Evenlode Catchment Partnership

FreshWater Watch By earthwatch EUROPE

Water Quality in the Evenlode Catchment 2024

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Thank you to all the citizen scientists, the Evenlode Catchment Partnership, Tony Bostock (Riverfly) and Kevin Carolan (mapping).

Acronyms and Abbreviations

AMP	Asset management plan
BOD	Biological oxygen demand
CDOM	Coloured dissolved organic matter
CNL	Cotswold National Landscape
DEFRA	Department for the Environment, Food & Rural Affairs
DMTS	Dimethyl trisulfide
DO	Dissolved oxygen
DTBBQ	2,5-Di-tert-butyl-1,4-benzoquinone
EA	Environment Agency
ECP	Evenlode Catchment Partnership
EDM	Event Duration Monitoring
FWW	FreshWater Watch
GUKWB	Great UK WaterBlitz
LTA	Land treatment area
MiM	Moreton-in-Marsh
MuW	Milton-under-Wychwood
PNEC	predicted no-effect concentration
SAGIS	Source Apportionment Geographical Information System
STW	Sewage Treatment Work
2,4-DTBP	2,4-Di-tert-butylphenol

Executive summary

Background

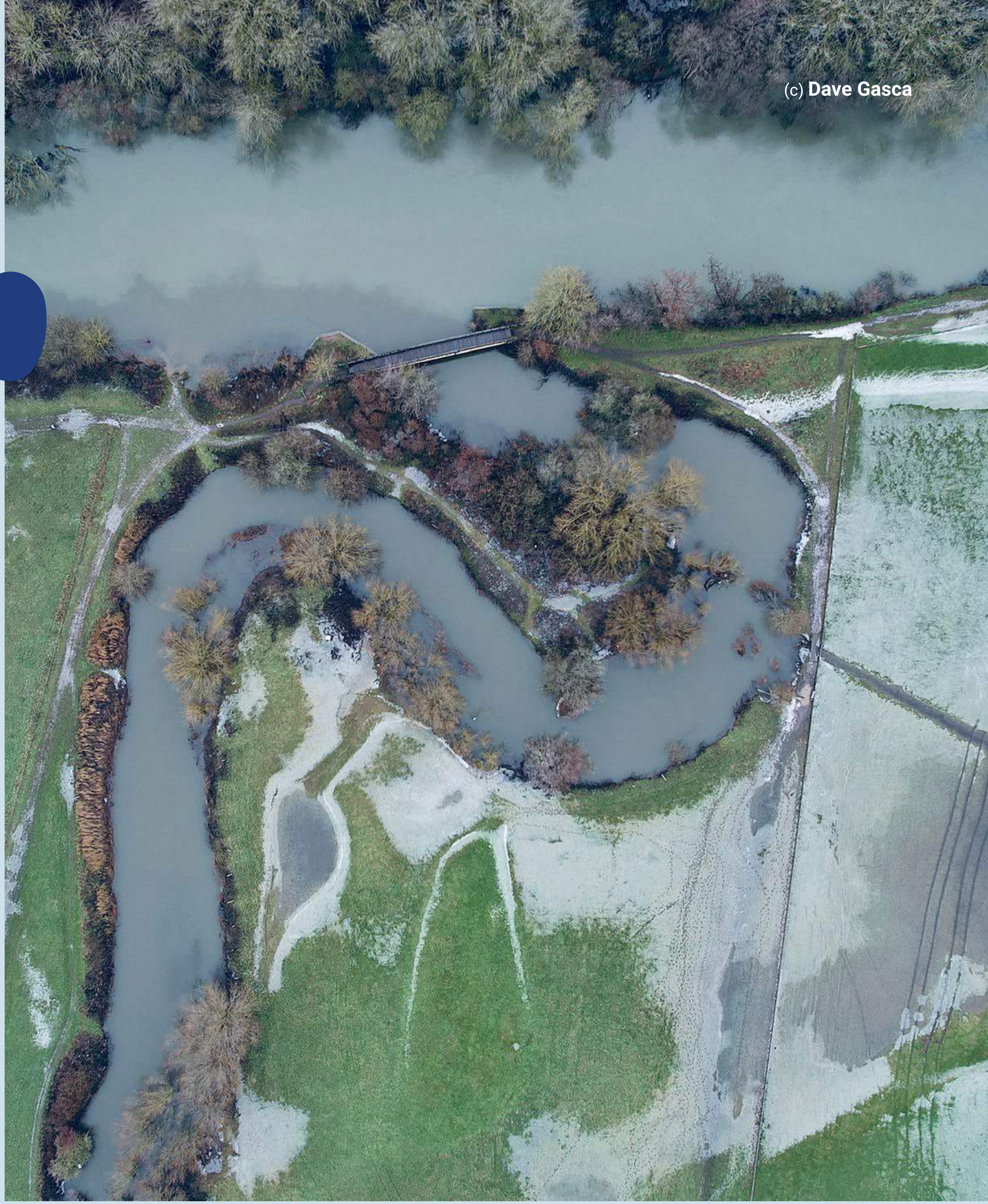
The River Evenlode runs for 45 miles (72 km) through its 166 square mile (430km^2) catchment in the Cotswolds, before joining the Thames at Cassington.

The Evenlode Catchment Partnership (ECP) is led by Wild Oxfordshire, bringing together partners from across the catchment including community members, the Environment Agency (EA), Earthwatch Europe, and Thames Water, with the aim of improving the catchment for the benefit of wildlife and people. **The goal is to return the waterbodies of the Evenlode catchment to 'good ecological status'.**

The activities described in this report were funded by the Thames Water Smarter Water Catchment initiative. Due to the failure of Thames Water to mitigate to any meaningful extent their negative impact on the waterbodies and aquatic ecology of the Evenlode catchment, the ECP terminated this funded relationship with Thames Water as of 31/03/2025. The extent of this negative impact and the absence of any improvement in any measurable aspect of water quality forms the larger part of this report, which focuses on water quality in the River Evenlode and its tributaries.

The River Evenlode is reported by local residents to have degraded over recent years in terms of water clarity, aquatic macrophytes, and fish stocks. It is known from existing research that the catchment has high nitrate concentrations (likely from agriculture) and is also impacted by phosphates - 65% to 83% of which has been stated in government reports to originate from the nineteen sewage treatment works (STWs) that are present in the catchment.

Consequently, the ECP's water quality-related activities in recent years (and specifically in 2024) aimed to provide a medium-term, detailed understanding of spatial and temporal water quality issues with an emphasis on nitrate and phosphate concentrations. Monitoring included regular testing of water quality using the Freshwater Watch approach, and recording of benthic invertebrate abundance by volunteer citizen scientists using the Riverfly approach, as well as the gathering and analysis of near-continuous data from installed water quality monitoring sondes by Earthwatch staff. Additionally, other publicly available data such as STW discharge event duration monitor (EDM) records, and EA water quality, rainfall, river level, and fish survey data were considered.


(c) Dave Gasca

(c) Earthwatch Europe

Citizen science

Citizen scientists conducted monthly and WaterBlitz FreshWater Watch (FWW) testing. 820 FWW surveys were collected at 160 sites during 2024 (up from 32 in 2023). This far exceeds the 173 surveys at 18 sites carried out by the EA in 2024. A total of 225 participants were recorded, with more than 60 regularly engaging in testing. FWW sampling was densest on the main stem of the Evenlode and tributaries in the upper and western parts of the catchment, with relatively few samples taken on the Glyme and the Dorn. Areas that were identified as lacking data in 2023 were targeted, resulting in all waterbodies having at least two surveys carried out in 2024, while 10 had more than 15 surveys taken, and five had more than 72 surveys taken (maximum 289).

Citizen scientists also increased the coverage of Riverfly aquatic invertebrate surveys. 69 Riverfly surveys were taken at 28 sites (up from 12 in 2023) by 21 citizen scientists, (up from 11 in 2023). Several citizen scientists who had regularly undertaken Riverfly sampling undertook further training to apply the “Extended Riverfly” method. Records kept by the Coldstone Angling Club provided historic data on fish abundance.

Sondes

Four sondes that were deployed in 2022 continued to monitor and report real-time, near-continuous data upstream and downstream of Chipping Norton and Milton-under-Wychwood STWs. In August one sonde was moved from Chipping Norton to a site downstream of the Moreton-in-Marsh STW as part of the case study investigation there. This near-continuous data provided far greater daily and seasonal detail and information, albeit at only five sites, than monthly FWW testing or laboratory-analysed EA sampling.

Findings

There was high-level agreement between the findings of citizen science surveys and EA surveys. For both approaches, a small percentage of surveys recorded good nitrate concentrations, whilst the majority of phosphate concentrations recorded were good. The reasons for this are discussed in Section 5.

Nitrate

Method	< 1.0 mg/L (Good, % surveys)	1.0 – 2.0 mg/L (Moderate, % surveys)	>2.0 mg/L (Poor, % surveys)
Citizen science (n = 820)	19	24	56
EA (n= 173)	2	6	92

Phosphate

Method	< 1.0 mg/L (Good, % surveys)	1.0 – 2.0 mg/L (Moderate, % surveys)	>2.0 mg/L (Poor, % surveys)
Citizen science (n = 820)	70	11	19
EA (n= 173)	60	20	20

Spatially, good nitrate concentrations were mainly recorded in tributary headwaters, with very few on the River Evenlode itself. Surveys recording poor and moderate phosphate concentrations were typically clustered downstream of STWs.

In terms of overall water quality, which combines nitrate and phosphate results, the citizen scientists' findings agreed with the EAs reporting: no waterbodies in the Evenlode catchment achieved good status in 2024, with the water industry and agriculture stated prominently amongst the reasons for this by the EA. The FWW data revealed that water quality tended to decrease from the headwaters to the confluence, despite increasing downstream dilution. However, water quality in some headwater streams was also poor, for example near Moreton-in-Marsh.

Whilst Riverfly sampling resulted in only two trigger-level breaches, fish numbers and diversity have fallen critically in recent years.

The case studies based on sonde data found that water quality decreased significantly below STWs, with the determinands marking STW effluent displaying diurnal patterns that closely reflected those of domestic water use. They also found that the flow in the receiving water bodies was insufficient to mitigate the daily STW discharge, particularly during summer low flows. Encouragingly, a preliminary study showed that the establishment of a wetland downstream from Chipping Norton STW had a notably beneficial effect on phosphate concentrations despite the wetland still being in the early stages of establishment.

(c) Earthwatch Europe

Conclusions

Citizen science coverage improved spatially and in terms of the number of sites, samples, and people involved, with the findings of poor water quality agreeing with those of the EA. High nitrate concentrations mainly (but not exclusively) from agriculture were compounded by high phosphate concentrations downstream of STWs (also a source of nitrates). Point source nutrient pollution is relatively straightforward to curtail and the effects of mitigation are easier to measure, making STW maintenance and upgrade a logical response to the issues found in the Evenlode catchment. However, whilst Thames Water committed to provide phosphate stripping at thirteen Evenlode works under Asset Management Plan (AMP8) they then reneged on that commitment. Currently, Thames Water is relying on dilution in receiving watercourses to mitigate nutrient levels, a strategy which has been failing historically and which will be less and less effective given the extensive housing developments planned in the catchment.

Recommendations

The partner organisations of the ECP should continue to seek alternative funding sources in order to continue to support citizen science water quality monitoring activities.

Citizen science monitoring should continue, with volunteers taking over group manager tasks such as data verification and analysis/reporting from Earthwatch Europe.

Citizen scientists should actively use their data to pressurise the relevant institutions to set and ensure compliance with stringent water quality standards that will achieve the aim of returning the River Evenlode and its tributaries to good ecological status.

Further investigation should be carried out into the phosphate-stripping potential of constructed wetlands to support their wider establishment for both water quality and biodiversity improvement.

The Evenlode catchment

Background

The River Evenlode is a 45-mile-long tributary of the River Thames, running through the Cotswolds (Figure 1). The River Evenlode rises out of the limestone that underlies the Cotswolds, flowing south-east towards the clay vales of the River Thames.

The landscape has important national and international significance, and includes the Cotswolds National Landscape (CNL), Sites of Special Scientific Interest, Conservation Target Areas, and the World Heritage Site of Blenheim Palace. The catchment includes important habitats including beechwoods, limestone grasslands, lowland meadows and fens. These habitats all support a wide range of wildlife, including remaining populations of nationally endangered water voles and tree sparrows. There is an important angling community on the Evenlode, where bullheads, chub, roach, and trout are present.

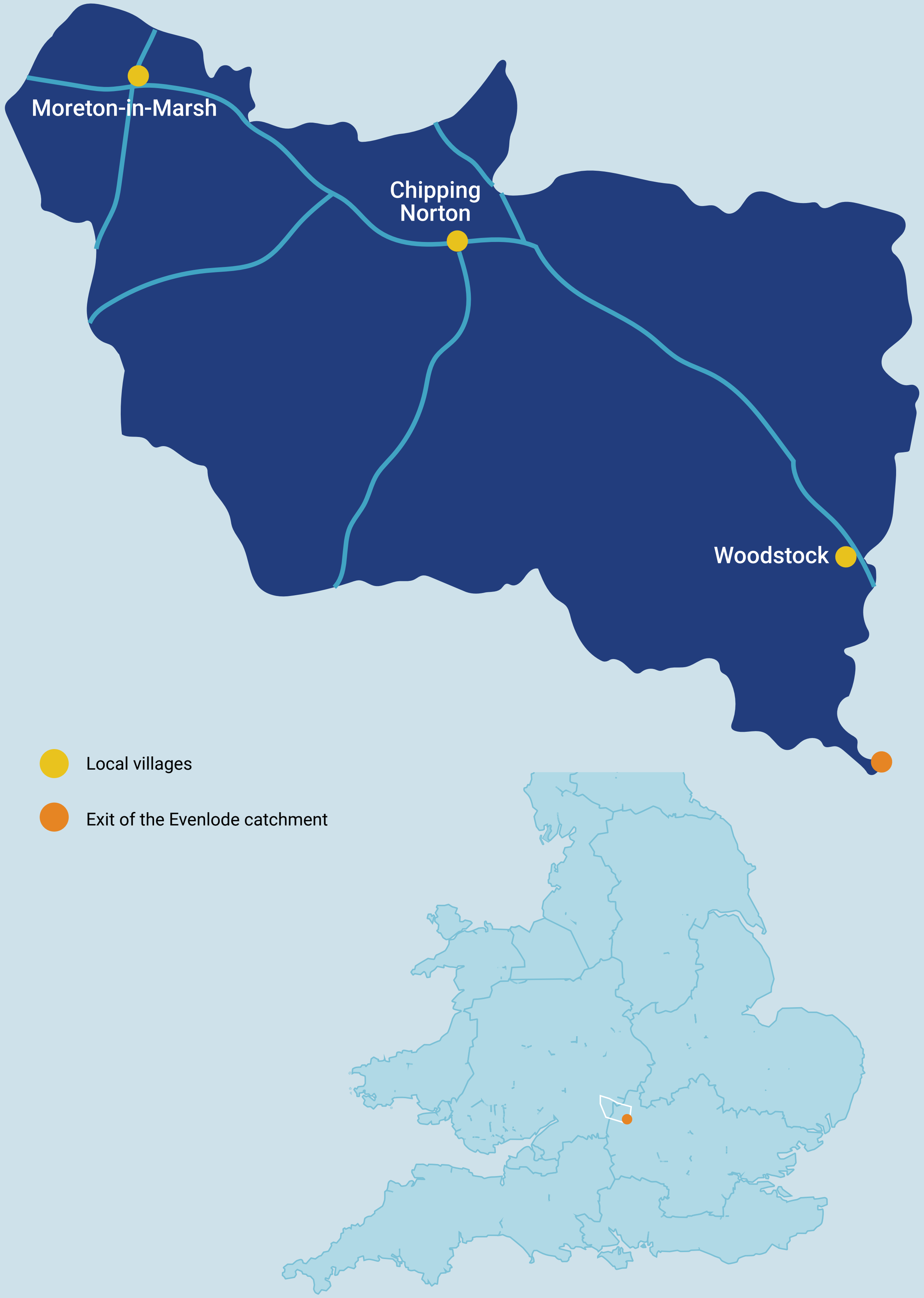


Figure 1: The location of the Evenlode catchment.

The Evenlode Catchment Partnership (ECP) is led by Wild Oxfordshire and brings together partners from across the catchment including members of the Evenlode community, the Environment Agency (EA) and Earthwatch Europe, all working towards improving the catchment for the benefit of people and the environment. **The water quality goal is to return the Evenlode and its tributaries to 'good ecological status'.**

The Evenlode catchment is 430 km^2 in area and is divided into 18 waterbodies (see EA, 2023):

- Bledington Brook (Source to Evenlode)
- Blenheim Lakes
- Coldron and Taston Brooks
- Cornbury Park Lakes
- Cornwell Brook and tributaries (Source to Evenlode)
- Dorn (Source to Glyme)
- Evenlode (Bledington to Glyme confluence)
- Evenlode (Compton Bk to Bledington Bk) and 4 Shires
- Evenlode (Glyme to Thames)
- Evenlode (Source to Four Shires S) and Longborough Stream
- Glyme (Dorn confluence to Evenlode)
- Glyme (Enstone to Dorn)
- Glyme (Source to Enstone)
- Heythorpe Stream and tributaries
- Little Compton Brook and tributaries (Source to Evenlode)
- Littlestock Stream to tributary of Evenlode at Shipton
- Sars Brook (source to Evenlode downstream Bledington)
- Westcote Brook (source to Evenlode at Bledington)

Figure 2: A fox crossing a water meadow (Photo: R. Rustage)

The major tributaries are the Glyme and the Dorn. Additionally, there are lakes with high cultural value at Blenheim, Cornbury Park, Kidlington Park, and Glympton Park. The river habitats in the Evenlode catchment have been compromised by a combination of historical channel modification. Channels in many parts of the catchment have been over-deepened, widened and straightened, resulting in uniform channel morphology, and separation of the rivers from their floodplains. This has negatively impacted biodiversity and reduced the rivers' natural capacity to mitigate pollution and flood events. There are numerous weirs (including 35 on the Glyme alone) that modify river flow and create barriers to fish movement. The cumulative effect of these modifications leaves the catchment vulnerable to flooding while reducing water quality and biodiversity (Loiselle et al., 2024).

According to the EA, none of the 18 waterbodies has "Good Ecological Status" or "Good Chemical Status" (Evenlode Operational Catchment/Catchment Data Explorer, 2025).

Water quality stressors

Background

Legacy and ongoing pollution (including sediment, nitrate, and phosphate) from point sources such as sewage treatment works (STWs) and diffuse sources such as agricultural run-off and septic tanks impact the catchment.

While phosphate is typically the main driver of eutrophication in freshwater ecosystems, elevated nitrate concentrations can have complementary and separate impacts. In fact, the concentrations of both nutrients need to be controlled to reduce their overall impact (Wurtsbaugh *et al.*, 2019).

Nutrient pollution (i.e. excess phosphorus and nitrogen concentrations) can lead to harmful algal blooms as well as the overgrowth of epiphytic and benthic algae and other micro-organisms in rivers (Jarvie *et al.*, 2006). This can negatively impact in-stream vegetation communities, because the resulting growth of epiphytes on macrophytes as well as the increase in phytoplankton can change the composition of original aquatic vegetation biodiversity. Following such overgrowth, excess rotting vegetation can deplete available dissolved oxygen (DO), not only leading to hypoxic "dead zones" that reduce fish populations but also generating compounds that negatively impact the safety of water supplies and the recreational use of the water body. These conditions impede the functioning of river and lake ecosystems and have major impacts on biodiversity of both fauna and flora, as well as increasing the emission of greenhouse gases (Loiselle *et al.*, 2024).

The Evenlode, as part of the Thames River system, is known to have high concentrations of dissolved nitrogen-based nutrients, (i.e. ammonium, nitrate, and nitrite) from agriculture and wastewater (UK Environment Agency, 2019), but eutrophication tends to be limited if concentrations of available phosphorus (as phosphate) remain low. However, the Source Apportionment Geographical Information System (SAGIS, 2022) calculated that 65% of the average phosphorus contribution across the Evenlode catchment came from STWs. For some sub-catchments, this value is much higher, such as 82.9% in Little Compton Brook and tributaries. Phosphate stripping is currently installed in only three of the nineteen STWs in the catchment. These are in the Dorn and Glyme tributaries, at Enstone, Middle Barton and Woodstock STWs.

Monthly water quality monitoring by the ECP citizen scientists using the Freshwater Watch (FWW) method provides vital data and information for prioritising STW asset improvements, evidencing mitigation interventions, and revealing monitoring gaps. Using this data, the ECP is working with local landowners to support land management practices that will reduce nutrient runoff and increase biodiversity, such as minimum tillage and improved soil fertility management in agricultural areas (ECP, 2023). The ECP is also involved in improving the natural capacity of the catchment to mitigate pollution loads by interventions including creation of "leaky" dams, wetlands, and the reconnection of the river to its floodplain. Long term and detailed engagement with Thames Water to address the evidenced downstream impacts of STWs has unfortunately had little effect in terms of phosphate reduction. The summary of findings from the previous ECP water quality reports for the past three years can be found online (ECP Report 2022).

Population and housing growth

Population growth and housing development increases the amount of waste that STWs receive. It is generally assumed that the population of the Evenlode catchment is increasing, and housing is observably being developed throughout the catchment and particularly in Moreton-in-Marsh Woodstock and. Chipping Norton. Population and housing figures are however difficult to source for the area defined by the Evenlode catchment as the catchment boundaries are not coincident with administrative boundaries, and because figures for 2024 were not consistently available from Thames Water at the time of reporting. Population figures calculated by West Oxfordshire District Council based on council tax data and granted planning applications are often at odds with Thames Water figures, and may not apply to those parts of the catchment falling under other authorities.

Sewage treatment works

Figure 3 shows the location of the STWS in the Evenlode catchment, and of the sondes that measure near-continuous water quality parameters (See Chapter 4).

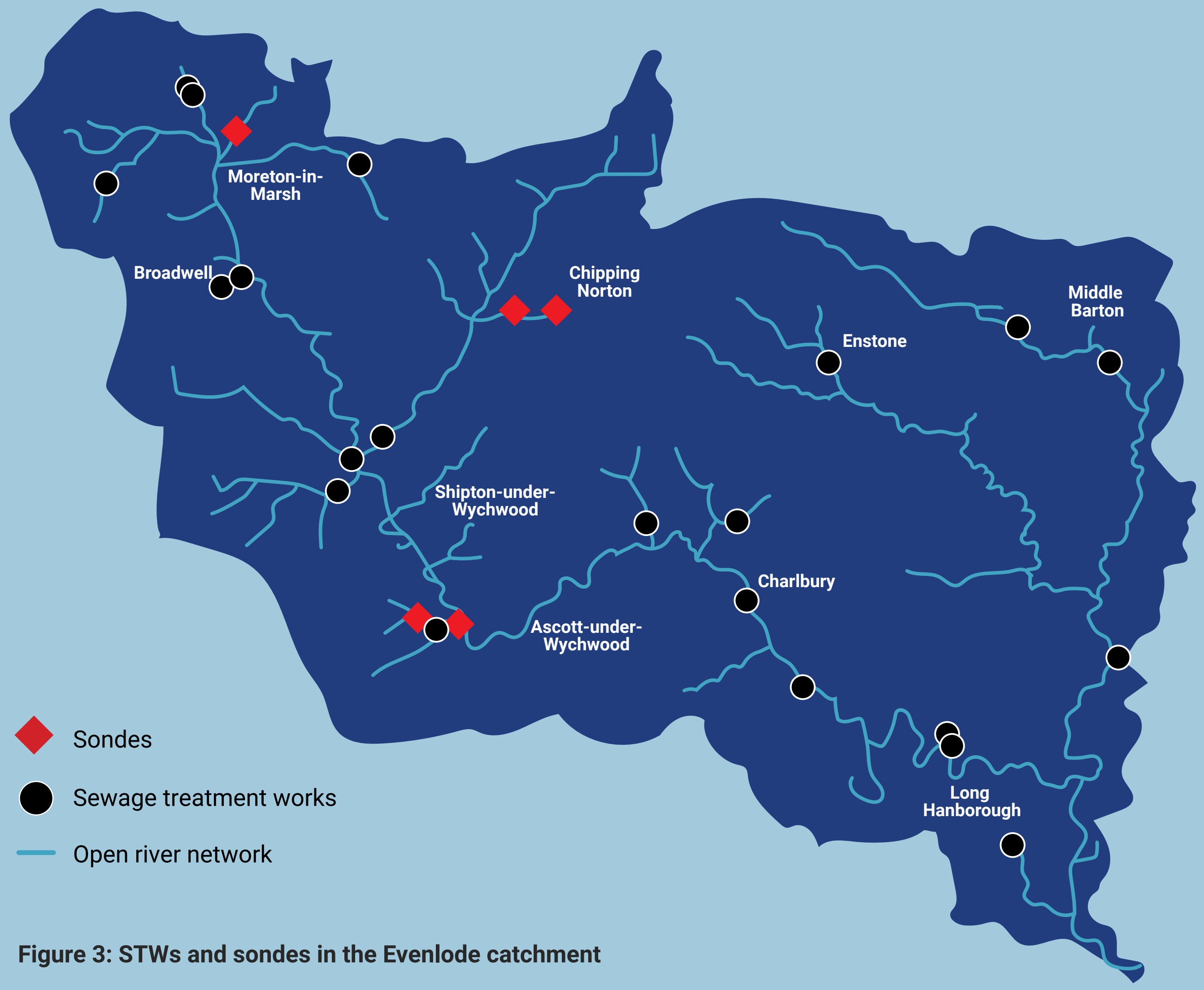


Figure 3: STWs and sondes in the Evenlode catchment

The volume flows to STWs in the catchment are expected to increase in line with housing development in the area. Unfortunately, the daily volume flow data for 2024 will not be available from Thames Water until later in 2025, so the graph in Figure 4 is likely to have changed significantly with the increased housing development experienced in the catchment in 2024.

There is however some evidence of increasing flows in those areas that have already experienced housing development up until 2023, with Church Hanborough STW and Woodstock STW showing the biggest increase in average daily flows in this period. There has been significant housing development pressure in Moreton in Marsh since 2024 with a proposed population increase ~20% served by the STW, but it is not possible to quantify this impact until the 2025 data is released.

Evenlode STW's Annual Average Daily Flows (m3)

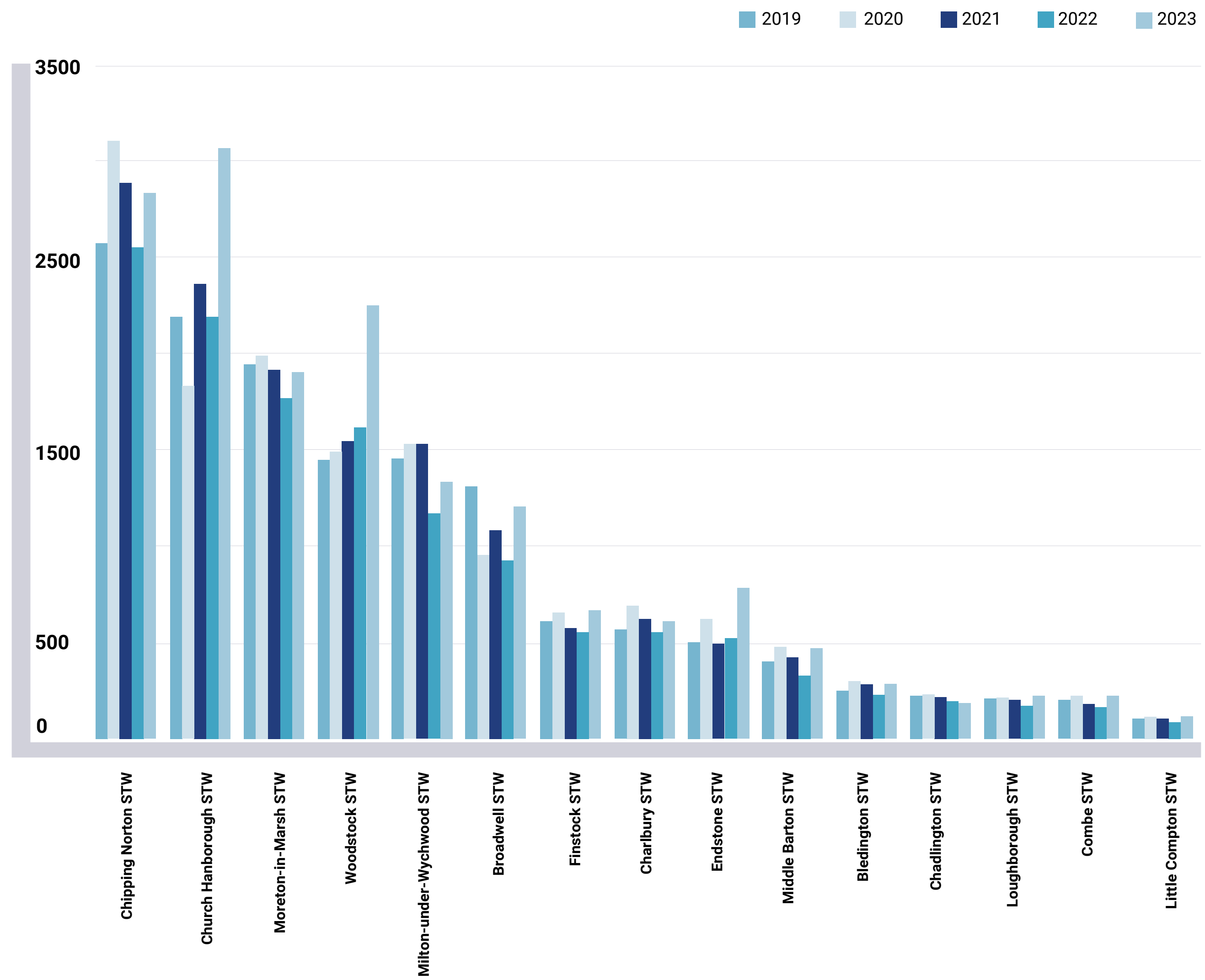


Figure 4: STW annual average daily flows 2019 – 2023 (No data for Great Rollright STW, Sandford St Martin STW, Spelsbury STW)

The combined effect of these increases in population served by the works appears to be more frequent discharge of Storm Sewage Overflows (see next section), and increased flow of treated discharge, sometimes into streams that are already under pressure from the volume and concentration of untreated and treated sewage released.

Storm sewage overflows

Storm overflows occur during periods of heavy rain when there is a risk of stormwater overwhelming the sewage transport infrastructure and backing up into homes and from inspection covers (Figure 5). One important reason for this back up is that investment in STW maintenance and expansion has not kept pace with development over past decades, whilst groundwater infiltration of the sewage network and STW infrastructure is a further factor. This was acknowledged as long ago as 2021 in a blog post by the Department for the Environment, Food & Rural Affairs (DEFRA). The blog highlighted an amendment of the Environment Bill to ensure that water companies progressively reduced their adverse impacts from storm overflows and that Government developed a statutory plan to reduce discharges from storm overflows and their adverse impact (DEFRA, 2021).

Figure 5: Thames water inspection cover near Chipping Norton showing paper waste and sanitary products deposited on the grass due to backup and overflow following rainfall (Photo: R Rustage)

During storm sewage overflows, the STW is bypassed, and raw sewage is released directly into rivers. In order to understand the impacts of untreated sewage from storm overflows, water companies (i.e. Thames Water in the Evenlode Valley) were legally required to fit 'Event Duration Monitors' by the end of 2023 to record when storm overflows occurred. These monitors have revealed that some of the STWs in the Evenlode catchment have discharged for a staggering number of hours, with several STWs discharging for over 2000 hours per year, which equates to more than 83 days. (Figure 6).

Storm Sewer Overflow - number of hours discharging

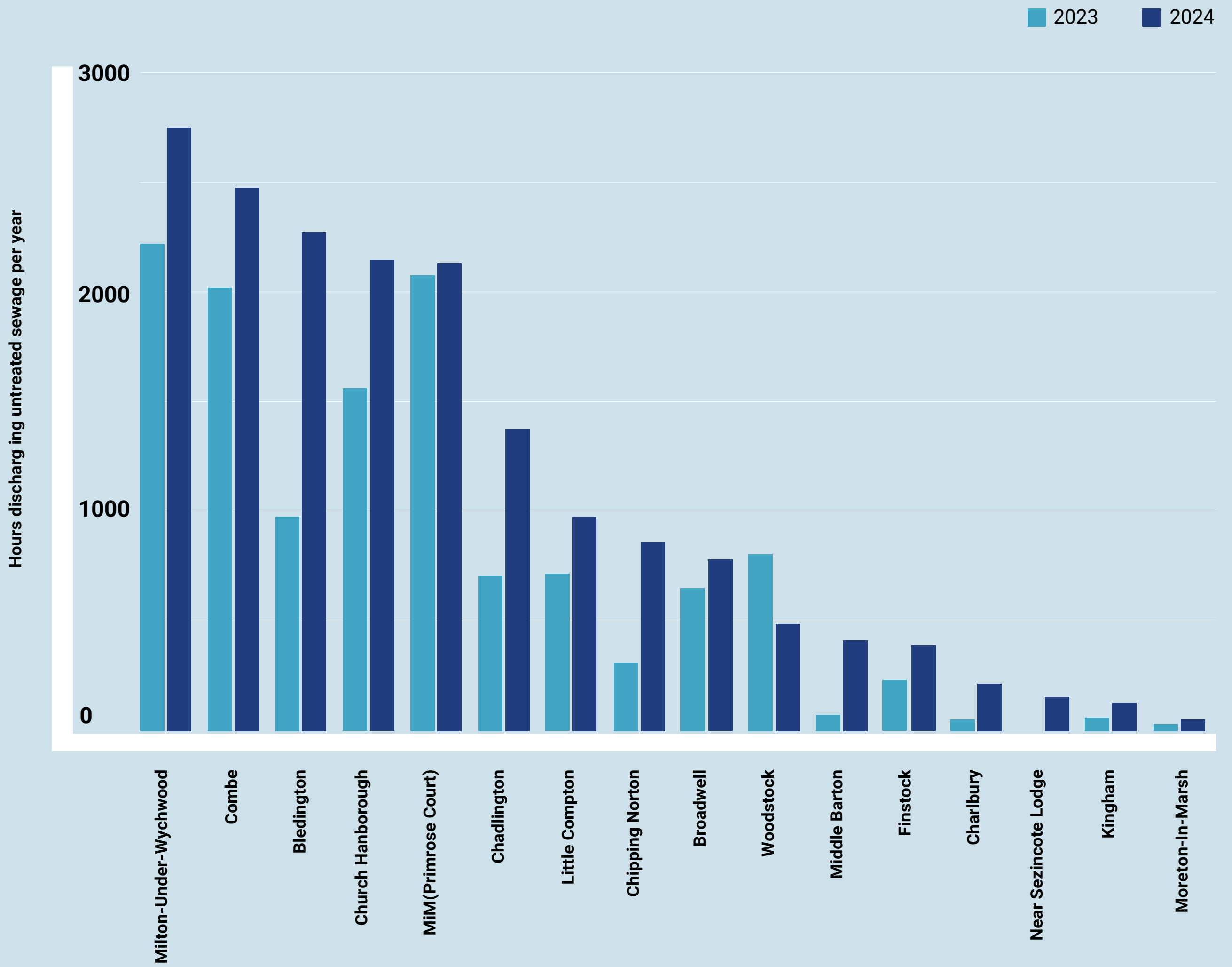


Figure 6: Comparison of storm overflows from a number of STWs in the Evenlode catchment for 2023 and 2024

Unfortunately, these monitors do not record the volume or composition of the untreated sewage released, nor has any significant work been done to establish the sensitivity of the specific stream or tributary receiving the overflow. Hence, despite a government monitoring programme, the quantity (in terms of concentration and load) of nutrients, organic material, and other contaminants including pharmaceuticals, heavy metals and forever chemicals entering our rivers from storm discharges is unknown. Note that routine EA monitoring of watercourses is monthly, i.e., calendar-based rather than event-based, and is unlikely to coincide with storm overflows. Further, there is evidence to suggest that "storm overflows" also occur when there is no heavy rainfall that could potentially mitigate their impacts, through dilution (Hammond et al., 2021). This is often referred to as 'dry spilling' and may be caused by groundwater infiltration, which occurs when sub-surface water enters poorly maintained infrastructure. Untreated sewage discharges during normal rainfall and dry weather contradicts the Urban Waste Water Treatment (England and Wales) Regulations (1994) which allow spilling only during exceptional weather circumstances.

The ECP has used their website, as well as social media and newsletters throughout the year to bring this issue to public attention (Figure 7).

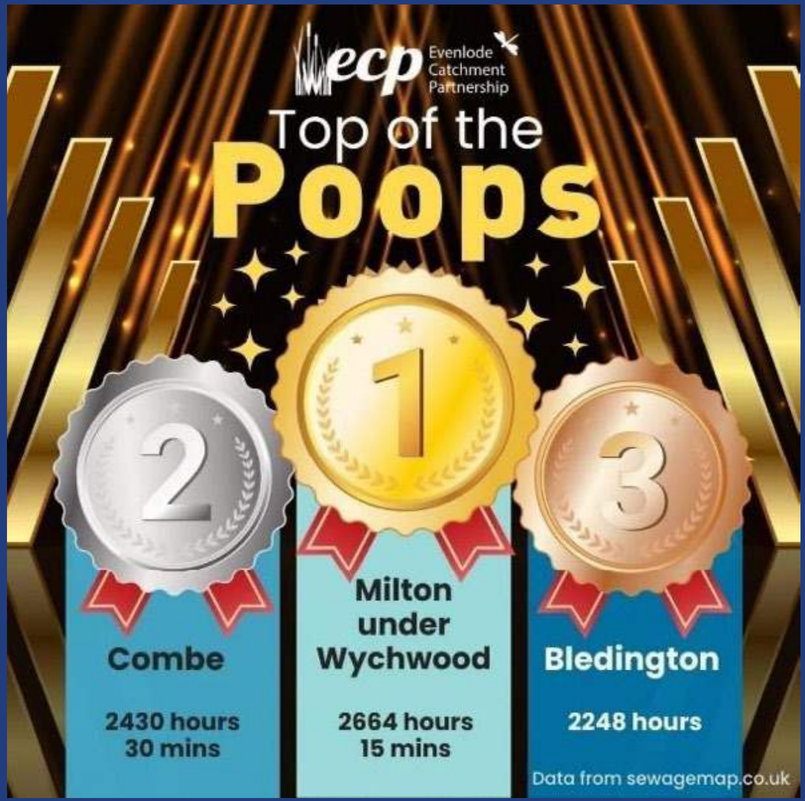


Figure 7: Graphic showing the top three STWs in terms of EDM overflow hours for 2024

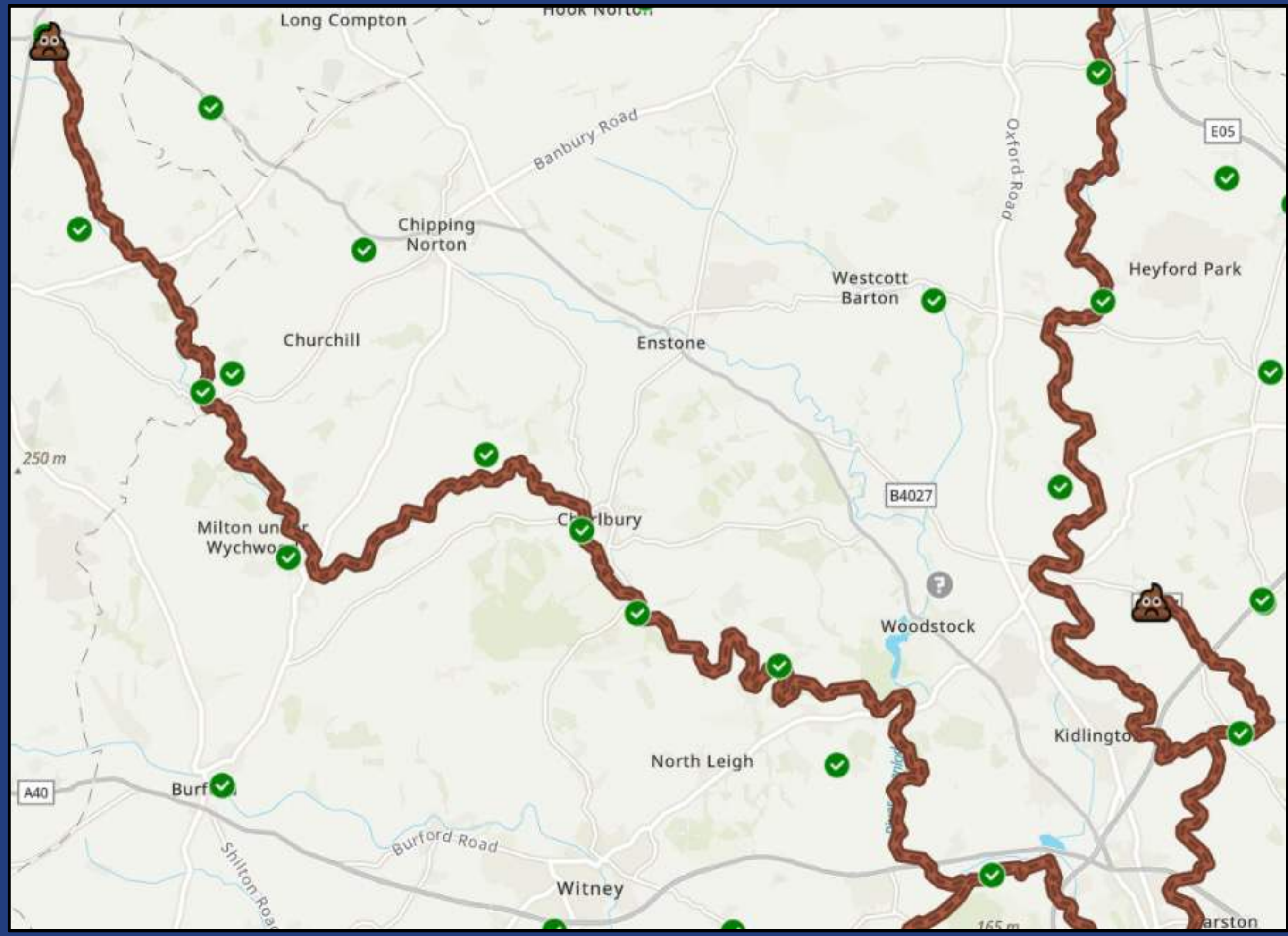


Figure 8: Screenshot of the Sewage Map, showing that Primrose Court sewage pumping station in Moreton-in Marsh was discharging and impacting the main stem of the Evenlode

There are several online resources that the public can access to find out in real-time when STWs are releasing storm overflows, and to gain historic information. These include EDM Map | Storm discharge data | River health | Thames Water; Sewage Map | The Rivers Trust; and Sewage Map (Figure 8).

Figure 9: A series of connected ponds in the Littlestock Brook designed to capture sediment and nutrients from the surrounding farmland. (Photo: D. Gasca-Tucker).

Agriculture

Land use in the Evenlode catchment is predominantly arable agriculture. Stock farming is also prevalent but is largely pastoral. Intensive chicken farming (as, for example, in the Wye catchment) is not present. Managing nutrient pollution from agricultural sources is complex, and a range of different solutions need to be applied to reduce this diffuse source of nutrient impact on rivers (Figure 9). This can include reducing fertiliser application, no-till farming, and the construction of wetlands and nutrient retention ponds (Defra, 2024).

Natural sources of nitrate and phosphate include animal waste, whilst manufactured fertilizers containing N and P have been applied to crops since the first patented fertilisers were developed in the 1840s. Together, this creates not only a nutrient rich surface layer that can be removed as run-off during heavy or prolonged rainfall (Figure 10), but has also provided a legacy source of N and P. These nutrients leach into the soil and are moved by groundwater through the sub-surface layers of rocks and soils to eventually form the baseflow of the Evenlode and its tributaries. Increasingly, human waste in the form of “cake” from STWs is being stockpiled and spread on fields in the Evenlode catchment, which can runoff directly into rivers as well as leach into soils beyond the root zone. Farm tracks that connect fields to watercourses, manure heaps close to riverbanks or ditches, and milking parlour/ stock shed washing into drains also add to point source agricultural nutrient pollution. These may have greater impact in winter due to increased rainfall and lack of vegetation or crops to hold soil and slow runoff.

A.

B.

Figure 10: A) Flooding in November 2024 and B) the aftermath of flooding, showing the loss of topsoil which, with its nutrients, has been washed into the river (Photo: R Rustage)

Road runoff

Across our road networks, surface water runoff washes into the environment every time it rains. Roadway runoff is mostly connected to storm sewers or combined sewers through storm drains; they are not commonly connected to the sewage system and are, therefore, capable of entering our freshwater environments without treatment (Figure 11). In England alone, there are more than 18,000 outfalls associated with the motorways and main roads and likely more than a million local highway drains discharging directly to watercourses. See Section 6 for a case study on road runoff research in the Evenlode.

Figure 11: A) Road runoff entering a drain which is B) connected directly to a watercourse (Photo: L Bannatyne)

PFAS

PFAS, or per- and polyfluoroalkyl substances, are often referred to as "forever chemicals" due to their persistence in the environment and resistance to degradation. These chemicals can originate from various sources, including industrial processes, household products, and firefighting foams (AECOM, 2023). Once they enter the water system, they can be challenging to remove and may pose risks to both human health and the environment. Globally, these chemicals are becoming an increasingly significant concern. The ECP has been active in highlighting the presence of PFAS in the Evenlode catchment, for example downstream of the Fire Service College near Moreton-in-Marsh where the PFOS levels in fish were measured to be 950 times over the European environmental quality standard limit, and the surface water has measured 2,000 times the annual regulatory limit. The EA has been actively monitoring the presence of PFAS there and in other parts of the Evenlode catchment, recognising the potential risks these chemicals pose to both human health and the environment. The EA's approach is part of a broader strategy to manage and reduce PFAS pollution across the UK.

Water quality data sources

Background

Water quality data was collected during 2024 both by citizen scientists and using installed equipment. Citizen scientists conducted monthly FWW testing as well as taking part in the ECP Spring WaterBlitz in April, and the Great UK WaterBlitzes (GUKWBs) in June and September.

Citizen scientists also regularly undertook Riverfly surveys to assess the abundance and assemblages of aquatic invertebrates. Four sondes that monitored and reported real-time, near-continuous data were deployed in the catchment. Other sources of data include rainfall and nutrient testing data available from the EA.

Rainfall

Rainfall data provides insight into the hydrological conditions in the Evenlode catchment throughout the year. Data are available from the EA: environment.data.gov.uk/flood-monitoring/assets/demo/index.html. Monthly rainfall totals for 2024 from Chipping Norton and Worsham Mill are shown in Figure 12.

2024 Rainfall

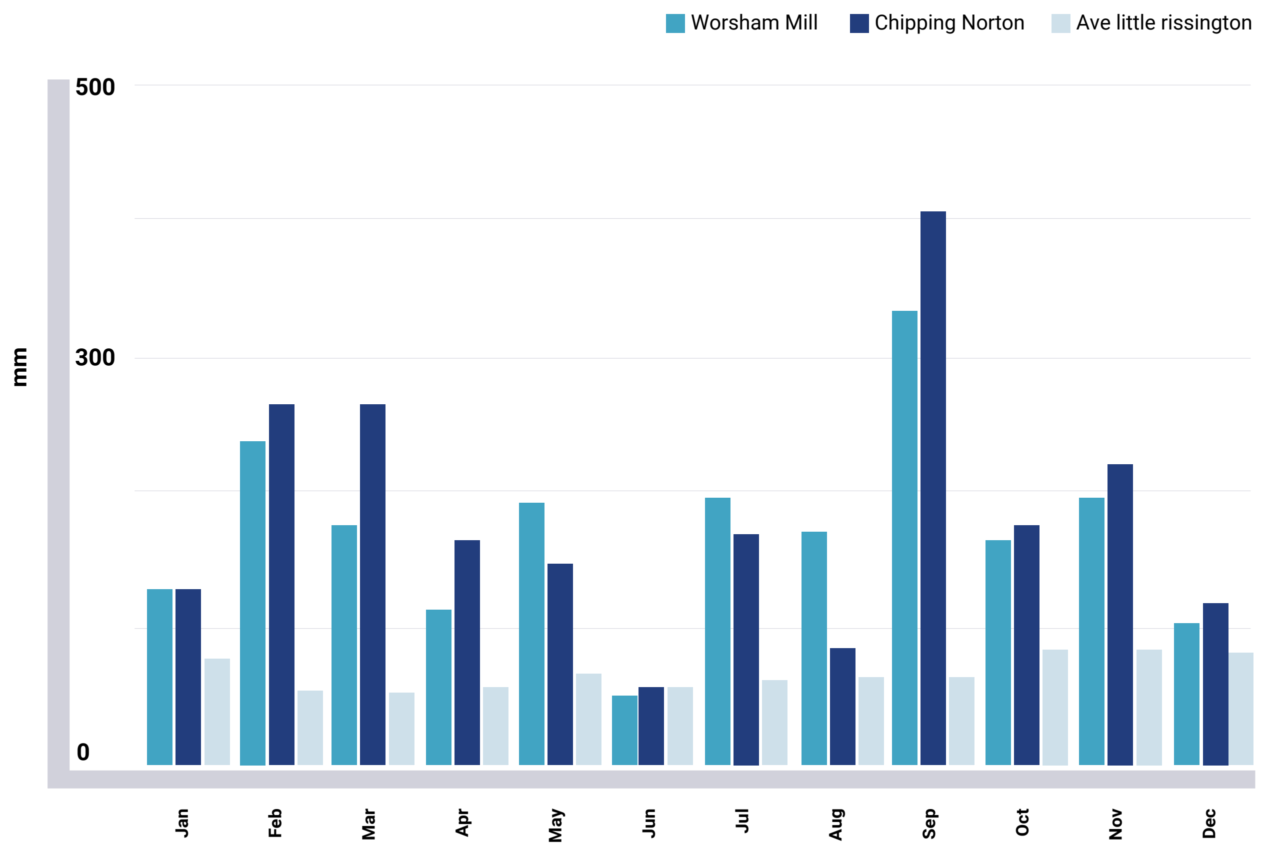


Figure 12: Monthly rainfall in the Evenlode catchment measured by the EA at Worsham Mill and Chipping Norton, and 30-year average rainfall measured at Chipping Norton. Average rainfall source: Check Average Rainfall by Month for Chipping Norton

2024 was a wet year. The rainfall in every month of 2024 exceeded the 30-year average, with only the driest month, June, approaching the average rainfall figure. February, March, October, November and particularly September were notably wetter than the average, with the Met Office describing September in Oxfordshire as the wettest since records began. High rainfall can affect water quality in the Evenlode catchment in two ways - firstly, STWs are more likely to release untreated sewage as storm overflows, and secondly, the increased flows provide dilution capacity for these overflows. Any decrease in nutrient concentrations is therefore likely to be due to dilution, and even though the concentrations may be lower, the nutrient load may be extremely high due to the increased volume of water.

FreshWater Watch water quality monitoring

The information in this section is mainly drawn from the FWW methods manual (11 September 2024) available here: https://www.freshwaterwatch.org/pages/explore-our-data

FWW is a citizen science project run by environmental charity Earthwatch Europe with a specific focus on water quality monitoring. The project explores the impacts of pollution in freshwater ecosystems and evaluates river restoration and catchment management practices around the world. The FWW project was established in 2012 by Earthwatch Europe in partnership with HSBC as part of the HSBC Water Programme. In 2015, the project was launched as a global, accessible citizen science project.

The FWW water quality sampling methodology and online platform provide a flexible resource, comprising:

- a smartphone application for data collection,
- cost-effective water quality testing kits,
- a Secchi tube to measure visual water clarity (turbidity) and
- a sophisticated online platform.

The platform (https://www.freshwaterwatch.org/) not only provides the means to carry out basic data analysis and gain feedback on sampling sites, but also gives access to learning resources and facilitates the development of an engaged global volunteer community. The FWW sampling card illustrates the thresholds for good, moderate and poor nutrient concentrations (Figure 13).

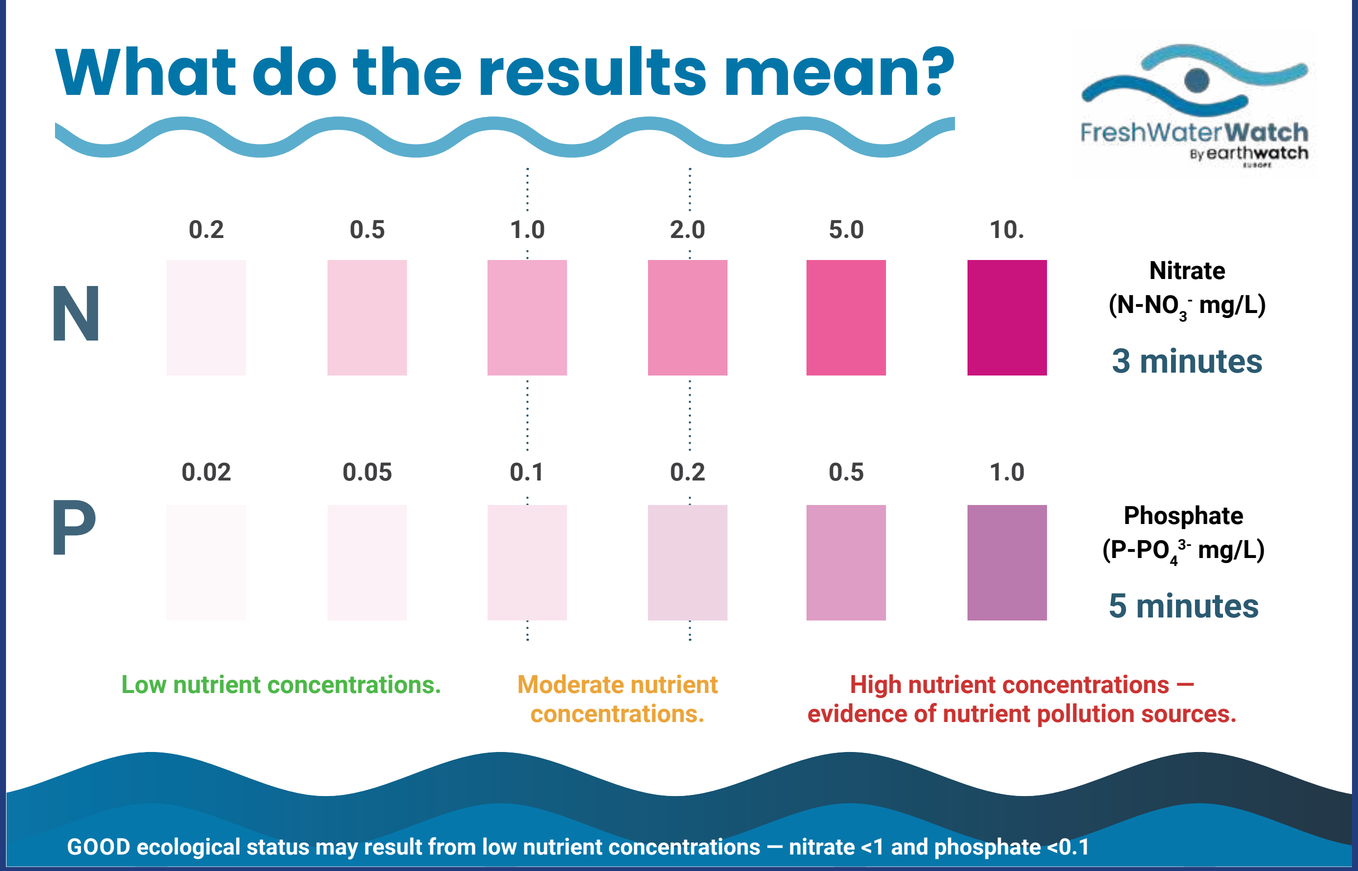


Figure 13: FWW test card showing the thresholds for good, moderate and poor nutrient concentrations

An "acceptable" limit of < 1 mg/L nitrogen nitrate and 0.10 mg/L PO4 3- is used in FWW, above which eutrophication and associated impacts to macrophyte communities from decreased light availability from algal growth and turbidity are likely.

The overall water quality at the sampling site is derived from nutrient and turbidity data recorded via the FWW survey, together with the citizen scientists' observations of water colour, algae, pollution sources and other inputs. This is displayed on FWW maps (Explore our data | FreshWater Watch) as good (green pins), moderate (orange pins) or poor (red pins), using the nutrient thresholds on the test card. For GUKWB testing, no turbidity measurements are taken.

Including the April, June, and September WaterBlitzes, ad hoc sampling, and the regular monthly sampling, 820 FWW surveys were collected at 160 monitoring sites during 2024, with a total of 225 participants recorded. The number of citizen scientists increased steadily from 2015 - 2021 and stabilised with more than 60 ECP citizen scientists regularly active for each of the past three years (Figure 14).

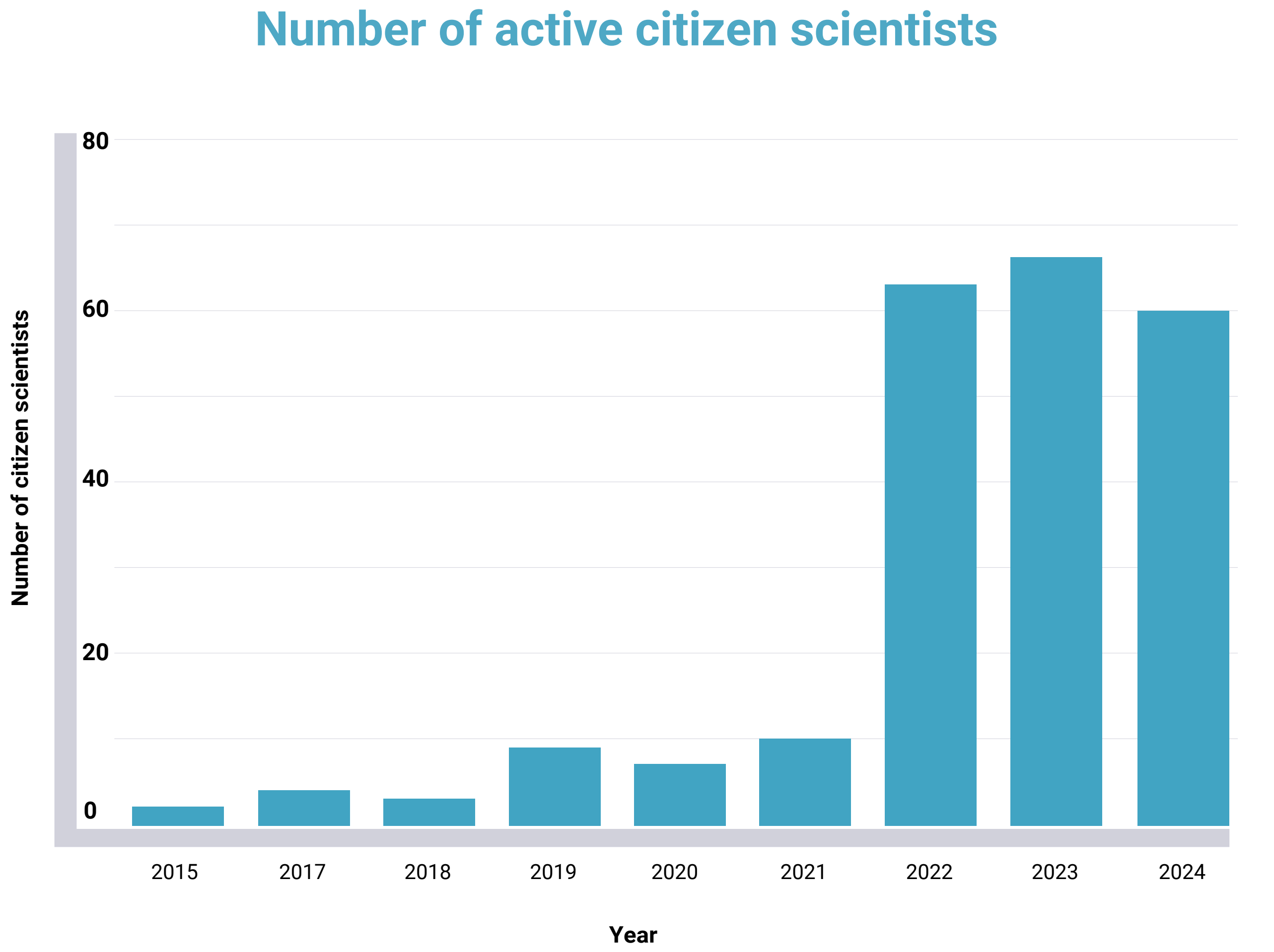


Figure 14: Growth of citizen science in the Evenlode catchment 2015 – 2024

Environment Agency water quality monitoring

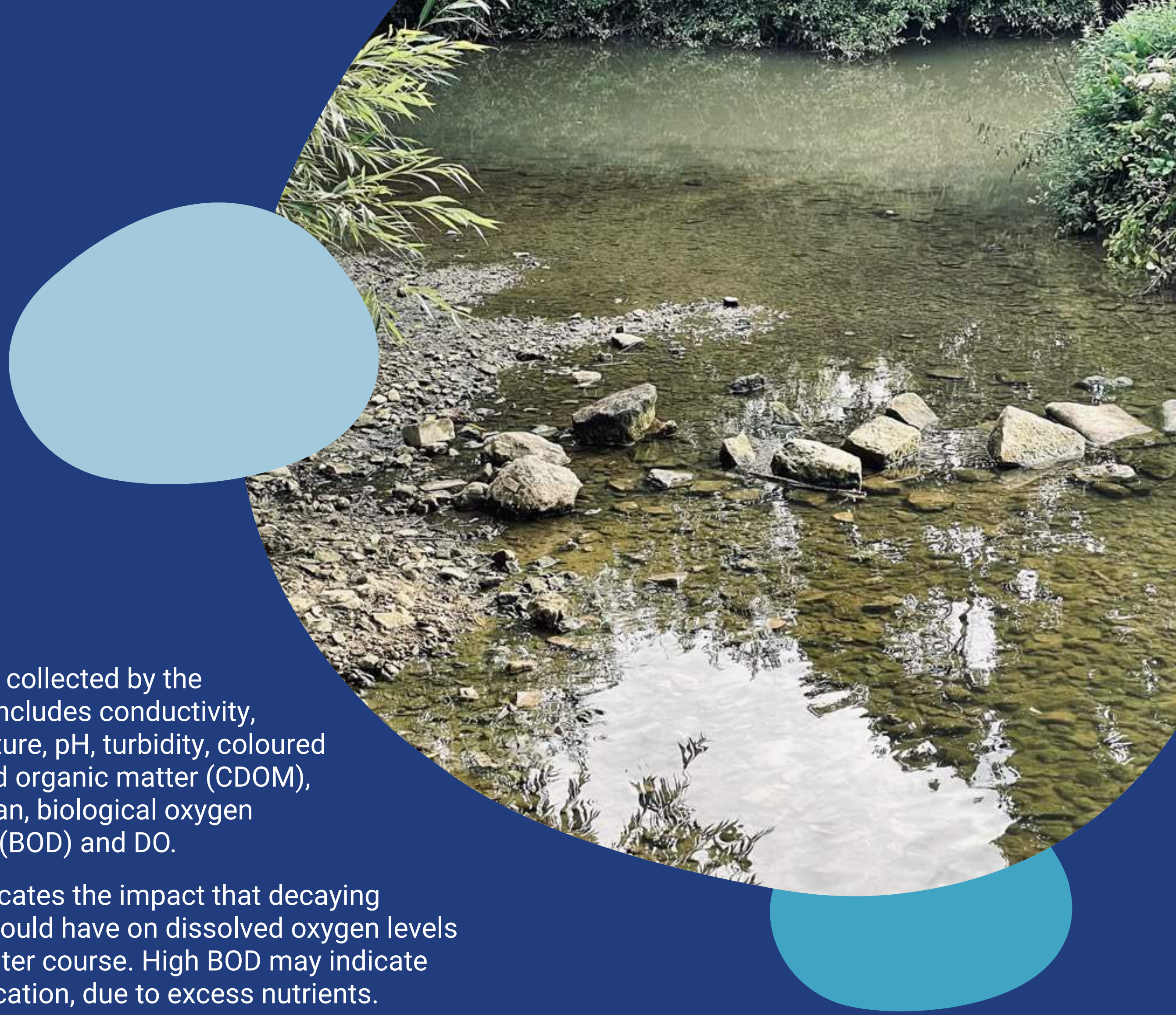
The EA collected data from 15 to 18 sites each month as part of their national water quality monitoring campaign (Figure 15). A total of 173 monthly samples were collected, with between five and twelve (average eight) samples collected at each site throughout the year. Nitrate as N, and orthophosphate reactive as P analysed by the EA are comparable with the N and P concentrations measured by citizen scientists using the FWW test kits, and with P monitored by the four Proteus sondes.

Installed water quality monitoring sondes

Earthwatch Europe with RS Hydro installed four Proteus sondes in the Evenlode catchment in 2022, upstream and downstream of two STWs; Chipping Norton and Milton-under-Wychwood. These sondes measure water quality parameters at 15-minute intervals and send data to an accessible digital platform in real time. This near-continuous data improves insight into the ecosystem's health and functions in greater detail than monthly FWW testing or laboratory-analysed EA sampling, by revealing patterns of daily cycles and seasonal fluctuations, as well as the changes in water quality caused by pollution and precipitation events. However, sonde data is spatially very limited by comparison to the catchment-wide data collected each month by citizen scientists, and even the EA. Figure 15 shows an installed sonde (A), and two stilling wells: one for a pressure logger to record water depth (B), and one for the sonde itself (C). Figure 16 shows a sonde, with the sensors protected by a copper screen, which has been taken from the stilling well and is about to be cleaned to remove sediment, algae and invertebrates.

Figure 15: Near-continuous water quality monitoring. A) the proteus sonde; B) the pressure logger stilling well; C) the sonde stilling well.

Figure 16: Maintaining a Proteus Instruments multi-parameter sonde (Photo: L. Bannatyne) INSET: Proteus sonde with the protective cage removed.



The data collected by the sondes includes conductivity, temperature, pH, turbidity, coloured dissolved organic matter (CDOM), tryptophan, biological oxygen demand (BOD) and DO.

BOD indicates the impact that decaying matter would have on dissolved oxygen levels in the water course. High BOD may indicate eutrophication, due to excess nutrients.

Phosphorus is comparable with the EA and FWW data, with a strong correlation to sewage discharges at the sonde locations.

Tryptophan is an amino acid, indicative of organic contamination and microbial activity. Sewage discharge is the dominant source at these locations.

Turbidity indicates the total suspended solids present, which may be linked to rainfall and river flow, or to the introduction of solid matter, or to algae.

CDOM is the light-absorbing part of organic matter. It does not specifically measure sewage, but at the sonde locations, there is a strong correlation between CDOM and the sewage discharges.

Conductivity indicates the amount of dissolved solids and inorganic content present. These are present naturally in freshwater bodies, due to the subsurface movement of water through rocks and soils. However, high levels of dissolved solids are indicative of pollution sources such as discharge from STWs.

DO is present in freshwater from atmospheric absorption and as a byproduct of photosynthesis. Low DO is (i.e. < 4 mg/L) can be lethal to fish and is negatively impacted elevated water temperature and decaying organic matter which may be elevated downstream of STWs.

Measurements of ammonium (NH4+) by an ion selective electrode were shown to have several problems (short term baseline drift, rapid loss of calibration) in a focused study on sonde data quality control. Ammonium measurements are not currently being included in long term monitoring.

Riverfly benthic invertebrate monitoring

Riverfly monitoring protocols guide citizen scientists to record data about benthic invertebrate Riverfly is a simple, standardised monitoring method whereby citizen scientists use a kick sampling technique in the riverbed at fixed location and record the numbers and assemblages of the benthic invertebrates that they catch. Eight key groups of freshwater invertebrates are surveyed to provide an overall score. Changes in water quality are assessed by comparing the resulting score against an established and site-specific 'trigger level. (CaSTCo, 2025). Trigger level breaches are reported directly to the EA who respond after two consecutive breaches by collecting a sample for laboratory analysis of invertebrate species and abundance. Figure 17 shows Riverfly monitoring sites for 2024.

Figure 17: Riverfly sampling sites 1 January - 31 December 2024 (Source: Riverfly Map - Riverfly - Riverfly Partnership - Cartographer)

A number of citizen scientists who had regularly undertaken Riverfly sampling were trained to use the "Extended Riverfly" method which involves the identification of a wider range of invertebrates (33 species) and provides greater insight into water quality, sediment, and flow.

Fish abundance and assemblage monitoring

Between March and August 2024, the EA undertook electrofishing surveys at 33 sites in the Evenlode catchment. The sites are shown in Figure 18.

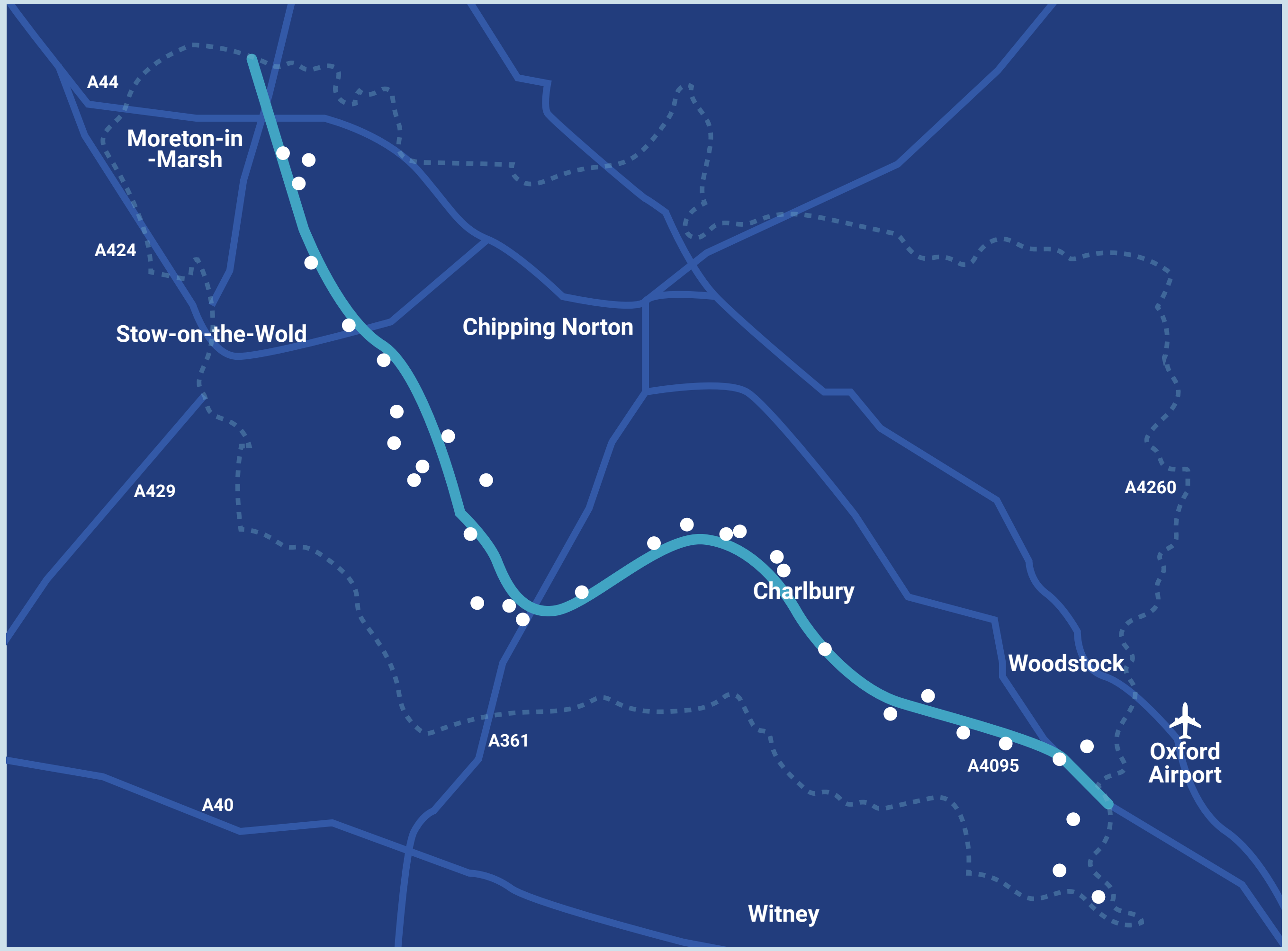


Figure 18: Electrofishing sites March – August 2024 (Source: EA Ecology & Fish Data Explorer).

Historic data and information on fish species and abundance (from 1981 onwards) for the River Evenlode near Ascott-under-Wychwood were also available from the Coldstone Angling Club.

2024 Water quality analysis

Background

This section combines citizen science and EA data to describe the nitrate, phosphate and overall water quality status across the Evenlode catchment and throughout the year, and where possible to compare these findings with accepted thresholds.

Setting thresholds for nutrient concentrations in freshwater bodies is a complex process. There are few large-scale studies that address background and elevated nitrogen, or more specifically thresholds for nitrate concentrations in rivers, streams, lakes and ponds. Spatially, nitrogen concentrations will vary significantly, based on local geological and land use conditions. Base nitrogen concentrations in different regions can range from above 2 mg/L to below 1 mg/L. Multiple studies suggest that the threshold from oligo - to mesotrophic conditions lies at 0.7 mg/L total nitrogen. Considering that nitrate is a large portion of total nitrogen, a limit of 1 mg/L nitrogen nitrate is used in FWW. This limit will avoid impacts to macrophyte communities from decreased light availability from algal growth and turbidity. When phosphate is expressed as P- PO_4^{3-} a common guideline for ecologically impacted surface waters is 0.10 mg P- PO_4^{3-} /L. This can be lower for lakes that are at risk of harmful algal blooms (e.g. cyanobacteria) and excessive algal and macrophyte productivity with related impacts on biodiversity, dissolved oxygen, and potable water sources. Concentration limits in streams may be higher, and in water bodies with high alkalinity.

Nitrate

Figure 19 shows the spatial distribution of FWW nitrate results for 2024 in terms of good (<1.0 mg/L), moderate (1.0 – 2.0 mg/L) and poor (>2.0 mg/L) concentrations. The EA water body boundaries are shown.

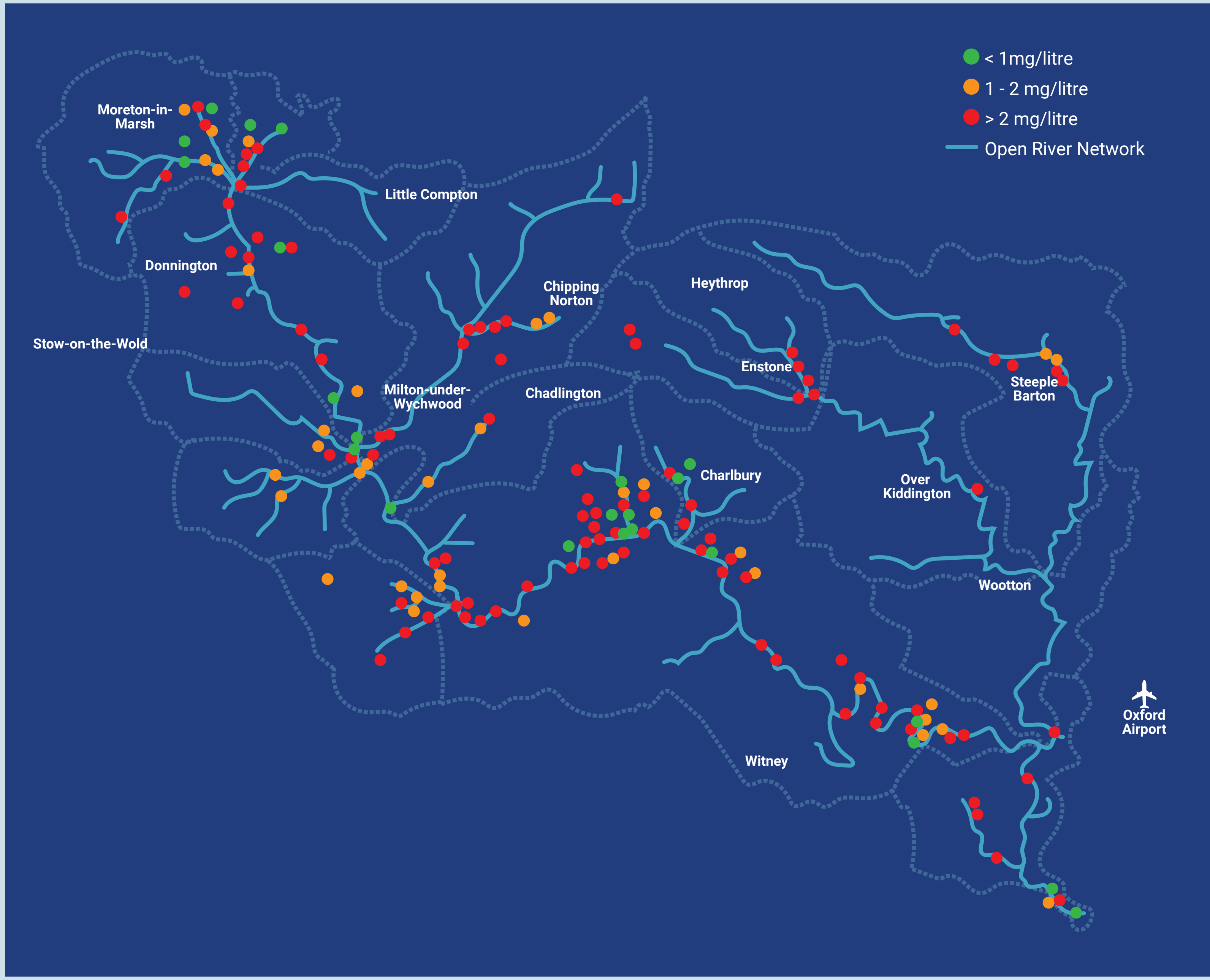


Figure 19: Map showing FWW nitrate concentrations for 2024

The predominance of "Poor" and "Moderate" nitrate concentrations is apparent, particularly for the Evenlode itself and downstream of STWs. Good concentrations were mainly recorded in tributary headwaters, with very few on the River Evenlode itself.

It is difficult to make a direct spatial comparison between FWW and EA nitrate concentrations. In addition to using different analytical approaches, EA and FWW samples were typically not taken at the same time. However, Figure 20 and 21 respectively compare the percentage of FWW (n=820) and EA (N = 170) surveys that recorded good, moderate and poor nitrate concentrations in 2024.

Nitrates: FWW 2024

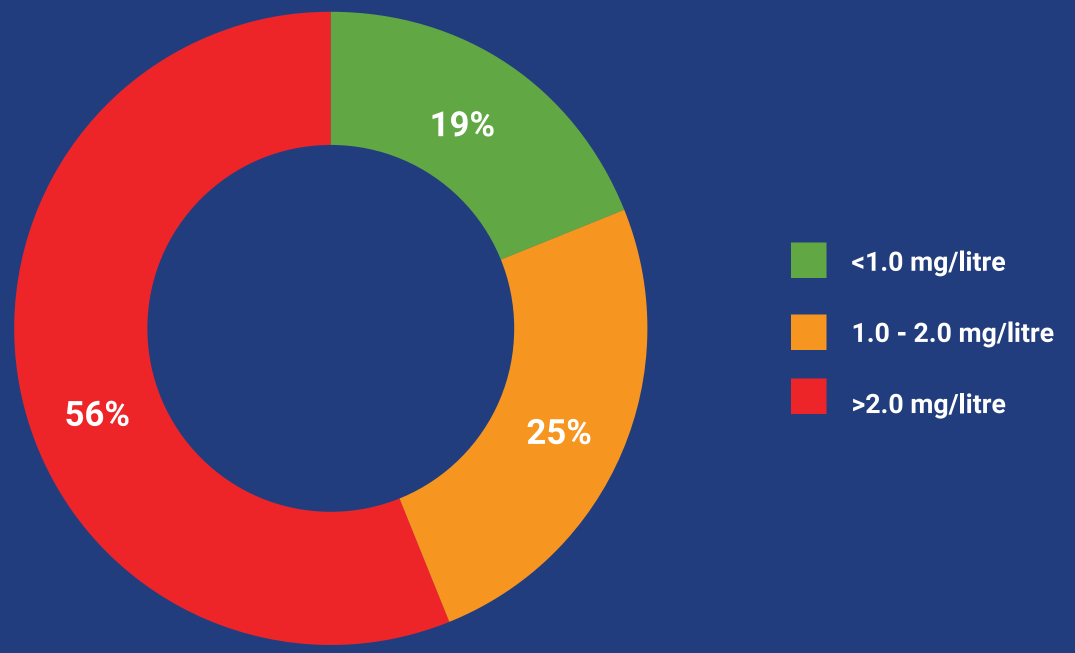


Figure 20: Percentage of FWW surveys (n=820) showing low (<1.0 mg/L), moderate (1.0 – 2.0 mg/L) and poor (>2.0 mg/L) nitrate concentrations for the Evenlode catchment in 2024

Nitrate: EA 2024

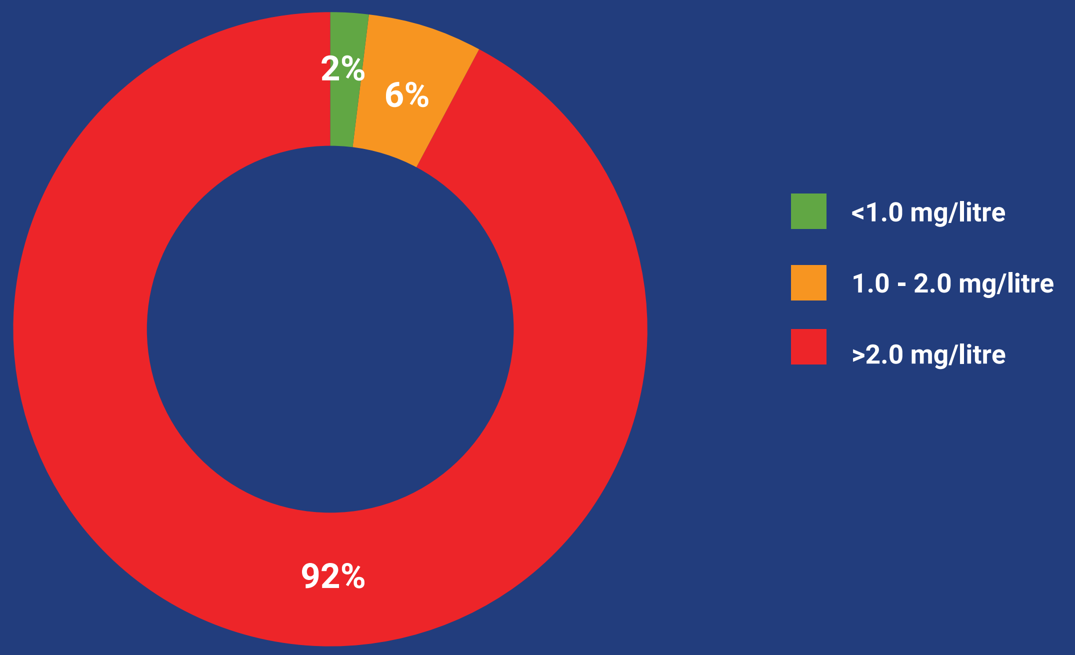


Figure 21: Percentage of EA surveys (n= 173) showing low (<1.0 mg/L), moderate (1.0 – 2.0 mg/L) and poor (>2.0 mg/L) nitrate concentrations for the Evenlode catchment in 2024

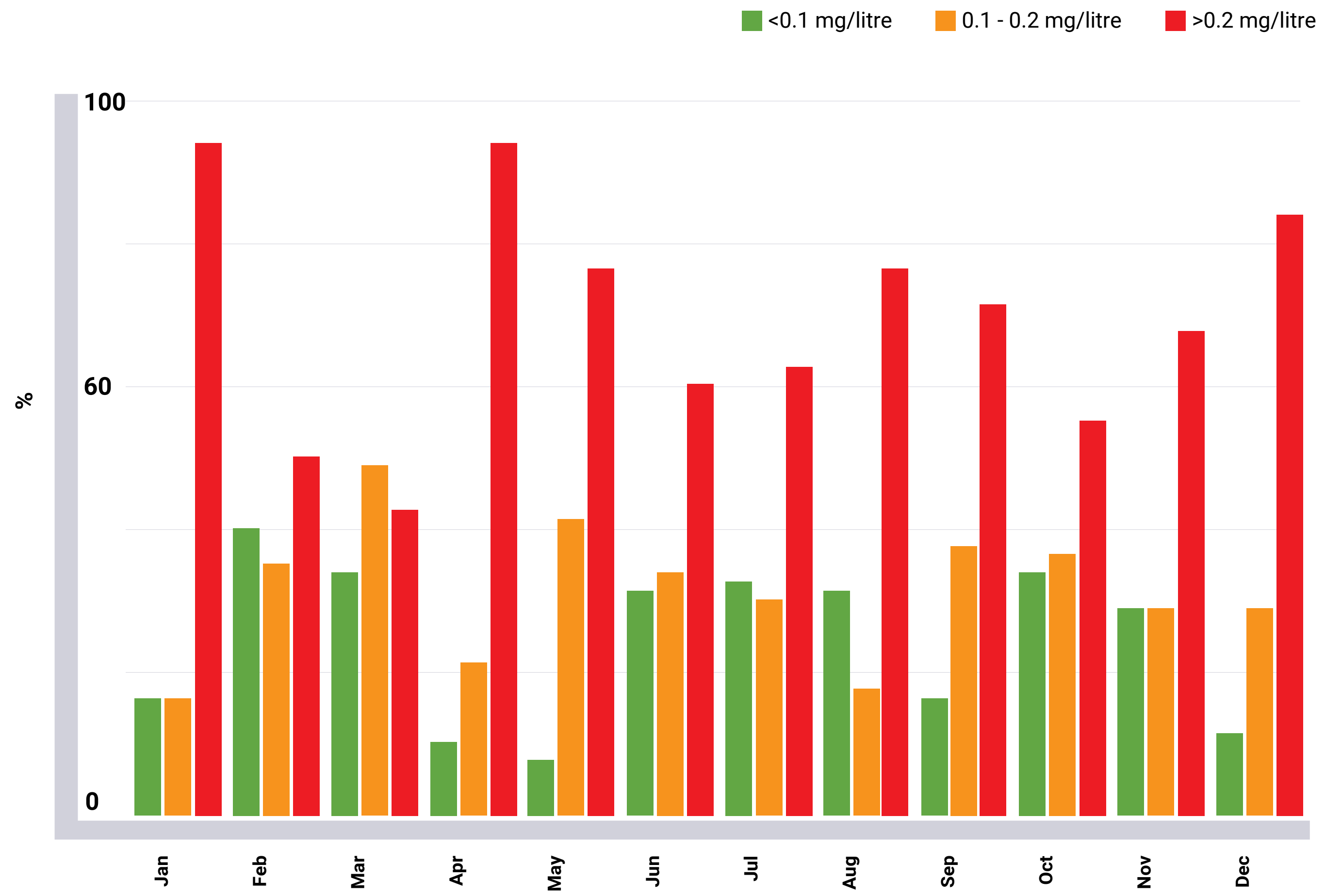


Figure 22: Percentages of FWW surveys showing low (<1.0 mg/L), moderate (1.0 – 2.0 mg/L) and poor (>2.0 mg/L) nitrate concentrations per month for the Evenlode catchment in 2024

It is very clear that despite the differences in sampling method, both datasets tell the same story: Taking 1.0 mg/L nitrate as the upper limit, nitrate concentrations in the Evenlode catchment are at best "good" less than 25% of the time, at worst 4% of the time. Nitrate concentrations varied throughout the year, as shown in Figure 22.

Monthly reports are available on the ECP website that provide further detail in terms of rainfall and storm overflows. In brief, it has been found that the variations tend to be related to rainfall and therefore a combination of surface runoff and dilution, rather than reductions in the volumes discharged from STWs.

Phosphate

Figure 23 shows the spatial distribution of FWW phosphate results for 2024 in terms of good (<0.1 mg/L), moderate (0.1 – 0.2 mg/L) and poor (>0.2 mg/L) concentrations. The EA water body boundaries are shown.

Whilst "Good" phosphate concentrations predominate, the clustering of red and orange points along the River Evenlode, and particularly downstream of STWs, is evident. Figure 24 and 25 respectively compare the percentage of FWW (n=820) and EA (N = 170) surveys that recorded good, moderate and poor phosphate concentrations in 2024.

Figure 23: Map showing FWW P concentrations for 2024

Phosphate: FWW 2024

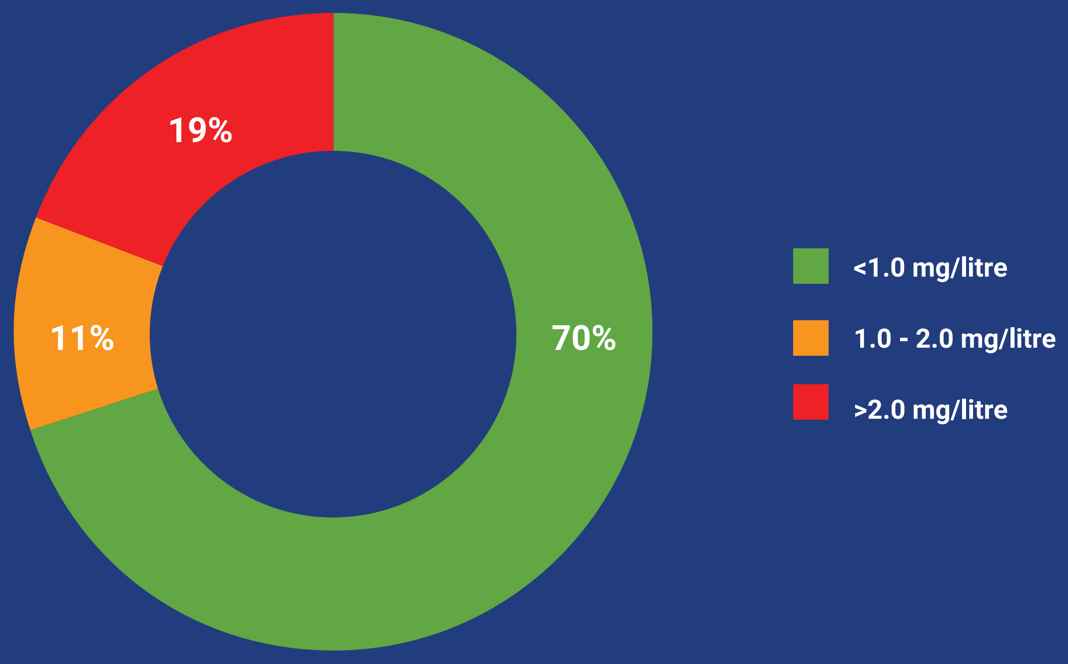


Figure 24: Percentage of FWW surveys (N = 820) showing low (<0.1 mg/L), moderate (0.1 – 0.2 mg/L) and poor (>0.2 mg/L) phosphate concentrations for the Evenlode catchment in 2024

Phosphate: EA 2024

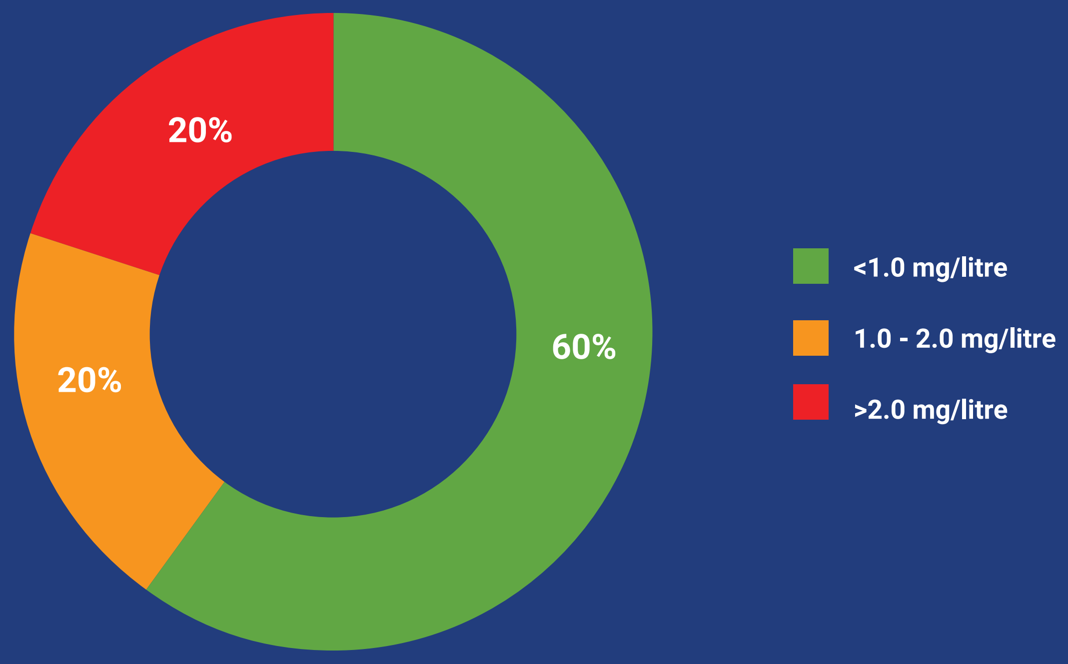


Figure 25: Percentage of EA surveys (n = 173) showing low (<0.1 mg/L), moderate (0.1 – 0.2 mg/L) and poor (>0.2 mg/L) phosphate concentrations for the Evenlode catchment in 2024

The agreement between the datasets is notable. Again, the message from both data sets is the same: Taking 0.1 mg/L as the upper limit, phosphate concentrations are poor ~25% of the time, and good ~65 – 70% of the time. The seasonal variation is shown in Figure 26.

The mitigating effect of dilution during the wetter months (January – March and October to December) is clearly seen in Figure 27.

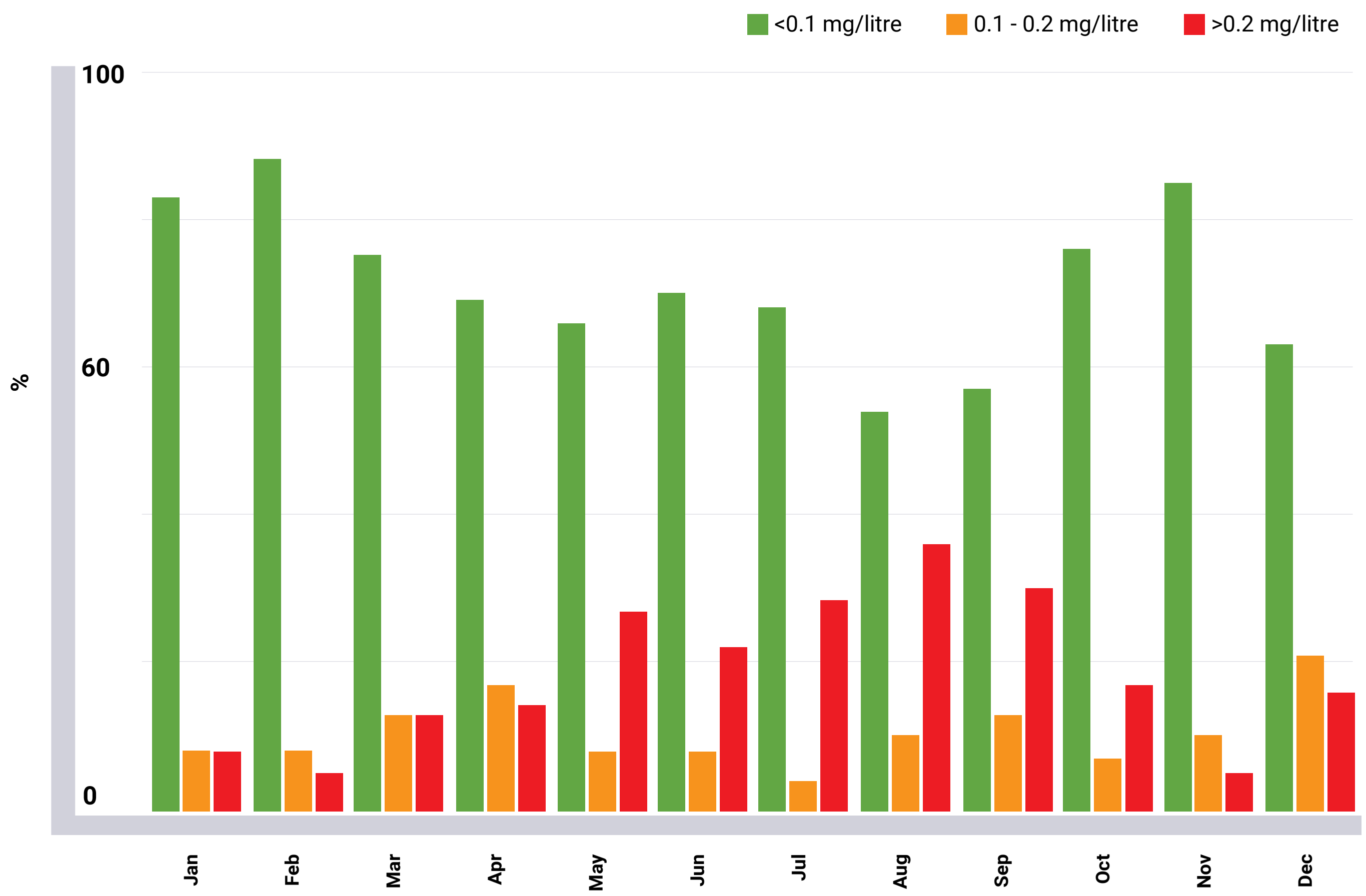


Figure 26: Percentages of FWW surveys showing low (<0.01 mg/L), moderate (0.1 – 0.2 mg/L) and poor (>0.2 mg/L) phosphate concentrations per month for the Evenlode catchment in 2024

Riverfly

69 Riverfly surveys were taken from January 1 - December 31 2024 (Figure 17). Of these, two trigger level breaches were recorded. Both the breaches were the Sars Brook at Sarsden Glebe (2nd and 4th August). Of these, the latter was a confirmed breach, but no reported action was taken by the EA.

Fish

Fish numbers in the Evenlode are very poor. The decline in fish species and numbers has been closely monitored by the Coldstone Angling Club, who fish the River Evenlode near Ascott Under Wychwood. In an excellent example of citizen science, Coldstone Angling Club have kept meticulous records of the weight of fish caught during their fishing tournaments since the early 1980s (Figure 27).

Total weight of fish caught (lbs), Ascott Under Wychwood, River Evenlode

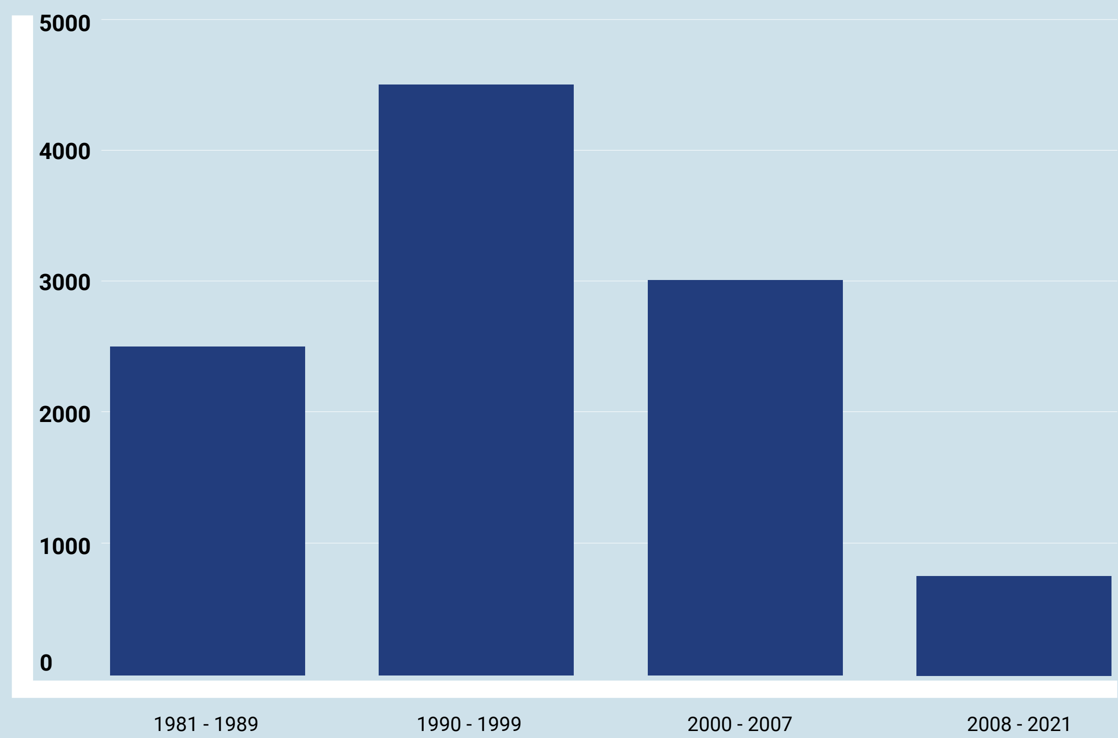


Figure 27: Total weight of fish caught on the River Evenlode at Ascot-under-Wychwood

The main species caught were coarse fish, including barbel, dace, chub, perch, roach etc, but the decline in numbers and diversity was notable, until in 2020/21 the tournament could not be held due to the decline in fish size and numbers. The full reports are available from the ECP website.

More recent data on fish abundance and assemblages was available from the EA electrofishing survey undertaken in the Evenlode catchment March – August 2024 (Table 1). Note that small species such as minnow, stone loach, bullhead etc, though regularly caught in the fine mesh of Riverfly nets, were too small to be caught using electrofishing and were not included in the data.

Table 1: Evenlode electrofishing survey results March – August 2024 (Source: EA Ecology & Fish Data Explorer).

SITE	Perch	Roach	Gudgeon	Chub	Dace	Tench	Pike	Barbel	Brown/ sea trout	Total	Dominant species; other comments
Moreton in the Marsh upper evenlode									3	3	Brown trout
Moreton in the Marsh-Evenlode									7	7	Brown trout
Four Shires Stream											N/A
Evenlode above Oddington									32	32	Brown trout
Oddington U/S of A436									17	17	Brown trout
Daylesford	2	2	6		1				23	34	Brown trout
Kingham		2	1		1				16	20	Brown trout
Bledington Brook											Brown trout
Cornwell Brook - Kingham Mill Hotel									8	8	Brown trout
Westcote Brook									7	7	Brown trout
Bledington					1				18	19	Brown trout
Cornwell Brook - Evenlode Confluence		7	5	6	16				8	42	Good mix of species
Sars Brook									2	2	Brown trout
Bruern			10	9	7		1		4	31	Good mix of species
Littlestock Brook Site A (u/s STW)											Minnow, stone loach and some trout known
Littlestock Brook Site B (d/s STW)									6	6	Brown trout
Shipton-Under-Wychwood	1	4	18	15	2		6			46	Good mix of species
Ascott-Under-Wychwood		8	1	10						19	Chub
Pudlicote Enhancement		3		12			1		2	18	Chub
Chadlington Stream									16	16	Brown trout
Dean Grove	1	2	1	10			2			16	Chub. Good mix of species
Grove Lane D/S									2	2	Brown trout
Charlbury Upper Channel	21	63	5	1	1		3			94	Roach! Very good mix of species
Charlbury		17	7	23	2	1	5		2	57	Chub. Good mix of species
Finstock		5	4	15	2		2	1	1	30	Chub. Good mix of species
Ashford Mill	4	4	1	10	11		1		3	34	Very good mix of species
Lower Ridings Farm		1	4	5	1	1	1			13	Good mix of species
Combe - Grintley Hill	1		2	6		4	5			18	Good mix of species
Blenheim Sawmill	1			1		2	2		2	8	Good mix of species
Hanborough (Blenheim enhancement)	2	2	7	6	2		2		2	23	Very good mix of species
Bladon (Blenheim enhancement)	6	7	1	7	4		4			29	Good mix of species
Goose Eye Farm				7					3	10	Chub
Hanborough Stream											N/A

Encouragingly, trout dominated the upper parts of the catchment including the River Evenlode itself, probably due to habitat. Chub dominated in the lower Evenlode. Dace were present throughout the catchment, in good numbers in some places. There was a notable abundance of roach found near Charlbury, though since 1990 they have been noted for their generally diminished population upstream of there. Though not to be expected in large numbers, the presence of pike indicated that there was sufficient prey available to support a predator species. However, lamprey species were not recorded during the survey, and (anecdotally) are absent from the river. These figures do not provide information in terms of fish size and age, but are low overall. There is strong evidence to suggest that poor water quality, particularly in Spring, can kill the eggs and larvae of coarse fish, an important "silent" impact of nutrient pollution (Hübner et al., 2009).

Water quality overview

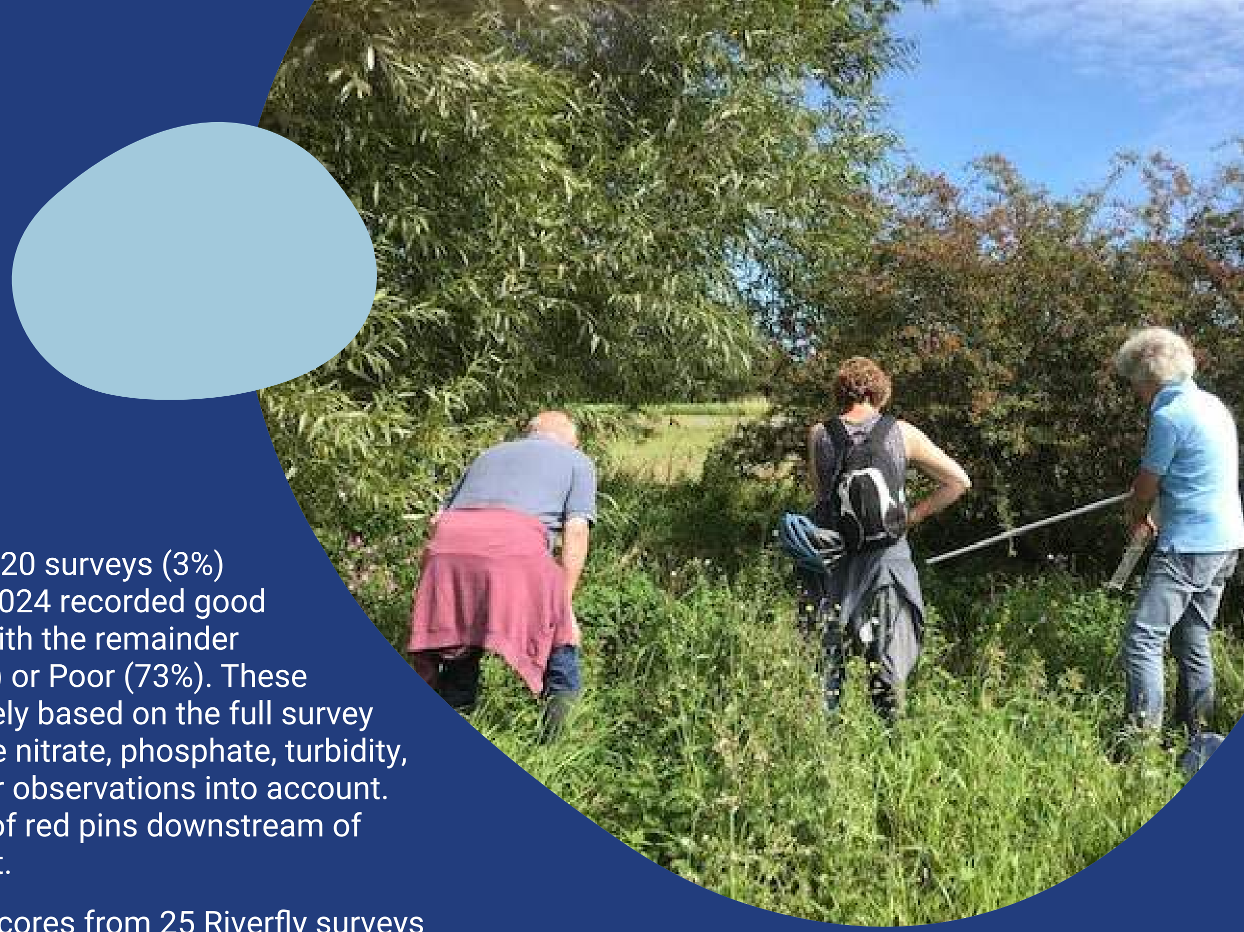
Whilst the predominance of "Good" phosphate concentrations in both the FWW and EA results appears favourable, it does not automatically equate to "Good" ecological status, or "Good" phosphate classification. This is demonstrated in Table 2 which summarises the most recent (2019 to 2022) ecological status and phosphate classification for the waterbodies in the Evenlode catchment, according to the EA's Catchment Data Explorer platform (Evenlode Operational Catchment | Catchment Data Explorer).

Water body name Comparing the	Ecological status	Phosphate classification
Evenlode (Source to Four Shires S) and Longborough Stream	Moderate	Moderate
Evenlode (Compton Bk to Bledington Bk) and 4 Shires	Poor	Poor
Little Compton Brook and tributaries (Source to Evenlode)	Moderate	Moderate
Bledington Brook (Source to Evenlode)	Poor	Moderate
Cornwell Brook and tributaries (Source to Evenlode)	Moderate	Poor
Westcote Brook (source to Evenlode at Bledington)	Moderate	Moderate
Sars Brook (source to Evenlode downstream Bledington)	Moderate	High*
Littlestock Stream to tributary of Evenlode at Shipton	Poor	Poor
Coldron and Taston Brooks	Moderate	Good
Heythorpe Stream and tributaries	Poor	High
Glyme (Source to Enstone)	Moderate	Moderate
Glyme (Enstone to Dorn)	Moderate	High
Dorn (Source to Glyme)	Poor	Moderate
Evenlode (Bledington to Glyme confluence)	Moderate	Poor
Evenlode (Glyme to Thames)	Poor	Poor
Glyme (Dorn confluence to Evenlode)	Poor	Good

Table 2: EA ecological status and phosphate classification for waterbodies in the Evenlode catchment (Source: Evenlode Operational Catchment | Catchment Data Explorer)

Although phosphate in five of the sixteen waterbodies is classified as "Good" or" High", the ecological status of all the waterbodies is Moderate (9) or Poor (7). The reported reasons for not achieving good status varied but typically included the impact of particularly STWs and also of agriculture. While Thames Water committed to provide phosphate stripping at 13 Evenlode works under AMP8 they then reneged on that commitment. The water quality results determined from citizen science FWW testing throughout the year (Figure 28) are in line with those from the EA as seen from the spatial distribution of surveys showing good (green), moderate (orange) and poor (red) water quality. The survey percentages are represented by the inset pie chart.

Figure 28: Spatial distribution of FWW Water quality results (n = 820).



Only 26 of the 820 surveys (3%) undertaken in 2024 recorded good water quality, with the remainder Moderate (24%) or Poor (73%). These results are largely based on the full survey results that take nitrate, phosphate, turbidity, algae, and other observations into account. The clustering of red pins downstream of STWs is evident.

Averaging the scores from 25 Riverfly surveys that were undertaken by one citizen scientist between 2017 and 2024 reveals the impact on benthic invertebrate abundance of Milton-under-Wychwood STW (Table 3).

Table 3: The impact of Milton-under-Wychwood STW on benthic invertebrate abundance

Year	# surveys	Upstream Riverfly score	Downstream Riverfly score
2017	1	3	4
2018	6	5.7	4.1
2019	6	6.3	4.7
2020	4	5.5	3.3
2021	2	5	3.5
2022	2	6	3.75
2023	3	6	5.3
2024	1	8	9
Average score		5.7	4.7

A higher score denotes greater abundance and diversity of benthic invertebrates, which in turn implies a healthier and more biodiverse watercourse (Riverfly Partnership). The data in Table 3, particularly between 2018 and 2021 when more surveys were undertaken, suggests that the discharge from Milton-under-Wychwood STW is negatively impacting the downstream ecology.

It is helpful to present water quality results using the simplified approach adopted for the Great UK WaterBlitz, in which the FWW nitrate and phosphate concentrations alone are used to determine the percentage of surveys that record "Acceptable" water quality (i.e., when nitrate <1.0 mg/Litre and phosphate<0.1 mg/Litre) or "Unacceptable" water quality. The seasonal variation in water quality using this approach is shown in Figure 29.

Water quality 2024

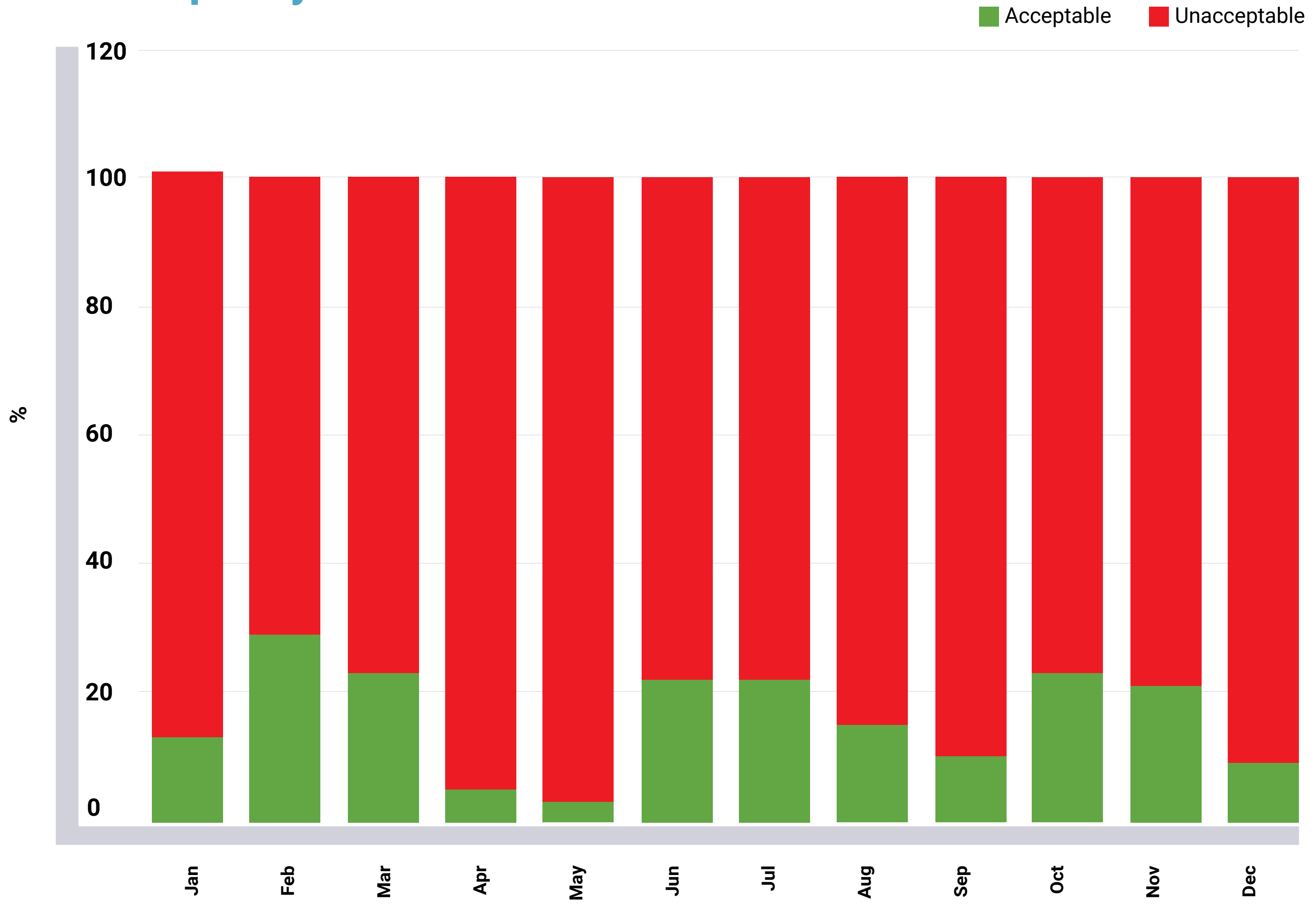


Figure 29: Graph representing the percentage of FWW surveys showing acceptable (i.e., < 1.0 mg/L nitrate AND < 0.1 mg/L phosphate) and unacceptable water quality per month

The percentage of surveys across the catchment that showed acceptable water quality varied throughout the year, but was generally below 25%, and in April and May was only 5% and 3% respectively. In general, the percentage of surveys showing acceptable water quality improves during wetter months, indicating that dilution is driving the apparent improvement in water quality. However, since raw sewage is typically released at this time, nutrients loads may be high despite low concentrations. Figure 30 uses the same approach to represent the 12 waterbodies that had >5 surveys recorded (n = 812), and as far as possible orders the waterbodies from the headwaters to the confluence with the Thames, with the four sections of the River Evenlode itself shown as the top two and bottom two bars.

FWW water quality 2024

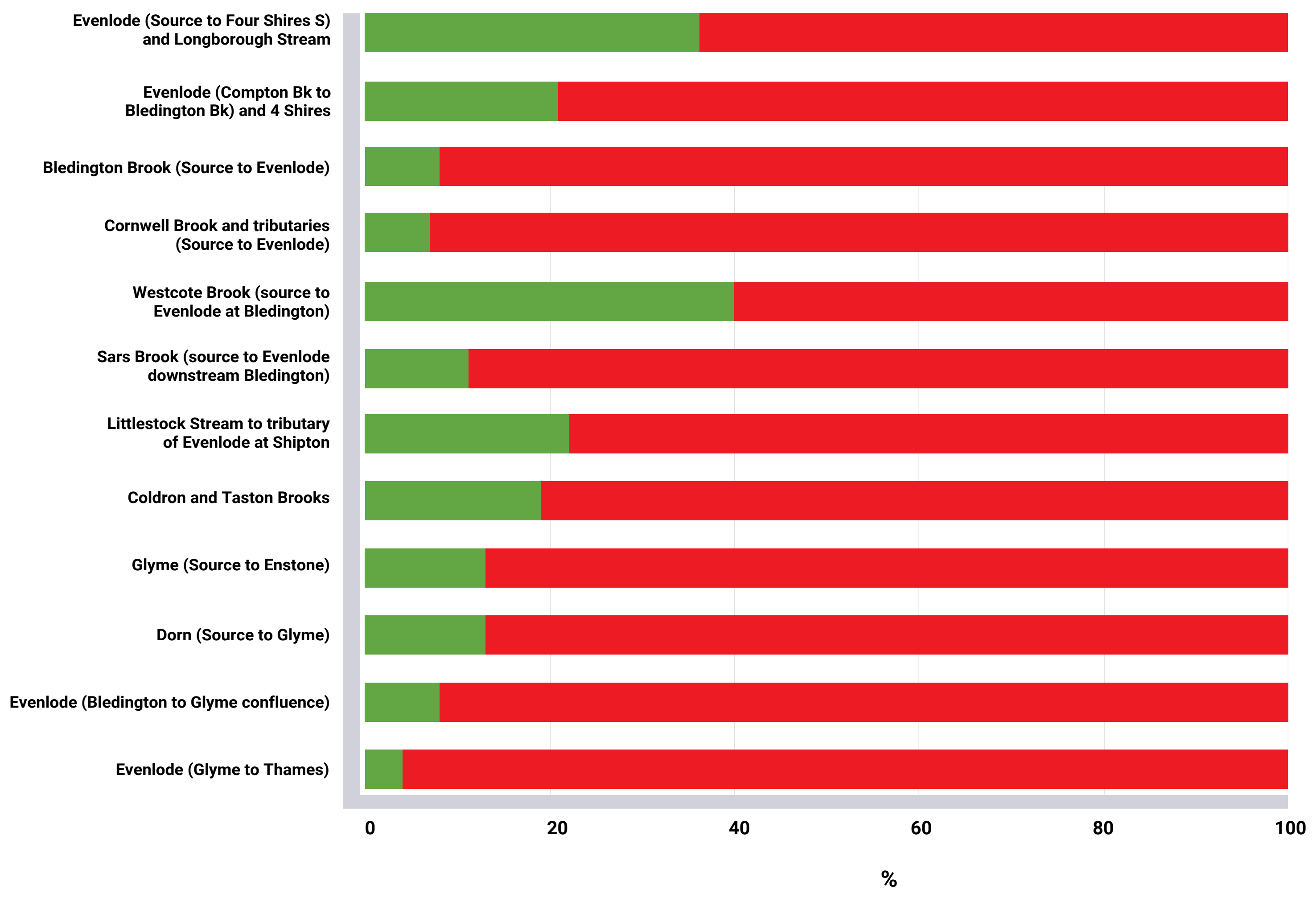


Figure 30: Graph showing the percentage of FWW surveys (n=812) showing acceptable (i.e., < 1.0 mg/L nitrate AND < 0.01 mg/L phosphate) and unacceptable water quality for waterbodies with >5 datapoints

It is apparent from this upstream to downstream representation that better water quality is recorded more frequently at the headwaters, with some tributaries (e.g., Bledington, Cornwell and Sars Brooks) contributing strongly to the obvious downstream decline in the percentage of surveys recording good water quality (from 36% to 4%). The cumulative discharge from the nineteen STWs and the inflow of nutrient-rich runoff and groundwater from farmland overcomes the assimilative ability of the River Evenlode, despite the natural increase in flow from the headwaters to the outlet of the catchment.

The citizen science FWW approach to determining water quality in the Evenlode catchment in 2024 was supported by the more stringent EA approach. This confirms that the citizen scientists applied the FWW monitoring protocols consistently and carefully. Their efforts throughout the year provided a robust dataset with a large number of datapoints and wide coverage, which can be analysed with a high degree of confidence. The findings underline community concerns for the health of the River Evenlode and its tributaries, pointing to the point-source impact of phosphates from STWs against the diffuse background and legacy of nitrate from agriculture.

(c) Rob Rustage

Case studies

Background

It was possible to overcome the difference between sampling time and location to compare the EA and sonde phosphate data sets. Figure 31 shows a comparison between phosphate data derived by one of the sondes and from EA samples that were taken 10 m from the sonde. The sonde value that was recorded immediately after the EA sample time was used, i.e., the data was recorded less than 15 minutes apart. The matched samples were then plotted against each other to create a linear regression and the R2 was calculated as a measure of correlation.

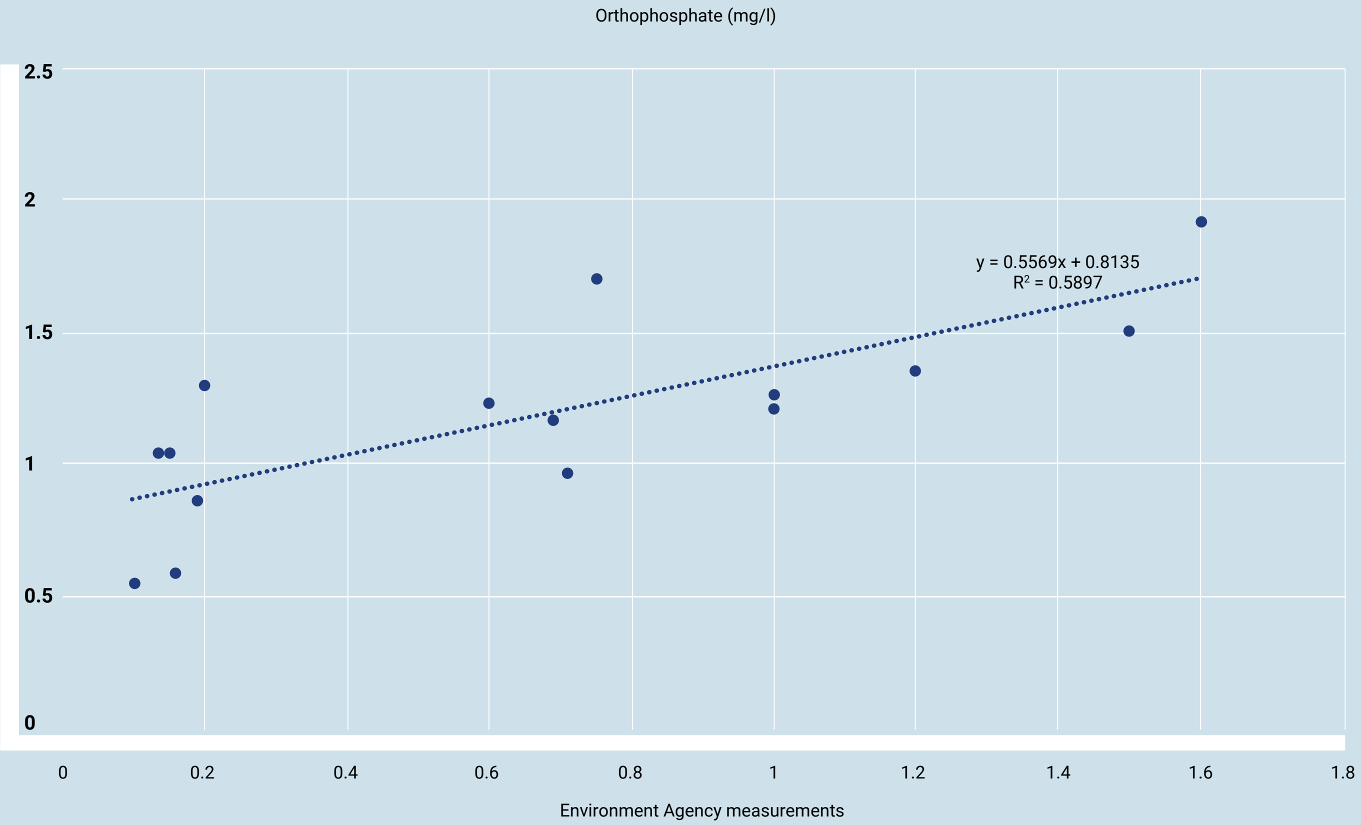


Figure 31: Correlation between sonde P values and EA P values recorded within 10 meters and 15 minutes

Although two different measurement approaches were used, the two datasets support each other well across the range of concentrations from 0.01 mg/L to 1.9 mg/L. This allows confidence in the phosphate trends and patterns measured by the sondes, for example as used for the following Littlestock Brook case study.

Milton-under-Wychwood STW

The Littlestock Brook receives the outflow from the Milton-under-Wychwood (MuW) STW. MuW STW was one of 112 projects that Thames Water did not complete as required under AMP7 (April 2019-March 2025). The revised project timescale for delivery is August 2026.

As shown in Figure 4, MuW STW has the fifth-highest annual average daily flows of all the STWs in the Evenlode catchment from 209 – 2023 and has been "Top of the Poops" in terms of total hours releasing untreated effluent straight into the Littlestock Brook – over 2000 hours in 2023, and 2664 hours in 2024. The concentration of nutrients provided by this constant daily flow of treated sewage and high episodic release of untreated sewage were shown by citizen science FWW testing to be high, warranting further investigation. Proteus Instruments multi-parameter probes were therefore installed ~600m upstream of the STW and ~400m downstream of the STW in February 2022 respectively to assess the impact of MuW STW on the brook. Monthly data reports are available here that provide further detail to the example given here.

The EA took fourteen phosphate samples over the period 2023/2024, whilst the sonde took nearly 22,000 readings over the same period. The average of the fourteen EA phosphate samples was 0.64 mg/l (Water Framework Directive classification - Moderate), but this does not show the seasonal trend revealed by the sonde (Figure 32). Splitting the 14 EA samples into summer/winter averages results in 1.05 mg/l (Poor) in summer and 0.23 mg/l (Moderate) in winter, when additional dilution is available.

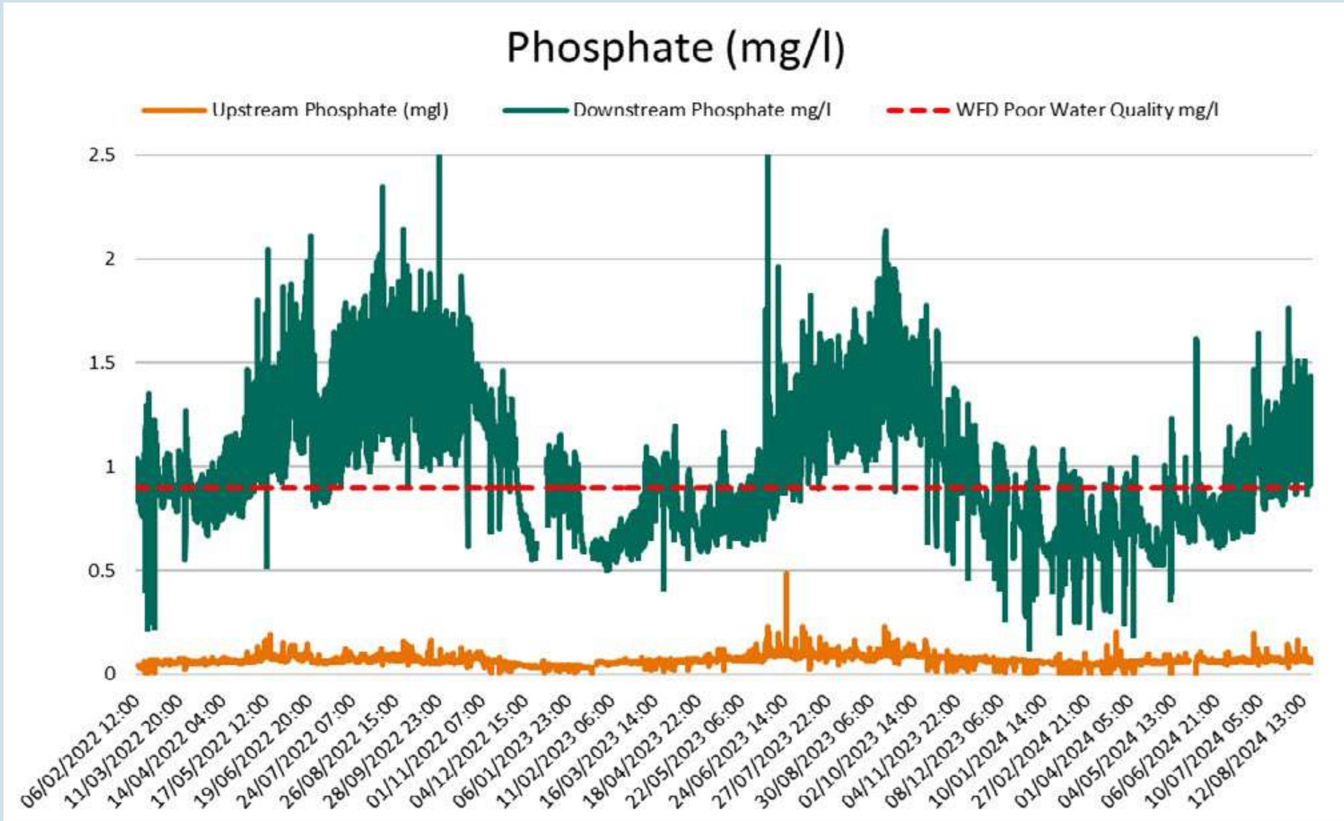
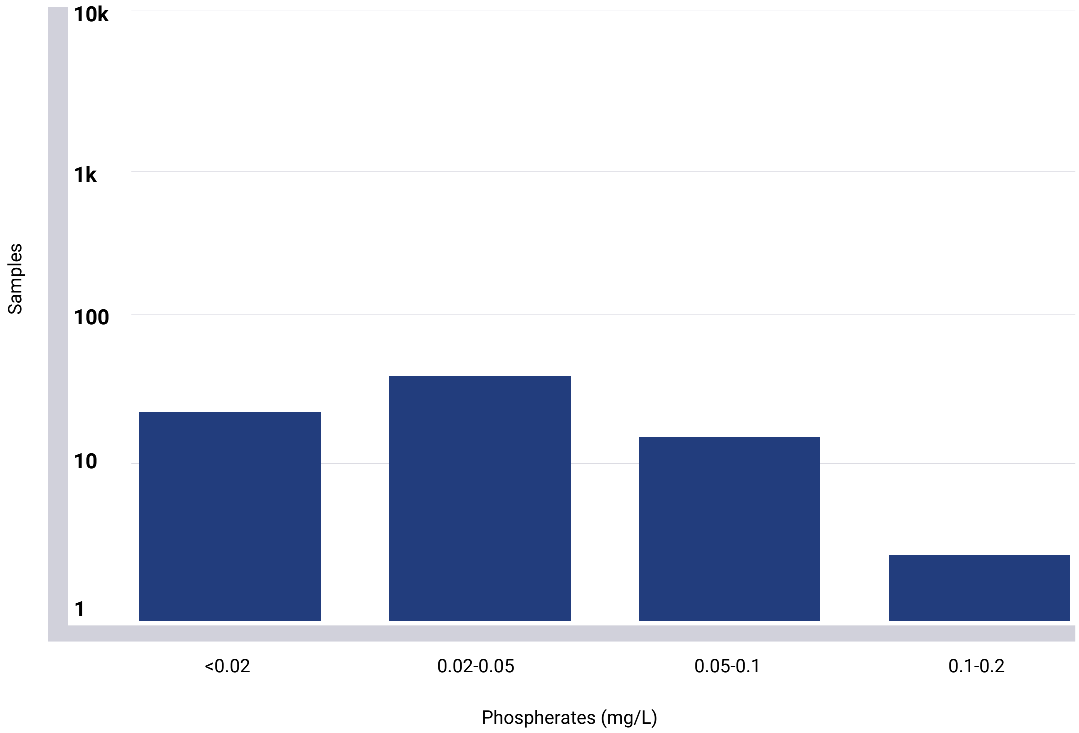


Figure 32: Sonde phosphate data above and below Milton-under-Wychwood STW 06/02/2022 – 12/08/2024

The impact of the STW on the phosphate concentrations derived from the sonde measurements is very clear from the sonde data upstream (orange) and downstream (green) in Figure 32. Both the EA and sonde data sets are in the same range reported by citizen scientists at Meadow Lane bridge below MuW STW. Of the 103 citizen science FWW samples taken at Meadow Lane, 70 showed high levels of phosphates, with 30 reporting 0.5 -1 mg/Litre, and 40 reporting >1 mg/Litre, which is the upper limit that the Kyoritsu test kits can measure (Figure 33).



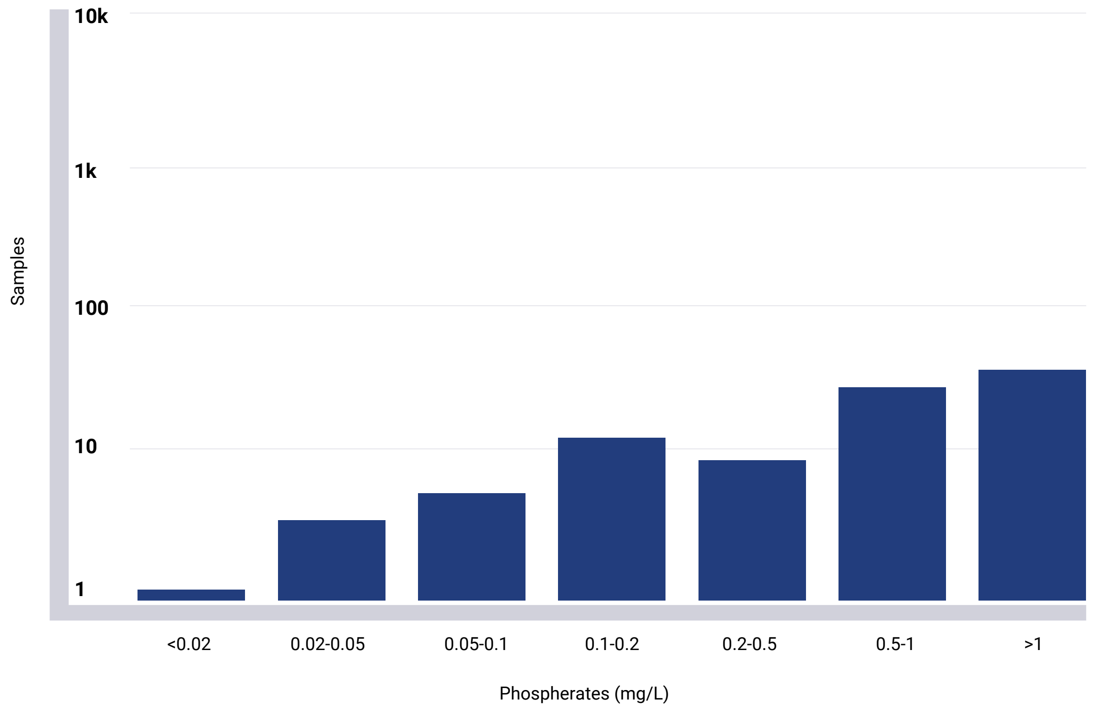


Figure 33: Citizen scientist FWW samples taken A) upstream of MuW and B) downstream of MuW STW at Meadow Lane bridge

Despite the MuW STW being able, for the most part, to comply with the sanitary standards in the environmental permit issued by the EA, this analysis shows that the STW has a significant negative impact on the water quality of the Littlestock Brook and is the main contributor to the brook being classified as being of 'poor water quality'.

The EA environmental discharge permit conditions for the treated sewage effluent discharge from the STW (which are based on only 12 monthly samples) are too lax to protect the water quality of Littlestock Brook. They do not contain any limits for phosphate. This is a significant omission as phosphate is one of the main determinants that causes the brook to be classified as having 'poor water quality'.

There is insufficient dilution available in the brook to absorb the flow and concentration of pollutants that are discharged from the STW. Even at times when all the flow to the works is processed and treated to the permit standards, the dilution is insufficient for the brook to reach Good Ecological Status due to the STW discharge. This situation is exacerbated in the summer months when the flow in the brook is low, but the STW discharge remains steady.

As well as the treated sewage effluent discharge, the works also has a permit to release untreated sewage when the works is overwhelmed from 'storm sewage effluent resulting from rainfall or snowmelt'. These untreated sewage discharges exceed 2,200 hours discharging per year; far more than what would be expected from 'rainfall or snowmelt' in Milton under Wychwood, suggesting that illegal 'dry' discharges (i.e., in the absence of precipitation) may have taken place. It is obvious that there is insufficient capacity in the sewerage system and STW to treat the full flow and this leads to frequent use of the untreated storm overflow discharge to avoid overwhelming the STW.

The operation of the storm overflow under an historic 'Temporary Deemed Consent' makes determination of the level of illegality of the untreated sewage discharges problematic. It is therefore incumbent on the EA to promptly review and re-issue a revised permit with environmental conditions that protect the Littlestock Brook.

On the basis of these findings, the ECP recommends that;

- Given the poor performance of the present works, there should be no further development in the area served by MuW STW, until the STW is upgraded to treat all of the flow, and the treatment process is enhanced to ensure that the quality of the effluent discharged does not harm the brook.
- The EA reviews the permit and sets tighter limits that protect the water quality and ecology of the brook. This will require enhancements to MuW STW and its associated sewerage network, to include both the enhanced quality and increased quantity of treatment.
- The EA sets a phosphate limit in the STW discharge permit at a level that protects the water quality of the brook. This will require enhancements to MuW STW, to include phosphate stripping. Thames Water committed to phosphate stripping here and at 12 other sites in the Evenlode during AMP8 but subsequently withdrew those commitments.
- The EA must rigorously enforce the conditions of the Storm Overflow Permit in order to force Thames Water to make improvements to the sewage system and the STW, to reduce the frequency of untreated sewage discharges.

Click here to read the detailed report on Littlestock Brook.

Moreton-in-Marsh STW

The streams and tributaries at Moreton-in-Marsh (MiM) form some of the headwaters of the River Evenlode. In response to concerns raised regarding proposed additional housing development at MiM, Earthwatch undertook an investigation in June 2024 using existing data sources to evaluate the impact on the River Evenlode. FWW and EA data were analysed to evaluate the current impact of the MiM STW discharge on the River Evenlode. A sonde was installed downstream of the MiM STW to improve understanding of the STW impact.

The Evenlode below MiM STW is currently designated by the EA as having 'Poor Water Quality'. It is clear that MiM STW is a significant contributor to this poor water quality. The permit conditions set for MiM STW do not appear to be to be protecting the watercourse. The MiM STW permit does not include a limit for phosphates, which is one of the contributing factors to the 'Poor Water Quality' designation. Additionally, there is insufficient dilution in the river at the discharge point to cope with the existing pollutant load discharged.

There are three problematic sewer overflows in Moreton-in-Marsh. There are two at Primrose Court: the Land Treatment Area (LTA), which discharged over 2000 hours of untreated sewage in 2024, and the combined sewage outlet which discharged for 40 hours. The third is 'Near Sezincote Lodge' (where the event duration monitor was offline for all of 2023), which discharged for 145 hours in 2024. The frequency of operation of Primrose Court indicates that the STW does not have adequate capacity even for the existing population, given that Primrose Court is intended to provide protection (extra capacity) for the STW. MiM STW was one of 112 upgrade projects that Thames Water committed (but failed) to complete during the AMP7 period (April 2019 - March 2025), and which is now due for delivery December 2027, with Primrose Court LTA due by October 2027. The ECP has low confidence that either target date will be met. According to Thames Water, Primrose Court is not expected to be compliant with government targets for storm overflows before 2045-50 (Thames Water, 2025). The postponed scheme for MiM STW does now contain a phosphate limit of 0.25 mg/l.

The number of additional houses proposed in Moreton-in-Marsh is significant and likely to overwhelm the capacity of the sewer system and the existing STW which will further degrade water quality. The current MiM STW permit allows for a population equivalent of around 5,700. The current Thames water AR24 Population Equivalent served is 6,346, with a population increase projection to 7000 by 2030. The housing developments that have already been agreed by the planning authority and that are in various stages of construction include a development of 15 dwellings at Davies Road; 69 dwellings at Evenlode Road; and 250 dwellings at Dunstall Farm; and a residential care home with 60 beds . Due to the concerns regarding STW capacity, the application for Dunstall Farm development had been constrained with Grampian conditions for the first 50 homes that had been built. However, a loop hole was found due to poor wording of the Grampian conditions, and the full development of 250 homes will now be connected to MiM STW without necessary upgrades taking place.

A conservative estimate of the population increase due to the new dwellings given an average of 2.4 people per home and the additional sewage load from the care home suggests an additional population equivalent of over 840 reporting to the MiM STW with no current plan to improve efficiency or increase capacity.

Additional pollutant sources, for example residential sewage misconnections at Blenheim Meadow, have been identified in the catchment from the EA and FWW samples. Although these appear to be intermittent and to have less impact than the MiM STW discharge, these additional sources need further investigation.

On the basis of these findings, the ECP recommends;

- For the EA - The current environmental permit for MiM STW needs tightening to better protect the river and to include a limit for phosphates.
- For Thames Water - MiM STW needs upgrading to improve the quality of final effluent to reduce the environmental impact in the stream. The sewage also needs further treatment to reduce the phosphate load in the discharge. This should be done urgently and ideally before any additional sewage load is accepted.
- For Thames Water - The sewers in Moreton-in-Marsh need to be improved to prevent the spillage of untreated sewage effluent, and to ensure that all effluent discharged into the sewer is transported to MiM STW.
- For the Local Authority – although issues of sewage discharges are normally the remit of the water company and the environmental regulator, it appears that the impact of additional development has not been considered or accounted for in planning processes and should be given more weight.
- For the ECP (citizen scientists and sonde) and the EA - continuing water quality monitoring is required to better understand the impacts of MiM STW on the River Evenlode, in order to protect the environment for the future.

Road runoff

Tyre-wear pollution is a very serious and growing environmental problem, and one that is being exacerbated by the growing popularity of large, heavy passenger vehicles and the increasing number of heavy goods vehicles on the roads. What's more, this pollution is completely unregulated, unlike exhaust emissions which are being addressed by car makers thanks to the pressure placed on them by European emissions standards. New cars now emit less particulate exhaust matter, but there is growing concern around 'non-exhaust emissions'.

Non-exhaust emissions are particles released into the air from brake wear, tyre wear, road surface wear and resuspension of road dust during on-road vehicle usage. No legislation is in place to limit or reduce these emissions, but they cause a great deal of concern for both air and water quality.

In Summer 2024 a group of citizen scientists collected samples from the Evenlode and Windrush catchments, from puddles on roads, water running from roads into rivers, and directly from rivers, for chemical analysis. Antioxidants, stabilizers and rubber compounds, indicative of tyre pollution, were

[1] https://environment.data.gov.uk/catchment-planning/v/c3-plan/WaterBody/GB106039037410

found in 100% of samples collected. This data was collected from the 26th July to the 2nd of August, during a period characterised by heavy rains and high river flows.

Seven pollutants of emerging concern, characteristic of tyre-wear are highlighted here. These volatile organic compounds and semi-volatile organic compounds consist of antioxidants, stabilizers and rubber compounds:

1. Styrene,
2. Dimethyl trisulfide (DMTS),
3. Benzene, 1,3-bis(1,1- dimethylethyl),
4. 2,4-Di-tert-butylphenol (2,4-DTBP),
5. 2,5-Di-tert-butyl-1,4-benzoquinone (DTBBQ),
6. Benzene, 1-methyl-4-(1-methylethenyl) and
7. 1,4-Benzenediol, 2,6-bis(1,1-dimethylethyl).

Combinations of these chemicals, indicative of tyre-wear, were found in every single sample collected. The presence of these chemicals on roads adjacent to rivers, and in river water itself, suggests that pollution from non-exhaust emissions is impacting these important habitats.

Styrene occurs naturally in a variety of foods such as fruits, vegetables, nuts, beverages, and meats; but it is primarily a synthetic chemical used to make products such as rubber, plastic, insulation, fiberglass, pipes, automobile parts, food containers, and carpet backing. Styrene can be toxic to aquatic organisms at relatively low concentrations. It is strongly advised not to let the chemical enter into the environment2.

DMTS is a typical volatile organic sulphide, which leads to rotten eggs or rotting stench in water, mainly from the death and decomposition of high-density blue algae and microbial decomposition of sulphur-containing organic matter in water.

Benzene, 1,3-bis(1,1- dimethylethyl) is an alkylbenzene. These chemicals are liquids with relatively low boiling points that are used primarily as solvents or as starting materials in the synthesis of other chemicals and drugs. In general, the toxicity of alkylbenzenes has been found to be relatively low. However, in high concentrations they might pose significant and potential health risks to man and the environment4.

2,4-DTBP is a member of the class of phenols carrying two tert-butyl substituents at positions 2 and 4. It has a role as a bacterial metabolite, an antioxidant and a marine metabolite. 2,4-DTBP is often a major component of violate or essential oils and it exhibits potent toxicity against almost all testing organisms5.

DTBBQ is a member of p-quinones and a member of benzoquinones. Quinones can be toxic to aquatic life, including fish, mussels, and crustaceans.

Benzene, 1-methyl-4-(1-methylethenyl) or p-cymene is a monocyclic hydrocarbon and a monoterpene. It can be toxic to aquatic life if it enters waterways.

1,4-Benzenediol, 2,6-bis(1,1-dimethylethyl) is another alkylbenzene: in high concentrations they might pose significant and potential health risks to man and the environment.

The concentration of these chemicals in micrograms per millilitre (ug/ml) are shown in Table 4.

Site name	Road	Water Type	Styrene	DMTS	Benzene, 1,3-bis (1, 1- dimethylethyl)	2, 4-DTBP	DTBBQ	p-cymene	1, 4-Benzenediol, 2,6-bis (1,1-dimethylethyl)
			Rubber	Rubber	Stabilizer	Antioxidant/ Stabilizer	Antioxidant/ Stabilizer	Rubber	Antioxidant
Enstone Speed Camera	A44	Running on the road	0	0.028	2.336	0.224	0	0	0.014
Enstone PO	A44	Running on the road	0.177	0.084	3.775	0.283	0	0	0.049
Lidstone	Unnamed	Running on the road	0	0.405	2.793	0.279	0	0	0.025
London Road	London Road	Puddle	0	0	6.184	0.141	0	0	0.008
Cornwell Brook	Unnamed	Running on the road	0	0	5.987	0.168	0	0	0.012
Stow Road	A436	Puddle	0	0.023	0.956	0.032	0.013	0	0
Bourton	A429	Running on the road	0	0	4.02	0.16	0	0	0.009
Top Road	Unnamed	Puddle	0	0	4.837	0.198	0	0	0.011
Windrush	Unnamed	Puddle next to river	0	0	3.031	0.131	0	0	0.039
Barton	Unnamed	Puddle next to river	0	0	0.432	0	0	0	0
Critchford Lane	Critchford Lane	Stream	0	0	4.671	0.216	0	0	0
River @ Critchford	Critchford Lane	River	0	0	5.951	0.284	0	0	0.007
Ford	B4077	Puddle next to river	0	0.012	1.979	0.109	0.12	0	0.013
Enstone A44	A44	Road pipe into river	0	0	1.907	0.198	0	0	0
A44 Chipping Norton	A44	Running on the road	0	0	6.367	0.174	0	0	0.046
Moreton in Marsh	Car Park	Road pipe into river	0	0	2.06	0.167	0.033	0.046	0.008

Table 4: Chemical concentrations from road runoff in the Evenlode catchment 26/07/2024 - 02/08/2024

Most of these chemicals could not be found in the NORMAN Ecotoxicology Database. However, 2,4-DTBP has a predicted no-effect concentration (PNEC) of 0.32 micrograms per litre (ug/L). Concentrations of 2,4-DTBP were higher than its PNEC across all samples in which it was detected. 1,4-Benzenediol, 2,6-bis(1,1-dimethylethyl) has a PNEC of 1.21ug/L. Concentrations of this chemical were also higher than its PNEC across all samples in which it was detected.

To read the full report, please follow this link.

The positive impact of wetlands

In 2023, the ECP worked with a local landowner to create a dedicated wetland space at Cornwell Estate on Chipping Norton Brook. The brook receives treated and untreated effluent from Chipping Norton STW, which provides most of the flow in times of low rainfall for example in summer.

Figure 34 compares phosphate recorded above the wetland (i.e., below the STW) with concentrations recorded below the wetland. Note that the sonde derives phosphate concentration from other determinants.

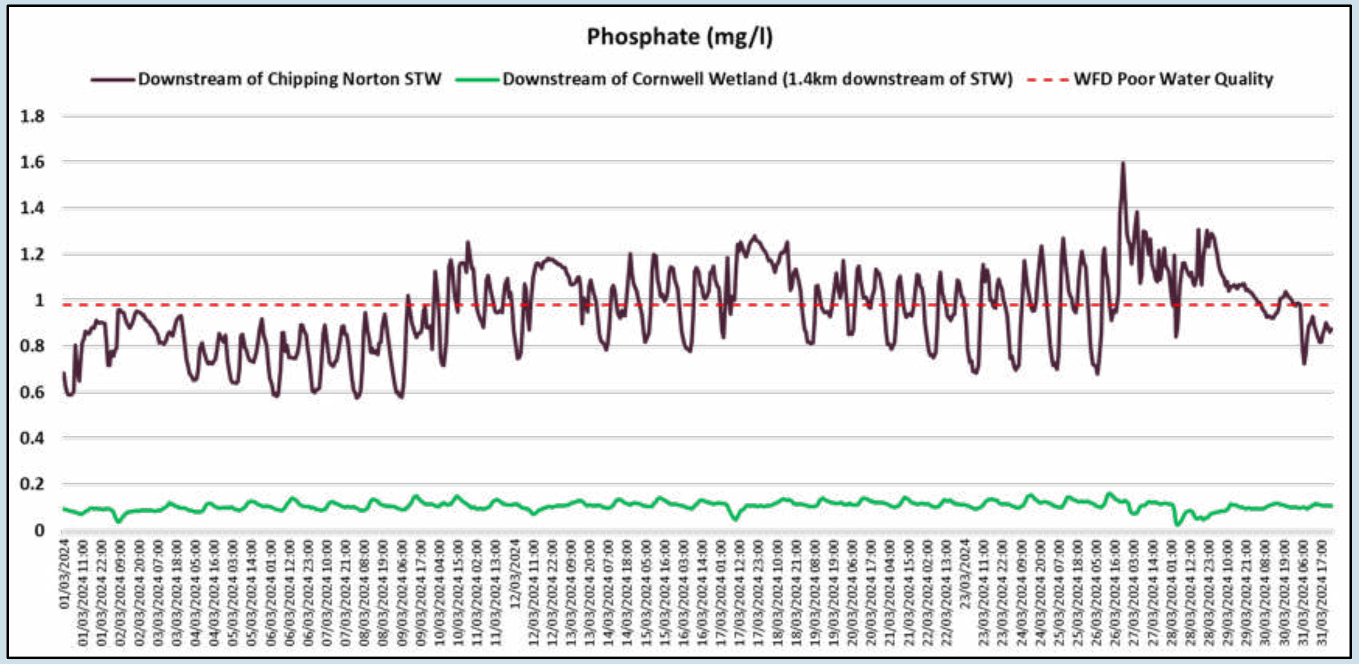


Figure 34: Phosphate recorded above and below the Cornwell wetland

Phosphate concentrations above the wetland were much higher, with the near-continuous data showing the twice daily peaks that reflect domestic water usage. Below the wetland, phosphate concentrations were much lower with significantly diminished peaks, smoothing the daily pattern. Figure 35 shows ammonia (NH4) levels above and below the wetland.

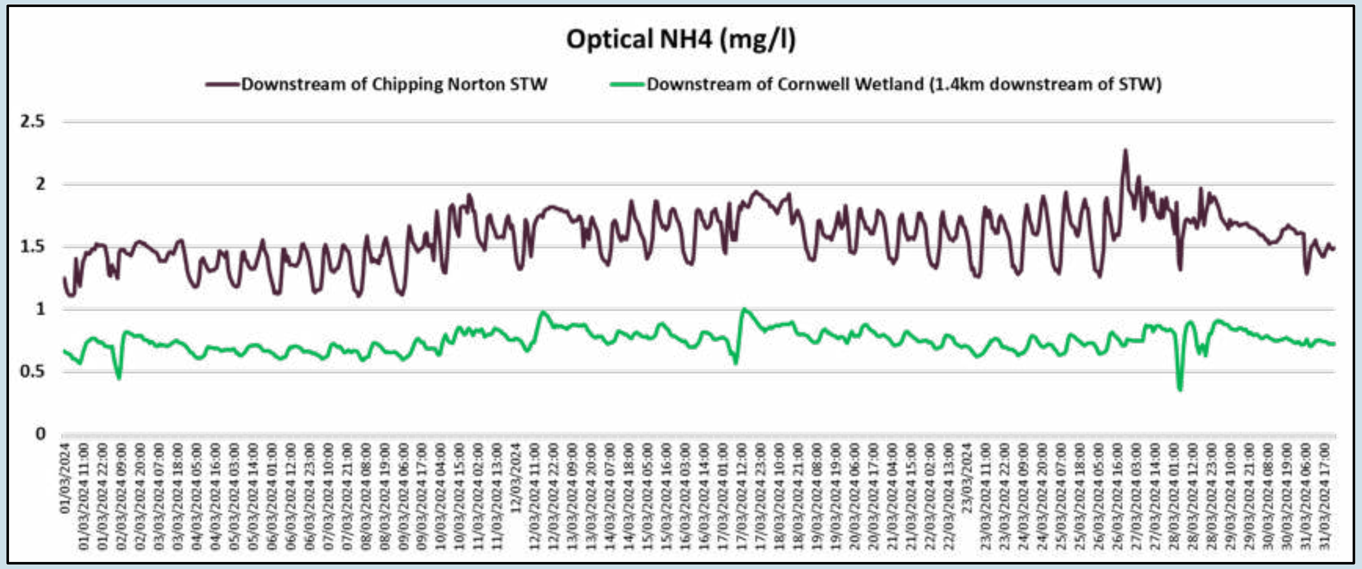


Figure 35: Ammonia recorded above and below the Cornwell wetland

Ammonia concentrations below the STW/ above the wetland were high, showing twice daily peaks as well as spikes following high rainfall, falling when dilution took effect. Below the wetland, concentrations remained high but were significantly reduced, with diminished daily peaks.

The wetland at the time of this study was in the early stages of establishment, with vegetation still sparse and mainly comprising pioneer species. Nevertheless, slowing the water and allowing it to move more naturally within the landscape already resulted in positive impacts on water quality, in addition to providing a habitat for many important species and providing natural flood management. These initial results are extremely encouraging and indicate the potential for more work, not only to monitor through the establishment of the wetland but also to investigate the more widespread use of soil-based filtration systems. These could be developed across the catchment in partnership with landowners.

Summary and conclusions

The activities described in this report were undertaken by the ECP under the umbrella of the Thames Water Smarter Water Catchment initiative

The ECP decided to terminate its funded relationship with Thames Water as of 31/03/2025, effectively bringing the involvement of several of the partners to a close. This ended important and successful activities including analysing FWW data, coordinating and training citizen scientists, and sonde maintenance/data analysis. This decision was unanimous and was due to the continuing failure of Thames Water to implement STW maintenance/improvement or to otherwise mitigate to any meaningful extent their considerable negative impact on the waterbodies and aquatic ecology of the Evenlode catchment. The absence of any improvement in any measurable aspect of water quality in the face of an increasingly robust water quality dataset vindicates this decision.

Over the course of 2024, citizen science coverage improved spatially and in terms of the number of sites, samples, and people involved. The agreement between the more rigorous (but spatially restricted) EA sampling method and the simpler, cheaper FWW method allowing the results from the larger and more widespread citizen science dataset to be confidently used as evidence of poor water quality in the Evenlode catchment.

High "background" nitrate concentrations are likely to be attributable to legacy and current farming practices in the Evenlode catchment, but nitrate concentrations were notably elevated downstream of STWs. Although background concentrations were low, phosphate concentrations notably increased downstream of STWs. Elevated nitrate concentrations can hamper the growth and survival of amphibians, fish, and some invertebrates, as well as compounding the negative impacts of, for example, increased sediment and/or pollution loads. High phosphate concentrations in particular increase the potential for eutrophication, with 65% to 83% of phosphate pollution stated in government reports as originating from the nineteen STWs that are present in the catchment

Controlling nitrate concentrations is important for reducing eutrophication in several areas of the catchment, but is more complex to achieve due to the diffuse and legacy nature of the source, compared with the accepted and effective chemical, engineering, and nature-based solutions that are readily available for phosphate-stripping at STWs. It is worth noting that Thames Water committed to provide phosphate stripping at thirteen

(c) Earthwatch Europe

Evenlode works under AMP8 (2025 – 30) but have since reneged on that commitment.

Given the very high number of hours that STWs discharged raw sewage under the guise of Storm Overflows, any apparent improvement in data from sampling and from sondes during high flows was reliant on the excess rainfall experienced throughout 2024. In the absence of planned STW upgrades and maintenance, this is an unsustainable situation for the future health of the River Evenlode since pressure on STW infrastructure will increasing sharply due to government pressure for new housing developments.

Recommendations

Despite the decision to dissociate from Thames Water funding, citizen science should continue in the Evenlode catchment to extend the valuable data record that the volunteers have provided since 2015, monitoring the trajectory of change into the future.

Given the emerging economic, statutory, and regulatory forces and frameworks shaping the future structure and activities of Thames Water, a robust water quality monitoring strategy has never been more important for the protection of the Evenlode catchment. All ECP partners should therefore actively and vigorously pursue all appropriate funding opportunities in order to support the activities described in this report, in order to provide evidence that would lead to the aim of returning the waterbodies to good ecological status.

The Wild Oxfordshire and Evenlode Catchment Partnership (WO&ECP) Community Group has made provision for sufficient FWW sampling kits to allow monthly testing at all sites until December 2025. The Group will continue to be supported by Earthwatch Europe as one of the 65 community groups currently active in the UK and globally, with all submitted surveys adding to the online database and maps.

As with all other community groups, WO&ECP citizen scientists should be encouraged to undertake training to become Group Managers, verifying and correcting the groups' data and using the available online resources to undertake data analysis and reporting.

Riverfly and Extended Riverfly surveying should continue in collaboration with established Riverfly groups and mentors. Provision has been made for replacement equipment for 2025.

The EA should be encouraged to make better use of citizen science data in general and FWW data in particular in terms of their statutory water quality monitoring and compliance enforcement role. FWW data has been shown to be a robust, repeatable and reliable approach to water quality testing that can be used to prioritize further, more rigorous investigations.

Citizen scientists should be encouraged to use the data that they have provided to apply pressure on Thames Water, local authorities, national government and the EA. They should be supported to demand appropriate responses to current STW deficiencies and future housing developments, and for the setting of stringent water quality standards that are appropriate for waterbody protection, and for compliance enforcement through regular monitoring and significant consequences to polluters.

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