WB Name	WB ID	Failing WB	Current Permit (mg/l)	Permitted average dry weather flow (m^3/d)	2030 Permit (mg/l)	Permitted average current load (kg/yr)	Proposed 2030 load (kg/yr)	Load reduction (kg/yr)	% load reduction
Beulah STW	Afon Cammarch - source to conf R Irfon	GB109055041880	No	5	67.50	3	123.19	73.96	49.22	40
Llanwrtyd Wells STW	Irfon - conf Cledan to conf R Wye	GB109055037090	No	5	477.63	2	871.67	139.56	732.10	84
Crossgates STW	Ithon - conf Camddwr Bk to conf R Wye	GB109055042270	No	5	307.00	2	560.28	224.26	336.01	60
Llanbister STW	12. Ithon - conf Gwenlas Bk to conf Camddwr Bk	GB109055042140	Yes	5	18.26	4	33.33	26.68	6.65	20
Builth Road STW	19. Builth Dulas Bk - source to conf R Wye	GB109055037160	Yes	5	32.50	3	59.31	35.61	23.70	40
Hundred House STW	20. Camnant Brook - source to confluence R Edw	GB109055042370	Yes	5	6.38	4	11.63	9.31	2.32	20
Cilmery STW	3. Afon Chwefru - source to conf R Irfon	GB109055042190	Yes	5	28.75	4	52.47	42.00	10.47	20
Llanigon STW	30. Digedi Bk - source to conf R Wye	GB109055036980	Yes	5	40.38	0.5	73.68	7.37	66.31	90
Painscastle STW	18. Bach Howey Bk - source to conf R Wye	GB109055037060	Yes	5	17.50	3.5	31.94	22.37	9.57	30
Llandegley STW	15. Mithil Bk - source to conf R Ithon	GB109055041960	Yes	5	16.25	1	29.66	5.94	23.72	80
Llanfilo STW	22. Dulas Bk - source to conf Afon Llynfi	GB109055036920	Yes	5	16.25	2	29.66	11.87	17.79	60
Tirabad STW	Tirabad Dulas - source to conf R Irfon	GB109055036690	No	5	15.00	4	27.38	21.92	5.46	20

Table 59 Estimated phosphorus load reduction from upgrading PTP with exempted discharges

Sub-catchment	Failing WB Name	Exemption type	Flow (m^3/d)	Estimated annual P load (kg/yr)	Estimated P load with an upgraded system (kg/yr)	P load reduction (kg/yr)	% phosphorus load reduction
Upper Wye	3. *Afon Chwefru - source to conf R Irfon*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	5. *Cledan - source to conf R Irfon*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	6. *Aran - source to conf R Ithon*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	8. *Clywedog Bk - conf Bachell Bk to conf R Ithon*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	9. *Clywedog Bk - source to conf Bachell Bk*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88

Sub-catchment	Failing WB Name	Exemption type	Flow (m^3/d)	Estimated annual P load (kg/yr)	Estimated P load with an upgraded system (kg/yr)	P load reduction (kg/yr)	% phosphorus load reduction
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	11. *Howey Bk - source to conf R Ithon*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	12. *Ithon - conf Gwenlas Bk to conf Camddwr Bk*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	15. *Mithil Bk - source to conf R Ithon*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	16. *Nantmel Dulas - source to conf R Ithon*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	17. *Afon Llynfi - conf Dulas Bk to conf R Wye*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	18. *Bach Howey Bk - source to conf R Wye*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	19. *Builth Dulas Bk - source to conf R Wye*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	22. *Dulas Bk - source to conf Afon Llynfi*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88

Sub-catchment	Failing WB Name	Exemption type	Flow (m^3/d)	Estimated annual P load (kg/yr)	Estimated P load with an upgraded system (kg/yr)	P load reduction (kg/yr)	% phosphorus load reduction
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	25. *Edw - source to conf Colwyn Bk*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	26. *Scithwen Bk - source to conf R Wye*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	27. *Triffrwd - source to Dulas*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	28. *Afon Llynfi - source to conf Dulas Bk*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	29. *Clyro Bk - source to conf R Wye*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	30. *Digedi Bk - source to conf R Wye*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	33. *Wye - conf Afon Elan to conf R Ithon*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88

Sub-catchment	Failing WB Name	Exemption type	Flow (m^3/d)	Estimated annual P load (kg/yr)	Estimated P load with an upgraded system (kg/yr)	P load reduction (kg/yr)	% phosphorus load reduction
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
Lower Wye	34. *Llanymynech Bk - source to conf R Trothy*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	35. *Llymon Bk - source to conf R Trothy*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	36. *Trothy - conf Llanymynach Bk to conf Llymon Bk*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	37. *Trothy - conf Llymon Bk to conf R Wye*	002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88

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Sub-catchment	Failing WB Name	Exemption type	Flow (m^3/d)	Estimated annual P load (kg/yr)	Estimated P load with an upgraded system (kg/yr)	P load reduction (kg/yr)	% phosphorus load reduction
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
	38. *Tintern Bk - source to conf R Wye*	001 - New discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88
		002 - Existing discharge to surface water of five cubic metres or less	5	17.71	0.73	16.98	95.88

APPENDIX K PRIVATE SEWERAGE SYSTEMS

K.1 ESTIMATED LOAD CALCULATIONS

To calculate the annual phosphorus load entering the catchment, the default ST and PTP concentrations obtained from the Wales Nutrient Budget Calculator (Herefordshire Council, 2019) and the flow rates from the Permitted Discharges Register (NRW, 2025d) and the Water Quality Exemptions Register (NRW, 2025b) were used. The default concentration of total phosphorus (TP) from the calculators for ST is 11.6kg TP/l and for PTP is 9.7kg TP/l, and the following equation was used to estimate the annual nutrient load:

$$Pollutant\ load\ (kg) = \ flow\ (m3)\ \times\ 1{,}000\ \times\ concentration\ (mg/l)\ /\ 1{,}000{,}000\ \times\ 365$$

The load reduction that can be achieved from upgrading PSS to a newer unit is based on the following assumptions:

- The current ST system discharges the full quantity of daily flow of effluent detailed in the Permitted Discharges Register (NRW, 2025d) and the Water Quality Exemptions Register (NRW, 2025b).
- The current effluent has a TP concentration of 11.5mg TP/l for ST and 9.7mg TP/l for PTP (Herefordshire Council, 2019)).
- The upgraded system achieves a concentration of 0.4mg TP/l with chemical treatment (GRAF, 2023).

It is important to note that manufacturers provide different guarantees on the concentration of TP in the final effluent, and not all system upgrades will provide the same removal rates. GRAF UK systems can also achieve a TP removal rate of 1.6mg/l for non-chemical treatment systems (GRAF,2023).

Table 60 details the potential load reduction calculations for all PSS identified in the Welsh Wye catchment.

Table 60 Phosphorus loads from registered private sewerage systems and the load reduction that can be achieved from upgrades.

Sub Catchment	Operational Catchment	Ref	Failing WB name	Private sewerage system	Annual load (kg)	Upgraded load (kg)	Load reduction (kg TP/yr)	% load reduction
Lugg	Arrow Lugg Frome	1	*Gilwern Bk - source to conf R Arrow*	PTP	9.32	0.32	9.00	96.55
				PTP	11.65	0.40	11.25	96.55
Upper Wye	Irfon	3	*Afon Chwefru - source to conf R Irfon*	PTP	17.71	0.73	16.98	95.88
		4	*Afon Gwesyn - source to conf R Irfon*	PTP	10.17	0.35	9.82	96.55
		5	*Cledan - source to conf R Irfon*	PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		6	*Aran - source to conf R Ithon*	PTP	23.30	0.80	22.50	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	17.71	0.73	16.98	95.88

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Sub Catchment	Operational Catchment	Ref	Failing WB name	Private sewerage system	Annual load (kg)	Upgraded load (kg)	Load reduction (kg TP/yr)	% load reduction
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		8	*Clywedog Bk - conf Bachell Bk to conf R Ithon*	PTP	27.12	0.94	26.18	96.55
				PTP	17.71	0.73	16.98	95.88
		9	*Clywedog Bk - source to conf Bachell Bk*	PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		11	*Howey Bk - source to conf R Ithon*	PTP	17.71	0.73	16.98	95.88
		12	*Ithon - conf Gwenlas Bk to conf Camddwr Bk*	PTP	4.66	0.16	4.50	96.55
				PTP	13.98	0.48	13.50	96.55
				PTP	17.37	0.60	16.77	96.55
				PTP	17.71	0.73	16.98	95.88
		15	*Mithil Bk - source to conf R Ithon*	PTP	17.71	0.73	16.98	95.88
		16	*Nantmel Dulas - source to conf R Ithon*	ST	4.24	0.15	4.09	96.55
				PTP	17.71	0.73	16.98	95.88
	Wye Ithon to Hay	17	*Afon Llynfi - conf Dulas Bk to conf R Wye*	PTP	42.37	1.46	40.91	96.55
				PTP	26.48	0.91	25.57	96.55
				PTP	16.95	0.58	16.36	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		18	*Bach Howey Bk - source to conf R Wye*	PTP	2.97	0.10	2.86	96.55
				PTP	17.71	0.73	16.98	95.88
		19	*Builth Dulas Bk - source to conf R Wye*	PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88

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Sub Catchment	Operational Catchment	Ref	Failing WB name	Private sewerage system	Annual load (kg)	Upgraded load (kg)	Load reduction (kg TP/yr)	% load reduction
				PTP	17.71	0.73	16.98	95.88
		22	*Dulas Bk - source to conf Afon Llynfi*	PTP	31.78	1.10	30.68	96.55
				PTP	19.07	0.66	18.41	96.55
				PTP	6.36	0.22	6.14	96.55
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		24	*Edw - conf Clas Bk to conf R Wye*	PTP	4.24	0.15	4.09	96.55
				PTP	4.24	0.15	4.09	96.55
		25	*Edw - source to conf Colwyn Bk*	PTP	8.47	0.29	8.18	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		26	*Scithwen Bk - source to conf R Wye*	PTP	17.71	0.73	16.98	95.88
		27	*Triffrwd - source to Dulas*	PTP	30.51	1.05	29.45	96.55
				PTP	17.71	0.73	16.98	95.88
		28	*Afon Llynfi - source to conf Dulas Bk*	ST	8.13	0.28	7.85	96.55
				PTP	10.59	0.37	10.23	96.55
				PTP	17.79	0.61	17.18	96.55
				PTP	6.36	0.22	6.14	96.55
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		29	*Clyro Bk - source to conf R Wye*	PTP	6.36	0.22	6.14	96.55
				PTP	17.71	0.73	16.98	95.88
		30	*Digedi Bk - source to conf R Wye*	PTP	8.47	0.29	8.18	96.55
				PTP	17.71	0.73	16.98	95.88

Sub Catchment	Operational Catchment	Ref	Failing WB name	Private sewerage system	Annual load (kg)	Upgraded load (kg)	Load reduction (kg TP/yr)	% load reduction
	Wye Source to Ithon	33	*Wye - conf Afon Elan to conf R Ithon*	PTP	6.36	0.22	6.14	96.55
				ST	4.24	0.15	4.09	96.55
				PTP	10.17	0.35	9.82	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
Lower Wye	Trothy	34	*Llanymynech Bk - source to conf R Trothy*	ST	6.36	0.22	6.14	96.55
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		35	*Llymon Bk - source to conf R Trothy*	PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		36	*Trothy - conf Llanymynach Bk to conf Llymon Bk*	PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
		37	*Trothy - conf Llymon Bk to conf R Wye*	PTP	7.41	0.26	7.16	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	9.15	0.32	8.84	96.55
				PTP	3.43	0.12	3.31	96.55
				PTP	5.08	0.18	4.91	96.55
				PTP	19.24	0.66	18.57	96.55
				PTP	17.71	0.73	16.98	95.88

Sub Catchment	Operational Catchment	Ref	Failing WB name	Private sewerage system	Annual load (kg)	Upgraded load (kg)	Load reduction (kg TP/yr)	% load reduction
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88
	Wye OP Catch	38	*Tintern Bk - source to conf R Wye*	PTP	6.99	0.24	6.75	96.55
				PTP	4.24	0.15	4.09	96.55
				PTP	17.71	0.73	16.98	95.88
				PTP	17.71	0.73	16.98	95.88

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