ANNEX A2.3.1

Phase 1 Water Quality Modelling

This document has been written in line with the requirements of the RAPID gate two guidance and to comply with the regulatory process pursuant to Severn Trent Water's and Affinity Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Severn Trent Water and Affinity Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

Grand Union Canal Transfer SRO

Affinity Water, Severn Trent Water, Canal & River Trust

JBA consulting

Grand Union Canal SRO Water Quality Modelling, Gate 2 Phase 1

Final Report

May 2022

www.jbaconsulting.com

Affinity Water

SEVERN TRENT

Author names redacted

JBA consulting

JBA Project Manager

[redacted]
JBA Consulting, Pipe House, Lupton Road, WALLINGFORD, Oxfordshire, OX10 9BS

Revision History

Revision Ref/Date	Amendments	Issued to
S3-P01 26/01/2022	Draft Report	Affinity Water, Severn Trent Water
S4-P02 06/04/2022	Final Report	Affinity Water, Severn Trent Water
S4-P03 03/05/2022	Revised Final Report following additional comments	Affinity Water, Severn Trent Water
D1-P04 04/10/2022	Final issue	Affinity Water, Severn Trent Water

Contract

This report describes work commissioned by Affinity Water, by purchase order AWP120016343 dated 18/05/2021. Affinity Water's representative for the contract was [redacted]. [redacted] of JBA Consulting carried out this work.

Prepared by .... [redacted] BA CertWEM CEnv MCIWEM C.WEM

Technical Director

.... [redacted] BSc, MSc, GGA

Analyst

Reviewed by .... [redacted] MSc MEng MCIWEM C.WEM

Senior Analyst

Purpose

This document has been prepared as a Final Report for Affinity Water. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Affinity Water.

Copyright

Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 58g if 100% post-consumer recycled paper is used and 73g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Contents

List of Figures

List of Tables

Abbreviations

BOD	Biochemical Oxygen Demand
DO	Dissolved Oxygen
FMP	Flood Modeler Pro
GUC	Grand Union Canal
MPER	Metals Permitting (software package)
RMDV	Recommended Maximum Discharge Value
RQP	River Quality Planning (software package)
SRO	Strategic Resource Option
STW	Severn Trent Water
UPM	Urban Pollution Management
WFD	Water Framework Directive
WTW	Water Treatment Works

1 Introduction

This report documents phase 1 of the Grand Union Canal (GUC) Strategic Resource Option (SRO) water quality assessment, undertaken as part of the Gate 2 assessment of the proposed water transfer. The modelling and associated survey works for Gate 2 are being carried out in four phases:

- Phase 1 – scoping of modelling and survey requirements
- Phase 2 – surveys
- Phase 3 – Model development / enhancement
- Phase 4 – Concept design

Note that separate reports have been issued documenting other aspects of Phase 1 including the pound characterisation, Aquator and hydraulic model development method statements and the specifications for the topographic and hydrometric surveys. In section 2 of this report, a source > pathway > receptor approach is adopted to identify the potential mechanisms by which the proposed transfer of treated effluent via the GUC could result in water quality deterioration or benefits, either within the Canal or in connected watercourses. This is used to identify the priorities for further water quality assessment as part of Gate 2. The full water quality assessment is scoped in section 3. This section also reviews the software options for the water quality assessment.

2 Source > Pathway > Receptor Analysis

2.1 Introduction

In this section we review the potential sources and pathways of water quality issues which could impact upon environmental receptors, principally the canal, the watercourses into which the canal connects and the habitats that they support. The objective of this exercise is to identify all potentially significant sources and pathways of contamination which might be impacted by the proposed transfer scheme, and to consider how and by whom these aspects will be considered. The sources considered were:

- Contaminants normally encountered within Minworth final effluent
- Contaminants normally encountered within Minworth storm effluent
- Increased transfer of water from areas of lower water quality to areas of higher water quality
- Accidental spillage or illegal discharge into the Minworth sewerage system or into the Grand Union, Oxford or Coventry Canals or into connected watercourses or drainage systems
- Unknown, unmeasured contaminants in wastewater
- Sediments present within the canal
- Water Treatment Works (WTW) wastewater discharge to the canal

2.2 Contaminants normally encountered within Minworth final effluent

2.2.1 Source

Contaminants that would normally be encountered and sampled for within treated effluent from Minworth.

2.2.2 Pathways

Discharge to the Coventry Canal at Atherstone, the proposed point of discharge of the treated effluent into the canal system.

2.2.3 Receptors

Grand Union Canal at the selected point of discharge.

2.2.4 Detection methods

Minworth treated effluent quality is routinely sampled at present. There are a limited number of EA sampling points on the canals (see Table 2-1), however this issue is being rectified by the ongoing programme of water quality sampling for the GUC SRO.

2.2.5 Is significant environmental impact feasible as a result of the transfer?

Yes, there is potential for a deterioration in canal water quality at the point of discharge. Causing a significant deterioration (usually defined as a 10% deterioration, or 3% where the receiving water quality is already bad, or a class deterioration) is not permittable under the Water Framework Directive as implemented in UK law.

2.2.6 Initial assessment

This risk has been investigated in the Gate 1 Water Quality Stages 1 & 2 report (APEM Ltd, 2021). At Stage 1, this compared the existing water quality at the canal discharge locations with the existing Minworth effluent. Determinands where the Minworth water quality was better than the receiving water were screened out. The impacts of other determinands were investigated at stage 2 using the EA's River Quality Planning (RQP) and

Metals Permitting (MPer) models to identify recommended maximum discharge values (RMDVs) required to lead to a load-standstill situation in the receiving canal pound. These are being used to guide the design of the Minworth treatment processes.

2.2.7 Mitigation measures

Minworth Effluent Reuse is a separately funded SRO which is considering two options, the GUC SRO and a discharge to the River Avon to supplement the Severn to Thames Transfer SRO. The Minworth Effluent Reuse SRO is assessing the requirements for additional effluent treatment at Minworth which would be required. The GUC SRO and Minworth SRO teams are co-operating to assess the level of treatment that would be required such that a load standstill (or better) result is achieved in the receiving canal pounds.

2.2.8 What further assessment is required?

It is anticipated that the Gate 1 Water Quality Assessment (APEM Ltd, 2021) should be updated and extended at Gate 2 to take account of:

- Further water quality samples from the ongoing sampling programme (led by Atkins)
- Flow gauging as part of the hydrometric surveys (led by JBA), and
- Design treated effluent concentrations from the Minworth design team (Jacobs).
- Discussions with the Environment Agency to establish an approach to assessing the water quality impact, taking a consistent approach for this and other SROs investigating effluent transfers.
- Beyond Gate 2, consideration should be given to continued monitoring and possibly further modelling to improve understanding of whether there are any changes to the nature of Minworth effluent during periods of prolonged dry-weather, as these would be the periods when the scheme would operate at its full transfer rate.

2.3 Contaminants normally encountered within Minworth storm effluent

2.3.1 Source

Contaminants that would normally be encountered within storm effluent from Minworth.

2.3.2 Pathways

Overflows from storm tanks will continue to discharge to the River Tame.

2.3.3 Receptors

Whilst the volume and quality of storm effluent discharged to the Tame will not be changed by the proposed transfer, the reduced discharges of treated effluent to the Tame may lead to an increased impact from the storm discharges.

2.3.4 Detection methods

Storm effluent is not currently sampled, either by the Environment Agency or by the water quality sampling regime implemented for this project.

2.3.5 Is significant environmental impact feasible as a result of the transfer?

Yes, if the reduction in treated effluent being discharged to the Tame significantly reduces the river flow, there is a potential for an increased water quality impact as a result of wet weather events which lead to storm discharges from Minworth.

2.3.6 Initial assessment

We are not aware of any previous assessments of this issue, although STW may have previous Urban Pollution Management (UPM) or similar assessments and models.

2.3.7 Mitigation measures

If a significant impact is identified, it may be possible to consider redirecting treated effluent flows back to the Tame during rainfall events when the Minworth storm tanks are discharging. The impact of doing this on the transfer could be mitigated through the use of storage at Minworth, along the transfer route or at Leighton Buzzard.

2.3.8 What further assessment is required?

It is recommended that this risk should be assessed further, as part of the Minworth SRO.

2.4 Increased transfer of water from areas of lower water quality to areas of higher water quality

2.4.1 Source

The transfer is anticipated to convey between 23Ml/d and 111Ml/d (0.26 to 1.16m^3/s) of mixed treated effluent and canal water, creating the potential to move water from areas of relatively low quality (where the impacts of the canal have been mitigated by the load standstill approach discussed in section 2.2.7) into areas of higher water quality.

2.4.2 Pathways

The transfer of water using the canal and the new infrastructure of pumps on uphill sections and by-weirs on downhill sections required to facilitate the increased flow of water would be the pathway. In particular, the transfer of water across summit pounds where there is currently little, or no movement of water creates a new pathway.

2.4.3 Receptors

The canal and the watercourses to which it connects. In particular the Environment Agency have highlighted linkage with the River Tove and River Ouzel.

2.4.4 Detection methods

Comparison of existing water quality along the canal and in the adjoining watercourses could identify the likelihood of this risk. Water quality modelling could then be used to quantify current-day and potential future transfers of lower water quality into areas of higher quality.

2.4.5 Is significant environmental impact feasible as a result of the transfer?

Yes, the transfer will create significant additional movements of water across canal summits (up to 115MLD) where previously there had been very limited mixing of flows. These flows will be such that the majority of water in many canal pounds, particularly during summer, will derive from the transfer rather than the existing canal feeders, and consequently there is significant potential for change in water chemistry.

2.4.6 Initial assessment using Environment Agency historic sampling

The Environment Agency water quality data archive (Environment Agency, 2021) was downloaded for the full period available, 2000 to 2021. Sites where sampling currently or historically has been carried out from either the canals along the transfer route or the connected watercourses were identified. This work was undertaken prior to the decision to discharge the transfer to the Coventry Canal at Atherstone and abstract from the GUC at Leighton Buzzard, and hence included all sections of canal and connected watercourses within the possible transfer route, including the Birmingham & Fazeley Canal and the GUC south of Tring summit.

Determinand values were analysed in a pivot table to calculate the mean and 10th, 90th and 95th percentile for each determinand at each sampling station, as well as the number of samples taken during the 21-year period.

Overall, the spatial and temporal coverage of the sampling, particularly from canals, was found to be poor, with long sections canal unsampled and a reduction in sampling since 2013 in the Coventry Canal and Birmingham & Fazeley Canal. This issue had previously been identified and was one of the drivers for the water quality surveys currently underway (Atkins, 2021).

In total, 12 sites relevant to this study were identified. These are summarised in Table 2-1, with results tabulated in Appendix A. In total, 338 determinands have been analysed at least once across these 12 sites. A selection of determinands that have been sampled across all sites, and with at least 30 samples at the majority of sites was identified. These were graphed, with the X-axis showing chainage from Minworth and the Y-axis showing the concentration at each sampling location. Figure 2-1 and Figure 2-2 show examples for Ammonia and Cadmium, and graphs for all determinands analysed are shown in Appendix A. In the example of Ammonia, historic levels in the Birmingham / Fazeley Canal and Coventry Canal are low compared to the Grand Union at Long Buckby and Pitstone, and to the Rivers Tove and Ouzel, although higher than the Bulbourne and Gade. Given this, and that ammonia will naturally oxidise to nitrite, indicates that there is a low risk of transfer water causing a downstream increase in ammonia concentrations.

By contrast, cadmium levels in the Birmingham / Fazeley Canal and Coventry Canal are around 50% higher than at all downstream sampling locations (although below the EQS of 0.25mg/l for waters with hardness > 200mg (Environment Agency, 2021)). In the case of cadmium, treating effluent to just ensure no deterioration at the point of discharge would significantly increase the risk of causing a deterioration downstream, although not one which would exceed the EQS.

The risk of causing a deterioration downstream is considered for each determinand in Table 2-2.

Table 2-1: Environment Agency water quality sampling sites

Sample Site ID	Sample Site Name	X	Y	Earliest Sample Year	Final Sample Year	Chainage from Minworth (m)	Notes
MD-80226020	Birmingham/Fazeley Canal Fazeley	420335	301975	2000	2013	14,088	No sampling since 2013
MD-79851780	Coventry Canal Polesworth	425860	302304	2000	2013	19,088	No sampling since 2013
MD-79848780	Coventry Canal Judkins Quarry Nuneaton	435300	292500	2000	2020	34,276	Limited sampling (mainly metals) since 2010
AN-GUCM250L	Grand Union Canal Long Buckby Wharf	461238	265431			87,373	
AN-04M06	R. Tove Bozenham Mill	476642	248243	2000	2020	115,908	
AN-08M04	R.Ouzel Orchard Mill	488502	230900	2000	2020	146,346	
AN-08M02	R.Ouzel Grange Mill	491100	227200	2000	2020	152,586	
TH-PTAR0135	GUC (Pitstone Reach) At Marsworth	491990	214180	2000	2020	164,925	

Sample Site ID	Sample Site Name	X	Y	Earliest Sample Year	Final Sample Year	Chainage from Minworth (m)	Notes
TH-PCNR0191	Bulbourne Above G.U.C. At Lock 55, Berkhamsted	499670	207784	2000	2018	176,079	
TH-PCNR0047	G.U.C. 1500m Below Berkhamsted STW	502647	206349	2000	2020	179,604	
TH-PCNR0004	Bulbourne Above Gade	505440	205846	2000	2021	182,443	
TH-PCNR0055	Gade Above G.U.C., Rickmansworth	507300	194300	2000	2021	195,683	

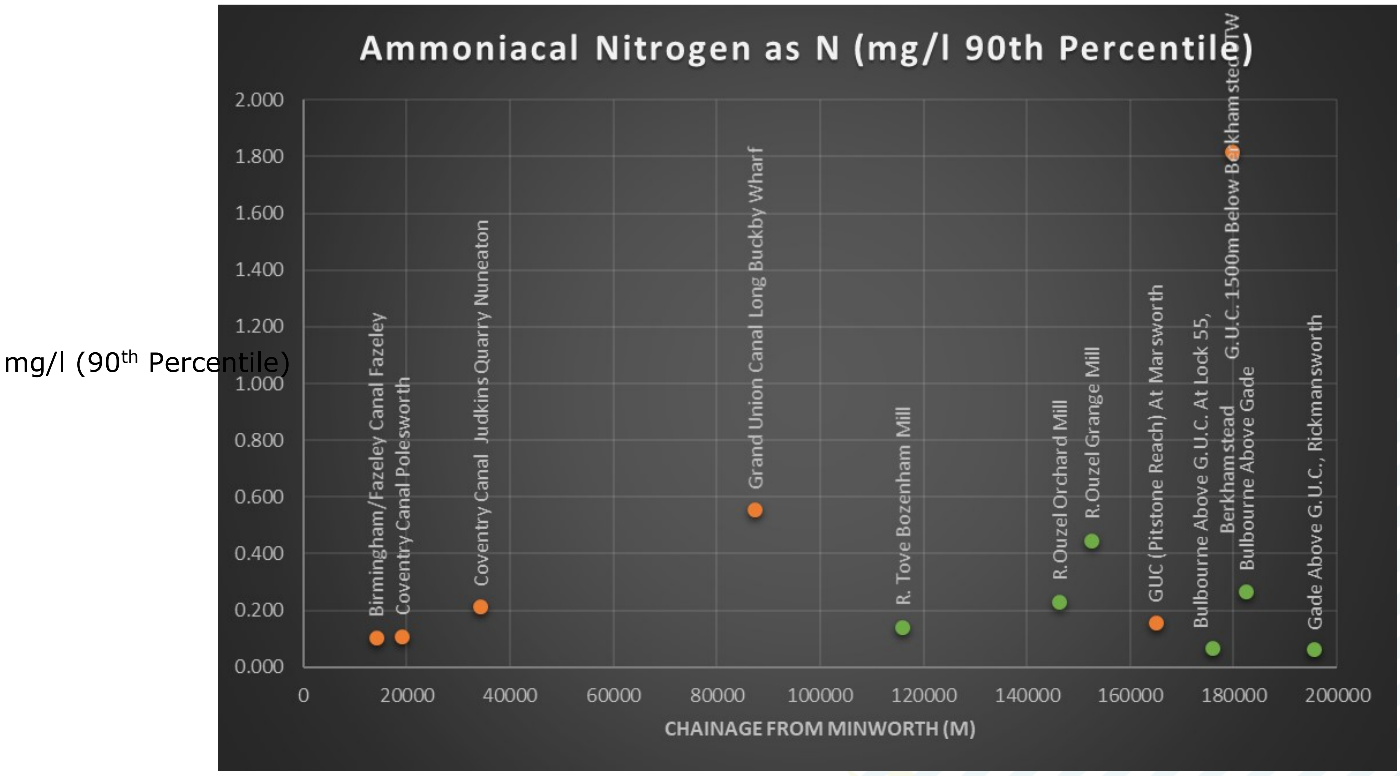


Figure 2-1 Ammoniacal nitrogen, 90th percentile 2000 – 2021

Note: Orange points represent canal sampling locations, green points represent river sampling locations.

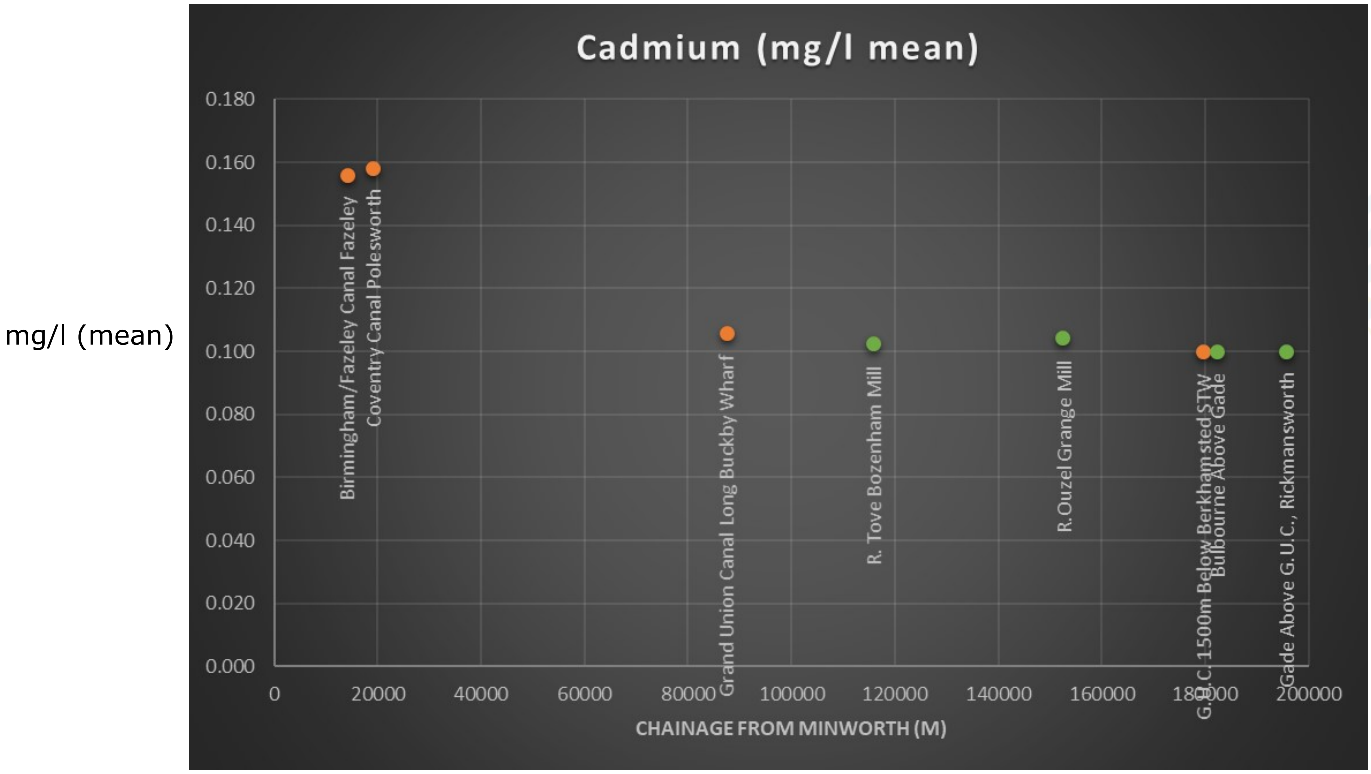


Figure 2-2 Cadmium mean, 2000 – 2021

Note: Orange points represent canal sampling locations, green points represent river sampling locations.

Table 2-2: Assessment of the risk of causing a downstream deterioration

Group	Determinand	Risk of causing downstream deterioration	Further work required
General characteristics	Alkalinity	MEDIUM - Alkalinity within the Birmingham / Fazeley and Coventry canals is significantly lower than in downstream watercourses, so increased spills to rivers could have a detrimental impact.	Check latest monitoring results and proposed discharge concentrations. Consider for further investigation using water quality model
	pH	LOW – pH in the Birmingham / Fazeley and Coventry canals is lower than the Tove and Ouzel but similar to the Bulbourne and Gade – and is within normal range.	Check latest monitoring results and proposed discharge concentrations.
Sanitary determinands	Un-ionised Ammonia	LOW – unionised ammonia and ammonia in the Birmingham / Fazeley and Coventry canals is lower than downstream canal pounds and the Tove and Ouzel, but higher than the Bulbourne and Gade. The GUC 1,500m	Check latest monitoring results and proposed discharge concentrations. Consider for water quality modelling if the transfer
	Ammoniacal nitrogen		

Group	Determinand	Risk of causing downstream deterioration	Further work required
		below Berkhamsted STW is a significant outlier of high ammonia[1].	route will include part of GUS.
	Biochemical Oxygen Demand	LOW – BOD is in the Birmingham / Fazeley and Coventry canals is lower than in the downstream canal pounds. DO is lower, but this is likely to be related to very low flows. The transfer has potential to significantly improve re-aeration at by-weirs.	Check latest monitoring results and proposed discharge concentrations. Use the water quality model to investigate the impacts of the transfer on re-aeration and dissolved oxygen. This is a potential benefit of the transfer.
	Dissolved Oxygen % saturation		
Metals and halogens	Cadmium	HIGH – Concentrations in the Birmingham / Fazeley and Coventry canals are 50% higher than all downstream stations.	Check latest monitoring results and proposed discharge concentrations. Include in water quality modelling if proposed discharge concentration is significantly above downstream concentrations.
	Chloride	LOW – concentrations in the Birmingham / Fazeley and Coventry canals are lower than the Ouzel, higher than the Tove, Bulbourne and Gade, but much lower everywhere than the EQS of 250mg/l.	Check latest monitoring results and proposed discharge concentrations.
	Copper	HIGH – Concentrations in the Birmingham / Fazeley canals are ~30% higher than all downstream stations.	Check latest monitoring results and proposed discharge concentrations. Include in water quality modelling if proposed discharge concentration is significantly above downstream concentrations.
	Zinc	HIGH – Concentrations in the Birmingham / Fazeley canals are ~400% higher than all downstream stations.	Check latest monitoring results and proposed discharge concentrations.

[1] Affinity Water have been in communications with Thames Water regarding discharges at Berkhamsted.

Group	Determinand	Risk of causing downstream deterioration	Further work required
			Include in water quality modelling if proposed discharge concentration is significantly above downstream concentrations.
Nutrients and nitrogen compounds	Orthophosphate	LOW - concentrations in the Birmingham / Fazeley and Coventry canals are significantly lower than all downstream stations except the Bulbourne.	Check latest monitoring results and proposed discharge concentrations.
	Total Nitrogen	LOW - concentrations in the Birmingham / Fazeley and Coventry canals are significantly lower than all downstream stations.	Check latest monitoring results and proposed discharge concentrations.
	Nitrate		
	Nitrite		

2.4.7 Initial assessment using Grand Union Canal sampling

Following completion of the assessment using the historic EA sampling data, results of the sampling being undertaken for the GUC SRO became available. Results up to round 8 were analysed, which covered sampling up to and including June 2021. Full details of the sampling regime currently in place are provided in the Water Quality Monitoring Phase 2 Quarterly Report Q2 2021 (Atkins, 2021).

The 9 sampling sites are arranged in order, from site 1 (Minworth WwTW effluent) to the further downstream site 9 before the GUC interacts with the River Colne. Site 2 relates to the Route 1, site 3 to Route 3 and site 4 to Route 6.

The risk of a downstream deterioration as a result of transfer flows was assessed as follows:

- The mean and 90th percentile values as calculated by Atkins for each determinand were used.
- A risk score was applied, based on comparison of the concentration in Minworth WwTW effluent and concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) with all downstream sites, as summarised in Table 2-3. The 50% cut-off between the Medium and High risk is, at this stage, arbitrary, and in effect Medium and High risk score should be treated the same in that both will require further analysis.
- The overall risk score was calculated based on the worst risk scoring for both the mean and 90th percentile concentrations.

Table 2-3: Risk scoring summary

Risk	Criteria	No. of determinands
Not WFD	Not assessed for potential deterioration as not a WFD determinand	330
Very Low	Concentrations at Minworth are lower than at all canal sampling points	23
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge	12

Risk	Criteria	No. of determinands
	sufficient to prevent deterioration if overflows to rivers aren't increased.	
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.	2
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.	38

Full results of the risk assessment are provided in Appendix B.

2.4.8 Mitigation measures

- Where feasible, treatment at Minworth should be to a standard which can be demonstrated to cause no deterioration at all canal pounds and connected watercourses downstream.
- Increasing the frequency of overflows from canal to connecting watercourse as a result of the transfer is undesirable for many reasons, not least because it would be a loss of transfer water. Hence the hydraulic design should aim to not increase overflows to connected watercourses. This will reduce the risk of causing a deterioration where linked watercourses have higher water quality than the transfer flows.
- The Environment Agency's guidance on no deterioration (Environment Agency, 2012) sets out a hierarchy of permitting options for sanitary determinands and phosphorous. These may need to be explored if no deterioration at all downstream waterbodies cannot be evidenced.

2.4.9 What further assessment is required?

- Determinands which represent a medium or high risk of leading to a downstream deterioration should be investigated using the water quality model. See section 3 for details of how this will be modelled.
- The transfer scheme has potential to improve re-aeration and therefore increased dissolved oxygen levels in the canal. This should be modelled sufficiently to assess potential benefit.

2.5 Accidental spillage or illegal discharge into the Minworth sewerage system or into the Grand Union, Oxford or Coventry Canals or into connected watercourses or drainage systems

2.5.1 Source

Accidents such as road traffic incidents, operator errors, or deliberate illegal discharges into the Minworth sewerage system, into the canals on the transfer route or into connected canal branches, watercourses or drainage systems.

2.5.2 Pathways

Where substances are not treatable by the treatment processes available at Minworth or are of such a high concentration that treatment capacity is compromised, contaminants could pass through the treatment processes and be discharged into the GUC, and from there transferred along the canal and potentially into connected watercourses, facilitated by the transfer scheme. The transfer scheme also increases the potential to transfer pollution incidents within the canal itself or connected watercourses and drainage systems further and faster than under the baseline scenario.

2.5.3 Receptors

The canal and connected watercourses.

2.5.4 Detection methods

Real-time monitoring within the treatment stream at Minworth is already in place. If this expanded (to include additional determinands where technologies allow) and extended to include the canal transfer route, it could be used to provide early warnings of indicators of unusual loads. Regular sampling of treated effluent. The existing pollution reporting and response activities of the Environment Agency and Severn Trent Water could detect and intercept some, though not all, such incidents.

2.5.5 Is significant environmental impact feasible as a result of the transfer?

Yes, because the transfer exposes the GUC and connected watercourses to risks from Minworth to which they are not currently exposed, and provides a pathway for transfer of contaminated water along the canal. However, the scheme does provide both increased opportunities to detect this type of incident through implementation of additional real-time monitoring at Minworth, and would reduce some of the load (and risk) to the River Tame. Discussions with The Canal and River Trust have identified that this issue has not led to significant issues on other canal transfer schemes. The controls inherent within a canal enable pollution incidents to be isolated to specific pounds, in contrast to river systems where there is limited or no flow control available to manage pollution incidents.

2.5.6 Initial assessment

To identify the potential scale of this source of contamination risk, the Environment Agency's database of pollution incidents (Environment Agency, 2021) for the period March 2001 to September 2021 was queried. This records all incidents where a category 1 or 2 was assigned to at least one medium (air, land and water). The database provides the location, date and categories of each incident, but does not assign the source or, in the case of water-based incidents, the water body. To overcome this issue, the number of incidents within the Minworth catchment and within 20m of the transfer route on the GUC were selected – this was considered to be a suitable distance within which incidents were likely to have been on the canal rather than on an adjoining but unconnected waterbody. The results are summarised in Table 2-4.

Table 2-4: EA recorded water pollution incidents within Minworth catchment and within 20m of GUC transfer route

Pollution Incident Category (Water)	Within Minworth STW catchment	Within 20m of preferred GUC transfer route option (Atherstone to Leighton Buzzard)	Within 20m of all GUC transfer route options
1 - Major damage / effect	11	2	3
2 – Significant damage / effect	58	3	5
3 – Minor damage / effect	20	0	0
4 – No impact	87	0	0

Whilst there were a significant number of incidents recorded within the Minworth catchment, it is important to note that the database does not record the source of these, so the number of these associated with wastewater systems is not known. Notably, however, only one water pollution incident is recorded during this 20-year period at the Minworth WwTW outfall at Water Orton Lane.

2.5.7 Mitigation measures

Mitigation measures would likely include:

- Real-time monitoring at Minworth
- Real-time water quality monitoring within the GUC.
- A time-of-travel estimation system to forecast the rate of propagation through the canal system.
- Procedures to stop the transfer to prevent further conveyance of contaminants.

2.5.8 What further assessment is required?

Phase 3 modelling should include testing of the fate of a conservative pollutant downstream of the discharge point(s).

2.6 Unknown, unmeasured contaminants in wastewater

2.6.1 Source

Un-monitored or illegal activities discharging to the Minworth sewerage system. Other contaminants for which we do not yet having analytical techniques or regular sampling, but are not necessarily being illegally discharged (e.g., EDCs, pharmaceuticals)

2.6.2 Pathways

Passage through the Minworth WwTW, discharge to the canal and conveyance along the canal as a result of the transfer.

2.6.3 Receptors

The canal and connected watercourses.

2.6.4 Detection methods

Atkins Phase 2 Water Quality Monitoring report (Atkins, 2021) sets out a comprehensive approach to WQ sampling, including emerging substances.

2.6.5 Is significant environmental impact feasible as a result of the transfer?

Yes, because the transfer exposes the GUC and connected watercourses to risks from Minworth to which they are not currently exposed and provides a pathway for transfer of contaminated water along the canal. However, the scheme does provide both increased opportunities to detect this type of incident through implementation of additional real-time monitoring at Minworth and would reduce some of the load (and risk) to the River Tame.

2.6.6 Initial assessment

No initial assessment of this risk has been undertaken; however, it is considered that (Atkins, 2021) has considered previously unmeasured contaminants and put into place a comprehensive monitoring programme.

2.6.7 Mitigation measures

Mitigation measures would likely include:

- Liaison with regulators and the wider industry to continue research into emerging substances.

- Continue a pre and post construction water quality monitoring regime, reviewing periodically to include new emerging substances as and when recommended by the Drinking Water Inspectorate and/or World Health Organisation (WHO).
- Real-time monitoring at Minworth and within the GUC. Real-time monitoring currently is on able to cover a limited range of determinands, but these can, in some cases, be used as proxy indicators of issues arising from other substances.
- A time-of-travel estimation system to forecast the rate of propagation through the canal system.
- Procedures to stop the transfer to prevent further conveyance of contaminants.

2.6.8 What further assessment is required?

- Allow for the costs of installing and implementing a real-time monitoring system within the scheme costs (engineering consultant).

2.7 Sediments present within the canal

2.7.1 Source

Sediments currently deposited within the canal, possibly including contaminated sediments.

2.7.2 Pathways

Risk that sediments are entrained as a result of higher velocities when the transfer scheme is in operation, suspending sediments within the water and transferring along the GUC.

2.7.3 Receptors

The canal and connected watercourses.

2.7.4 Detection methods

- The topographic survey will collect hard and soft bed measurements at specified cross-sections of the canal, enabling the depth of sediments to be assessed.
- The sediment sampling survey will analyse the nature and chemistry of sediment samples along the canal.

2.7.5 Is significant environmental impact feasible as a result of the transfer?

Potentially yes, in particular if sediments currently contained within the canal were to be transferred in higher loads into connected watercourses.

2.7.6 Initial assessment

The baseline and transfer scenario hydraulic models from Gate 1 were re-run to record shear stress, an optional output in Flood Modeller Pro. These simulations were originally undertaken to inform the selection of sites for the sediment survey. Shear stress is a force acting at the boundary layer between water moving at a given speed, and the bed where velocity is zero. When the diameter of the sediment material is known, shear stress can be used to assess when sediments can be eroded, transported and deposited.

Sediment deposits will be collected and analysed by the parallel investigation being led by Mott MacDonald. This will identify the nature of the sediments. We would anticipate that they would typically consist of fairly uniform, cohesive sediments, given the likelihood of a predominance of fine particles (clay and silt sizes), slow rates of deposition and relatively low velocities even during flood peaks. Typically for cohesive sediments, the critical shear stress at which sediments start to be eroded, is around $2N/m^2$. This will be determined for the sediment samples taken, either directly using a shear strength test, or using published ranges for known dry densities.

Results from the Gate 1 models indicate minimum and maximum shear stresses of less than 2N/m^2 almost everywhere north of Tring summit, with significantly higher values on the Grand Union South (now no longer part of the preferred transfer route) and on linked watercourses, however the Gate 1 schematisation of these pounds does not lend itself to accurate assessment of the hydraulics of the canal pounds. This will be addressed through the Gate 2 model development.

2.7.7 Mitigation measures

- Where a significant increased risk of localised erosion is identified, some localised modifications to channels, scour protection measures or by-passes might be necessary.
- Where highly contaminated sediments are identified and there is an increased risk that these become mobilised as a result of the transfer, dredging to remove contaminated sediments may be necessary.

2.7.8 What further assessment is required?

- Following completion of the baseline and future scenario hydraulic model, results for shear stress and change in shear stress as a result of the transfer should be analysed to identify locations with increased sediment erosion potential.
- Results should be overlaid with the results of:
    - Sampled sediment characteristics to identify the likelihood of increased erosion,
    - The potential for presence of contaminated sediments, and
    - Locations where increased interaction with connected watercourses is predicted.
    - Results should be developed into a sediment erosion risk map.
- A full sediment transport model of the whole transfer route is not proposed at this stage, and if sediment transport modelling is considered to be required, it would be advisable to limit this to high-risk sections.

2.8 Water Treatment Works wastewater discharge to the canal

2.8.1 Source

Water treatment works generate a proportion of wastewater from back-washing filters etc, which may be too concentrated with certain contaminants to be fed back into treatment. The volume and nature of this water is dependent upon the quality of the raw water, the water treatment processes employed and any subsequent settling and treatment prior to discharge to the environment.

2.8.2 Pathways

The preferred option for abstraction and treatment of water from the canal is close to Leighton Buzzard. Wastewater arising from the new water treatment works would need to be discharged. In this location, the canal is falling from south to north, i.e., opposite to the direction of the transfer.

This following section refers to the potential water quality considerations should an option to discharge the treatment works backwash into the canal appear most suitable. At this stage, a final decision on this particular matter has not been made, and the SRO design team are also considering alternative options for this waste stream, such as discharge to sewer.

2.8.3 Receptors

The canal and connected watercourses. If concentrations are increased significantly at the point of discharge, the WTW could also be impacted as the quality of the incoming water would deteriorate. This could occur even if the discharge is located to the south of the intake, because the flow of the canal is northwards at this point, therefore potentially returning contaminants back to the intake.

2.8.4 Detection methods

The likely volumes of WTW wastewater discharges, and their contaminant load should be calculated by the WTW design team.

2.8.5 Is significant environmental impact feasible as a result of the transfer?

Yes. Canal flows are typically low, and in dry summer conditions are likely to be limited to lock leakage only at night, when boat movement is very low. Therefore, there is limited dilution available, other than the transfer flows themselves. Because at Leighton Buzzard the canal flows and transfer flows are in opposition, the quality of the transfer flow could be impacted by the WTW wastewater discharge, irrespective of whether this is discharged upstream or downstream of the point of abstraction.

2.8.6 Initial assessment

A simple mass-balance spreadsheet model was developed to provide an initial assessment of this issue. The spreadsheet calculates concentration of a conservative, fully dissolved contaminant on a daily timestep. The variables which can be set by the user are:

- Volume of the pound in which the abstraction and WTW wastewater discharge takes place.
- Starting concentration of the contaminant in the pound (before transfer and abstraction commences).
- The daily volume of the transfer, the canal flow and the WTW wastewater flow.
- The starting concentration of the contaminant in the transfer flow, the canal flow and the WTW wastewater.

The model was initially tested with four scenarios to test its function and to provide some indicative results on how concentrations of a contaminant might change over time in the canal and the raw water sent to treatment. The starting values applied in the four scenarios are shown in Table 2-5.

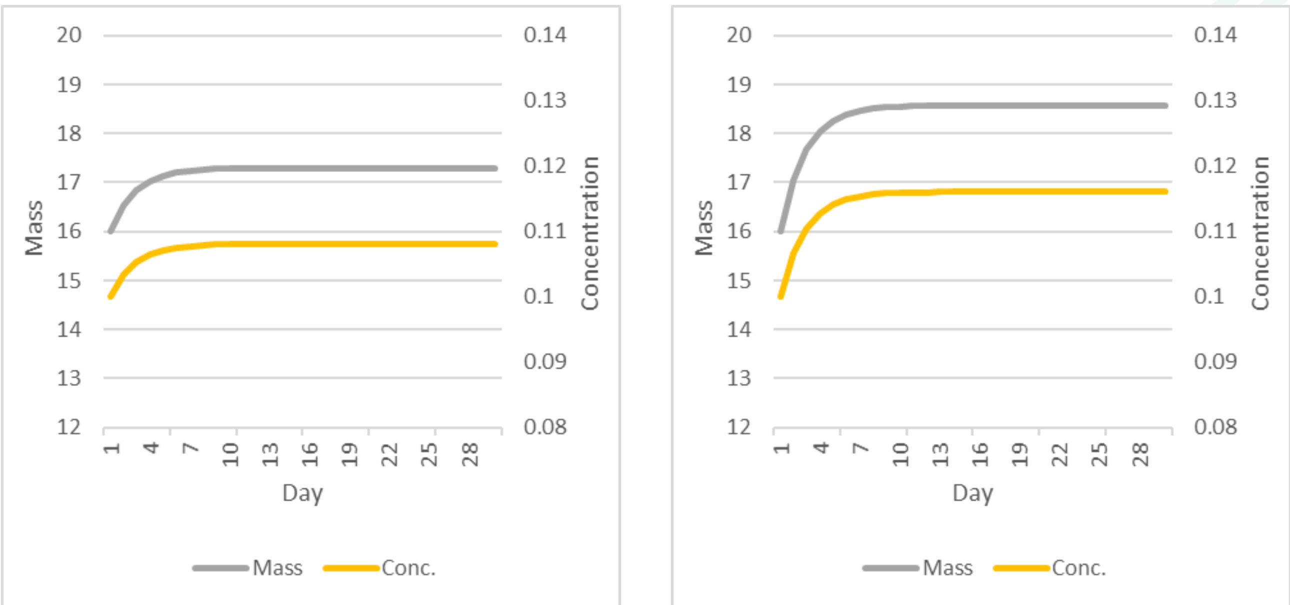
Table 2-5: WTW wastewater discharge mass-balance model scenarios

Scenario	Pound		Transfer flow in		Canal flow in		WTW wastewater discharge flow in	
	Vol (Ml)	Conc.	Vol (Ml)	Conc.	Vol (Ml)	Conc.	Vol (Ml)	Conc.
1 – long pound, WTW wastewater discharge 1% of transfer, concentration 10* transfer	160	0.1	100	0.1	10	0.1	1	1
2 – long pound, WTW wastewater discharge 2% of transfer, concentration 10* transfer	160	0.1	100	0.1	10	0.1	2	1

Scenario	Pound		Transfer flow in		Canal flow in		WTW wastewater discharge flow in	
	Vol (Ml)	Conc.	Vol (Ml)	Conc.	Vol (Ml)	Conc.	Vol (Ml)	Conc.
3 – short pound, WTW wastewater discharge 3% of transfer, concentration 10* transfer	16	0.1	100	0.1	10	0.1	3	1
4 – short pound, WTW wastewater discharge 1% of transfer, concentration 10* transfer	16	0.1	100	0.1	10	0.1	1	1

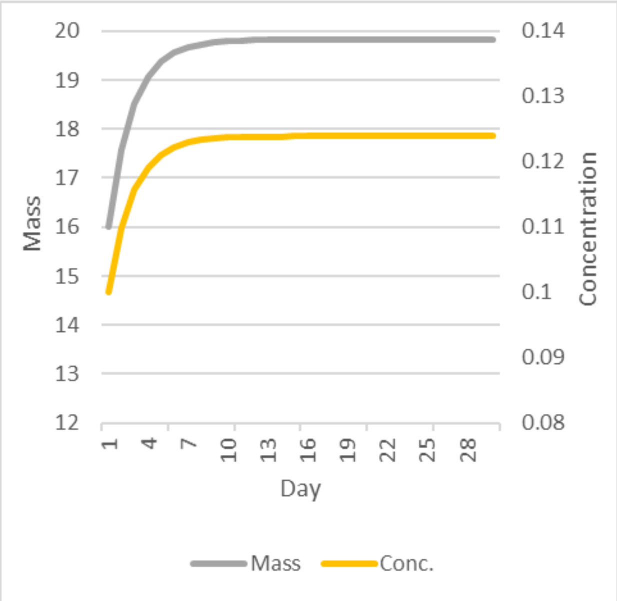
Results are graphed and discussed in Figure 2-3. These illustrate that any increase in concentration within the pound is sensitive to the volume (or concentration) of the WTW wastewater discharge. In scenario 3, with a WTW wastewater discharge of 3% of transfer volume and 10 times the concentration, concentrations would increase in the canal by 12%. This would be enough to cause a WFD deterioration if this occurred for a WFD determinand.

Figure 2-3: Concentration and mass of a conservative substance, days 1-30

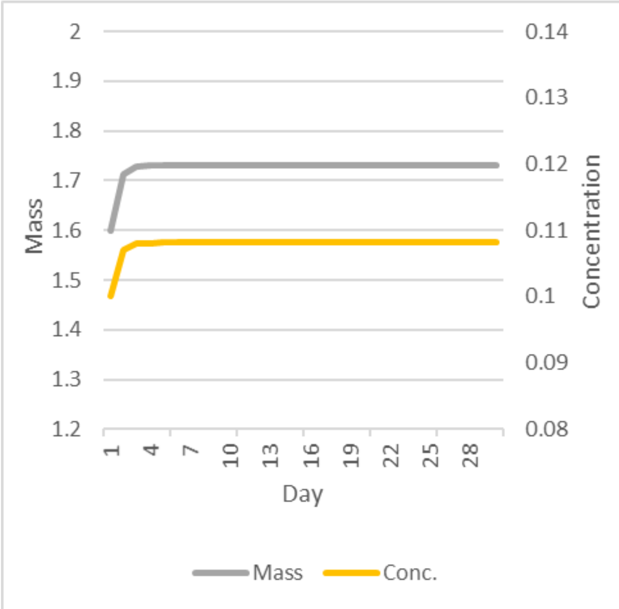


Scenario 1 – Concentrations peak at 8% above base, reaching equilibrium after 20 days.

Scenario 2 – Concentrations peak at 12% above base, reaching equilibrium after 20 days.



Scenario 3 – Concentrations peak at 12% above base, reaching equilibrium after 20 days.



Scenario 4 – Similarly to Scenario 1, concentrations peak at 8% above base, but over only 6 days due to the shorter pound length. Note mass scale adjusted in this graph as mass is tower due to shorter pound length.

The mass-balance model has the following assumptions and limitations:

- Flow and concentration values applied in the scenarios above are indicative to illustrate the potential for deterioration as a result of the WTW wastewater discharge.
- Contaminants are assumed to be fully mixed within the canal pound.
- The model does not currently represent any back-pumping flows, although these could easily be added.
- Only conservative, dissolved contaminants can be modelled.
- Testing scenarios are based on user-defined combinations of flow and concentration. WFD compliance needs to be assessed against mean or percentile standards.
- Continuous use of the transfer at 115MLD is assumed, when in reality this will be variable.

2.8.7 Mitigation measures

The WTW designers may need to consider a treatment train to improve the quality of the WTW wastewater discharge prior to discharge to the canal. This in turn would create a potentially contaminated sludge which would need to be suitably disposed of.

2.8.8 What further assessment is required?

WTW designers will confirm the likely volumes of WTW wastewater discharge and the concentrations of contaminants they contain. The mass-balance model can initially be used to test potential WFD deterioration, using refined input values for the pound, transfer flow, upstream canal flow and WTW wastewater discharge. Where there is potential for a deterioration, this should be further tested by deriving statistical flow and quality distributions and testing compliance using RQP (and MPer if metals are a concern).

If significant concentrations of suspended sediment are predicted to be present in the WTW wastewater discharge, these could deposit in the canal in some flow states, leading to a concentration of contaminated sediment. This risk will initially be assessed using the sediment risk assessment methodology described above in section 2.7.8. More detailed sediment transport modelling around the WTW may be required if the risk is found to be significant.

3 Selection of water quality modelling methodology

3.1 Objectives

The source > pathway > receptor analysis has identified the objectives for the water quality modelling:

- Determinands present in Minworth effluent at higher concentrations than at downstream sampling locations which represent a medium or high risk of leading to a downstream deterioration should be investigated using the water quality model.
- The transfer scheme has potential to improve re-aeration and therefore dissolved oxygen levels in the canal. This should be modelled sufficiently to assess potential benefit.
- The hydraulic model results should be used alongside sediment sampling data to identify areas of high shear-stress and potential for sediment erosion and in particular for erosion of contaminated sediments.
- A full sediment transport model of the whole transfer route is not proposed at this stage, however if, following the erosion assessment using shear-stress there are concerns about erosion in specific locations, some targeted sediment transport modelling may be required.
- test potential WFD deterioration as a result of WTW wastewater discharge, initially using the mass-balance model with refined input values for the pound, transfer flow, upstream canal flow and WTW wastewater discharge. Where there is potential for a deterioration, this should be further tested by deriving statistical flow and quality distributions and testing compliance using RQP (and MPer if metals are a concern).
- If significant concentrations of suspended sediment are predicted to be present in the WTW wastewater discharge, the risk of deposition will initially be assessed using the sediment risk assessment methodology described above.

3.2 Water quality modelling platforms

The water quality modelling platforms available to the study were considered and are compared in Table 3-1.

Table 3-1: Review of water quality modelling software

Software / brief description	Advantages	Disadvantages	Meets objectives of this study?
Aquator. Water resources model being used within this study to model the overall water-balance	• Already in use in this study	• No water quality or sediment transport capabilities	No
Flood Modeller Pro (FMP). 1D hydrodynamic model principally for rivers and open channels. Used in this study for the hydraulic modelling.	• Already in use in this study. • Several experienced FMP modellers in the project team. • Includes water quality and sediment transport modules. • Used extensively for	• Water quality model is not widely used. • Water quality is run after the hydraulic simulation; therefore, erosion or deposition of sediment does not change channel hydraulics.	Potentially

Software / brief description	Advantages	Disadvantages	Meets objectives of this study?
	EA flood models.		
Mike-11. 1D hydrodynamic model principally for rivers and open channels. Probably the most widely used model for deterministic water quality and sediment transport modelling in rivers in the UK.	• Proven track-record in the UK. • Can be run to allow sediment erosion / deposition to change channel hydraulics.	• Would require conversion of the FMP hydraulic model. • An additional license cost would be required.	Yes
River Quality Planning (RQP) and Metals Permitting (MPer). EA stochastic models used for impact assessment and determining permits at the point of discharge.	• Simple to apply to a small number of locations. • Used by the EA for permitting.	• Not able to cope with bi-directional flows in a canal. • Not able to assess downstream deterioration.	Only for point of discharge assessments
SIMCAT. EA stochastic models used for impact assessment and determining permits at a river basin scale.	• Models currently available for all rivers. • Fast and stable as not dependent upon hydraulics.	• Assumes flow all in one direction – modelling uphill pounds with opposing directions of canal and transfer flow not possible. • GUC isn't currently represented in EA SIMCAT models	No

From this initial review, Mike-11 or Flood Modeller Pro were short-listed as potential modelling platforms. Whilst the capabilities of Mike-11 are well known in this field in the UK, there were clear advantages in being able to retain the modelling in Flood Modeller Pro. Given the low usage of FMP's water quality module, however, its capabilities are not well known. It was therefore decided to undertake testing to confirm whether the module would be suitable for this study.

3.3 Flood Modeller Pro Water Quality module testing

3.3.1 Module overview

The 1D water quality solver is designed for modelling water quality in open channels (Jacobs, 2019). The hydraulic model must first be built and run. The water quality solver then runs separately, using flow data from the hydraulic simulation.

Model boundaries can be represented as concentration-time and concentration-flow. Alternatively, the SOURCE function can be used to represent statistical discharges, for example a wastewater treatment works outfall or a tributary, using a mean and standard deviation of flow and concentration, along with hourly, daily and monthly shape functions, enabling diurnal, weekly and seasonal changes to be represented.

The following processes and variables can be modelled:

- Conservative pollutants
- Decaying pollutants
- Coliforms
- Salt
- Water temperature
- Sediment
- Oxygen balance (DO, BOD)
- Water/Sediment oxygen interactions
- Phytoplankton
- Macrophytes
- Benthic algae
- pH

The solver is depth-averaged, meaning that modelled parameters are assumed to be evenly distributed up and down the water column, however for sediment transport it operates a four-layer model composed of the water column, fluffy bed, bed and pore water.

3.3.2 Preliminary testing

Preliminary testing of the module was carried out using two models:

- A fluvial model provided with the software as a tutorial.
- A small fluvial modelled developed by JBA for another client.

In both cases, the model was set up with a time-varying conservative pollutant being introduced at the top of the modelled reach. Selection of a suitable low timestep to ensure a Courant number of less than 1/3 was critical to ensuring stable and conservative results. In both cases, once this was achieved, the results were analysed, and it was found that the mass of pollutant was balanced across the simulation.

These tests proved the basic functionality of the model. The study then moved on to test the module on part of the Grand Union Canal. During the test, Flood Modeller Pro developers Jacobs provided technical support, identifying that this is available for the water quality solver.

3.3.3 Testing using the Grand Union South model

The Gate 1 model of the Grand Union South was selected for this test, as it was the most developed of the three Gate 1 hydraulic models. At the time of testing, transfer options which included the canal south of Tring summit were still being considered. Whilst these options have now been rejected in favour of an abstraction at Leighton Buzzard, the following remains a valid test of the Flood Modeller Pro water quality module in a canal.

The test again involved introducing a conservative pollutant of concentration of 1,000mg/l at the head of the model (node GU4955). The simulation was run for the period of 180 days from November 2013 to April 2014, as per the Gate 1 testing, to test the model across a wide range of wet and dry weather flow states.

Results were analysed, and long-sections showing pollutant concentrations along the GUC in Figure 3-1 and Figure 3-2. Two issues were identified:

- The reduction in concentrations in the GUC seen at points along its length are indicative of points where flow is diverted out of the canal and into a parallel watercourse. For example, at Bank Mill Lane Berkhamsted (highlighted on Figure 3-1), the vast majority of flow in the Canal diverts into the southern channel of the River Bulbourne. A similar situation occurs at Home Park Mill Link Road, Kings Langley. These sections of the canal are effectively zero flow in the model, even in high flow states, hence why concentrations don't equalise with their parallel river channels which are modelling all of the flow. This points to the need to represent by-weirs around locks to improve the representation of flow and the advection of contaminants through the canal.

- The model was not conservative, instead generating mass along the length of the modelled system. Mass balances along sections of open channel were found to be stable, however mass was being generated at channel bifurcations and structures. Testing identified that this issue would be possible to overcome, with careful development of the model schematisation. The key message for the next phase of model development is that the model should be tested for water quality stability in parts, as each major section of the canal model is updated using the topographic survey, rather than waiting until the model is completely developed. In this way, issues with model stability can be addressed more quickly, without the need to rerun the full model.

3.3.4 Model testing conclusions

Despite the issues identified above, it was concluded that Flood Modeller Pro does offer a suitable platform for the water quality assessment, and we are confident that the technical issues identified can be addressed as the model is developed. FMP also offers programme advantages over Mike-11, because:

- it is the chosen platform for the hydraulic modelling,
- Model cross-sections in FMP format will be automatically generated from the topographic survey, and
- An automation tool to link flows calculated in the Aquator model with the FMP model has already been developed.

3.4 Proposed approach to water quality modelling

3.4.1 Overview

Following the decision that Flood Modeller Pro would be an acceptable platform to progress the water quality modelling, the following methodology is proposed in order to meet the objectives set out in section 3.1.

- The latest available observed data from the water quality sampling will be used.
- FMP will be used to test the potential for a WFD deterioration for multiple determinands, using a conservative pollutant.
- The FMP model will also be developed to model dissolved oxygen, sufficiently to enable an assessment of the potential benefit of the transfer to improve DO in the canal.
- The water quality model will be run for the same timespan as the hydraulic model – this period is to be determined but is expected to be a period of 10-20 years, or more if run times permit.
- A combination of the mass balance model, along with RQP and MPer should be used to assess potential deterioration as a result of the WTW wastewater discharge.

These are discussed in more detail below.

3.4.2 Update the observed data

Observed data from the ongoing sampling exercise will be used both to test the potential for a deterioration to occur, and to calibrate the baseline Dissolved Oxygen model. Ideally a 12-month period of sampling should be used (or 24-month where available) to calculate the water quality statistics for each determinand. We will work closely with Atkins to ensure that as long a period of water quality data is utilised, without causing delay to the modelling programme. Once available, the exercise described in section 2.4.7 will be re-run using the latest observed data.

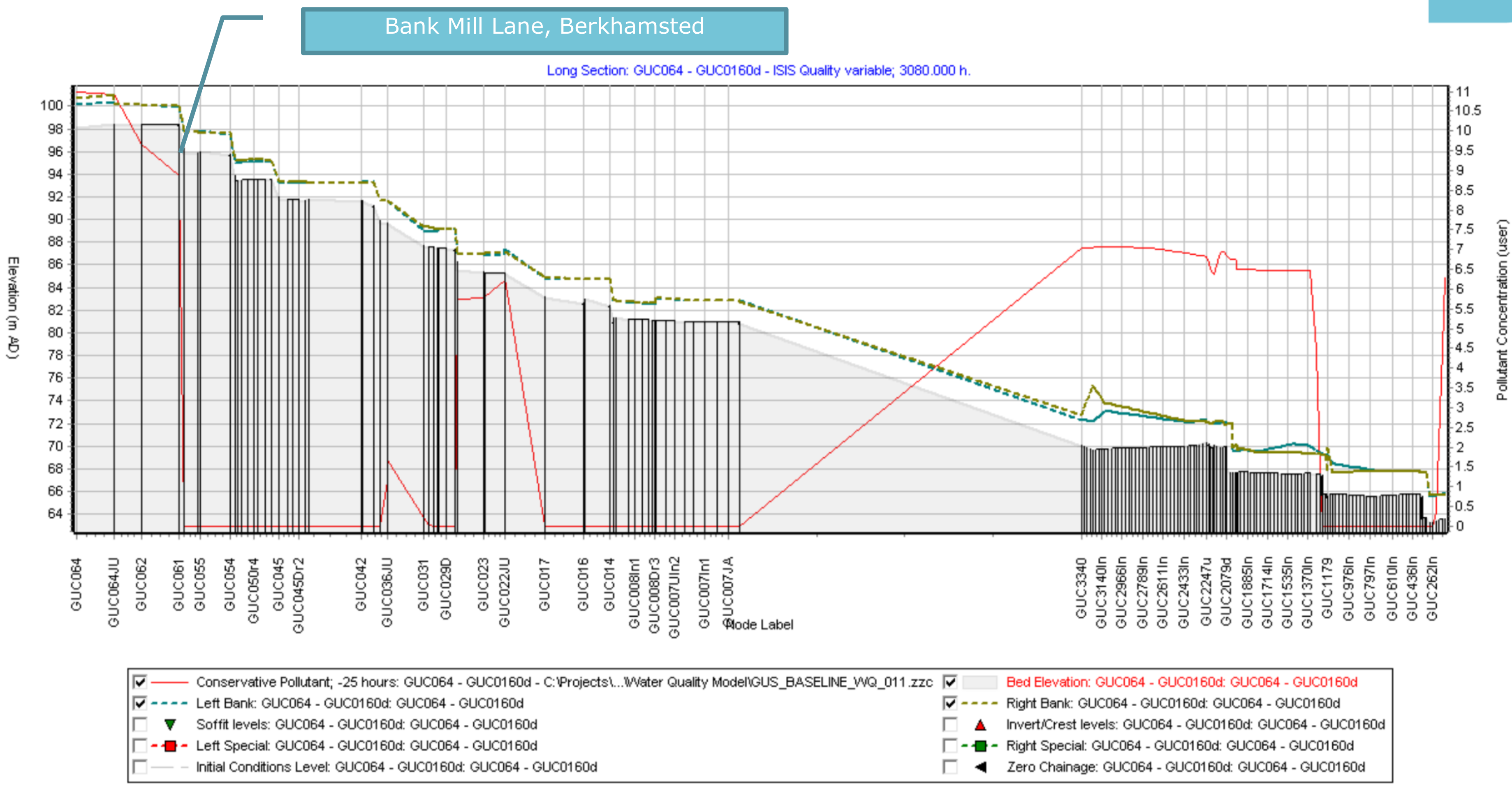


Figure 3-1 Long section of pollutant concentrations along GUC, wet weather period (3080 hours)

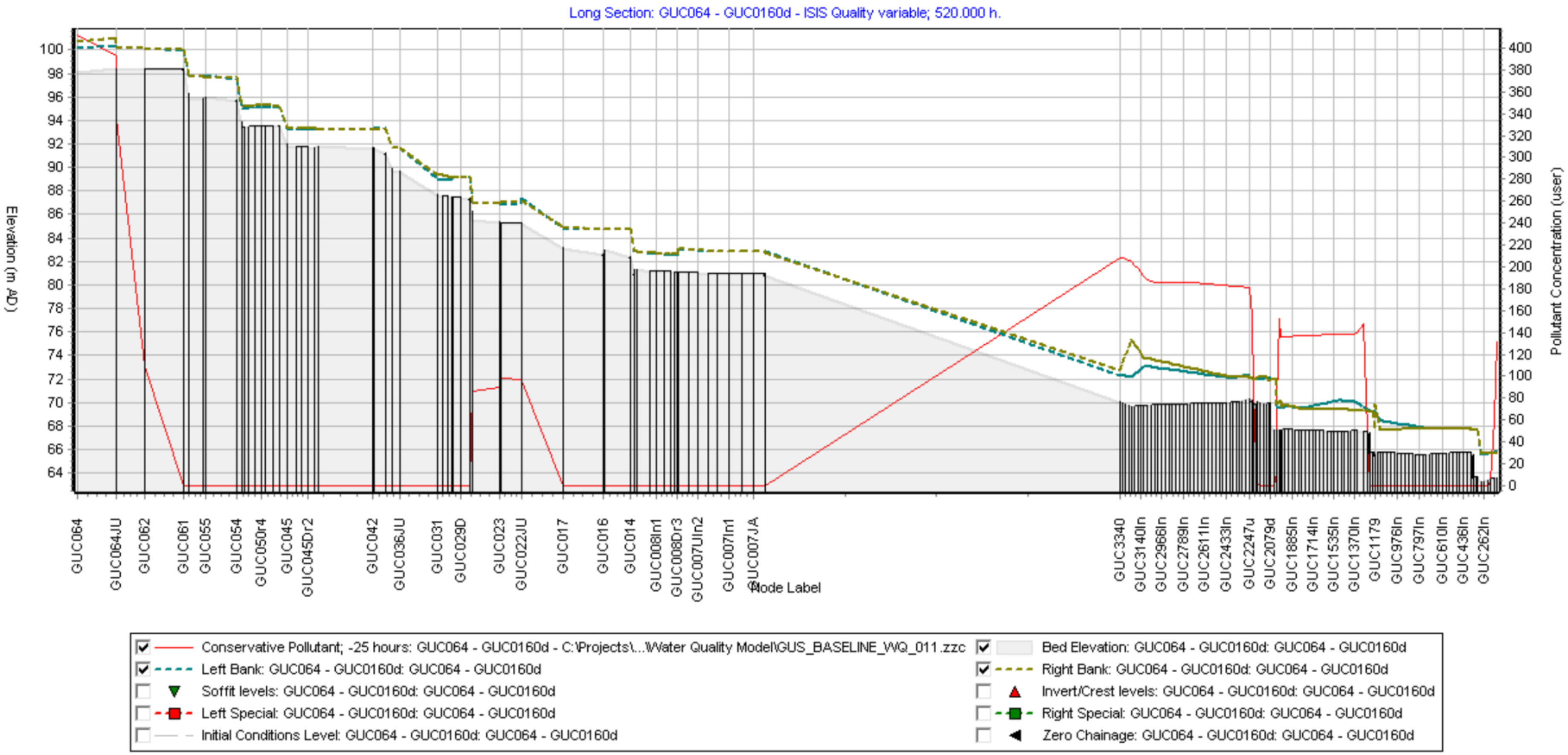


Figure 3-2 Long section of conservative pollutant concentrations along GUC, dry weather period (520 hours)

3.4.3 Modelling of a conservative pollutant to test for deterioration

It is not considered to be feasible or necessary to build a calibrated model of every determinand for which a WFD model could potentially occur. Even with the sampling in place, not all possible sources (feeders and other discharges) or sinks (connected watercourses or canal branches) are covered. Furthermore, with 40 high and medium risk determinands identified, modelling each of these individually would be exceptionally time-consuming and difficult to achieve within the time constraints of the Gate 2 work.

A simplified approach is therefore recommended, based on modelling a conservative pollutant within the transfer flow, to identify the proportion of flow within the canal which has originated from the transfer, at any specific location and time. Using this approach, the potential concentration of each target determinand with the transfer operating will be calculated at each timestep (assuming a constant concentration in the canal). These concentrations will be compared to the observed concentration at that location, to determine if a deterioration could occur.

3.4.4 Modelling of dissolved oxygen

Again, it is not considered feasible or necessary to develop a fully calibrated model of DO along the transfer route in order to investigate the potential for DO improvements as a result of the increased flows and aeration at by-weirs as a result of the transfer. Dissolved oxygen in the canal will be influenced by Biochemical Oxygen Demand (BOD) both within the water and within sediments, the presence of oxidisable nitrogen and the growth and decay of macrophytes and phytoplankton, both seasonably and diurnally.

The three water quality monitors taking 15-minute DO and other readings are located on Grand Union South at previously considered abstraction locations. As the project has moved on to propose an abstraction point at Leighton Buzzard, there will be limited data on DO available for the length of the transfer route, and consequently achieving a calibrated model is likely to be unrealistic. The continuous water quality monitors should be moved to cover the preferred transfer route as part of Phase 4 of the monitoring. It is proposed to build a DO model using historic and recent DO, BOD and ammonia data, to attempt to validate this in the base model, and then to test the potential impacts of the transfer to change DO through the system.

3.4.5 Modelling the impact of the WTW wastewater discharge

Modelling the impact of the WTW wastewater discharge is anticipated to be an iterative process, working with the WTW designers. Modelling parameters for application within the mass balance, RQP and MPer models will be defined as follows:

- Canal flow: statistical distribution derived from hydraulic model.
- Canal water quality: statistical distribution derived from monitoring site 6, GUC at Grove, Leighton Buzzard.
- Transfer flow – 50Ml/d yield (model 57.5Ml/d to allow for losses) and 100Ml/d yield (model 115Ml/d to allow for losses).
- Transfer quality – initial test using proposed discharge standard for the Minworth discharge. Refine this using the water quality model results.
- WTW wastewater discharge flow – flow / volume and temporal variability to be defined by WTW designer
- WTW wastewater discharge quality – to be defined by WTW designers.

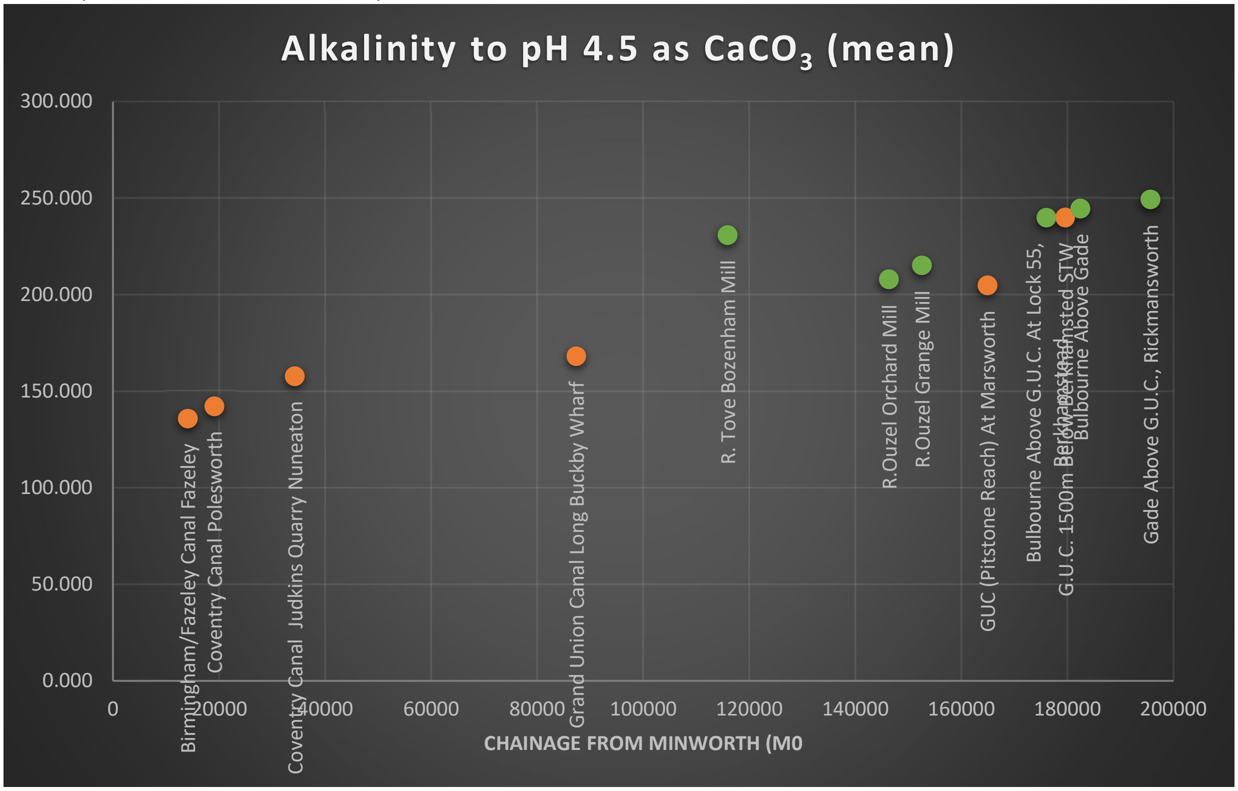
The mass-balance model can initially be used to test potential WFD deterioration, using refined input values for the pound, transfer flow, upstream canal flow and WTW wastewater discharge. Where there is potential for a deterioration, this should be further tested by deriving statistical flow and quality distributions and testing compliance using RQP (and MPer if metals are a concern).

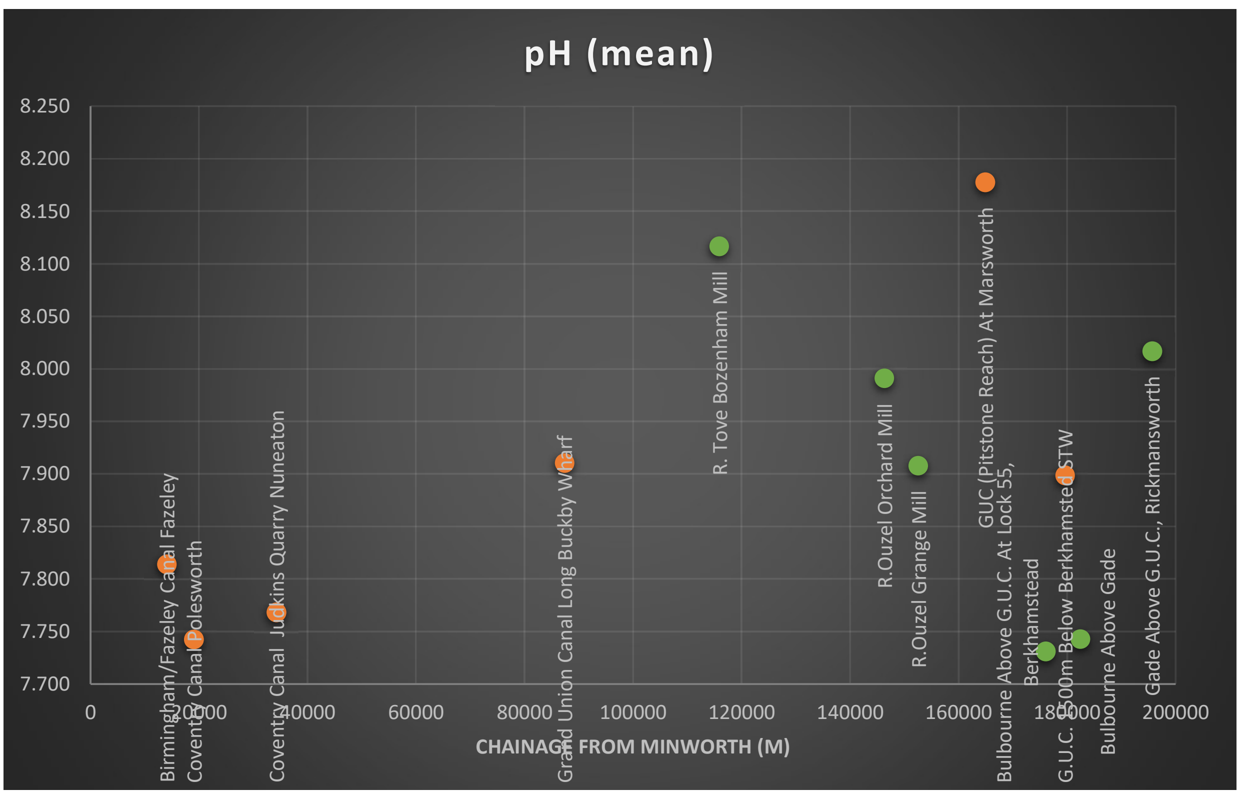
If significant concentrations of suspended sediment are predicted to be present in the WTW wastewater discharge, these could deposit in the canal in some flow states, leading to a concentration of contaminated sediment. This risk will initially be assessed using the sediment risk assessment methodology described in section 2.7.8.

Appendices

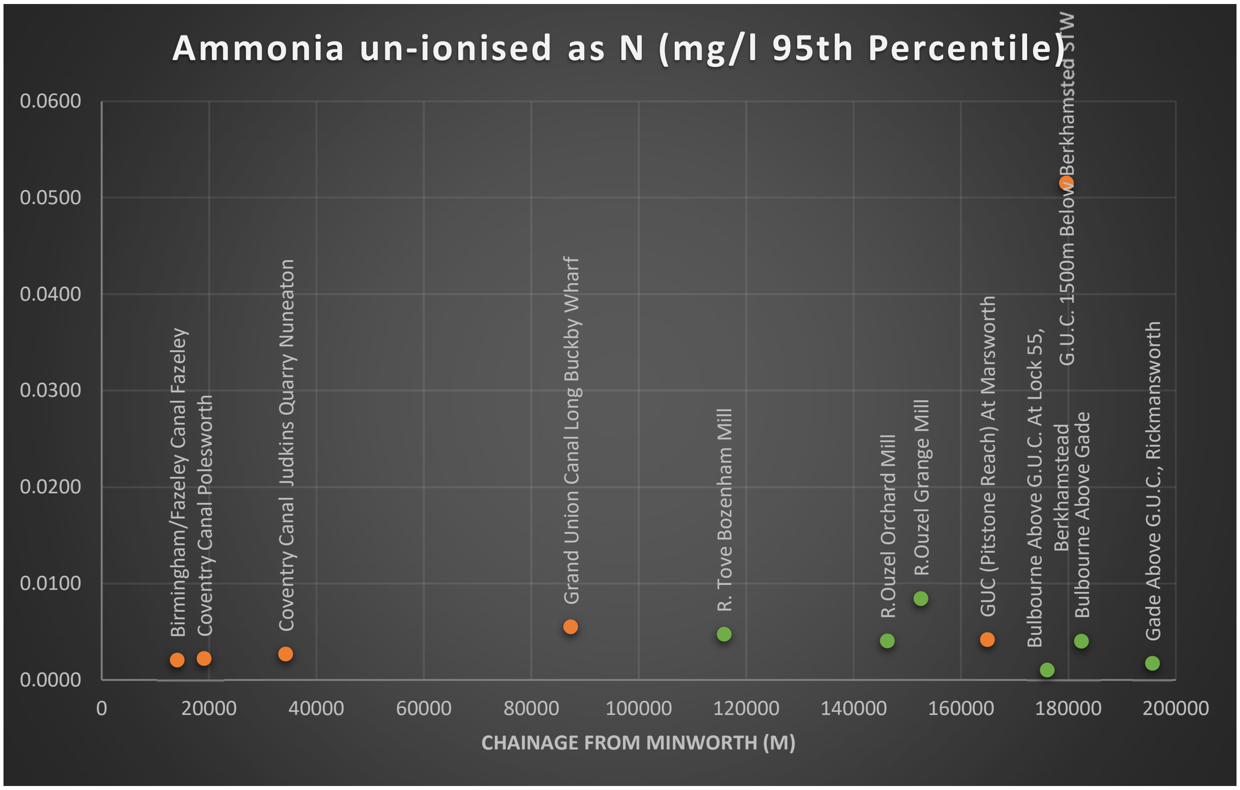
A Appendix: Analysis of EA Water Quality Records

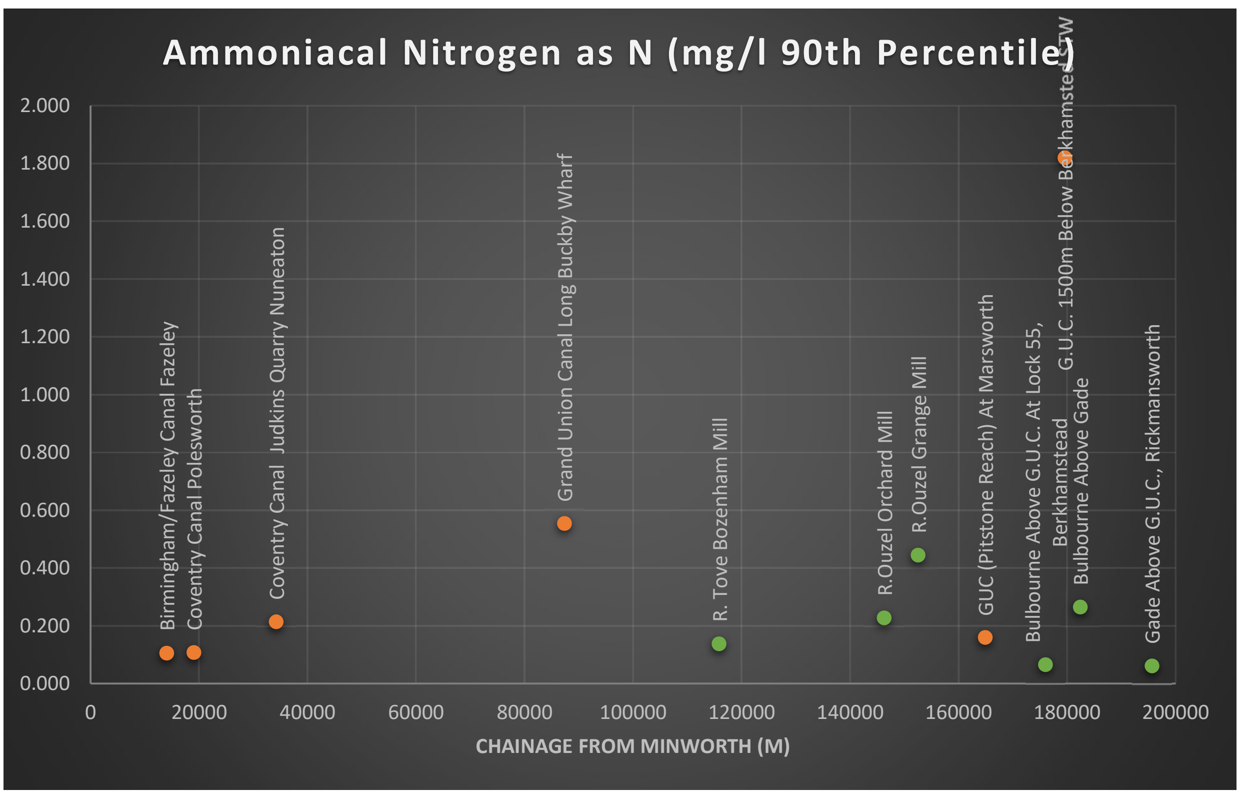
● Samples from canal ● Samples from watercourses



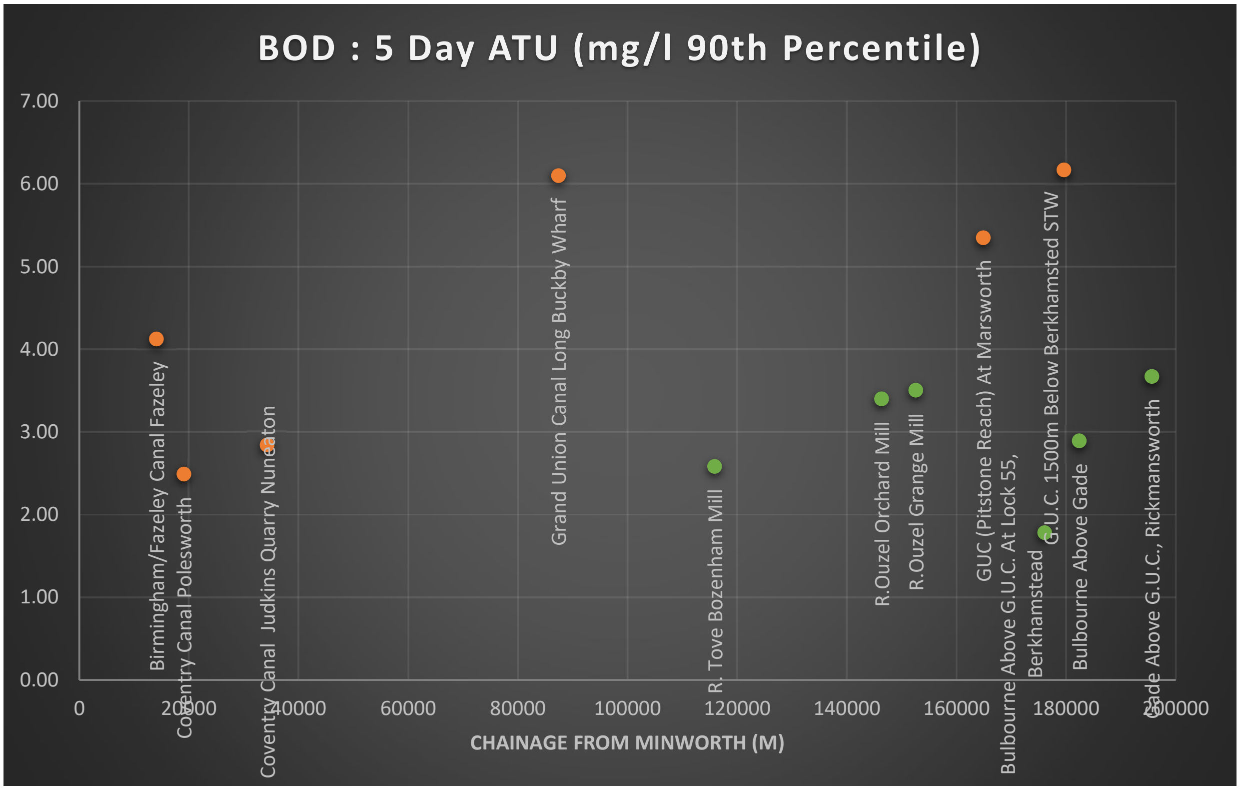


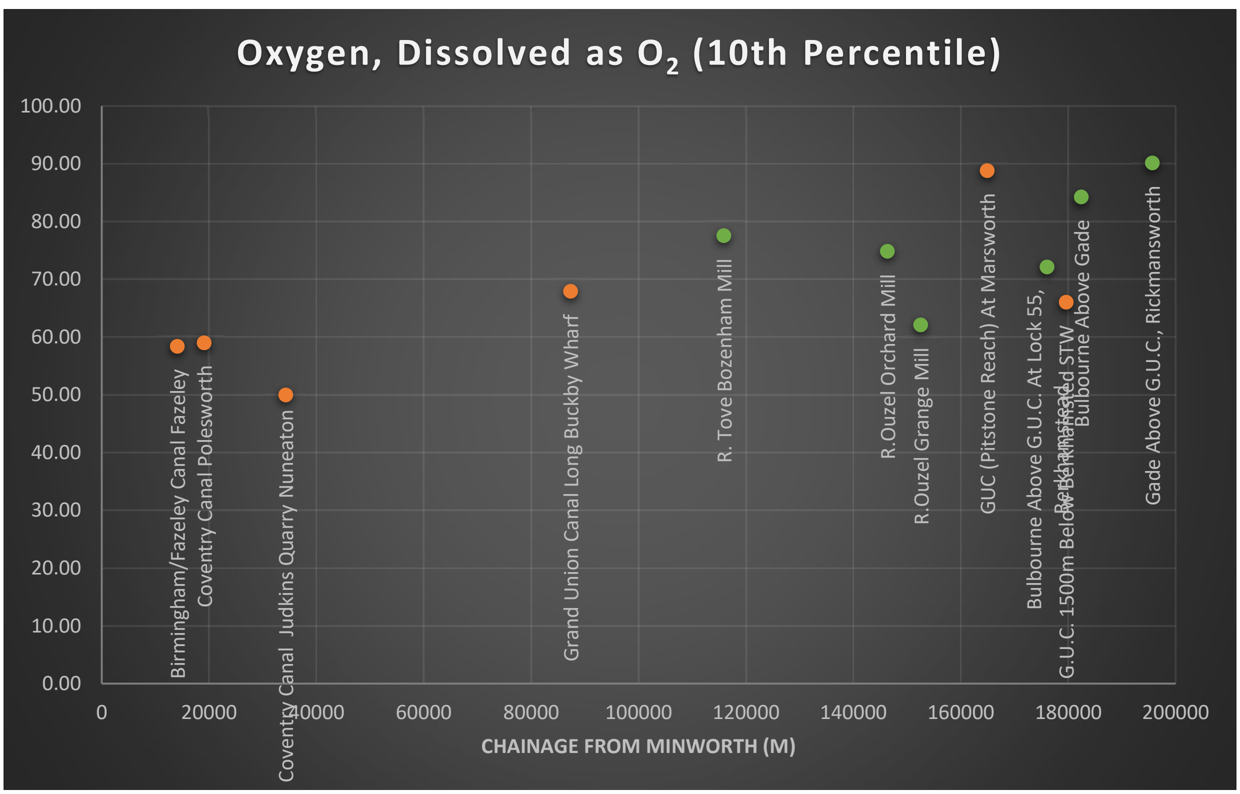
● Samples from canal ● Samples from watercourses



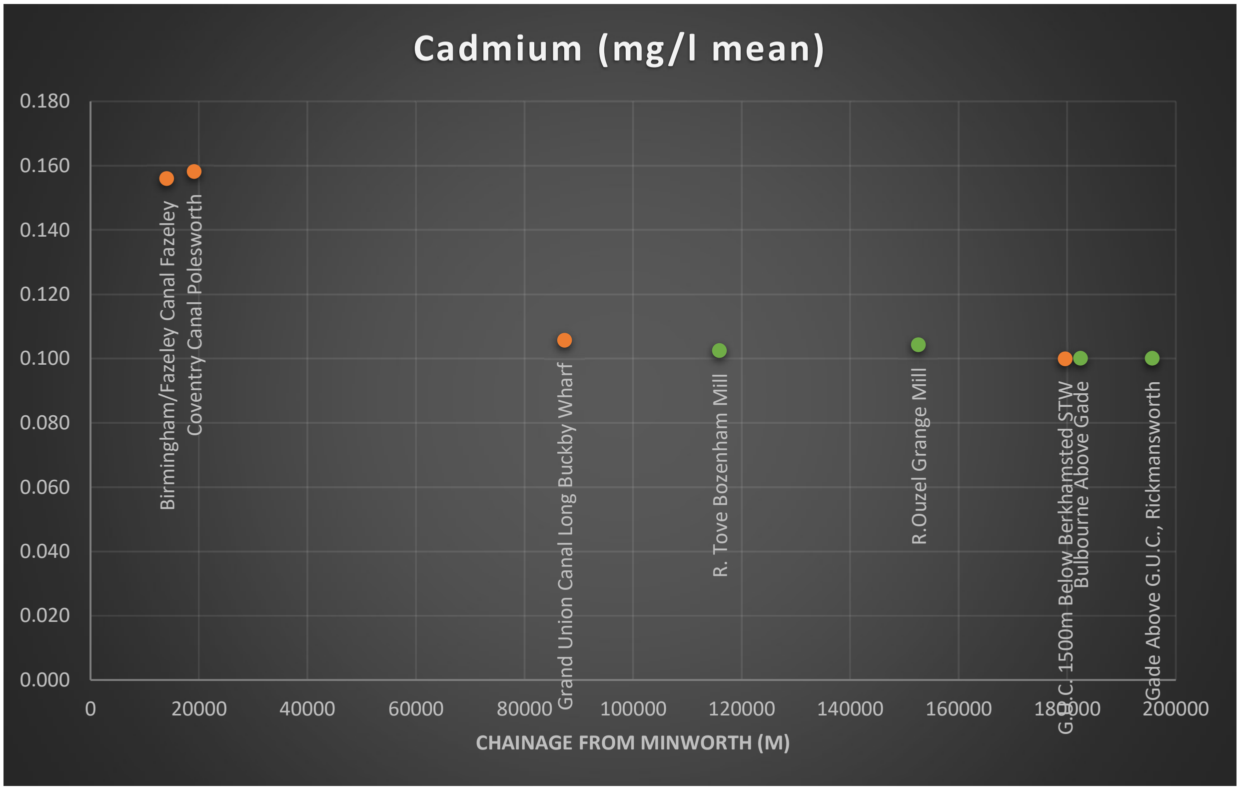


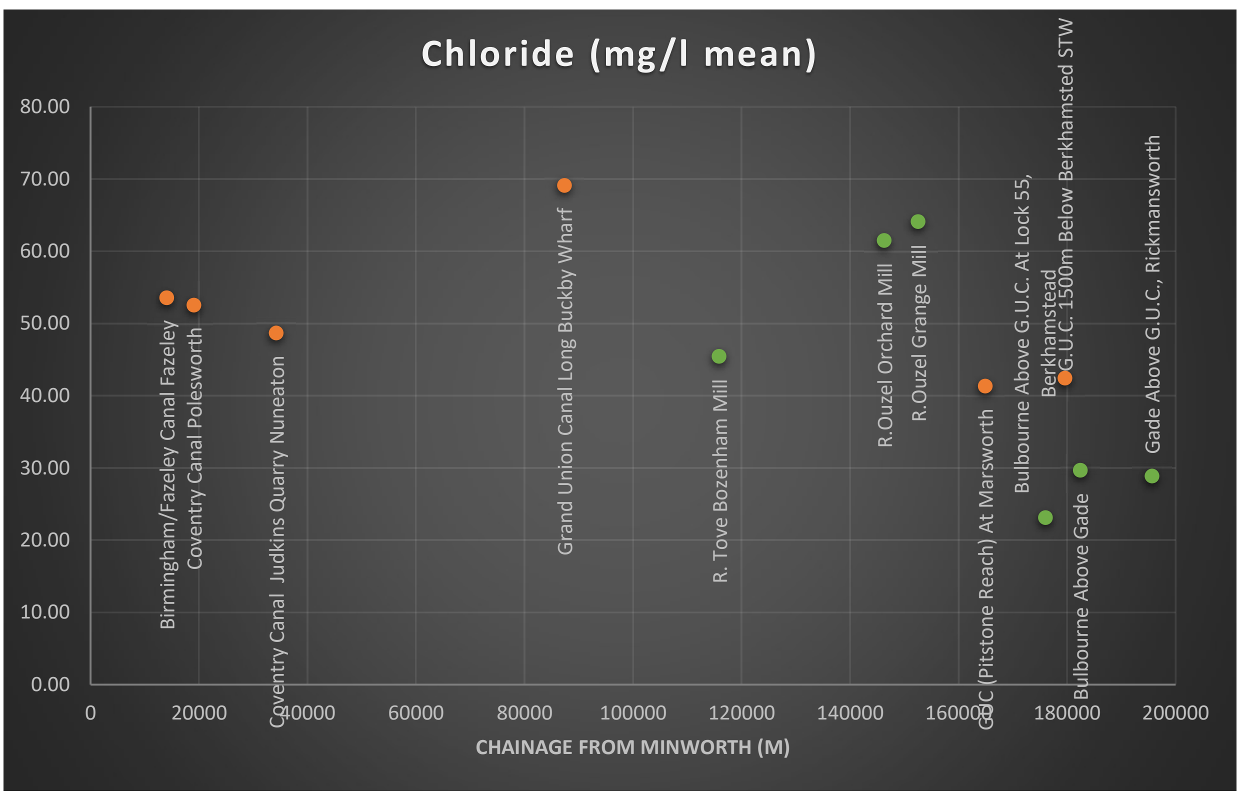
● Samples from canal ● Samples from watercourses



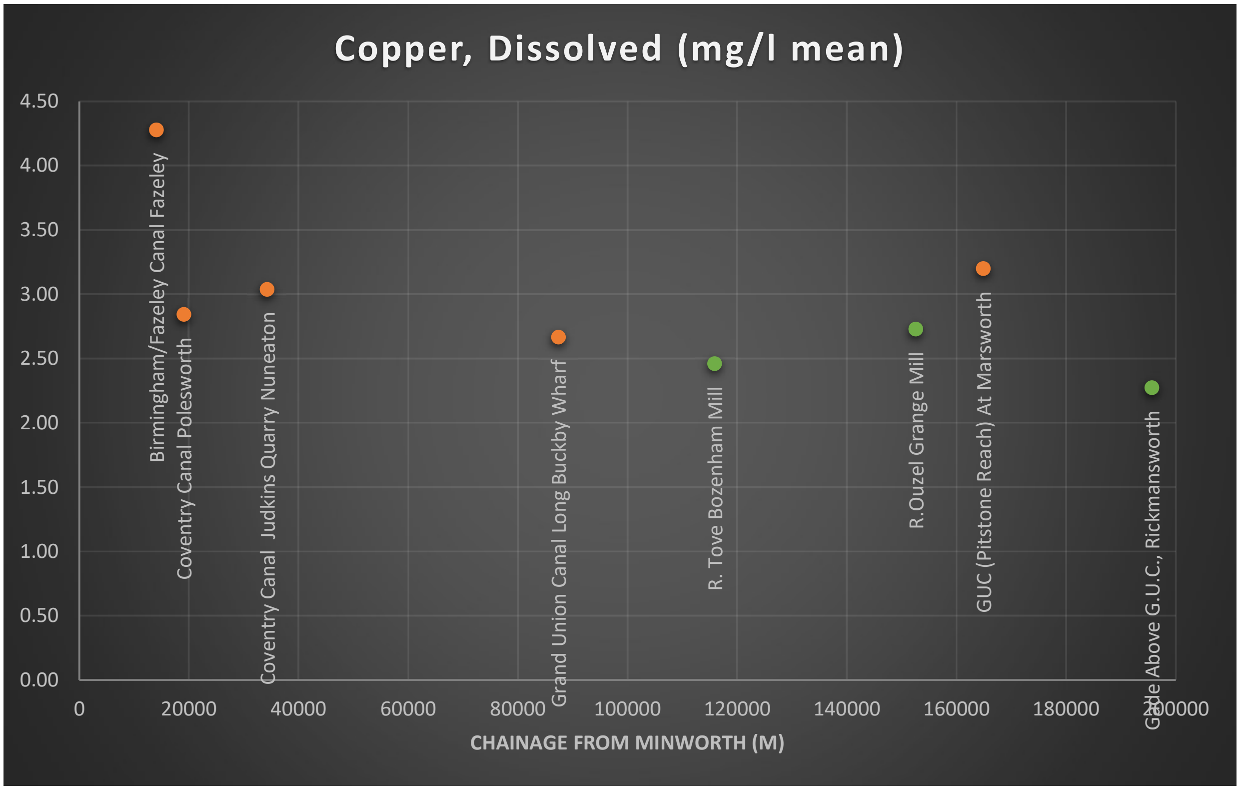


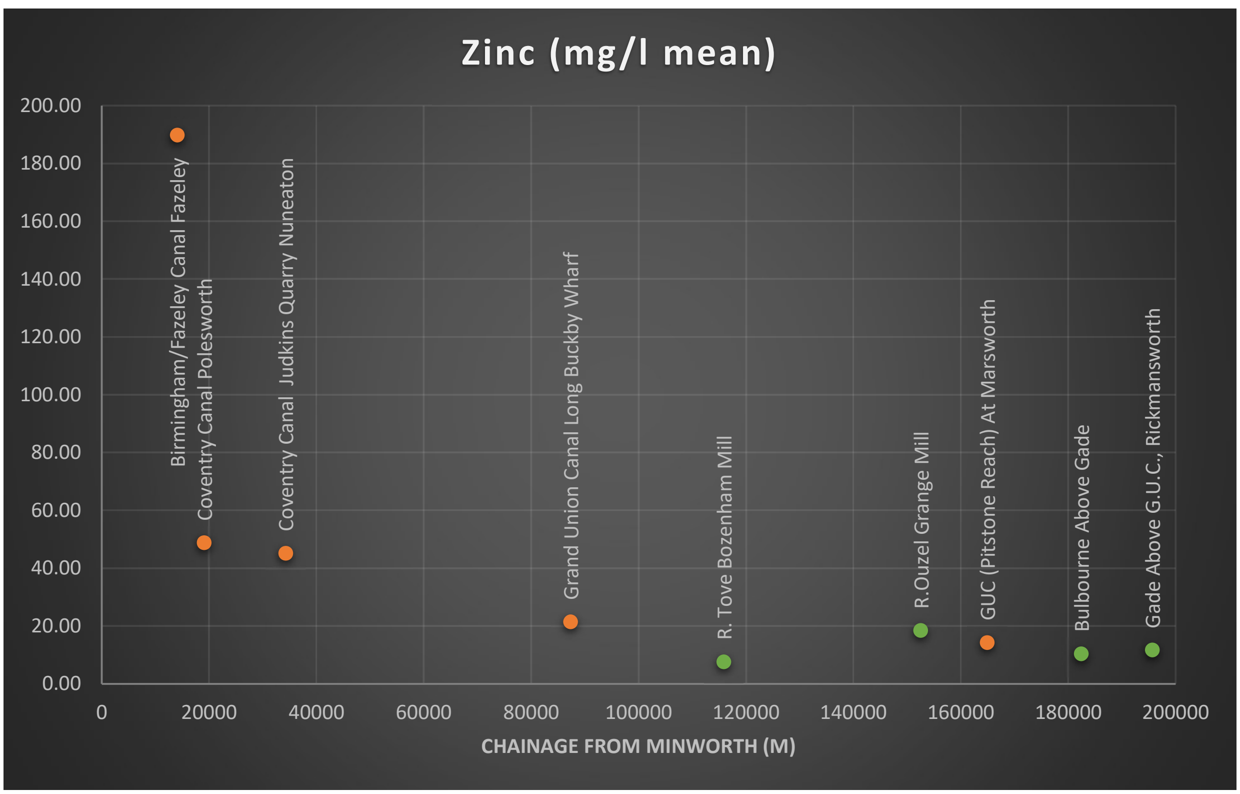
● Samples from canal ● Samples from watercourses

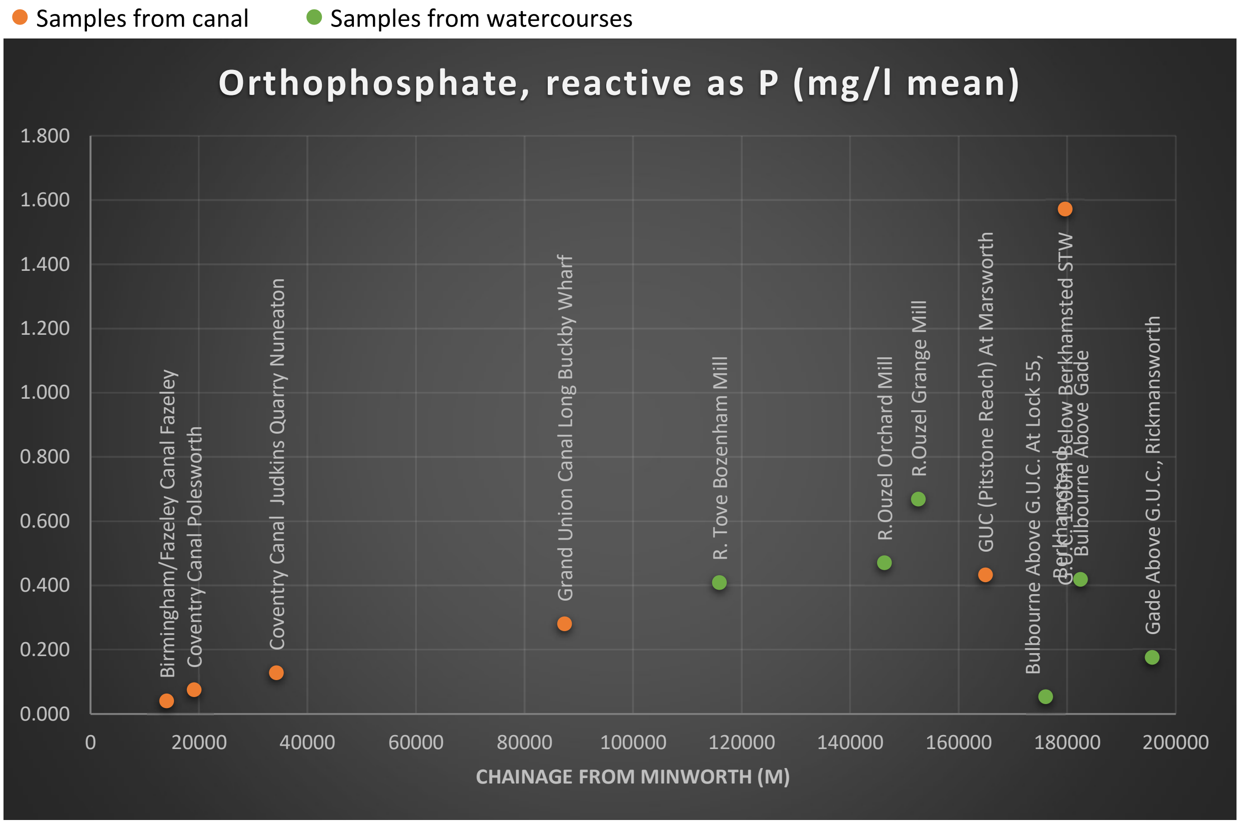


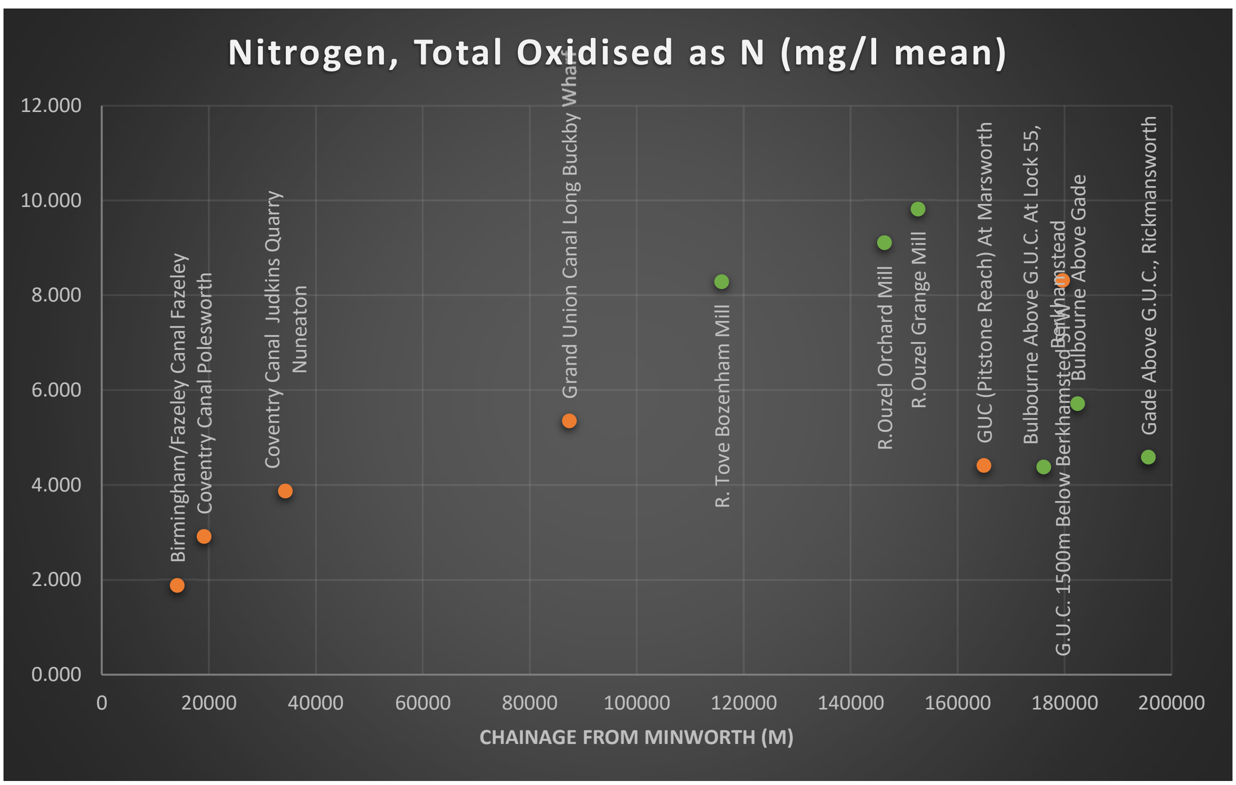


● Samples from canal ● Samples from watercourses

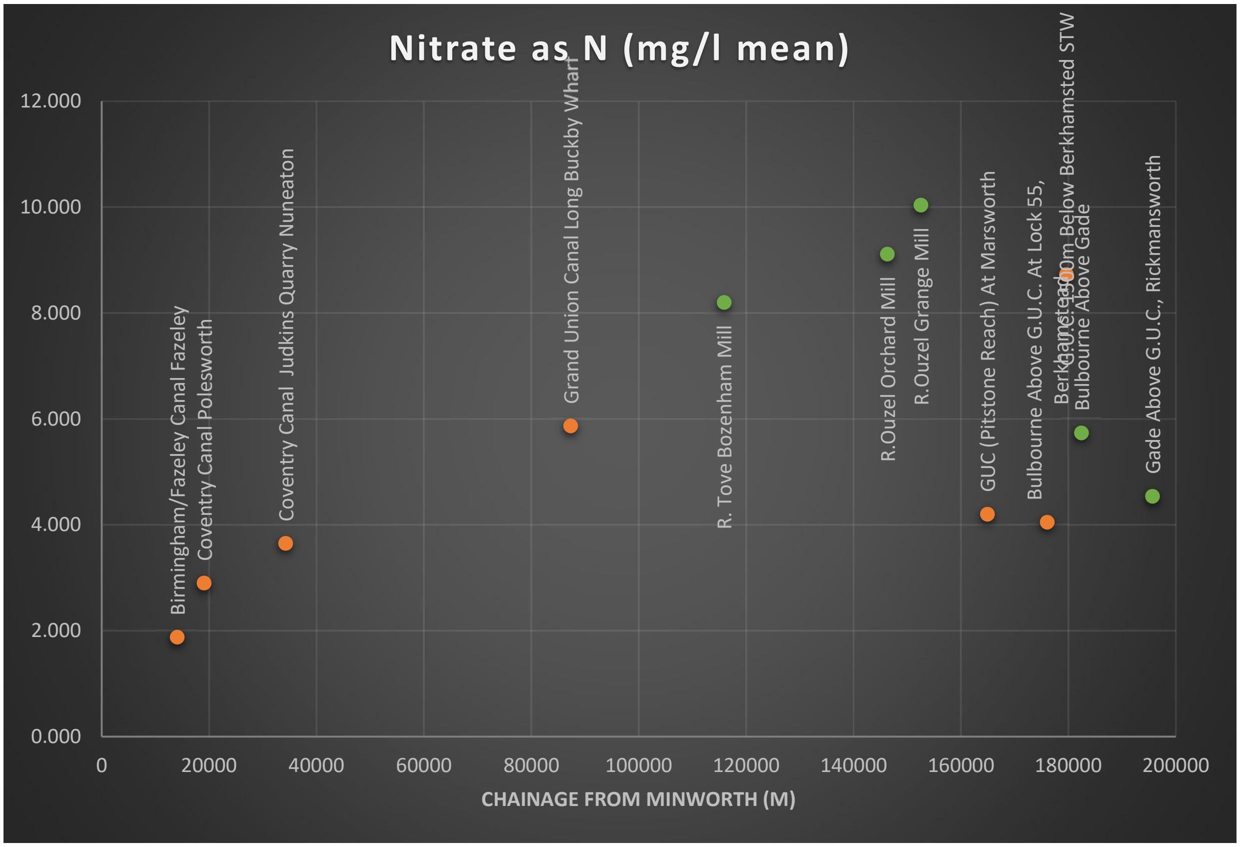


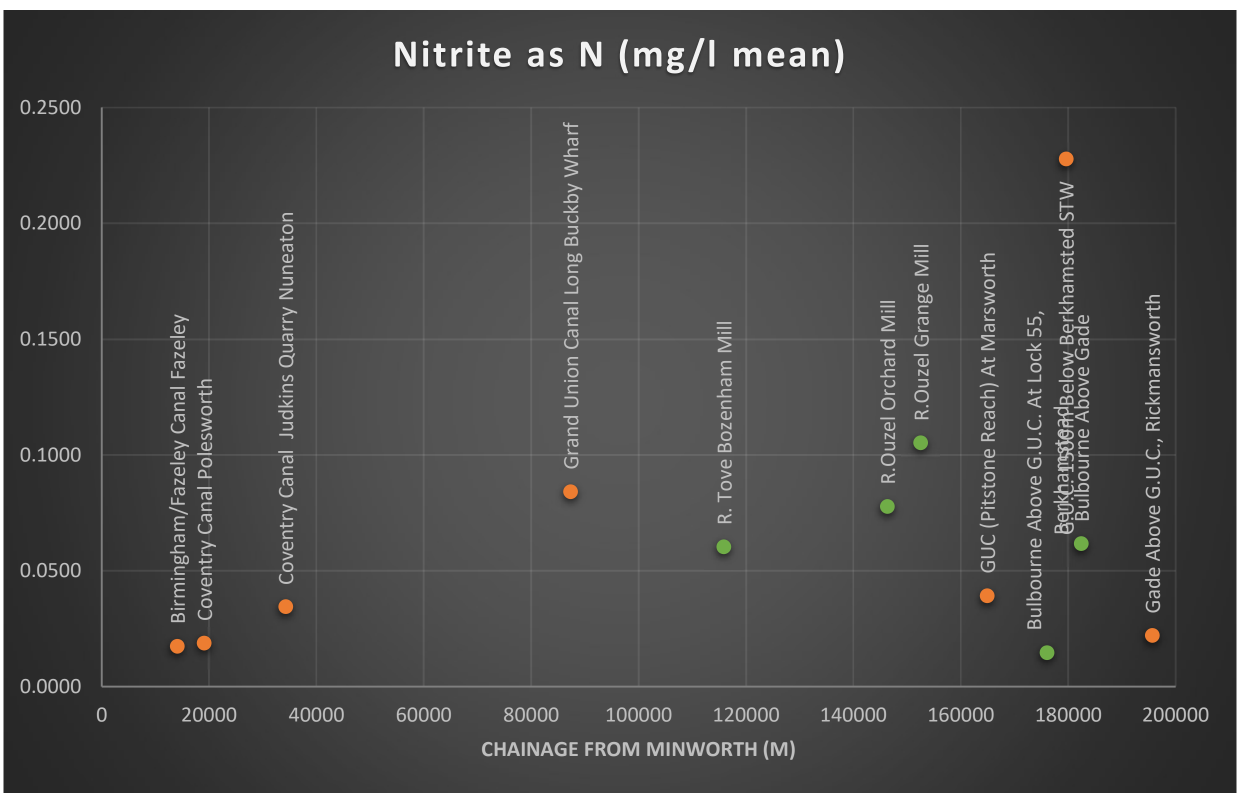



Samples from canal
Samples from watercourses
Orthophosphate, reactive as P (mg/l mean)
1.800
1.600
1.400
1.200
1.000
0.800
0.600
0.400
0.200
0.000
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
200000
CHAINAGE FROM MINWORTH (M)
Birmingham/Fazeley Canal Fazeley
Coventry Canal Polesworth
Coventry Canal Judkins Quarry Nuneaton
Grand Union Canal Long Buckby Wharf
R. Tove Bozenham Mill
R.Ouzel Orchard Mill
R.Ouzel Grange Mill
GUC (Pitstone Reach) At Marsworth
Bulbourne Above G.U.C. At Lock 55, Berkhamstead
G.U.C. 1500m Below Berkhamsted STW
Bulbourne Above Gade
Gade Above G.U.C., Rickmansworth


Nitrogen, Total Oxidised as N (mg/l mean)
12.000
10.000
8.000
6.000
4.000
2.000
0.000
0
20000
40000
60000
80000
100000
120000
140000
160000
180000
200000
CHAINAGE FROM MINWORTH (M)
Birmingham/Fazeley Canal Fazeley
Coventry Canal Polesworth
Coventry Canal Judkins Quarry Nuneaton
Grand Union Canal Long Buckby Wharf
R. Tove Bozenham Mill
R.Ouzel Orchard Mill
R.Ouzel Grange Mill
GUC (Pitstone Reach) At Marsworth
Bulbourne Above G.U.C. At Lock 55, Berkhamstead
G.U.C. 1500m Below Berkhamsted STW
Bulbourne Above Gade
Gade Above G.U.C., Rickmansworth

● Samples from canal ● Samples from watercourses





Sampling site								WFD Status					General Characteristics		Sanitary Determinands				Metals and Halogens				Nutrients and Nitrogen Compounds			
Sample Site ID	Sample Site Name	X	Y	Earliest Sample Year	Final Sample Year	Chainage from Minworth (m)	Notes	Waterbody ID	Waterbod Name	Overall Class	Ecological Class	Chemical Class	Alkalinity to pH 4.5 as CaCO3 (mg/l mean)	pH (mean)	Ammonia un-ionised as N (mg/l 95th Percentile)	Ammoniacal Nitrogen as N (mg/l 90th Percentile)	BOD : 5 Day ATU (mg/l 90th Percentile)	Oxygen, Dissolved as O2 (% Saturation, 10th Percentile)	Cadmium (mg/l mean)	Chloride (mg/l mean)	Copper, Dissolved (mg/l mean)	Zinc (mg/l mean)	Orthophosphate, reactive as P (mg/l mean)	Nitrogen, Total Oxidised as N (mg/l mean)	Nitrate as N (mg/l mean)	Nitrite as N (mg/l mean)
MD-80226020	Birmingham/Fazeley Canal Fazeley	420335	301975	2000	2013	14088	No sampling since 2013	GB70410212	Coventry and Ashby Canals	Good	Good	Fail	135.813	7.814	0.0021	0.106	4.13	58.40	0.156	53.58	4.28	189.89	0.040	1.885	1.877	0.0175
MD-79851780	Coventry Canal Polesworth	425860	302304	2000	2013	19088	No sampling since 2013	GB70410212	Coventry and Ashby Canals	Good	Good	Fail	142.167	7.743	0.0022	0.108	2.49	59.00	0.158	52.54	2.84	48.84	0.075	2.917	2.902	0.0189
MD-79848780	Coventry Canal Judkins Quarry Nuneaton	435300	292500	2000	2020	34276	Limited sampling (mainly metals) since 2010	GB70410212	Coventry and Ashby Canals	Good	Good	Fail	157.729	7.768	0.0027	0.214	2.84	50.00		48.69	3.04	45.19	0.128	3.874	3.652	0.0345
AN-GUCM250L	Grand Union Canal Long Buckby Wharf	461238	265431			87373		GB70510251	Grand Union Canal, Milton Keynes to Braunston summit	Moderate	Moderate	Fail	168.167	7.910	0.0055	0.555	6.10	67.90	0.106	69.13	2.67	21.44	0.280	5.355	5.868	0.0842
AN-04M06	R. Tove Bozenham Mill	476642	248243	2000	2020	115908		GB105033038180	Tove (DS Greens Norton)	Moderate	Moderate	Fail	230.824	8.117	0.0047	0.138	2.58	77.50	0.102	45.45	2.46	7.50	0.409	8.285	8.199	0.0603
AN-08M04	R.Ouzel Orchard Mill	488502	230900	2000	2020	146346		GB105033037971	Ouzel US Caldecote Mill	Moderate	Moderate	Fail	207.919	7.991	0.0040	0.227	3.40	74.80		61.51			0.470	9.107	9.109	0.0777
AN-08M02	R.Ouzel Grange Mill	491100	227200	2000	2020	152586		GB105033037971	Ouzel US Caldecote Mill	Moderate	Moderate	Fail	215.098	7.908	0.0084	0.445	3.50	62.11	0.104	64.09	2.73	18.40	0.668	9.819	10.036	0.1052
TH-PTAR0135	GUC (Pitstone Reach) At Marsworth	491990	214180	2000	2020	164925		GB70510191	Grand Union Canal, Tring summit to Milton Keynes	Moderate	Moderate	Fail	204.798	8.178	0.0042	0.160	5.35	88.82		41.32	3.20	14.28	0.433	4.412	4.201	0.0393
TH-PCNR0191	Bulbourne Above G.U.C. At Lock 55, Berkhamstead	499670	207784	2000	2018	176079		GB106039029890	Bulbourne	Poor	Poor	Fail	239.925	7.731	0.0010	0.066	1.78	72.14		23.08			0.053	4.380	4.049	0.0146
TH-PCNR0047	G.U.C. 1500m Below Berkhamsted STW	502647	206349	2000	2020	179604		GB70610185	Grand Union Canal, Berkhamstead to Maple Lodge (RIvers Bulbourne, Gade and Colne)	Moderate	Moderate	Fail	239.917	7.899	0.0515	1.819	6.17	66.02	0.100	42.43			1.572	8.318	8.730	0.2279
TH-PCNR0004	Bulbourne Above Gade	505440	205846	2000	2021	182443		GB106039029890	Bulbourne	Poor	Poor	Fail	244.522	7.743	0.0040	0.265	2.89	84.22	0.100	29.66		10.37	0.419	5.715	5.734	0.0616
TH-PCNR0055	Gade Above G.U.C., Rickmansworth	507300	194300	2000	2021	195683		GB106039029860	Gade (from confluence with Bulbourne to Chess)	Moderate	Moderate	Fail	249.238	8.017	0.0017	0.062	3.67	90.09	0.100	28.85	2.27	11.71	0.176	4.583	4.541	0.0221

B Appendix: Analysis of GUC Water Quality Samples

Risk	Criteria
Not WFD	Not assessed for potential deterioration as not a WFD determinand
Very Low	Concentrations at Minworth are lower than at all canal sampling points
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge sufficient to prevent deterioration if overflows to rivers aren't increased.
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.

			Mean concentration at sampling point										90th percentile concentration at sampling point										
Determinand	WFD?	EQSD?	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	Overall risk of D/S WFD deterioration
1,1,1-trichloro-2-(2-chlorophenyl)-2-(4-chlorophen			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
1,1,1-trichloroethane	Y	Y	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	Very Low
1,1,2-trichloroethane	Y	Y	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	Very Low
1,1-dichloro-2,2-bis(4-chlorophenyl)ethane			0.005						0.005	0.005	0.005	Not WFD	0.005						0.005	0.005	0.005	Not WFD	Not WFD
1,2-dibromoethane			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
1,2-dichloroethane			1						0.5	0.5	0.5	Not WFD	1						0.5	0.5	0.5	Not WFD	Not WFD
1,4-dioxane			1.0625						0.5	0.5	0.5	Not WFD	5						0.5	0.5	0.5	Not WFD	Not WFD
17A-ethinyloestradiol			0.0001363						0.000015	0.0001613	0.000015	Not WFD	0.00027						0.000015	0.00026	0.000015	Not WFD	Not WFD
17B-oestradiol			0.0013125						0.00015	0.0013	0.0001813	Not WFD	0.0029						0.00015	0.0019	0.0004	Not WFD	Not WFD
2,3,6-trichlorobenzoic acid (2,3,6-TBA)			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
2,4,5-trichlorophenol			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
2,4,5-trichlorophenoxyacetic acid (2,4,5-T)			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
2,4,6-trichlorophenol			0.01875						0.01	0.01	0.01	Not WFD	0.06						0.01	0.01	0.01	Not WFD	Not WFD
2,4-dichlorophenol		Y	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
2,4-dichlorophenoxyacetic acid (2,4-D)		Y	0.01	0.01	0.02125	0.01			0.01	0.0175	0.0125	Not WFD	0.01	0.01	0.07	0.01			0.01	0.07	0.03	Not WFD	Not WFD
2,4-dimethylphenol (2,4-xylenol)			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
2,5-dimethylphenol (2,5-xylenol)			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
22C plate count, neat			300						240.125	262.5	300	Not WFD	300						300	300	300	Not WFD	Not WFD
2-chlorophenol		Y	0.01	0.01	0.01	0.01			0.01125	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.02	0.01	0.01	Not WFD	Not WFD
2-EDD			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
2-EMD			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
2-methylisoborneol			25.25						10.2	7.2875	7.95	Not WFD	46.7						49	23.2	37.1	Not WFD	Not WFD
2-methylphenol (o-cresol)			0.015						0.01	0.01	0.01	Not WFD	0.05						0.01	0.01	0.01	Not WFD	Not WFD
3,4-dichloroaniline		Y	0.5	0.5	0.5	0.5						Not WFD	0.5	0.5	0.5	0.5						Not WFD	Not WFD
3,5-dimethylphenol (3,5-xylenol)			0.01						0.01	0.01375	0.01	Not WFD	0.01						0.01	0.04	0.01	Not WFD	Not WFD
37C plate count, neat			300						173.125	300	165.25	Not WFD	300						300	300	300	Not WFD	Not WFD
3-methylphenol (m-cresol)			0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
4-(2,4-dichlorophenoxy)butanoic acid (2,4-DB)			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
4-chloro-3-methyl phenol		Y	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
4-chlorophenol			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
4-methylphenol (p-cresol)			0.01625	0.01125	0.015	0.01125			0.01125	0.0125	0.0125	Not WFD	0.05	0.02	0.05	0.02			0.02	0.03	0.03	Not WFD	Not WFD
4-n-nonylphenol	Y			0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	Low		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	Low	Low
abamectin		Y	2.5	2.5	2.5	2.5						Not WFD	2.5	2.5	2.5	2.5						Not WFD	Not WFD
acid neutralisation capacity (ANC, unfiltered)	Y		1877.7778	3087.5	2612.5	2975	2800	3450	4125	3967.5	4812.5	Very Low	2300	3500	3500	3500	3200	3900	4900	4900	5300	Very Low	Very Low
aclonifen			0.05									Not WFD	0.05									Not WFD	Not WFD
acrylamide			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
alachor			0.01									Not WFD	0.01									Not WFD	Not WFD
aldrin			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
Algae cell count			118.75						8371.25	2456.25	2306.25	Not WFD	520						20500	5520	8010	Not WFD	Not WFD
Algal speciation			0						0	0	0	Not WFD	0						0	0	0	Not WFD	Not WFD
alkalinity as CaCO3	Y		92.222222	152.5	131.25	148.75	138.75	171.25	206.25	223.75	240	Very Low	110	170	180	170	160	190	250	250	260	Very Low	Very Low
alkalinity as HCO3			112.3875						251.75	273.125	292.625	Not WFD	134						305	305	317	Not WFD	Not WFD
alpha activity, total			37.50875						0.01	0.01	0.01375	Not WFD	300						0.01	0.01	0.03	Not WFD	Not WFD
alpha-HCH			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
aluminium dissolved	Y		9.8888889	7.625	55	108.75	45.25	21.125	14.125	9.125	8.125	High	20	26	280	350	180	67	67	21	21	Very Low	High
aluminium reactive	Y			6	11.375	6.25	4.375	5.625	6.75	4.25	4.375	High		25	41	23	19	27	36	20	16	High	High
aluminium total	Y		34.444444	128.5	319.125	535	262.5	130.375	57	51.625	60.625	Very Low	93	190	640	990	550	220	93	150	130	Very Low	Very Low
ametryne			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
ammonia	Y		0.0576471	0.039	0.0185	0.0185	0.0480625	0.0185	0.0185	0.0185	0.0206875	High	0.1	0.2	0.02	0.02	0.28	0.02	0.02	0.02	0.04	High	High
ammoniacal nitrogen	Y		0.2498333	0.0790625	0.087875	0.0961875	0.1174375	0.2434375	0.1534375	0.450875	0.051	High	1.1	0.27	0.35	0.3	0.5	0.72	0.4	1.4	0.16	High	High
ammonium as NH4			0.1633333						0.09375	0.281875	0.041875	Not WFD	0.7						0.25	0.895	0.18	Not WFD	Not WFD
anthracene			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
antimony dissolved	Y		0.9877778	2.1125	0.48	0.8625	0.66625	0.29	0.4225	0.229375	0.255	High	1.2	3.3	0.76	1.1	2.1	0.37	1.2	0.32	0.39	High	High
antimony total	Y		1.0011111	2.125	0.49	0.865	0.6725	0.4275	0.4775	0.2775	0.30125	High	1.3	3.3	0.76	1.1	2.1	0.87	1.2	0.38	0.58	High	High
arsenic dissolved	Y	Y	0.8422222	1.95	0.95875	2.15	1.39125	1.36375	0.53	0.8375	0.94	High	1.6	2.7	1.2	2.8	2.2	2.2	0.94	1.3	1.2	High	High
arsenic total	Y		0.8855556	2.485	1.16375	2.5	1.60875	1.67	0.6875	0.9875	1.08	High	1.71	3.62	1.52	3.4	2.3	2.5	1.14	1.38	1.31	High	High
ATMP			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
atrazine			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
azinphos methyl, dissolved		Y	0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
azoxystrobin			0.031875						0.025	0.025	0.025	Not WFD	0.08						0.025	0.025	0.025	Not WFD	Not WFD

Risk	Criteria
Not WFD	Not assessed for potential deterioration as not a WFD determinand
Very Low	Concentrations at Minworth are lower than at all canal sampling points
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge sufficient to prevent deterioration if overflows to rivers aren't increased.
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.

			Mean concentration at sampling point										90th percentile concentration at sampling point										
Determinand	WFD?	EQSD?	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	Overall risk of D/S WFD deterioration
barium dissolved			9.9777778						22.7625	17.375	35.125	Not WFD	14						29	21	44	Not WFD	Not WFD
barium total			11.377778						26.125	20.375	36.25	Not WFD	15						30	27	44	Not WFD	Not WFD
BDE-100	Y		0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	Very Low
BDE-153	Y		0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	Very Low
BDE-154	Y		0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	Very Low
BDE-183			0.00025									Not WFD	0.00025									Not WFD	Not WFD
BDE-28	Y		0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	Very Low
BDE-47	Y		0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	0.00025	0.0005	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	Very Low
BDE-99	Y		0.00025	0.0008	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	0.00025	0.0038	0.0005	0.0005	0.00025	0.0005	0.00025	0.00025	0.00025	Very Low	Very Low
benazolin			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
bentazone		Y	0.01	0.01	0.08	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.32	0.01			0.01	0.01	0.01	Not WFD	Not WFD
benzene			0.05	0.05	0.05	0.05			0.05	0.05	0.05	Not WFD	0.05	0.05	0.05	0.05			0.05	0.05	0.05	Not WFD	Not WFD
benzo(a)pyrene	Y		0.0012175	0.0179675	0.0168163	0.038375	0.005235	0.0088175	0.0175038	0.03885	0.0274313	Very Low	0.0026	0.0513	0.042	0.0831	0.00741	0.0165	0.0365	0.0693	0.078	Very Low	Very Low
benzo(b)fluoranthene			0.0010375						0.013375	0.030025	0.0206	Not WFD	0.0019						0.0263	0.0665	0.0518	Not WFD	Not WFD
benzo(g,h,i)perylene			0.001575						0.0123875	0.0301375	0.0209625	Not WFD	0.0027						0.0216	0.0533	0.054	Not WFD	Not WFD
benzo(k)fluoranthene			0.0005625						0.008975	0.0214875	0.0145	Not WFD	0.0011						0.0213	0.0435	0.0433	Not WFD	Not WFD
benzotriazole (1H-1,2,3-)			1.72125						0.07375	1.3175	0.21	Not WFD	2.4						0.17	2.28	0.28	Not WFD	Not WFD
benzyl butyl phthalate		Y	0.1	0.1	0.1	0.1						Not WFD	0.1	0.1	0.1	0.1						Not WFD	Not WFD
beryllium dissolved			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
beryllium total			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
beta activity, total			1.07						0.14	0.2325	0.14	Not WFD	5						0.14	0.88	0.14	Not WFD	Not WFD
beta-HCH			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
bifenox			0.006									Not WFD	0.006									Not WFD	Not WFD
biphenyl		Y	0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
bisphenol A			35.8375						5	8.2375	16.05	Not WFD	137						5	16.8	88.4	Not WFD	Not WFD
BOD (5 day)	Y		3.1222222	5.3625	5.15	7.025	3.7	4.8875	6.1375	8.475	4.9875	Very Low	8.1	9.4	11	12	9.6	25	25	26	25	Very Low	Very Low
boron dissolved			184.44444	548.75	265	117			27	30.5	25.875	Not WFD	230	700	350	180			36	38	32	Not WFD	Not WFD
boron total		Y	196.66667	562.5	273.75	122.625			32.25	34.625	29.125	Not WFD	240	710	380	190			42	41	37	Not WFD	Not WFD
boscalid			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
bromate			1.75						1	1	1	Not WFD	7						1	1	1	Not WFD	Not WFD
bromide			0.3088889	0.63875	0.21125	0.15875			0.13	0.12875	0.15875	Not WFD	0.54	3.8	0.4	0.33			0.36	0.29	0.34	Not WFD	Not WFD
bromine - total residual oxidant		Y	0.113125	0.17	1.864375	0.37						Not WFD	0.27	0.4	11.5	1.11						Not WFD	Not WFD
bromoacetic acid			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
bromochloroacetic acid			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
bromodichloromethane			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
bromoform			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
bromoxynil		Y	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
BTEX (benzene, toluene, ethylbenzene & o,p-xylene			0.5	1.0588235	1.0470588	1.0705882			0.5	0.5	0.5	Not WFD	0.5	2	2	2			0.5	0.5	0.5	Not WFD	Not WFD
C. perfringens veg & spores, confirmed			93.75						62.375	100	88.125	Not WFD	100						100	100	100	Not WFD	Not WFD
C10-13 chloroalkanes (total)			0.2									Not WFD	0.2									Not WFD	Not WFD
cadmium dissolved	Y		0.01	0.01125	0.055625	0.01	0.01	0.01	0.01	0.01	0.01	Very Low	0.01	0.02	0.18	0.01	0.01	0.01	0.01	0.01	0.01	Very Low	Very Low
cadmium total	Y		0.0144444	0.10375	0.185	0.03375	0.01125	0.025	0.01	0.01875	0.01625	High	0.05	0.2	0.43	0.06	0.02	0.13	0.01	0.05	0.04	High	High
calcium dissolved			54.222222						93.8	105.75	105.25	Not WFD	61						130	130	140	Not WFD	Not WFD
calcium total	Y		55.111111	69.875	124.875	46.75	75.625	96.625	106.125	112.625	112.875	High	61	81	170	54	85	110	120	130	130	High	High
CAPB as lauroylamide propylbetaine			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
carbendazim		Y	0.05	0.05	0.05	0.05			0.05	0.05	0.05	Not WFD	0.05	0.05	0.05	0.05			0.05	0.05	0.05	Not WFD	Not WFD
carbetamide			0.005						0.005	0.005	0.005	Not WFD	0.005						0.005	0.005	0.005	Not WFD	Not WFD
carbon tetrachloride			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
carbophenothion			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
chemical oxygen demand (COD)	Y		28.555556	41.625	47	27.625	18.125	98.375	67.875	17	11.875	High	40	150	240	42	24	640	420	32	24	High	High
chlorate			0.4875						0.36875	0.53125	1.075	Not WFD	1						0.5	1	6	Not WFD	Not WFD
chlordane			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
chlorfenvinphos			0.01									Not WFD	0.01									Not WFD	Not WFD
chloride		Y	72.555556	58.625	55.375	43.625			30.25	45.5	28.875	Not WFD	110	72	72	52			39	61	32	Not WFD	Not WFD
chlorine free			0.1444444	0.05625	0.11875	0.09375						Not WFD	0.5	0.1	0.4	0.3						Not WFD	Not WFD
chlorine total		Y	0.1444444	0.06875	0.11875	0.10625						Not WFD	0.5	0.1	0.4	0.3						Not WFD	Not WFD
chlorite			1.5						1.875	1.6875	1.875	Not WFD	1.5						3	3	3	Not WFD	Not WFD
chloroacetic acid			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
chloroform	Y		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	Very Low
chloronitrotoluenes		Y	0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
chlorophyll	Y		11.375	57.625	25.625	67.625	21.125	28	109.875	12.625	25.5	Very Low	21	84	56	236	47	55	487	31	66	Very Low	Very Low

Risk	Criteria
Not WFD	Not assessed for potential deterioration as not a WFD determinand
Very Low	Concentrations at Minworth are lower than at all canal sampling points
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge sufficient to prevent deterioration if overflows to rivers aren't increased.
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.

Determinand	WFD?	EQSD?	Mean concentration at sampling point										90th percentile concentration at sampling point										Overall risk of D/S WFD deterioration
			1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	
chlorothalonil		Y	0.0371875	0.0175	0.0175	0.0175						Not WFD	0.175	0.0175	0.0175	0.0175						Not WFD	Not WFD
chlorotoluron		Y	0.025	0.025	0.025	0.025			0.025	0.025	0.025	Not WFD	0.025	0.025	0.025	0.025			0.025	0.025	0.025	Not WFD	Not WFD
chlorpropham		Y	0.05	0.05	0.05	0.05						Not WFD	0.05	0.05	0.05	0.05						Not WFD	Not WFD
chlorpyrifos (chlorpyrifos-ethyl)			0.01									Not WFD	0.01									Not WFD	Not WFD
chromium (III) dissolved		Y	1.4333333									Not WFD	2									Not WFD	Not WFD
chromium (VI) dissolved		Y	3.5	3.5	3.5	3.9375			3.5	3.5	3.5	Not WFD	3.5	3.5	3.5	7			3.5	3.5	3.5	Not WFD	Not WFD
chromium dissolved	Y		1.7777778	0.72	0.500625	0.190625	0.351875	0.38	0.538125	0.706875	0.48375	High	4.3	1.9	1.2	0.65	1.4	0.98	1.7	1.8	1.2	High	High
chromium total	Y		18.211111	6.15625	3.464375	0.973125	0.723125	1.456875	1.258125	0.91	0.96625	High	140	25	20	1.8	1.5	3.4	5.1	1.8	2.4	High	High
clopyralid			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
cobalt dissolved		Y	1.9	0.2675	10.2125	0.16125			0.10625	0.13625	0.08	Not WFD	2.8	0.42	21	0.36			0.2	0.25	0.08	Not WFD	Not WFD
cobalt total			2.2444444	0.6425	13.625	0.42625			1.01375	0.25125	0.155	Not WFD	3.1	0.86	24	0.7			6.9	0.43	0.31	Not WFD	Not WFD
Coliform total			2420						1572.125	2420	2181.25	Not WFD	2420						2420	2420	2420	Not WFD	Not WFD
colour			27.888889						6.625	9.125	5.5625	Not WFD	39						14	17	17	Not WFD	Not WFD
conductivity @ 20øC	Y		757.33333	693.5	1202.25	578.125	598.375	628	581.125	688.125	607.75	High	822	743	1570	702	650	688	594	757	628	High	High
copper dissolved	Y	Y	0.7777778	4.725	1.8375	2.4625	0.6875	0.975	0.65	3.9125	1.3	High	1.4	6.6	3.4	4.5	1.3	1.4	1	5.7	2.1	High	High
copper total	Y		2	29.75	3.5875	5.625	1.175	2.4875	3.3625	7.425	2.925	High	3.5	50	6.4	8.5	1.8	5.2	9.9	9.4	7.2	High	High
coumaphos		Y	0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
Cryptosporidium			0						0	0	0	Not WFD	0						0	0	0	Not WFD	Not WFD
cyanazine			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
cyanide total		Y	20	20	20	20			20	20	20	Not WFD	20	20	20	20			20	20	20	Not WFD	Not WFD
cyanide, free (easily liberable)			10	10	10	10			10	10	10	Not WFD	10	10	10	10			10	10	10	Not WFD	Not WFD
cybutryne (Irgarol)			0.00125									Not WFD	0.00125									Not WFD	Not WFD
cyfluthrin		Y	0.05	0.05	0.05	0.05						Not WFD	0.05	0.05	0.05	0.05						Not WFD	Not WFD
cypermethrin	Y	Y	0.0002413	0.00004	0.000045	0.0000475	4.625E-05	0.00004	0.00004	0.0001725	5.125E-05	Medium	0.00042	0.00004	0.00008	0.0001	0.00009	0.00004	0.00004	0.00062	0.00009	High	High
dalapon			0.0425						0.01	0.01	0.01	Not WFD	0.09						0.01	0.01	0.01	Not WFD	Not WFD
DDT total			0.0125									Not WFD	0.0125									Not WFD	Not WFD
delta-HCH			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
demeton		Y	0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
desethyl atrazine			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
DHC benzene			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC cumene			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC decane			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC ethyl benzene			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC heptane			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC naphthalene			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC octane			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC phenanthrene			0.05						0.05	0.05	0.05625	Not WFD	0.05						0.05	0.05	0.1	Not WFD	Not WFD
DHC tetradecane			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
DHC toluene			0.05						0.05	0.05625	0.05	Not WFD	0.05						0.05	0.1	0.05	Not WFD	Not WFD
di(2-ethylhexyl)phthalate (DEHP)	Y		0.144375	0.075	0.075	0.075	0.075	0.075	0.075	0.086875	0.108125	Low	0.33	0.075	0.075	0.075	0.075	0.075	0.075	0.17	0.34	Low	Low
diazinon		Y	0.005	0.005	0.005	0.005			0.005	0.005	0.005	Not WFD	0.005	0.005	0.005	0.005			0.005	0.005	0.005	Not WFD	Not WFD
dibromoacetic acid			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
dibromochloroacetic acid			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
dibromochloromethane			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
dibutyl phthalate		Y	0.02125	0.035	0.02375	0.045						Not WFD	0.1	0.11	0.1	0.29						Not WFD	Not WFD
dicamba			0.01						0.01	0.01375	0.01	Not WFD	0.01						0.01	0.04	0.01	Not WFD	Not WFD
dichlobenil			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
dichloprop			0.01						0.01	0.02875	0.01	Not WFD	0.01						0.01	0.16	0.01	Not WFD	Not WFD
dichloroacetic acid			0.575						0.5	0.5	0.5	Not WFD	1.1						0.5	0.5	0.5	Not WFD	Not WFD
dichlorobenzene, total isomers		Y	0.05	0.05	0.05	0.05						Not WFD	0.05	0.05	0.05	0.05						Not WFD	Not WFD
dichlorobromoacetic acid			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
dichloromethane			1.3125									Not WFD	2.5									Not WFD	Not WFD
dichlorvos		Y	0.0005	0.0005	0.0005	0.0005						Not WFD	0.0005	0.0005	0.0005	0.0005						Not WFD	Not WFD
dicofol			0.00065									Not WFD	0.00065									Not WFD	Not WFD
dieldrin			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
diethyl phthalate		Y	0.01375	0.0125	0.01375	0.01						Not WFD	0.04	0.03	0.03	0.01						Not WFD	Not WFD
diethylene glycol monobutyl ether (DEGBE)			5						5	5	5	Not WFD	5						5	5	5	Not WFD	Not WFD
diflubenzuron		Y	0.0005	0.0005	0.0005	0.0005						Not WFD	0.0005	0.0005	0.0005	0.0005						Not WFD	Not WFD
diflufenican			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
dimethoate		Y	0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
dimethyl phthalate		Y	0.01	0.015	0.01625	0.0225						Not WFD	0.01	0.05	0.04	0.09						Not WFD	Not WFD

Risk	Criteria
Not WFD	Not assessed for potential deterioration as not a WFD determinand
Very Low	Concentrations at Minworth are lower than at all canal sampling points
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge sufficient to prevent deterioration if overflows to rivers aren't increased.
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.

			Mean concentration at sampling point										90th percentile concentration at sampling point										
Determinand	WFD?	EQSD?	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	Overall risk of D/S WFD deterioration
dioctyl phthalate			0.01	0.01	0.01	0.01375						Not WFD	0.01	0.01	0.01	0.04						Not WFD	Not WFD
dissolved organic carbon	Y		7.9888889	3.4375	3.95	4.075	3.5625	3.9125	2.6875	2.3875	1	High	13	5.5	5.7	6.1	4.7	5.7	10	3.5	1	High	High
diuron			0.025						0.025	0.025	0.025	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
doramectin		Y	2.5	2.5	2.5	2.5						Not WFD	2.5	2.5	2.5	2.5						Not WFD	Not WFD
DTPMP			1.56625						0.60125	3.59625	0.72125	Not WFD	6.02						1.31	7.52	1.62	Not WFD	Not WFD
E. coli			2268.75						157.25	2333.75	548.625	Not WFD	2420						866	2420	2420	Not WFD	Not WFD
EDTA		Y	76.125	50	50	50						Not WFD	143	50	50	50						Not WFD	Not WFD
endosulfan			0.01									Not WFD	0.01									Not WFD	Not WFD
endosulfan A									0.01	0.01	0.01	Not WFD							0.01	0.01	0.01	Not WFD	Not WFD
endrin			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
Enterococci, confirmed			100						26	94.375	67.625	Not WFD	100						100	100	100	Not WFD	Not WFD
epichlorohydrin			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
ethofumesate			0.025						0.025	0.025	0.025	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
ethylbenzene			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
fenchlorphos		Y	0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
fenitrothion		Y	0.005	0.005	0.005	0.005						Not WFD	0.005	0.005	0.005	0.005						Not WFD	Not WFD
fenoprop (2,4,5-TP)			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
flucofuron		Y	0.025	0.025	0.025	0.025						Not WFD	0.025	0.025	0.025	0.025						Not WFD	Not WFD
flufenacet			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
fluoranthene	Y		0.0018313	0.01455	0.0148625	0.025775	0.0063125	0.010975	0.016325	0.0415625	0.0227875	Very Low	0.0026	0.0424	0.0277	0.0484	0.0091	0.0178	0.0298	0.1	0.0491	Very Low	Very Low
fluoride		Y	0.64375	0.2225	0.34125	0.235			0.10375	0.10375	0.1025	Not WFD	0.76	0.25	0.39	0.38			0.14	0.12	0.12	Not WFD	Not WFD
fluroxypyr			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
formaldehyde		Y	25	25	25	25						Not WFD	25	25	25	25						Not WFD	Not WFD
gamma-HCH			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
geosmin			7.4125						2.7625	8.1	6.4125	Not WFD	16.1						8	18.1	22.3	Not WFD	Not WFD
Giardia			6.8888889						0.125	0.125	0	Not WFD	19						1	1	0	Not WFD	Not WFD
glyphosate		Y	0.47125	0.13	0.05875	0.07375			0.1725	0.235	0.1375	Not WFD	0.62	0.2	0.12	0.16			0.63	0.32	0.3	Not WFD	Not WFD
hardness as CaCO3	Y		172.88889	245	538	202.625	213.875	238.9	244.2125	268.9375	274.1	Very Low	192	270	752	230	245	317	335	325	351	Very Low	Very Low
hardness, total as Ca			69.55						97.90875	107.7	109.8375	Not WFD	76.9						134	130	141	Not WFD	Not WFD
heptachlor and heptachlor epoxide			0.0005						0.0005	0.0005	0.0005	Not WFD	0.0005						0.0005	0.0005	0.0005	Not WFD	Not WFD
hexabromocyclododecane (alpha)				0.00007	0.0000325	0.00003	2.875E-05	0.0000575	0.00002	0.0007963	0.000115	Not WFD		0.00009	0.00008	0.0001	0.00006	0.0001	0.00002	0.00124	0.0003	Not WFD	Not WFD
hexabromocyclododecane (beta)				0.00002	0.00002	0.0000225	0.00002	0.00002	0.00002	0.00025	2.375E-05	Not WFD		0.00002	0.00002	0.00004	0.00002	0.00002	0.00002	0.00034	0.00005	Not WFD	Not WFD
hexabromocyclododecane (gamma)				0.000065	3.688E-05	3.375E-05	0.000025	0.000025	0.000025	0.0002081	4.438E-05	Not WFD		0.00013	0.00012	0.00006	0.000025	0.000025	0.000025	0.00038	0.00018	Not WFD	Not WFD
hexabromocyclododecane (HBCDD)	Y		0.0010938	0.0001513	8.625E-05	0.000085	0.00007	8.875E-05	0.00007	0.001255	0.000155	High	0.0025	0.00024	0.0002	0.00019	0.00007	0.00015	0.00007	0.00192	0.00053	High	High
hexachlorobenzene			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
hexachlorobutadiene			0.01									Not WFD	0.01									Not WFD	Not WFD
indeno(1,2,3-cd)pyrene			0.0011125						0.014325	0.035975	0.0234	Not WFD	0.0022						0.0259	0.066	0.0616	Not WFD	Not WFD
ioxynil		Y	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
iron dissolved	Y		57	27	65.68125	101.1375	98	56.5	24.1	93.5	19.0875	High	65	50	370	320	380	200	81	150	58	High	High
iron total	Y		171.11111	277.5	392.375	413.75	546.25	251.25	93.875	448.75	102.125	High	310	480	850	1000	940	430	210	700	220	High	High
isodrin			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
isoproturon			0.002875						0.001	0.001	0.001	Not WFD	0.01						0.001	0.001	0.001	Not WFD	Not WFD
ivermectin			2.5	2.5	2.5	2.5						Not WFD	2.5	2.5	2.5	2.5						Not WFD	Not WFD
lead dissolved	Y		0.1516667	0.78375	0.515625	0.926875	0.1875	0.1375	0.248125	0.208125	0.1975	High	0.37	1.4	2.8	2.7	0.67	0.22	0.66	0.38	0.4	High	High
lead total	Y		0.3322222	10.0125	2.61625	4.475	1.22375	1.46375	1.1275	1.7075	1.9975	Very Low	0.58	16	6.6	6.5	2.4	2.4	2.4	4.2	5	Very Low	Very Low
linear alkylbenzenesulfonate			0.05						0.05	0.05625	0.05	Not WFD	0.05						0.05	0.1	0.05	Not WFD	Not WFD
linuron			0.005	0.005	0.005	0.005			0.005	0.005	0.005	Not WFD	0.005	0.005	0.005	0.005			0.005	0.005	0.005	Not WFD	Not WFD
m- & p-xylene			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
magnesium dissolved			9.1666667						1.6925	2.1125	1.775	Not WFD	10						2.2	2.5	1.9	Not WFD	Not WFD
magnesium total			9.1555556						1.7875	2.0375	1.725	Not WFD	10						2.2	2.4	2.1	Not WFD	Not WFD
malachite green			0.5	0.5	0.5	0.5						Not WFD	0.5	0.5	0.5	0.5						Not WFD	Not WFD
malathion			0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
mancozeb			1.1	0.10625	0.08125	0.11875						Not WFD	3.2	0.3	0.2	0.6						Not WFD	Not WFD
maneb			0.10625	0.09375	0.09375	0.075						Not WFD	0.3	0.25	0.25	0.25						Not WFD	Not WFD
manganese dissolved			104.88889	32.475	7311.25	30.75			12.525	16	5.275	Not WFD	130	180	15000	70			35	21	7.9	Not WFD	Not WFD
manganese total			114.88889	82.875	7650	79.25			22.4875	18	11.3875	Not WFD	160	210	15000	120			37	25	19	Not WFD	Not WFD
MCPA			0.0125	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.03	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
MCPB			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
mecoprop			0.04625	0.01	0.0125	0.01			0.01	0.03	0.01	Not WFD	0.07	0.01	0.03	0.01			0.01	0.17	0.01	Not WFD	Not WFD
mercury dissolved	Y		0.005	0.0039375	0.0045625	0.003375	0.003875	0.007375	0.0079375	0.0075	0.004625	Medium	0.017	0.015	0.013	0.014	0.016	0.027	0.025	0.026	0.015	Medium	Medium
mercury total	Y		0.0101111	0.011125	0.00725	0.010625	0.005875	0.00875	0.016	0.012	0.01375	High	0.037	0.017	0.015	0.035	0.016	0.031	0.045	0.035	0.034	Medium	High

Risk	Criteria
Not WFD	Not assessed for potential deterioration as not a WFD determinand
Very Low	Concentrations at Minworth are lower than at all canal sampling points
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge sufficient to prevent deterioration if overflows to rivers aren't increased.
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.

			Mean concentration at sampling point										90th percentile concentration at sampling point										
Determinand	WFD?	EQSD?	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	Overall risk of D/S WFD deterioration
metaldehyde			0.01375						0.01	0.01	0.01	Not WFD	0.03						0.01	0.01	0.01	Not WFD	Not WFD
metamitron			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
metazachlor			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
methiocarb			0.05	0.05	0.05	0.05						Not WFD	0.05	0.05	0.05	0.05						Not WFD	Not WFD
methoxychlor			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
metribuzin			0.025						0.025	0.025	0.025	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
mevinphos			0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
microcystin - LR			2.5						2.5	2.5	2.5	Not WFD	2.5						2.5	2.5	2.5	Not WFD	Not WFD
molybdenum dissolved			2.1666667						0.55	0.7375	0.55	Not WFD	2.8						0.55	1.4	0.55	Not WFD	Not WFD
molybdenum total			2.4333333						0.73125	1.14375	0.55	Not WFD	3.4						2	3.8	0.55	Not WFD	Not WFD
monuron			0.025						0.025	0.025	0.025	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
MTBE			0.5625						0.5	0.5	0.5	Not WFD	1						0.5	0.5	0.5	Not WFD	Not WFD
naphthalene			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
nickel dissolved	Y		13.877778	13.875	30.975	2.5	2.15	1.65	0.7875	0.9125	0.4375	High	17	17	66	3	2.7	2.1	1.6	1.5	0.8	High	High
nickel total	Y		14.777778	18.625	35.3375	3.65	2.6	2.7	2.35625	1.2125	0.85	High	17	24	68	5.1	3.6	4.1	11	1.5	1.2	High	High
nitrate	Y		76.756471	3.7166875	5.2265	10.33	4.24575	15.1575	20.075	39.0825	23.9075	Medium	184	24	15	26	12	36	52	90	44	High	High
nitrilotriacetic acid (NTA)			50	50	50	50						Not WFD	50	50	50	50						Not WFD	Not WFD
nitrite	Y		1.8703059	0.4814375	0.504375	0.5255	1.0765	0.99325	0.71625	1.677625	0.717	Low	5	3.6	2.4	1.8	3	2.6	2	5.6	1.8	High	High
nitrite & nitrate calculation			14.0975						3.87125	7.59	4.575	Not WFD	21.6						5.92	10.2	5.24	Not WFD	Not WFD
N-nitrosodibutylamine (NDBA)			0.0068125						0.002375	0.006825	0.00235	Not WFD	0.033						0.0067	0.0181	0.0063	Not WFD	Not WFD
N-nitrosodiethylamine (NDEA)			0.00185						0.0007875	0.001625	0.0013375	Not WFD	0.0052						0.0018	0.0043	0.0039	Not WFD	Not WFD
N-nitrosodimethylamine (NDMA)			0.0091						0.0007375	0.000825	0.000725	Not WFD	0.047						0.0012	0.0015	0.0017	Not WFD	Not WFD
N-nitrosodi-n-propylamine (NDPA)			0.0016875						0.000775	0.001175	0.0009875	Not WFD	0.0036						0.0027	0.0043	0.0044	Not WFD	Not WFD
N-nitrosomethylethylamine (NMEA)			0.000625						0.0005	0.0005	0.0005	Not WFD	0.0015						0.0005	0.0005	0.0005	Not WFD	Not WFD
N-nitrosomorpholine (NMOR)			0.0082375						0.0005	0.000875	0.000875	Not WFD	0.0216						0.0005	0.0035	0.0035	Not WFD	Not WFD
N-nitrosopiperidine (NPIP)			0.0100875						0.0005	0.0089625	0.0042875	Not WFD	0.031						0.0005	0.057	0.027	Not WFD	Not WFD
N-nitrosopyrrolidine (NPYR)			0.003625						0.0005	0.0009875	0.0007625	Not WFD	0.0071						0.0005	0.0025	0.0018	Not WFD	Not WFD
nonylphenol diethoxylate	Y			0.02	0.02	0.02	0.02	0.02	0.02	0.0225	0.02	Low		0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	Low	Low
nonylphenol ethoxylates (sum)	Y			0.1125	0.1125	0.1125	0.1125	0.1125	0.1125	0.11375	0.1125	Low		0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.12	Low	Low
nonylphenol monoethoxylate	Y			0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	Low		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	Low	Low
nonylphenol triethoxylate	Y			0.02	0.02	0.02	0.02	0.02	0.02	0.0225	0.02	Low		0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.02	Low	Low
nonylphenols (4-nonylphenol technical mix)	Y		0.2675	0.0325	0.025	0.025	0.02	0.0225	0.03625	0.15125	0.02	High	0.37	0.1	0.06	0.06	0.02	0.04	0.15	0.21	0.02	High	High
number of Crypto-like bodies 4-6um			0						0	0	0	Not WFD	0						0	0	0	Not WFD	Not WFD
o,p'-DDD			0.005						0.005	0.005	0.005	Not WFD	0.005						0.005	0.005	0.005	Not WFD	Not WFD
octylphenol diethoxylate	Y			0.015	0.015	0.015	0.015	0.01625	0.01625	0.01625	0.01625	Low		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	Low	Low
octylphenol ethoxylates (sum)	Y			0.0775	0.0775	0.0775	0.0775	0.0825	0.0825	0.0825	0.0825	Low		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	Low	Low
octylphenol monoethoxylate	Y			0.015	0.015	0.015	0.015	0.01625	0.01625	0.01625	0.01625	Low		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	Low	Low
octylphenol triethoxylate	Y			0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	0.01125	Low		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	Low	Low
octylphenols ((4-(1,1',3,3'-tetramethylbutyl)pheno	Y		0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	Very Low	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	Very Low	Very Low
odour			0						0	0	0	Not WFD	0						0	0	0	Not WFD	Not WFD
oestrone			0.01125						0.0005	0.00725	0.0005	Not WFD	0.019						0.0005	0.009	0.0005	Not WFD	Not WFD
omethoate			0.005	0.005	0.005	0.005						Not WFD	0.005	0.005	0.005	0.005						Not WFD	Not WFD
oocyst count			0						0.125	0	0	Not WFD	0						1	0	0	Not WFD	Not WFD
organic nitrogen	Y		2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.1875	2.5	Very Low	2.5	2.5	2.5	2.5	2.5	2.5	2.5	8	2.5	Very Low	Very Low
ORP			170.55									Not WFD	218									Not WFD	Not WFD
orthophosphate as PO4			0.325	0.111875	0.12125	0.2425						Not WFD	0.92	0.37	0.4	0.52						Not WFD	Not WFD
oxadixyl			0.025						0.025	0.025	0.025	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
oxamyl			0.025						0.025	0.025	0.025	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
o-xylene			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
p,p'-DDE			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
PAHs (sum of BbF, BkF, BghiP & I123cdP)									0.0490625	0.117625	0.0794875	Not WFD							0.0951	0.227	0.211	Not WFD	Not WFD
parathion			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
particulate organic carbon (calculated from TOC an			9.95625						0.55	0.29375	0.29375	Not WFD	70.3						1.8	0.6	0.6	Not WFD	Not WFD
pendimethalin			0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
pentachlorobenzene			0.0035									Not WFD	0.0035									Not WFD	Not WFD
pentachlorophenol			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
perfluorobutane sulfonic acid (PFBS)			0.00775						0.0025	0.0025	0.0025	Not WFD	0.009						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorobutanoic acid (PFBA)			0.015125						0.0085625	0.008875	0.008125	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
perfluorodecane sulfonic acid (PFDS)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorodecanoic acid (PFDA)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorododecane sulfonic acid (PFDoDS)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD

Risk	Criteria
Not WFD	Not assessed for potential deterioration as not a WFD determinand
Very Low	Concentrations at Minworth are lower than at all canal sampling points
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge sufficient to prevent deterioration if overflows to rivers aren't increased.
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.

			Mean concentration at sampling point										90th percentile concentration at sampling point										
Determinand	WFD?	EQSD?	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	Overall risk of D/S WFD deterioration
perfluorododecanoic acid (PFDoDA)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluoroheptane sulfonic acid (PFHpS)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluoroheptanoic acid (PFHpA)			0.0030625						0.0025	0.0025	0.0025	Not WFD	0.007						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorohexane sulfonic acid (PFHxS)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorohexanoic acid (PFHxA)			0.014						0.0028125	0.0025	0.0025	Not WFD	0.022						0.005	0.0025	0.0025	Not WFD	Not WFD
perfluorononane sulfonic acid (PFNS)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorononanoic acid (PFNA)			0.0025						0.0025	0.0025	0.0022675	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorooctane sulfonic acid (PFOS)			0.019625	0.029375	0.0066063	0.00641	0.0231238	0.0019925	0.00163	0.0017125	0.0018275	Not WFD	0.034	0.0464	0.00961	0.0084	0.0361	0.0035	0.00325	0.00258	0.00355	Not WFD	Not WFD
perfluorooctanoic acid (PFOA)	Y		0.0064375	0.005105	0.0044	0.003085	0.0036388	0.0019325	0.0021056	0.0029613	0.00237	High	0.008	0.00829	0.00494	0.00448	0.00609	0.00501	0.00353	0.00394	0.00335	High	High
perfluoropentane sulfonic acid (PFPS)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluoropentanoic acid (PFPA)			0.0054375						0.0025	0.0025	0.0025	Not WFD	0.008						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorotridecane sulfonic acid (PFTrDS)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluorotridecanoic acid (PFTrDA)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
perfluoroundecane sulfonic acid (PFUnDS)			0.0025						0.0030625	0.0025	0.0025	Not WFD	0.0025						0.007	0.0025	0.0025	Not WFD	Not WFD
perfluoroundecanoic acid (PFUnDA)			0.0025						0.0025	0.0025	0.0025	Not WFD	0.0025						0.0025	0.0025	0.0025	Not WFD	Not WFD
permethrin			0.0030625	0.0006875	0.00075	0.0006875						Not WFD	0.009	0.002	0.002	0.002						Not WFD	Not WFD
pH	Y		7.0625	8.075	7.7125	8.375	7.9375	8.0125	7.8375	7.8625	8.1375	Very Low	7.5	8.3	8.2	9.2	8.2	8.4	8.1	8.1	8.3	Very Low	Very Low
phaeophytin	Y			10	10	10	10	10	10	10	10	Low		10	10	10	10	10	10	10	10	Low	Low
phenol			0.5	0.5	0.5	0.5			0.5	0.5	0.5	Not WFD	0.5	0.5	0.5	0.5			0.5	0.5	0.5	Not WFD	Not WFD
picloram			0.025						0.01	0.01	0.01	Not WFD	0.05						0.01	0.01	0.01	Not WFD	Not WFD
pirimicarb			0.5	0.5	0.5	0.5						Not WFD	0.5	0.5	0.5	0.5						Not WFD	Not WFD
pirimiphos-methyl			0.005	0.005	0.005	0.005						Not WFD	0.005	0.005	0.005	0.005						Not WFD	Not WFD
polychloro chloromethyl sulphonamido diphenyl ethe			0.1	0.1	0.1	0.1						Not WFD	0.1	0.1	0.1	0.1						Not WFD	Not WFD
polycyclic aromatic hydrocarbons (PAH) sum			0.025						0.08625	0.20875	0.13875	Not WFD	0.025						0.17	0.4	0.34	Not WFD	Not WFD
potassium dissolved			16.888889						2.43875	5.7875	2.5875	Not WFD	21						4	9.7	3.3	Not WFD	Not WFD
potassium total			17.111111						2.6425	5.7375	2.4375	Not WFD	22						4.2	9.4	2.9	Not WFD	Not WFD
prochloraz			0.05	0.05	0.05	0.05						Not WFD	0.05	0.05	0.05	0.05						Not WFD	Not WFD
prometryn			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
propazine			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
propetamphos			0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
propyzamide			0.005625	0.005	0.0125	0.005625			0.005	0.005	0.005	Not WFD	0.01	0.005	0.03	0.01			0.005	0.005	0.005	Not WFD	Not WFD
Pseudomonas, confirmed			100						100	100	100	Not WFD	100						100	100	100	Not WFD	Not WFD
quimerac			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
quinoxyfen			0.05									Not WFD	0.05									Not WFD	Not WFD
radon			5						5	5	5	Not WFD	5						5	5	5	Not WFD	Not WFD
salinity @ 20øC	Y		0.3777778	0.35	0.625	0.3	0.3	0.3	0.3	0.3375	0.3	High	0.4	0.4	0.8	0.4	0.3	0.3	0.3	0.4	0.3	High	High
selenium dissolved			0.4988889						0.21375	0.264375	0.330625	Not WFD	0.59						0.67	0.54	0.5	Not WFD	Not WFD
selenium total			0.5188889						0.350625	0.488125	0.44125	Not WFD	0.68						0.67	1.5	0.66	Not WFD	Not WFD
silica, reactive (SiO2)			6.4666667						2.675	6.09375	7.575	Not WFD	7.5						8.2	8.3	11	Not WFD	Not WFD
silver dissolved			0.5	0.5	0.5	0.5			0.5	0.5	0.5	Not WFD	0.5	0.5	0.5	0.5			0.5	0.5	0.5	Not WFD	Not WFD
silver total			0.5	0.5	0.5	0.5			0.5	0.5	0.5	Not WFD	0.5	0.5	0.5	0.5			0.5	0.5	0.5	Not WFD	Not WFD
simazine			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
sodium dissolved			57.222222						11.0125	23.5875	13.375	Not WFD	68						17	39	16	Not WFD	Not WFD
sodium total			58.777778						12.65	24.625	13.5	Not WFD	68						17	37	16	Not WFD	Not WFD
soluble reactive phosphorus	Y		0.11375	0.036875	0.040625	0.07875	0.14625	0.19875	0.04625	0.54625	0.11625	Low	0.3	0.12	0.13	0.17	0.36	0.36	0.16	0.96	0.22	Low	Low
Somatic Coliphages			2.375						0.25	2.625	0	Not WFD	9						2	11	0	Not WFD	Not WFD
specific ABS at 245 nm			0.0875						0.025	0.0625	0.025	Not WFD	0.1						0.1	0.1	0.1	Not WFD	Not WFD
strontium dissolved			20.177778						0.2	0.2	0.2	Not WFD	180						0.2	0.2	0.2	Not WFD	Not WFD
strontium total			22222.4						0.2	0.2	0.2	Not WFD	200000						0.2	0.2	0.2	Not WFD	Not WFD
styrene			0.05									Not WFD	0.05									Not WFD	Not WFD
sulcofuron			0.025	0.025	0.025	0.025						Not WFD	0.025	0.025	0.025	0.025						Not WFD	Not WFD
sulphate			70.555556	90.875	386.25	54.5			28.75	24.125	17.125	Not WFD	110	110	590	71			34	27	20	Not WFD	Not WFD
sulphide or hydrogen sulphide	Y	Y	7.6666667	8	7.125	8.5	9	34	9.25	9.875	8.25	Low	22	22	22	23	22	210	20	18	16	Medium	Medium
Sum of BDEs (x6)				0.003	0.003	0.003	0.0015	0.0033333	0.0016875	0.0016875	0.0016875	Not WFD		0.003	0.003	0.003	0.0015	0.006	0.003	0.003	0.003	Not WFD	Not WFD
suspended solids @ 105øC	Y		10.222222	27.25	41.75	75.5	5155	24.25	23.625	12.6875	12.4375	Very Low	41	50	84	110	41000	62	55	23	36	High	High
tebuconazole			0.025						0.025	0.025	0.025	Not WFD	0.025						0.025	0.025	0.025	Not WFD	Not WFD
tebuthiuron			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
tecnazene			0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
terbutryn			0.0125						0.0125	0.01	0.01	Not WFD	0.03						0.03	0.01	0.01	Not WFD	Not WFD
tert-amyl methyl ether			0.25						0.25	0.25	0.25	Not WFD	0.25						0.25	0.25	0.25	Not WFD	Not WFD
tetra & trichloroethane total			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD

Risk	Criteria
Not WFD	Not assessed for potential deterioration as not a WFD determinand
Very Low	Concentrations at Minworth are lower than at all canal sampling points
Low	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are less than or equal to at all downstream canal sampling points. Ensuring no-deterioration at point of discharge sufficient to prevent deterioration if overflows to rivers aren't increased.
Medium	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are up to 50% greater than at least one downstream canal sampling points.
High	Concentrations at inflow routes 1 (sampling point 2) and 3 (sampling point 3) are over 50% greater than at least one downstream canal sampling points.

			Mean concentration at sampling point										90th percentile concentration at sampling point										
Determinand	WFD?	EQSD?	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	1	2	3	4	5	6	7	8	9	Risk of D/S WFD deterioration	Overall risk of D/S WFD deterioration
tetrachloroethane			0.05	0.05	0.05	0.05			0.05	0.05	0.05	Not WFD	0.05	0.05	0.05	0.05			0.05	0.05	0.05	Not WFD	Not WFD
tetrachloroethylene			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
thiobendazole			0.05	0.05	0.05	0.05						Not WFD	0.05	0.05	0.05	0.05						Not WFD	Not WFD
THM total			2						2	2	2	Not WFD	2						2	2	2	Not WFD	Not WFD
tin dissolved			0.2666667	0.25	0.2375	0.3375			0.25	0.275	0.2	Not WFD	0.5	0.6	0.5	1			0.6	0.8	0.2	Not WFD	Not WFD
tin total			0.3333333	0.3125	0.2375	0.3375			0.275	0.3125	0.2875	Not WFD	0.6	0.6	0.5	1			0.6	0.8	0.6	Not WFD	Not WFD
titanium dissolved			0.4333333						0.61875	0.5	0.4625	Not WFD	2						1.8	2	2.2	Not WFD	Not WFD
titanium total			1.3666667						1.5	2.1375	1.8125	Not WFD	4.5						2.6	3.2	3.6	Not WFD	Not WFD
toluene			0.05	0.05625	0.05	0.05			0.05	0.05625	0.05	Not WFD	0.05	0.1	0.05	0.05			0.05	0.1	0.05	Not WFD	Not WFD
total anions (sum of Br, Cl, F, NO2, NO3, PO4, SO4			205	154	447.125	107.7125			76.1875	102.9375	66.35	Not WFD	316	183	644	129			96.1	131	73.8	Not WFD	Not WFD
total dissolved solids			1949						474.25	582.375	989.5	Not WFD	8560						745	977	4600	Not WFD	Not WFD
total dry solids (180øC)			1828.8889						495	593.75	1001.25	Not WFD	8600						770	1000	4600	Not WFD	Not WFD
total organic carbon	Y		16.911111	4.7875	4.8875	6.3625	3.9875	5.0125	2.375	2.85	1.825	High	78	8.9	6.8	10	5.6	9.5	3.8	3.5	2.6	High	High
total oxidised nitrogen	Y		14.0975	0.80575	1.08775	2.035	1.038125	3.02875	3.87125	7.59	4.575	Medium	21.6	2.79	1.73	2.97	1.69	4.28	5.92	10.2	5.24	High	High
total phosphorus	Y		0.4711111	0.25	0.25875	0.35125	0.44	0.43375	0.26125	0.85125	0.28875	Low	0.81	0.6	0.91	1.1	1.2	0.67	0.5	1.1	0.62	High	High
transmission at 245 nm			83.35						93.4375	91.0875	92.375	Not WFD	89.4						101	109	99.7	Not WFD	Not WFD
triallate			0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	0.01	0.01	0.01	0.01			0.01	0.01	0.01	Not WFD	Not WFD
triazophos			0.01	0.01	0.01	0.01						Not WFD	0.01	0.01	0.01	0.01						Not WFD	Not WFD
tribromoacetic acid			0.5						0.5	0.5	0.5	Not WFD	0.5						0.5	0.5	0.5	Not WFD	Not WFD
tributyl phosphate			0.01	0.01	0.01125	0.01						Not WFD	0.01	0.01	0.02	0.01						Not WFD	Not WFD
tributyltin compounds (as tributyltin cation)	Y		2.944E-05	0.0001	8.625E-05	0.00015	0.0000275	0.0002444	0.000135	0.0388625	7.188E-05	High	0.00005	0.00014	0.00012	0.00021	0.00008	0.0014	0.0004	0.31	0.00016	Very Low	High
trichloroacetic acid			1.2						0.5	0.5	0.5	Not WFD	2.2						0.5	0.5	0.5	Not WFD	Not WFD
trichlorobenzenes			0.2									Not WFD	0.2									Not WFD	Not WFD
trichloroethylene	Y		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	Very Low	Very Low
trichloromethane (chloroform)			0.5									Not WFD	0.5									Not WFD	Not WFD
triclopyr			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
triclosan	Y		0.01875	0.005	0.006875	0.005	0.006875	0.005	0.005	0.005625	0.005	Medium	0.03	0.005	0.02	0.005	0.02	0.005	0.005	0.01	0.005	High	High
trifluralin			0.01						0.01	0.01	0.01	Not WFD	0.01						0.01	0.01	0.01	Not WFD	Not WFD
triphenyltin compounds (as tryphenyltin cation)			0.001	0.0008875	0.0018875	0.0008875						Not WFD	0.001	0.001	0.009	0.001						Not WFD	Not WFD
tritium			5						5	5	5	Not WFD	5						5	5	5	Not WFD	Not WFD
tungsten dissolved			5						5	5	5	Not WFD	5						5	5	5	Not WFD	Not WFD
tungsten total			5						5	5	5	Not WFD	5						5	5	5	Not WFD	Not WFD
turbidity			3.6666667						14.5	5.5	5.75	Not WFD	14						29	12	11	Not WFD	Not WFD
uranium total			5						5	5	5	Not WFD	5						5	5	5	Not WFD	Not WFD
vanadium dissolved			5	6.75	5	5			5	5	5	Not WFD	5	19	5	5			5	5	5	Not WFD	Not WFD
vanadium total			5	5	5	5			5	5	5	Not WFD	5	5	5	5			5	5	5	Not WFD	Not WFD
vinyl chloride			0.05						0.05	0.05	0.05	Not WFD	0.05						0.05	0.05	0.05	Not WFD	Not WFD
zinc dissolved	Y		36.444444	12.55	13.425	10.63125	6.50625	4.95625	14.7125	12.575	4.975	High	69	50	32	29	20	9.6	44	48	13	High	High
zinc total	Y		48.222222	98	36	22	16.4125	13.525	50	21.625	15.6625	High	110	140	65	30	28	19	130	48	30	High	High

References

APEM Ltd. (2021). Grand Union Canal Transfer SRO Water Quality Stages 1 & 2.

Atkins. (2021). Phase 2 Water Quality Monitoring 2021-22. Affinity Water.

Environment Agency. (2012). Water quality planning: no deterioraion and the Water Framework Directive. Environment Agency.

Environment Agency. (2021, 12 21). Retrieved from Water Quality Data Archive: https://environment.data.gov.uk/water-quality/view/landing

Environment Agency. (2021). Environmental Pollution Incidents (Category 1 and 2). Retrieved from https://data.gov.uk/dataset/c8625e18-c329-4032-b4c7-444b33af6780/environmental-pollution-incidents-category-1-and-2

Environment Agency. (2021, 08 10). Surface water pollution risk assessment for your environmental permit. Retrieved from https://www.gov.uk/guidance/surface-water-pollution-risk-assessment-for-your-environmental-permit

Jacobs. (2019). Flood Modeller Help. Jacobs.

JBA consulting

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
Broughton
SKIPTON
North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
ISO 27001:2013
ISO 45001:2018