

ECP monthly water quality data report December 2024



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1. Overview

This report provides a synopsis of water quality in the Evenlode catchment for December 2024. Rainfall data and combined sewage overflows (CSOs) from sewage treatment works (STWs) are considered as the “inputs” or drivers of water quality in terms of contamination and available dilution. No data were available for specific pollution sources other than from STWs, but diffuse pollution for agriculture, road runoff, and outflows from septic tanks and other small sewage treatment facilities at household level also impact water quality in the Evenlode catchment.

Data from citizen science (CS) Freshwater Watch (FWW) surveys, Environment Agency (EA) water sampling, and near-continuous sonde measurements were used to develop this synopsis. Sonde data is presented for 12 – 17 December to demonstrate the effects of high rainfall and storm overflow discharges on the sonde data. Freshwater Watch (FWW) surveying was carried out over the weekend of 13 - 16 December. All available EA data for December are presented. Riverfly results reported during December are also included. The data sources, determinands, and recording periods are summarised in **Table 1**.

2. Data sources and monitoring period

Table 1: Data types, sources, and monitoring periods

Data type	Data source	Start	End
Rainfall	Environment Agency	01/12/2024	31/12/2024
Combined Sewage Overflows	Thames Water	01/12/2024	31/12/2024
Nutrients	ECP FWW (citizen science)	13/12/2024	16/12/2024
Nutrients	Environment Agency	1/12/2024	31/12/2024
Various	ECP Proteus sondes	12/12/2024	16/12/2024
Riverfly	ECP citizen science	December 2024	

3. Rainfall data

Rainfall for December recorded at Worsham Mill and Chipping Norton is shown in **Figure 1**.

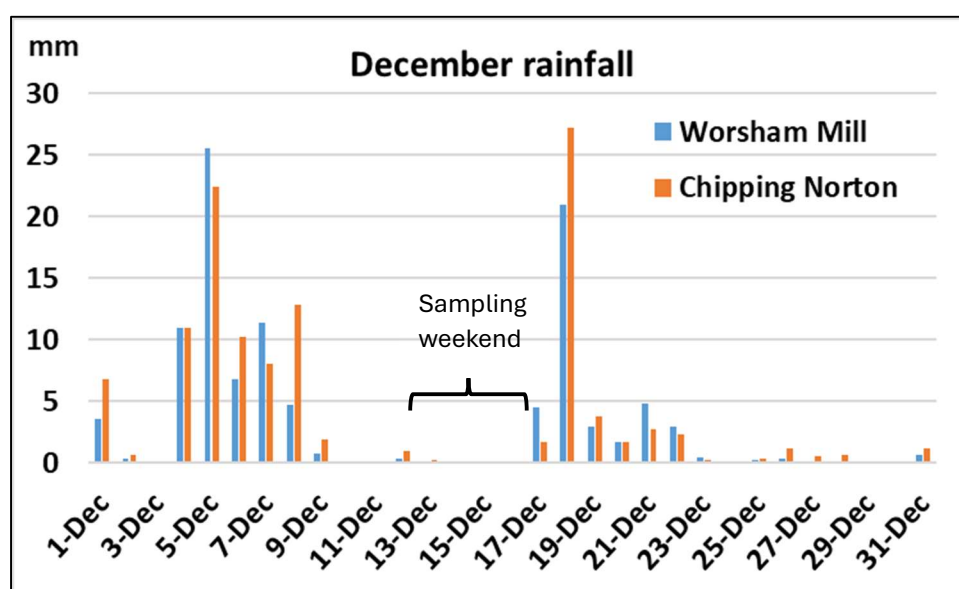


Figure 1: Rainfall at Worsham Mill and Chipping Norton 01/12/2024 – 31/12/2024

Although less than 1 mm of rain fell in the catchment over the sampling weekend, the preceding 10 days had been wet, with 68 mm and 61 mm falling at Chipping Norton and Worton Mill respectively. 70% of citizen scientists reported river levels as average, with 22% high and 9% low.

4. Combined sewage overflow data

The hours that CSOs were discharged from STWs into the River Evenlode and its tributaries during December are shown in **Figure 2**.

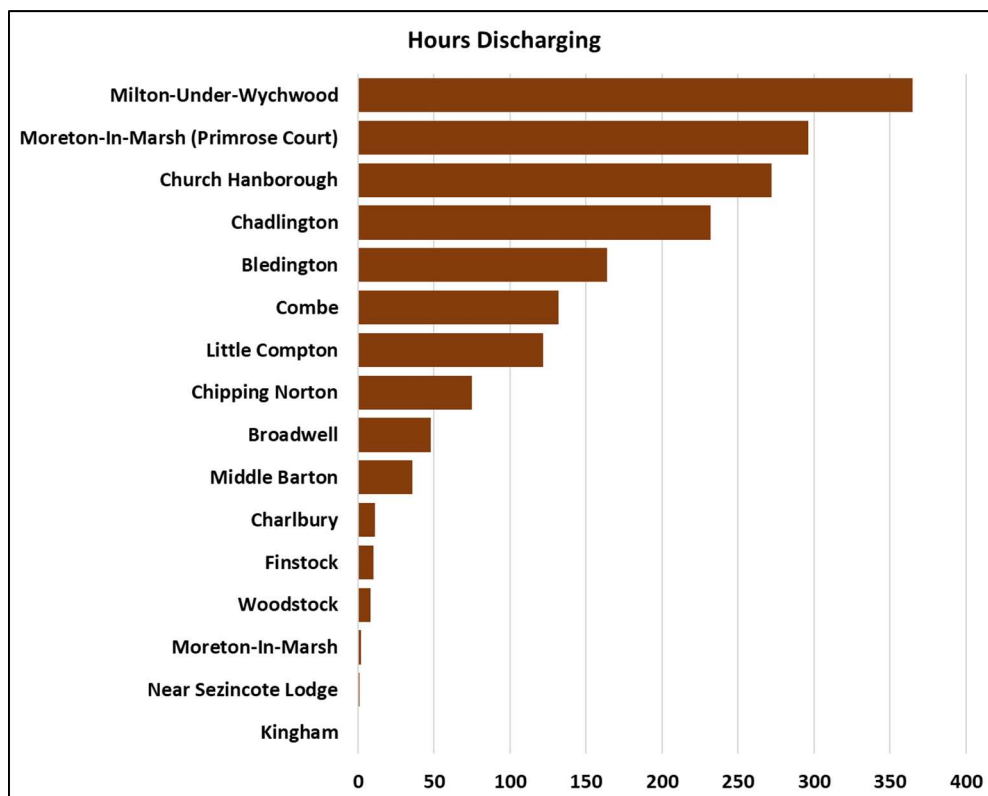


Figure 2: Combined sewage overflows 01/12/2024 – 31/12/2024

The five STWs at the top of the table all discharged for more than 150 hours in December with significant overflows occurring due to the rainfall ahead of the FWW sampling weekend. Many of the STWs overflowed for more hours than in November.

5. FWW and EA monitoring

23 FWW surveys were taken by 27 participants in December. It should be noted that this is the lowest number of participants for 2024 and this analysis is therefore based on a relatively small dataset with limited spatial coverage compared with other months.

The EA monitored 14 sites in the Evenlode catchment between 1 - 30 December. 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 in the Blue/Chipping Norton, Littlestock, and Four Shires Brooks.

Figure 3 shows the spatial distribution of FWW surveys that recorded poor (35%), moderate (43%), and good (22%) water quality throughout the catchment for December, with the percentage of each represented by the inset pie chart. The percentage of surveys recording good water quality fell slightly from November, whilst the percentage recording moderate water quality

greatly increased, reducing the percentage of surveys recording poor water quality. Water quality is derived from a combination of nitrate, phosphate, and turbidity values, as well as other observations, including of algae and of sewage fungus.

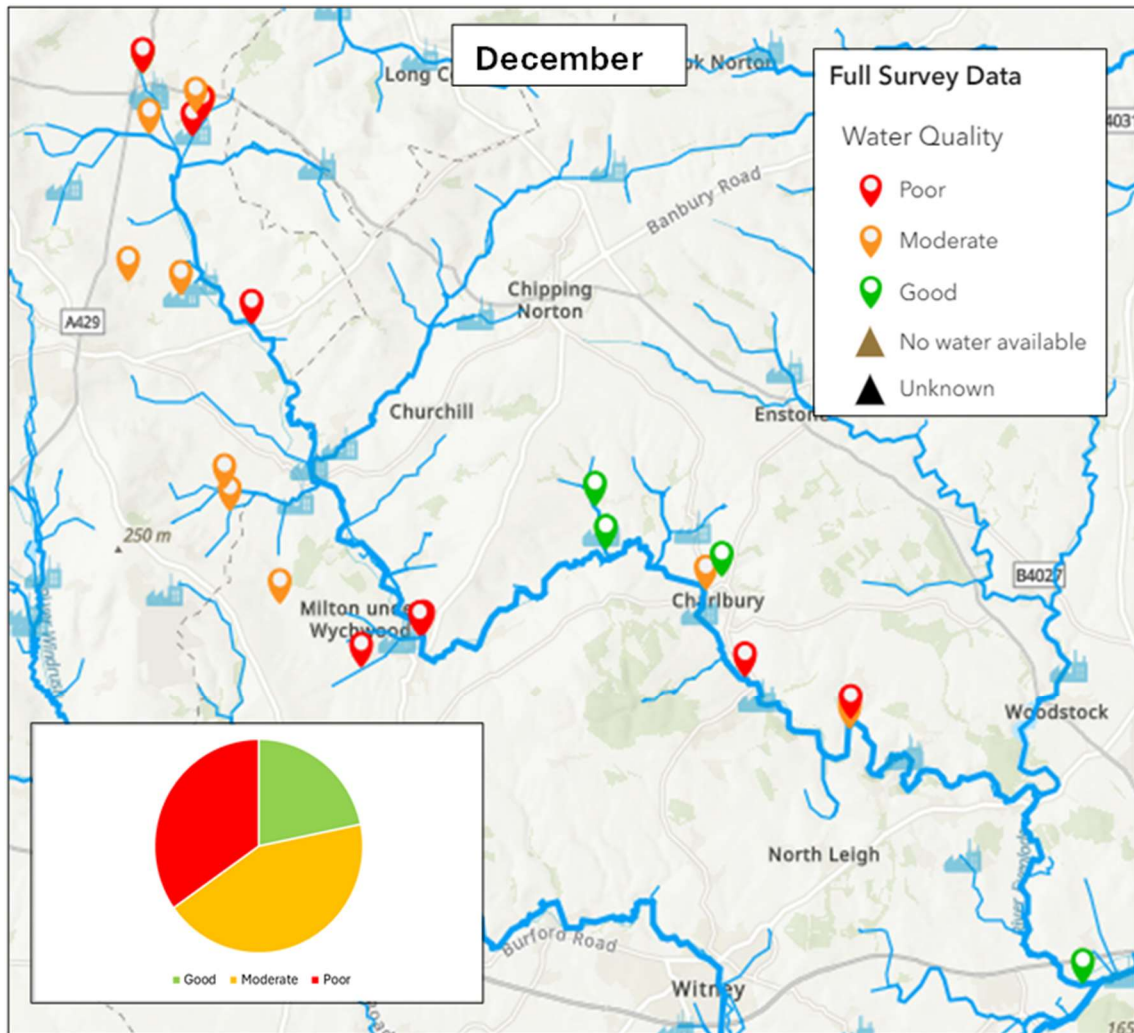


Figure 3: FWW full survey data (13 - 16 December)

Nutrient concentrations

Figure 4 shows the distribution of FWW and EA nitrate concentrations throughout the catchment with the percentage of each represented by the inset pie chart. Together with the graph in Figure 5 it shows that only three (13 %) FWW sites had nitrate concentration < 1.0 mg (low/good). These sites were on two tributaries that join the Evenlode near Charlbury. The majority of sites had moderate (39%) or high/poor (43%) nitrate concentrations: i.e., 87% of sites surveyed in December had unacceptable nitrate concentrations. None of the EA sites had nitrate concentrations < 2.0 mg/L, i.e. all had high/poor nitrate concentrations. The trend towards moderate nitrate concentrations supports the trend in overall water quality seen in Figure 3.

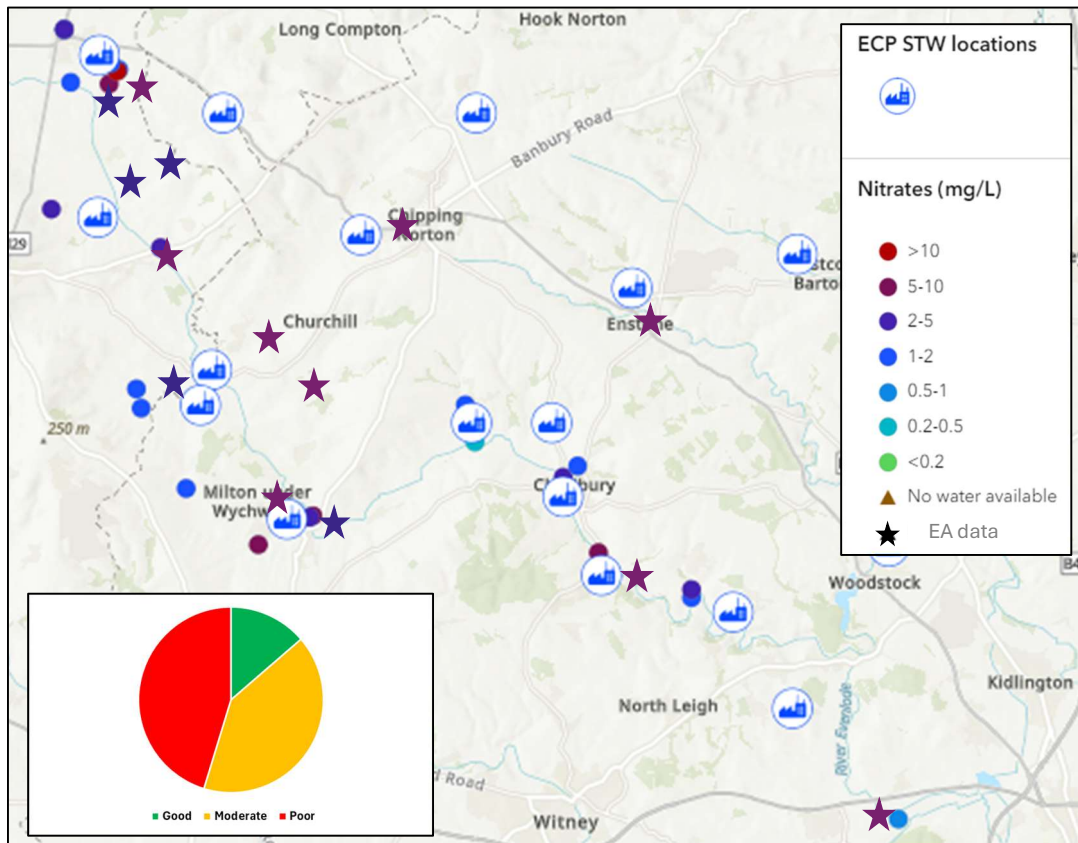


Figure 4: FWW (13 - 16 December) and EA (01 – 31 December) nitrate concentrations

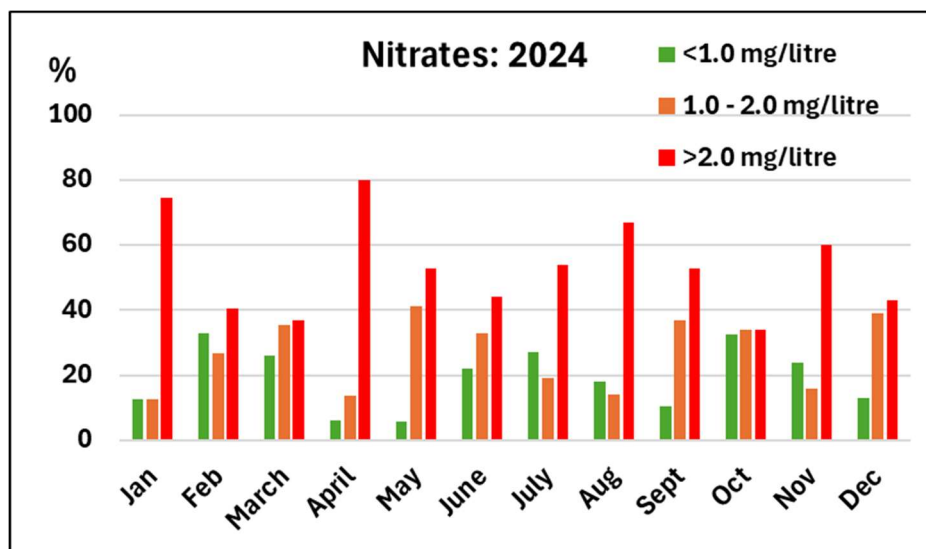


Figure 5: FWW nitrate concentrations January – December 2024

Figure 6 shows the distribution of FWW and EA phosphate concentrations. The inset pie chart indicates the percentage of FWW samples that showed low (74%), moderate (17%) and high (9%) P concentrations, which together with the graph in Figure 7 shows that phosphate concentrations continued to increase in December. EA phosphate concentrations tended to be slightly higher than those from FFW sampling throughout the catchment but had approximately the same pattern of low, moderate and high concentrations.

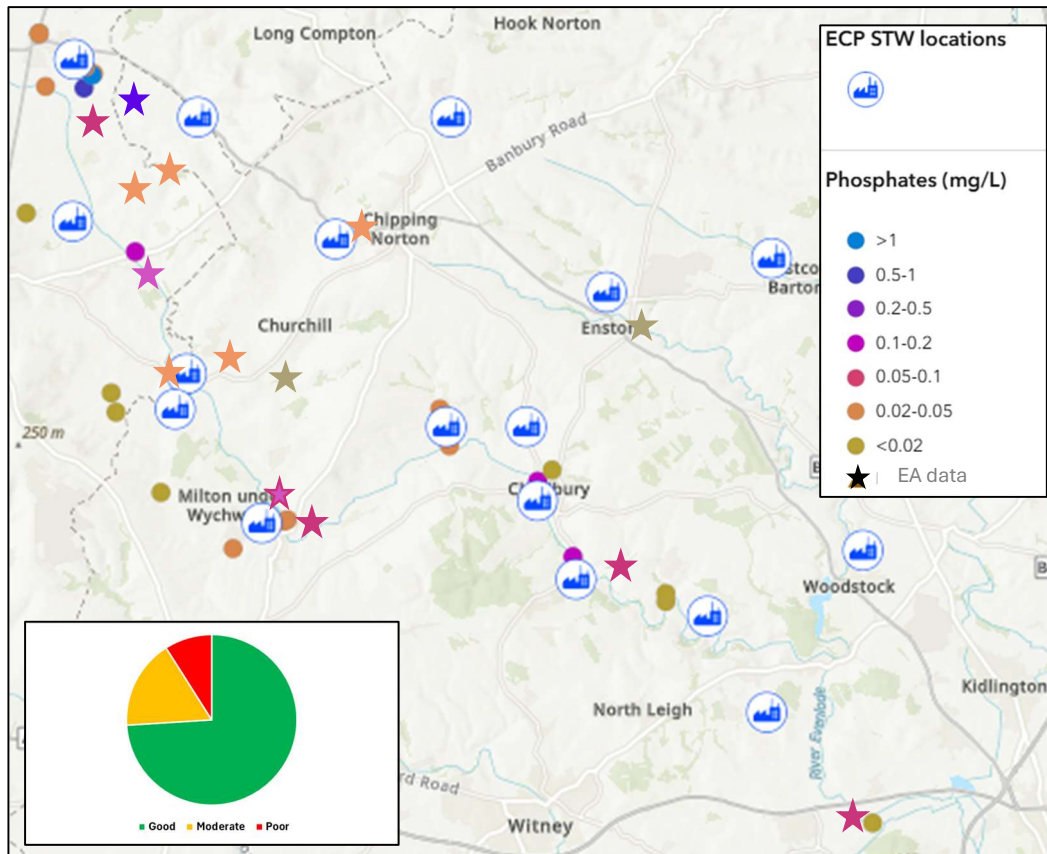


Figure 6: FWW (13 - 16 December) and EA (01 – 31 December) phosphate concentrations

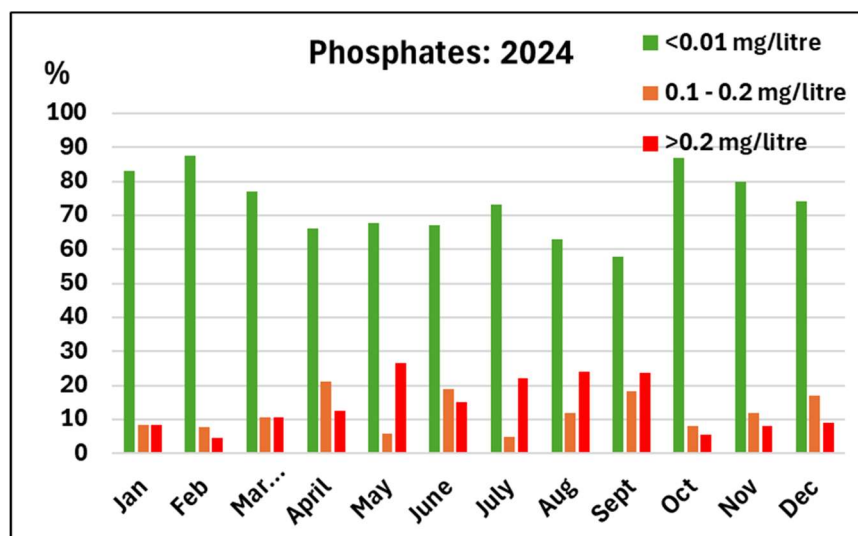


Figure 7: FWW phosphate concentrations January – December 2024

6. Riverfly data

Two Riverfly sites were surveyed in December in the Evenlode catchment. No trigger levels were breached (Figure 8).

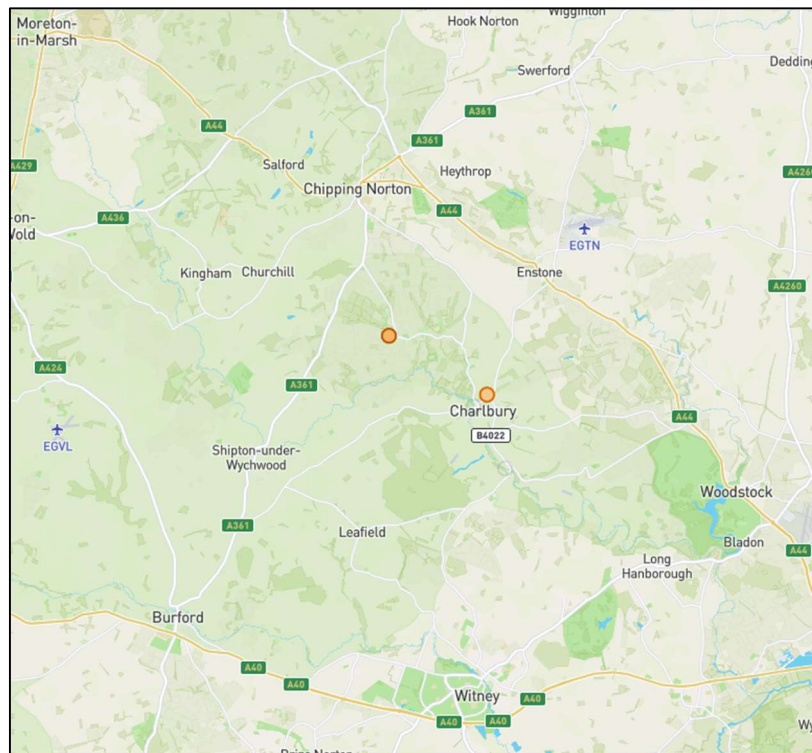


Figure 8: Riverfly surveys in the Evenlode catchment in December 2024

7. The Chipping Norton Brook (Also known as the Blue Brook)

Combined sewage outflows

Chipping Norton STW released Storm Overflow Discharges for 75 hours ahead of the sampling weekend in December (**Figure 2**).

FWW data

No FWW data was collected for the Blue Brook between 13 - 16 December:

EA data

The EA sampled the Blue Brook above Chipping Norton STW on 16th December, i.e. within the same time period as the FWW sampling weekend and the associated sonde data:

- N = 5 - 10 mg/L (high/poor)
- P = 0.02 – 0.05 (low/good)

In combination these nutrient concentrations indicated poor water quality upstream of the Chipping Norton STW, with N driving the unacceptable water quality.

Sonde data

One Proteus sonde is installed on the Blue Brook, downstream of the Chipping Norton STW.

The Proteus sondes measure and derive several determinands including Biological Oxygen Demand (BOD), phosphorus, tryptophan, turbidity, chromophoric dissolved organic matter (CDOM), conductivity, and dissolved oxygen (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.

Dissolved Oxygen (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.

BOD, CDOM, phosphorus, tryptophan, turbidity, conductivity and DO data from the sonde downstream of the Chipping Norton STW are shown in **Figure 10**

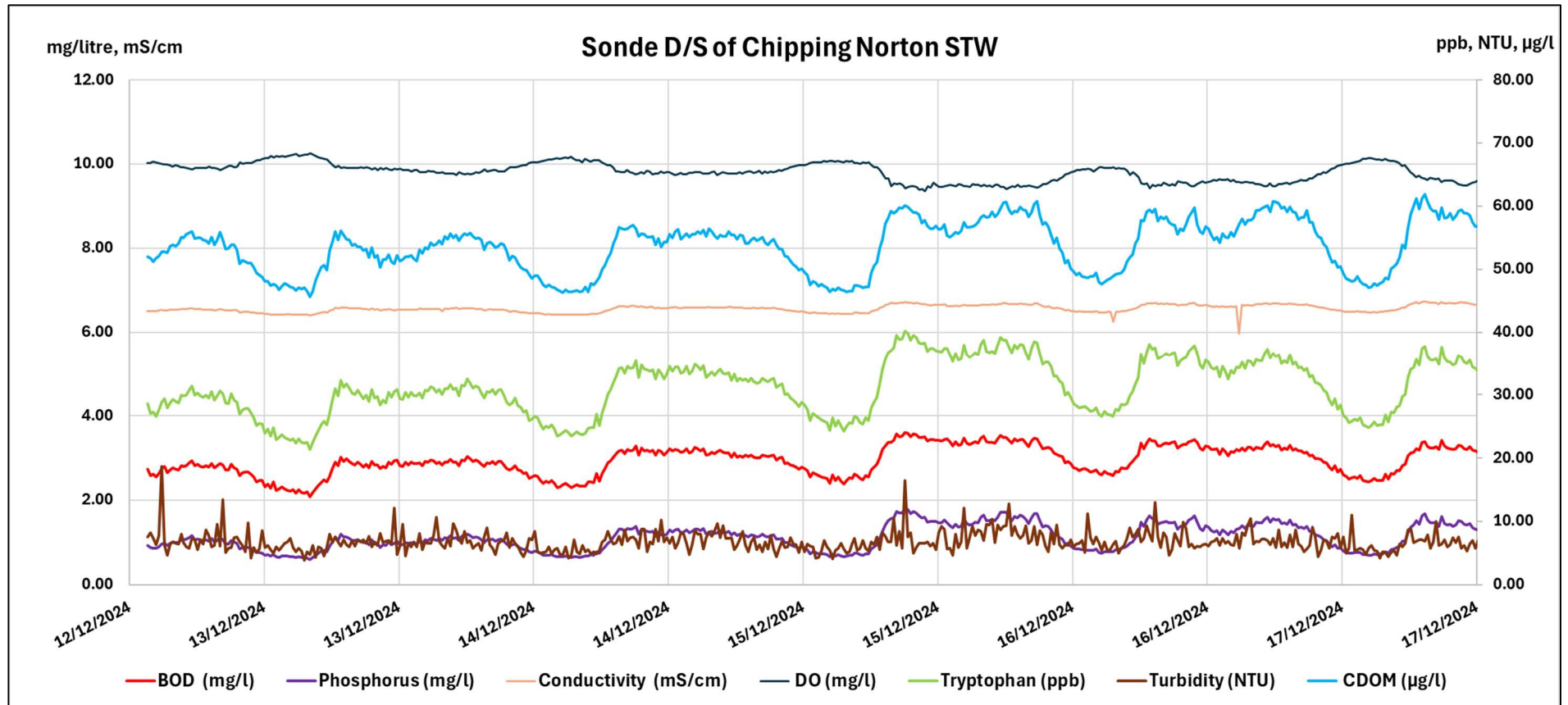


Figure 9: BOD, phosphorus, conductivity, DO, tryptophan, turbidity and CDOM for the Blue Brook downstream of Chipping Norton STW 12 - 17 December

The data pattern in **Figure 9** reflects the diurnal pattern of domestic water usage from the discharge of treated sewage from the STW. Little to no rain fell between the 12 – 17 December and so the pattern is entirely due to the STW discharge. DO% and CDOM exhibit a reciprocal relationship, demonstrating the effect of the organic matter present in the STW discharge on DO levels. Other determinands closely follow the pattern of CDOM. Average values for 12 – 17 December are summarised in **Table 2**.

Table 2: Average sonde data values for the Blue Brook downstream of the Chipping Norton STW for 12 - 17 December

Site	BOD (mg/l)	P (mg/l)	CDOM (µg/l)	Tryptophan (ppb)	Turbidity (NTU)	Conductivity (mS/cm)	DO (mg/l)
D/S STW	2.94	1.12	53.67	31.19	6.81	6.56	9.81

The average phosphate concentration recorded by the sonde is considerable higher than the upstream value measured on 16 December by the EA, indicating the impact of the STW on the receiving waterbody.

8. Littlestock Brook

Combined sewage overflows

Milton-under-Wychwood STW released raw sewage into the Littlestock Brook for 365 hours mainly before, but also during and after the FWW sampling weekend.

FWW and EA N data

Table 3 summarises the N concentrations and classifications, and the resulting water quality classes for samples taken from watercourses up-and downstream of the Milton-under-Wychwood STW.

Table 3: FWW and EA N sampling results around Milton-under-Wychwood STW

Data source	Location	N (mg/L)	Class
FWW	Evenlode U/S of confluence	5-10	High/poor
FWW	U/S of STW	5-10	High/poor
FWW	D/S of STW	2-5	High/poor
EA	D/S of STW	5-10	High/poor
EA	Evenlode D/S of confluence	2-5	High/poor

High N concentrations were found at all the sites summarised in **Table 2**, with lower concentrations downstream of the STWs.

Sonde data

Two Proteus sondes are installed on the Littlestock Brook. The sonde installed upstream of Milton-under-Wychwood STW malfunctioned on 3 December 2024.

BOD, CDOM, phosphorus, tryptophan, turbidity, conductivity and DO data from the sonde at Littlestock House downstream of the Milton under Wychwood STW are shown in **Figure 10**.

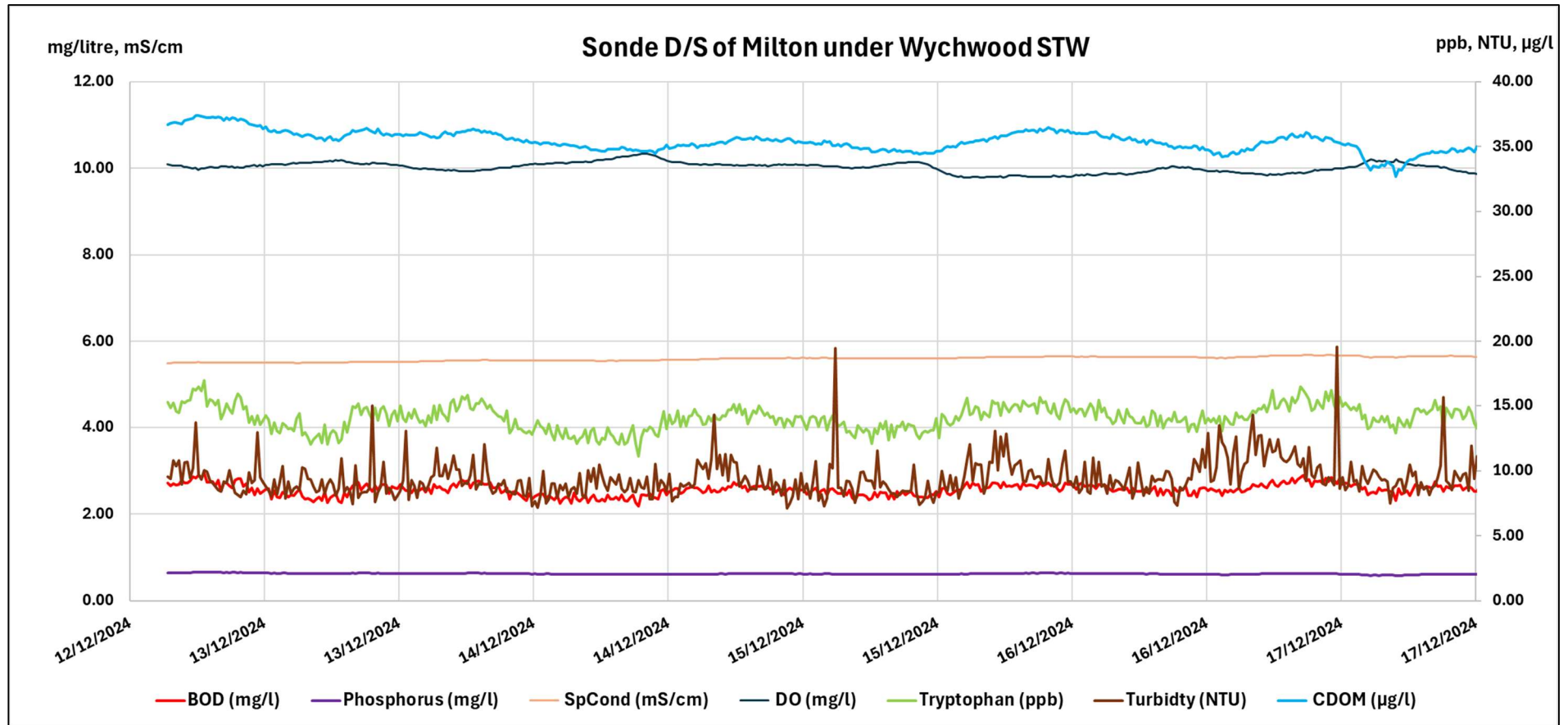


Figure 10: BOD, phosphorus, conductivity, DO, tryptophan, turbidity and CDOM for the Littlestock Brook at Littlestock House, downstream of Milton-under-Wychwood STW 12 - 17 December

The diurnal pattern of STW discharges is only faintly evident in Figure 10. Average values for 12 – 17 December are summarised in **Table 4 while**

Table 5 summarises the P concentrations from all available data sources up- and downstream of Milton-under-Wychwood STW.

Table 4: Average sonde data values for the Littlestock Brook downstream of the Milton under Wychwood STW for 12 - 17 December

Site	BOD (mg/l)	P (mg/l)	CDOM (µg/l)	Tryptophan (ppb)	Turbidity (NTU)	Conductivity (mS/cm)	DO (mg/l)
D/S STW	2.57	0.62	35.42	14.09	9.47	5.60	10.02

Table 5: P concentrations U/S and D/S of Milton-under-Wychwood STW

Data source	Location	P (mg/L)	Class	Water quality*
FWW	Evenlode U/S of confluence	0.02 – 0.05	Low/good	Poor
FWW	U/S of STW	0.02 – 0.05	Low/good	Poor
FWW	D/S of STW	0.02 – 0.05	Low/good	Poor
ECP sonde	D/S of STW	0.5 - 1	High/poor	Poor
EA	D/S of STW	0.1 – 0.2	Moderate	Poor
EA	Evenlode D/S of confluence	0.05 – 0.1	Low/good	Poor

* In combination with N concentrations

Apart from the sonde data, P concentrations were low/good upstream of Milton-under-Wychwood STW. Moderate P concentration was found downstream. The poor water quality both up- and downstream seems to have been driven by high nitrate concentrations.

9. The Four Shires Brook

A sonde is located on the Four Shires Brook, downstream of the outlet of the Moreton-in-Marsh STW.

Combined sewage overflows

Moreton-in-Marsh STW discharged untreated sewage for only 2 hours, on the 5th December.

FWW and EA data

Table 6 summarises the N and P concentrations and classifications, and the resulting water quality classes for samples taken from watercourses up-and downstream of the Moreton-in-Marsh STW.

Table 6: FWW and EA N and P sampling results around Moreton-in-Marsh STW

Data source	Location	N (mg/L)	Class	P (mg/L)	Class	Water quality
FWW	Fire College stream	1 - 2	Moderate	0.02 – 0.05	Low/good	Moderate
FWW	4 Shires Brook U/S (herd T)	1 - 2	Moderate	0.02 - 0.05	Low/good	Moderate
FWW (22/10/2024)	4 Shires Brook2, D/S	5 - 10	High/poor	0.5 - 1	High/poor	Poor

EA (17/10/2024)	4 Shires Brook, D/S	5 - 10	High/poor	0.2 – 0.5	High/poor	Poor
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Both nitrate and phosphate concentration increased below the STW, taking the water quality from moderate (driven by nitrates) to poor (driven by both nutrients). BOD, CDOM, phosphorus, tryptophan, turbidity, conductivity and DO data from the sonde on the Four Shires Brook downstream of the Moreton-in-Marsh STW are shown in **Figure 11**.

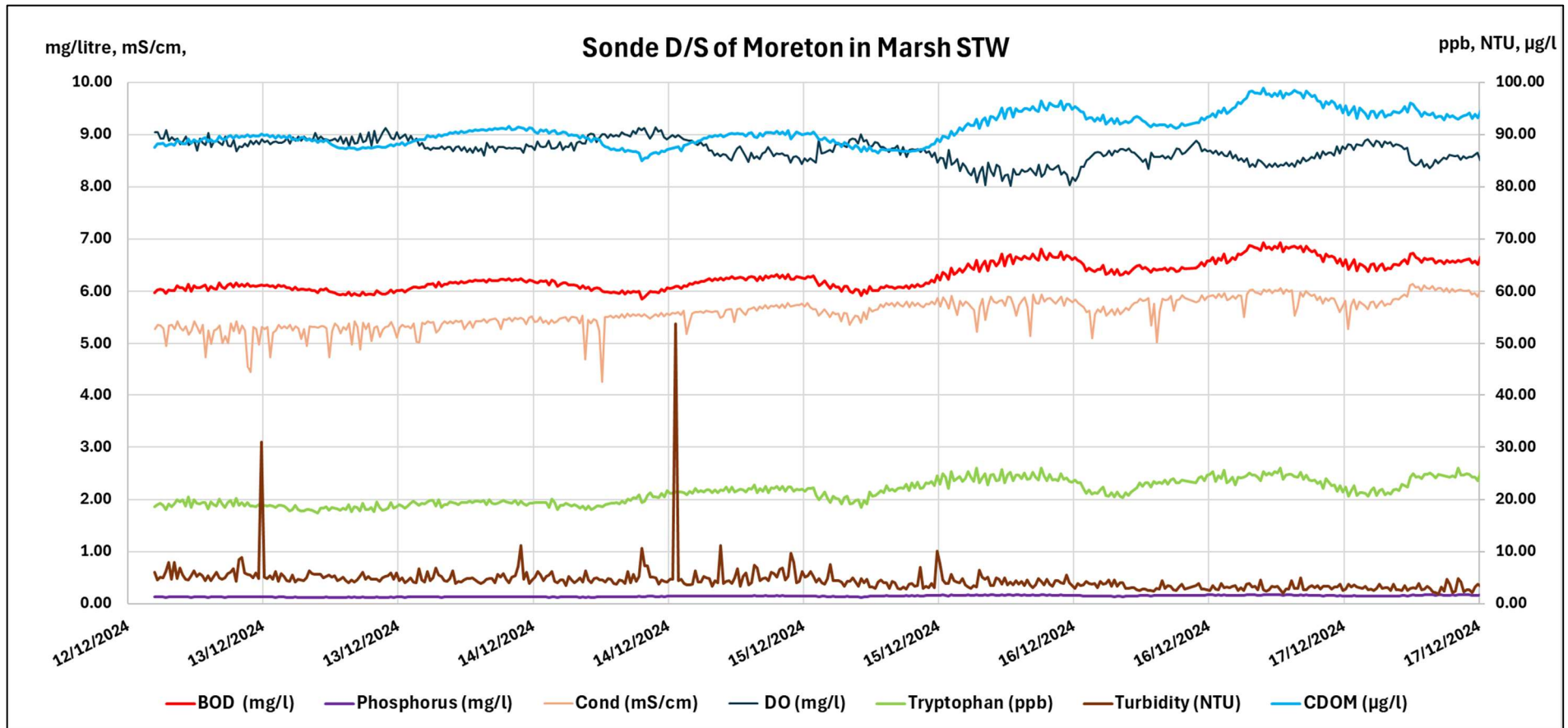


Figure 11: BOD, phosphorus, conductivity, DO, tryptophan, turbidity and CDOM for the Four Shires Brook downstream of Moreton-in-Marsh STW 12 - 17 December

Figure 11 shows that after a turbidity spike which occurred on 14th December at 15.00 the diurnal pattern associated with STW outflows become more pronounced, and (except for DO, which fell), all values were elevated. There was no rain since 12 December or during this period, so either falling levels of “natural” flow, or rising levels of STW output could be responsible for the strengthening of the signature that indicates STW discharge. **Table 7** summarises the average values recoded by the sonde in the Four shires Brook downstream of Moreton-in-Marsh STW.

Table 7: Average sonde data values for the Four Shires Brook downstream of the Moreton-in-Marsh STW for 12 - 17 December

Site	BOD (mg/l)	P (mg/l)	CDOM (µg/l)	Tryptophan (ppb)	Turbidity (NTU)	Conductivity (mS/cm)	DO (mg/l)
D/S STW	6.30	0.14	91.09	21.41	4.49	5.60	8.69

The average P concentration measured by the sonde 12 – 17 December was lower than that sampled by FWW and the EA below the STW, and was classified as “moderate”.

10. Summary

This analysis is based on relatively few data points with both FWW and EA sample numbers lower than usual. This means that comparisons of particularly FWW results between months are made cautiously.

Although the FWW sampling weekend was largely dry, water levels were average to high due to the rain that fell during the preceding week. Due to the rainfall, STWs typically doubled the number of hours that they released untreated sewage compared with November. The percentage of samples showing good water quality remained relatively unchanged from the previous month although the remaining 65% of samples showed a trend from poor in November to moderate in December.

The decline in water quality appeared to be driven by nitrate concentrations. However, the EA characterises the River Thames system as being a phosphate-limited system. In other words, although it is heavily impacted by nitrates from agriculture and wastewater, eutrophication will be suppressed provided that phosphate concentrations remain low¹. This emphasises the significance of the increased percentage of FWW surveys returning unacceptable (>0.01 mg/L) phosphate concentrations (**Figure 7**), and of the increased phosphate concentrations downstream of STWS (**Tables 5 and 6**).

¹ UK Environment Agency. (2018). "Water Quality in the River Thames: Nutrient Dynamics and Pollution Management." Environmental reports on the River Thames' nutrient levels and management of pollution.