United Utilities

Belmont Reservoir Drought Order Application

Environmental Assessment

Report

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Glossary

Term	Definition
AONB	Area of Outstanding Natural Beauty
BOD	Biochemical Oxygen Demand
CIEEM	Chartered Institute of Ecology and Environmental Management
CoR	Compensation only Reservoir
EA	Environment Agency
EAR	Environmental Assessment Report
EMP	Environmental Monitoring Plan
EQS	Environmental Quality Standard
GEP	Good Ecological Potential
GES	Good Ecological Status
HMC	Habitat Modification Class
HMS	Habitat Modification Score
HMWB	Heavily Modified Water Body
HoF	Hands off Flow
HQA	Habitat Quality Assessment
INNS	Invasive Non-Native Species
LOD	Limit of Detection
mAOD	Metres Above Ordnance Datum
MEP	Moderate Ecological Potential
Ml/d	Megalitres per day
NRW	Natural Resources Wales
RHS	River Habitat Survey
SAC	Special Area of Conservation
Sonde	A probe that automatically transmits information about its surroundings
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
UIA	Un-Ionised Ammonia
UU	United Utilities
WFD	Water Framework Directive

Executive summary

What is a drought order / drought permit?

In periods of unusually low rainfall, where water resources become scarce, powers are available to grant ordinary and emergency drought orders under the Water Resources Act 1991 (as amended). Drought permits are granted by the Environment Agency and drought orders and emergency drought orders are granted by the Secretary of State.

The water industry is required by the Government to demonstrate that they have adequate drought contingency plans, and there is a statutory duty for water companies to agree publicly available drought plans following consultation with the Environment Agency, the Secretary of State, the Water Services Regulation Authority (Ofwat) and other statutory bodies.

Drought order and drought permit options are identified in United Utilities' (UU) Drought Plan. The Drought Plan details the range of actions that UU will consider implementing during drought conditions in order to maintain essential water supplies to its customers and minimise environmental impact. In the case where there is no benefit or impact to public water supply, e.g. changes to compensation-only flows, the Environment Agency itself applies for the emergency drought order to the Secretary of State.

Background to Belmont Reservoir

Belmont Reservoir lies to the north of the town of Bolton and was constructed in 1826 by the Bolton Waterworks to supply water to the then rapidly expanding town of Bolton. It is an impoundment of the upper reaches of Eagley Brook and is used as a compensation release reservoir only. No water is abstracted from it for public supply.

Belmont Reservoir is one of the potential sites for drought orders listed within UU's Drought Plan. Because the reservoir is a compensation only reservoir (no water is abstracted from it for public supply), in the event of drought powers being required the Environment Agency would apply to the Secretary of State for a drought order.

What will the Drought Order entail?

Following a period of extended dry weather and an exceptional shortage of rain in 2025, the need for a drought order at Belmont Reservoir has been identified. The Environment Agency is applying for a drought order to reduce the compensation flow from 9 Ml/d to 4.5 Ml/d (Scenario 1). The objective of the drought order is to reduce the rate of reservoir drawdown to maintain both levels in the reservoir and some compensation flow in the downstream water course for longer, in order to preserve the reservoir and downstream ecology. There is a risk, under prolonged drought conditions, that the reservoir levels could drop to the point that the compensation flow ceases and there is little or no water remaining in the reservoir; the drought order aims to delay that eventuality. The drought order would be implemented for a period of up to six months. The assessment presented considers the impacts should a drought order be implemented from August/September 2025 until January/February 2026 inclusive for 6 months from the day of implementation. This is referred to as the proposed drought order in this report.

This environmental assessment also considers the potential impact of the drought order in combination with a potential drought permit at Jumbles Reservoir which would reduce the compensation flow to 12Ml/d. Hence this environmental assessment considers the following in-combination scenario (Scenario 2):

- Reduce the compensation release from Belmont Reservoir from 9 Ml/d to 4.5 Ml/d and Jumbles reservoir from 19.9 Ml/d to 12 Ml/d.

This environmental assessment does not consider in combination effects with a potential drought permit at nearby Delph Reservoir. Although Delph Reservoir is listed as a site for potential drought permits in UU's Drought Plan, there are no plans to implement a drought permit at Delph Reservoir in 2025.

What does this environmental assessment cover?

An Environmental Assessment Report (EAR), which includes a monitoring plan and mitigation measures, is required to support the drought order application. This EAR provides details of baseline environmental conditions, assess the environmental impacts of potential changes to the flow regime due to implementation of the drought order, and provides an Environmental Monitoring Plan (EMP) to support the requirement for baseline, during and post drought order monitoring.

Following a 'source-pathway-receptor' approach, this environmental assessment focuses first on examining how the proposed drought order (the 'source') will affect the hydrological, hydrogeological and geomorphological environment (the 'pathways'), and then considers how ecological and other features (the 'receptors') will respond to changes in those pathways.

This report forms the assessment of likely impacts of the proposed drought order on the pathways and receptors of interest for the Belmont investigation area: hydrology; habitat; geomorphology; water quality; ecology; and other receptors.

This environmental assessment also considers the impact that the drought order could have in combination with a potential drought permit at Jumbles Reservoir.

What are the likely impacts of the drought permit on the environment?

The predicted impacts on each pathway and significance of impact for each receptor are summarised in the dashboard summary below.

The predicted effects of the drought order on Belmont Reservoir are beneficial, because water levels will be maintained for longer than under conditions without the drought order. For the downstream water bodies, implementation of the Belmont drought order could have an impact of medium magnitude on flows in the Eagley Brook water body and an impact of low magnitude on flows in the River Tonge and River Croal water bodies.

In combination with a Jumbles drought permit, impacts on flows are expected to be of medium magnitude in the River Tonge and River Croal water bodies.

Negligible magnitude impacts are predicted for the River Irwell (Croal to Irk) water body in both scenarios (Belmont drought order alone or in-combination with a Jumbles drought permit).

Impacts on most water quality parameters (including nitrate, oxygen, BOD) are expected to be of low magnitude in the Eagley Brook, Tonge and Croal water bodies under both scenarios. Impacts of medium magnitude were predicted within Eagley Brook for ammonia and phosphate.

The relatively low sensitivity of the receptors to changes in these pathways means that the predicted impacts on receptors are of only minor significance, with the exception of brown trout in Eagley Brook, where there could be impacts of Moderate significance on spawning and egg incubation.

In combination with a Jumbles drought permit there could also be impacts of Moderate significance on brown trout spawning and egg incubation in the River Croal.

What monitoring will be carried out?

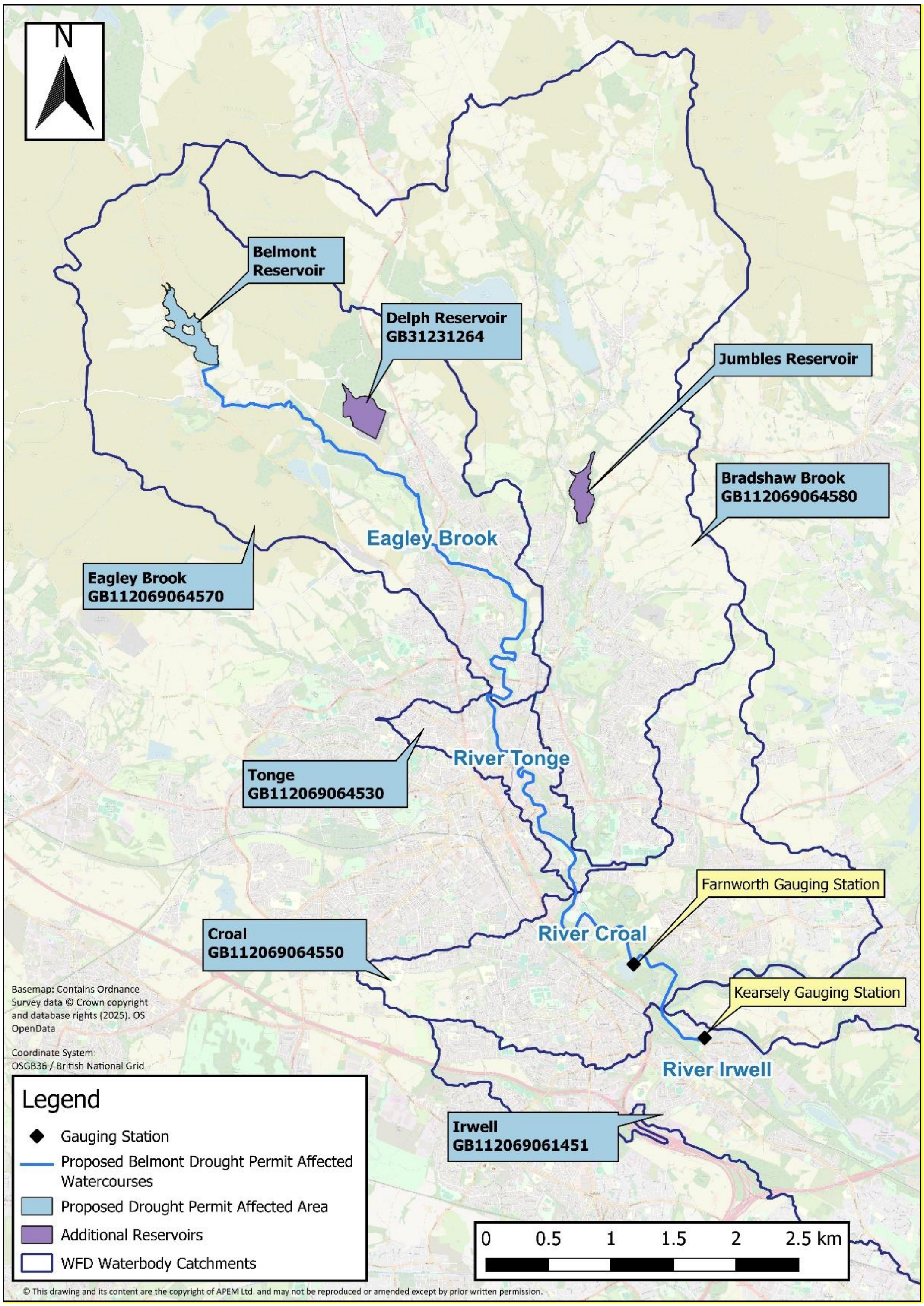
An EMP has been developed which includes pre-drought order implementation during-drought order implementation and post-drought order implementation monitoring.

Monitoring has been recommended to capture any changes before, during and after implementation of the drought order. This includes checking for signs of ecological stress including: potential effects on flow and water quality; inhibition of movement of fish past river structures or other barriers; habitat availability for adult and juvenile life stages (including spawning/nursery areas); and concentration of fish in restricted areas/pools which could increase susceptibility to predation, as well as evidence of establishment or expansion of invasive non-native species.

It is important to note that the level of monitoring is risk-based. The environmental assessment indicates that the proposed drought order presents a low risk to the environment (only minor negative impacts are predicted for most receptors in most water bodies). Nevertheless, given the risk to some fish species, at some life stages and the uncertainties inherent in some of the assessments undertaken, monitoring has been recommended to check the predicted degree of impact, and to identify any unexpected impacts to trigger mitigation measures, if needed.

What measures will be used to mitigate significant impacts?

Where significant negative impacts (defined for this report as those of moderate significance or greater) are identified during the environmental assessment process, there is a need to identify appropriate mitigation measures in order to avoid, reduce or remedy any impacts. Such measures may be implemented in advance of, during or after implementation of a drought order. Proposed mitigation actions focus protecting the fish populations of the downstream water bodies.



Belmont drought order Study Area[1]

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Table 0-1 Summary of potential impacts on pathways

Pathways	Impact magnitude A	S	O	N	D	J	F	Level of Confidence
Hydrogeology								
All water bodies	NA	NA	NA	NA	NA	NA	NA	NA
Hydrology								
Belmont Reservoir – Water level (Scenario 1)	N	N	N	N	N	N	N	Uncertain
Eagley Brook – River flow (Scenario 1)	M	M	M	M	M	M	M	Low
Tonge and Croal – River flow (Scenario 1 Belmont 4.5 Ml/d)	L	L	L	L	L	L	L	Low
Tonge and Croal – River flow (Scenario 2 Belmont 4.5 Ml/d + Jumbles 12 Ml/d)	M	M	M	M	M	M	M	Medium
Irwell (Croal to Irk) – River flow (both scenarios)	N	N	N	N	N	N	N	Medium
Geomorphology								
Eagley Brook – Sedimentation & In-stream habitat (Scenario 1)	M	M	M	M	M	M	M	Low
Tonge and Croal – Sedimentation & In-stream habitat (both scenarios)	L	L	L	L	L	L	L	Low
Irwell (Croal to Irk) – Sedimentation and in-stream habitat (both scenarios)	N	N	N	N	N	N	N	Low
Water Quality								
Eagley Brook (Scenario 1) biochemical oxygen demand, nitrate, dissolved oxygen	L	L	L	L	L	L	L	Medium
Eagley Brook (Scenario 1) ammonia, phosphate	M	M	M	M	M	M	M	Medium
River Tonge (Scenario 1)	L	L	L	L	L	L	L	Medium
All water bodies (Scenario 2)	L	L	L	L	L	L	L	Medium

Key:

Magnitude of impact on pathway		Significance of impact on receptor	
H	High		Major
M	Medium		Moderate
L	Low	(N)	Minor (Negligible)
N	Negligible		Uncertain
	Uncertain		Beneficial
NA	Not assessed	NA	Not assessed
-	Not applicable	-	Not applicable due to seasonality of receptor

Table 0-2 Summary of potential impacts on ecological receptors

	Sensitivity of receptor	Impact Significance							Level of Confidence
		A	S	O	N	D	J	F	
Fish (including angling groups)									
Eagley Brook - Brown trout: Spawning & egg incubation (both scenarios)	High	-							Medium
Eagley Brook - Brown trout: Juvenile (both scenarios)	Medium								Medium
Eagley Brook - Brown trout: Adults (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Tonge and Croal - Brown trout: Spawning & egg incubation (Scenario 1)	High								Medium
Tonge and Croal - Brown trout: Juvenile + Adults (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Croal - Brown trout: Spawning & egg incubation (Scenario 2)	Medium	-							Medium
Irwell (Croal to Irk) – Brown trout spawning & egg incubation (both scenarios)	High								Medium
Irwell (Croal to Irk) – Brown trout spawning & egg incubation (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
All water bodies - Bullhead: Spawning & egg incubation (both scenarios)	High	-	-	-	-	-	-	-	Medium
Eagley Brook - Bullhead: Juvenile + Adults (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Tonge & Croal – Bullhead: Juveniles (both scenarios)	Medium								Medium
Tonge & Croal – Bullhead: Adults (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Irwell (Croal to Irk) - Bullhead: Juvenile + Adults (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
All water bodies – Rheophilic coarse fish: Spawning & egg incubation (both scenarios)	High	-	-	-	-	-	-	-	Medium
Eagley Brook – Rheophilic coarse fish: Juvenile & adults (both scenarios)	Medium								Medium
Tonge & Croal – Rheophilic coarse fish: Juveniles & adults (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Irwell (Croal to Irk) – Rheophilic coarse fish: Juvenile & adults (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Eagley Brook - Eurytopic coarse fish: All life stages (both scenarios)	Medium								Medium
Tonge & Croal & Irwell - Eurytopic coarse fish: all life stages (both scenarios)	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
All water bodies – Angling groups (both scenarios)	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Macroinvertebrates									
All water bodies (except Irwell (Croal to Irk) (both scenarios)	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Irwell (Croal to Irk) (both scenarios)	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Low
Macrophytes and Diatoms									
All water bodies (except Irwell (Croal to Irk)	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Irwell (Croal to Irk)	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Low
Protected species									
All water bodies – wading birds, wildfowl & gulls, riverine birds	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
All water bodies – Common amphibians, reptiles	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium/ High
All water bodies – Bats, otters, great crested newt	Medium	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
All water bodies – Water voles, White-clawed Crayfish	High	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium/ Low
Invasive non-native species									
All water bodies – both scenarios	Variable	Variable – summarised as minor, beneficial*							Low

*Please note, a beneficial impact upon INNS receptors is considered to be a negative outcome for the environment.

Table 0-3 Summary of potential impacts on other receptors

		Impact Significance							
	Sensitivity of receptor	A	S	O	N	D	J	F	Level of Confidence
Other abstractors									
Belmont Bleaching and Dyeing (SW) (2569003014)	High								Uncertain
Belmont Bleaching and Dyeing (SW) (2569003018)	High								Uncertain
Turton Golf Club (SW) (2569003075)	High								Uncertain
Socio-economics, tourism and recreation									
All water bodies – Socio-economics	Low								High
Belmont Reservoir – Tourism and recreation	Low								High
River water bodies – Tourism and recreation	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	High
Aesthetics and landscape									
Belmont Reservoir – Aesthetics and landscape	Low								High
River water bodies – Aesthetics and landscape	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Medium
Archaeology and cultural heritage									
All water bodies	Not sensitive	NA	NA	NA	NA	NA	NA	NA	High
Designated sites									
All water bodies	Low	(N)	(N)	(N)	(N)	(N)	(N)	(N)	Low

Key:

Magnitude of impact on pathway		Significance of impact on receptor	
H	High		Major
M	Medium		Moderate
L	Low	(N)	Minor (Negligible)
N	Negligible		Uncertain
	Uncertain		Beneficial
NA	Not assessed	NA	Not assessed
-	Not applicable	-	Not applicable due to seasonality of receptor

1. Introduction

1.1 Background

United Utilities (UU) is the owner and operator of Belmont Reservoir to the north of the town of Bolton. Belmont Reservoir was constructed in 1826. It is an impoundment of the upper reaches of Eagley Brook. Aesthetically, the reservoir is typical of upland reservoirs in the North West of England. It is surrounded by moorland and agricultural land and has important aesthetic and recreational value for the local area. The reservoir is visible from surrounding roads, footpaths and cycle ways as well as forming an important feature within the local landscape.

The reservoir is a Compensation only Reservoir (CoR). This is because there is no abstraction of water from it for public water supply – its purpose is purely to provide a release of water (known as a compensation flow) to the downstream watercourse, Eagley Brook, for environmental protection. Belmont Reservoir is not listed as a source of supply in UU's Water Resources Management Plan nor as a drought source for public supply in UU's Drought Plan, however it is listed in the Drought Plan as a possible location for a CoR drought order.

As a water company, UU cannot apply for drought powers for CoRs as they are not connected to the public water supply system but instead, when drought powers are needed the Environment Agency (EA) would apply for a drought order.

Drought powers have not been previously applied for at Belmont Reservoir, although reductions in the compensation flow have historically been made in 1990/91; 1994; 1995/96 and 1999.

Drought order applications are a precaution against a worsening situation. Due to the time involved in the application, public inspection and determination period, drought orders are often applied for but not implemented due to rain arriving in the meantime.

There is a threat that storage in Belmont Reservoir will continue to decline if it remains dry and there is a risk that they may not refill if autumn/winter rainfall is insufficient. Drought orders can be granted for a maximum duration of 6 months; however, if storage in Belmont Reservoir improves above the drought order trigger storage (see Section 2.1.1), the drought powers would be lifted earlier.

The area affected by the Belmont drought order alone is the watercourse downstream of Belmont Reservoir as far as the confluence with the River Croal, a distance of approximately 15 km. In-combination with a possible drought permit at Jumbles Reservoir, the area potentially affected extends to the confluence with the River Irwell. The environmental impacts of the drought order, including the area impacted, are described in this Environmental Assessment Report (EAR).

This document is the application version EAR for a proposed drought order at Belmont Reservoir in 2025. The proposed drought order would allow reduction of the compensation release from Belmont Reservoir from 9 Ml/d to 4.5 Ml/d for a period of up to 6 months from August/September 2025 to January/February 2026.

Reducing the compensation flow would have the effect of conserving water for continued compensation flow release. This action will delay the run-dry date (the event that there is insufficient water to continue to supply a compensation flow from Belmont Reservoir) and expedite a return to typical water levels in the reservoir and downstream river at the end of the drought period.

1.1.1 Aims and objectives

The aim of this EAR is to assess the potential environmental issues that may occur as a result of reducing the compensation flow release from Belmont Reservoir during drought conditions. The scope of this report is to provide a hydrological impact and environmental sensitivity assessment using available baseline information and proposing environmental mitigation measures based on that sensitivity assessment. The objective of the drought order is to retain water within the reservoir and ensure there is sufficient flow to support the downstream environment without reaching a point when the reservoir empties completely and can no longer provide a compensation flow.

The study has included consideration of a wide range of features such as hydrology, geomorphology, water quality, aquatic ecology, heritage and other environmental issues (e.g. recreation and landscape).

The format and content of the document has been informed by the EA's guidance on drought planning and drought permits/orders (Environment Agency, 2024, 2025), amongst others (CIEEM, 2018), as well as similar example EARs for drought permit applications. This EAR builds upon a previous scoping study (Amec, 2013).

1.2 Drought orders and drought permits

In periods of unusually low rainfall, where water resources become scarce, powers are available to grant drought permits, ordinary drought orders and emergency drought orders under the Water Resources Act 1991 (as amended by the Environment Act 1995 and the Water Act 2003). Drought permits and drought orders are drought management actions that, if granted, can allow more flexibility to manage water resources and the effects of drought on public water supply and the environment (EA & Defra, 2019, updated 2025).

In the case of ordinary drought orders, the Secretary of State must be satisfied that either a serious deficiency of supplies of water in any area exists or is threatened, or that a deficiency in flow or level of water in any inland waterway sufficient to pose a threat to flora and fauna which depend on those waters, exists or is threatened. In either case the Secretary of State must also be satisfied that the reason for the deficiency is an exceptional shortage of rain.

Ordinary drought orders can be applied for under the Water Resources Act 1991 (Section 74) where there may be a change in terms of a variation of an abstraction licence condition, but additional changes may also be made, including discharging water to specified places and modifying or suspending discharges or the filtering/treating of water. Drought orders are authorised by the Secretary of State which can hold a public hearing to discuss the application if it deems one is necessary.

For emergency drought orders, the Secretary of State must be satisfied both that: by reason of an exceptional shortage of rain, a serious deficiency of supplies of water in any area exists or is threatened and that the deficiency is such as to be likely to impair the economic or social well-being of persons in the area.

Following the severe drought in northern England in 1995/96, the Government set out a wide range of actions to be taken by the water industry, including the need for water companies to demonstrate that they have adequate drought contingency plans. As required under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003 and in accordance with the Drought Plan Regulations 2005 the Drought Plan Direction 2020, water companies have a duty to prepare and maintain a Drought Plan.

Prospective drought order/permit options are identified in UU's current Drought Plan. The Drought Plan details the range of actions that UU will consider implementing during drought conditions to maintain essential water supplies to its customers and minimise environmental impact.

The environmental assessment of drought permits is undertaken in recognition of the guidance from the EA and Defra, as contained in:

- EA Water Company Drought Plan Guideline (2025).
- EA and Defra Guidance on Drought Permits and Drought Orders (2019, updated 2025).
- EA environmental assessment for water company drought planning supplementary guidance (2025).

An EAR, which includes a monitoring plan and mitigation measures, is required to support each drought order application. Each EAR should provide details of baseline flow conditions, assess impacts of potential changes to the flow regime due to implementation of the drought order, and provide an EMP to support the requirement for baseline, pre-implementation, during-implementation and post drought order recovery monitoring. It should also set out any mitigation measures to be implemented to reduce, avoid, mitigate or compensate for the environmental impact of the action.

1.3 Scope of assessment

This report is an application version EAR and considers the potential implementation of a drought order at Belmont Reservoir reflecting the up to six-month implementation period in the drought order application (beginning August/September 2025). The drought order option that is being applied for is to reduce the compensation release from Belmont Reservoir from 9 Ml/d to 4.5 Ml/d. Previous scoping reports are available (Atkins, 2008, 2009; Amec 2013) and information from these reports has been updated with available baseline data and tailored to produce an event-specific EAR reflecting the relevant antecedent conditions and actual impact of the individual drought order application in the six-month implementation period. The assessment also draws upon information and analyses carried out on the rivers Tonge, Croal and Irwell for the shelf copy EARs of Delph Reservoir (APEM, 2025a) and Jumbles Reservoir (APEM, 2025b)

Following a 'source-pathway-receptor' approach, this environmental assessment focuses first on examining how the proposed drought order (the 'source') will affect the hydrological, hydrogeological and geomorphological environment and water quality (the 'pathways'), and then considers how ecological and other features (the 'receptors') will respond to changes in those pathways.

As a preliminary screening step, the long list of pathways and receptors in Table 1-1 was reviewed to identify the environmental features of interest for inclusion in the environmental assessment. Features were excluded only if:

- The pathway or receptor is absent from the area of potential impact.
- There is no pathway by which the receptor could be impacted.
- The receptor is not sensitive to changes in these pathways.

Table 1-1 Environmental features considered in this environmental assessment

Category	Environmental feature	Included	Justification
Pathways	Hydrogeology	No	No relevant groundwater interactions
	Hydrology	Yes	
	Habitat and geomorphology	Yes	
	Water quality	Yes	
Ecological receptors	Macrophytes and diatoms	Yes	
	Macroinvertebrates	Yes	
	Fish (including angling groups)	Yes	
	Protected species	Yes	
	Invasive non-native species	Yes	
Other receptors	Socio-economics, tourism and recreation	Yes	
	Aesthetics and landscape	Yes	
	Archaeology and cultural heritage	Yes	
	Designated sites	Yes	
	Other abstractors	Yes	

1.4 Structure of this report

Figure 1-1 shows how the EA's requirements for environmental assessments of drought orders are satisfied by this report.

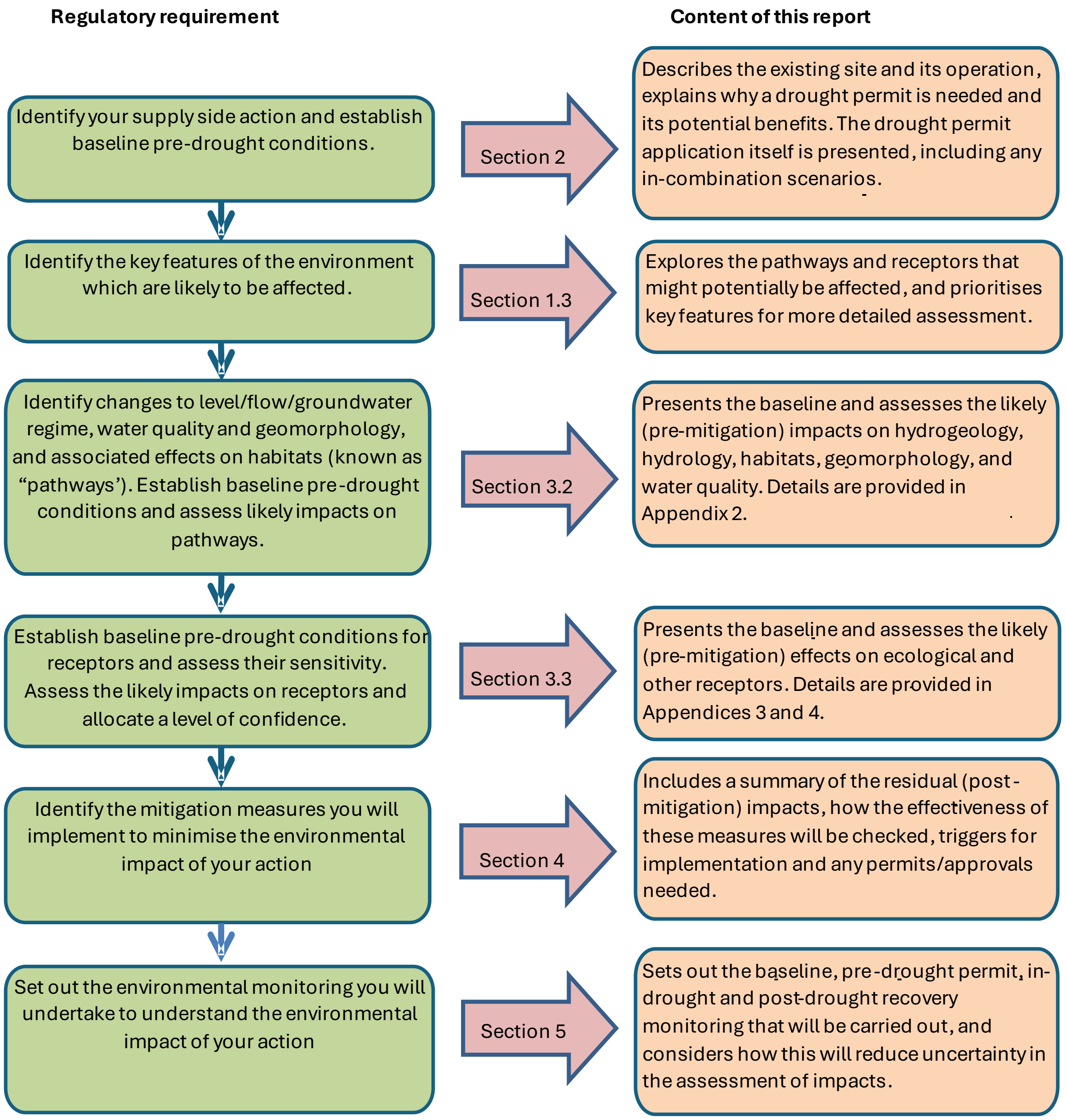

Figure 1-1 Flow chart detailing how the EA's requirements for drought permits/drought orders are satisfied by this report

2. Description of proposal

This Chapter:

- provides baseline pre-drought details of the reservoir (Section 2.1);
- provides details of the proposed drought order (Section 2.2);
- sets out the drought conditions which trigger the proposed drought order and the evidence to justify the proposed action* (Section 2.1);
- where there is a change to a compensation flow, explains where it is from/to and the extent of the area affected (which sites, water bodies and other abstractions will be affected) (Section 2.3); and
- describes the Water Framework Directive (WFD) status of the water bodies of interest (Section 2.4), and designated sites therein (Section 2.5).

* Further evidence is included in the application.

2.1 Site location and operation

Belmont Reservoir was constructed in 1826 and is an impoundment of the upper reaches of Eagley Brook, in the River Croal catchment. A map of the study area is presented in Figure 2-1. Belmont Reservoir is used as a CoR; no water is abstracted from it for public supply. The maximum depth of Belmont Reservoir is approximately 13.4 m, with a maximum gross volume of 2142 Ml. The reservoir has a 214 Ml dead water volume and, hence, has a maximum net volume of 1928 Ml. Dead water is the water at the bottom of a reservoir that is not normally utilised. Because the dead water zone is below the level of the compensation flow valve, if water levels were to drop to or below this level, water would need to be pumped to provide a compensation flow.

The operation of Belmont Reservoir is governed by impoundment licence No. NW/069/0003/001. The licensed compensation flow is 9 Ml/d and this is released into Eagley Brook. A summary is provided in Table 2-1.

Table 2-1 Summary of Belmont Reservoir current and proposed drought order compensation flows

Impoundment Licence No	Current Compensation Flow (Ml/d)	Proposed Drought Order Compensation Flow (Ml/d)
NW/069/0003/001	9	4.5

2.1.1 Drought triggers

The current drought triggers and actions set for Belmont Reservoir in the UU drought plan are:

- Trigger 1 - set at 66.63% storage – actions include:
    - Increase in monitoring of the reservoir level.
    - Confirm compensation release through gauging and adjust if necessary.
    - Assess rate and reason for reduction in storage.
- Trigger 2 - set at 49.94% storage – actions include:
    - Forecast potential need for a drought order.
    - Liaise with EA and Natural England.
    - Review requirement for environmental monitoring.
- Trigger 3 - set at 33.26% storage – actions include:
    - Depending on the forecast, start application for a drought order.
    - Undertake environmental monitoring and actions (e.g. fish rescue) if required.
    - Produce contingency plan.
- Trigger 4 - set at 14.67% storage – actions include:
    - Implement drought order.
    - Review contingency plan in case of reaching dead water.

2.1.2 Previous drought powers

The UU operational area has been subject to the following historic droughts and dry weather events:

- 1933/4: a two-season drought event concentrated in the south of UU's region.
- 1963: a two-month drought event affecting the West Cumbria Resource Zone.
- 1975/6: a two-season drought event that particularly affected the north of UU's region, including the Pennines.
- 1984: a single season summer drought event that particularly affected the north of UU's region including the Pennines.
- 1995/6: a severe two-season drought event that affected the whole of UU's region.
- 2003: a short-lived winter drought.
- 2010: a short-lived summer drought.
- 2018: a short-lived summer drought.
- 2020: a short-lived spring dry period.
- 2022: a summer drought.

Drought powers have not been previously applied for at Belmont Reservoir. This is because, prior to the impoundment licence issued in 2010, UU were able to reduce the compensation flow without a drought permit/order as the original Act of Parliament (The Bolton Improvement Act 1854) allowed this to happen. The impoundment licence issued in 2010 overwrote the previous compensation flow set in the 1854 Act and since then a drought order has been needed to reduce the compensation flow.

Reductions in the compensation flow from Belmont Reservoir under the original Act of Parliament (The Bolton Improvement Act 1854) occurred in 1990/91; 1994; 1995/96 and 1999. The lowest flow in Eagley Brook on these occasions was 6 Ml/d.

2.2 Proposed drought powers

In order to continue to supply water to the watercourses downstream of Belmont Reservoir (including Eagley Brook), the EA is applying for a drought order under Section 73(1)(b) of the Water Resources Act 1991 (as amended by the Environment Act 1995) to vary the conditions of the impoundment licence number NW/069/0003/001 to reduce the Belmont Reservoir compensation flow release from Belmont Reservoir to the downstream watercourse, Eagley Brook. If granted, the drought order would:

- Reduce the compensation flow release from 9 Ml/d to 4.5 Ml/d.

This application is required because it is perceived that:

- There exists a deficiency in the flow or level of water in the reservoirs which poses a serious threat to flora or fauna which are dependent on those waters or is threatened' and;
- 'The reason for the deficiency is an exceptional shortage of rainfall'.

The drought order, if granted, will ensure that compensation water continues to provide a flow for the downstream environment whilst preserving stocks in the reservoir itself whilst the drought order is in place.

This application is necessary due to an exceptional shortage of rainfall since spring 2025, which has resulted in very low storage levels in Belmont Reservoirs. Current reservoir storage is 32.70% full (as of 6th August 2025). The drought triggers set for Belmont Reservoirs in UU's drought plan were reached on:

- Trigger 1 (set at 66.63% storage) on the 5th May 2025
- Trigger 2 (set at 49.94% storage) on the 30th June 2025
- Trigger 3 (set at 33.26% storage) on the 4th August 2025

UU have commenced the actions associated with the above drought triggers as set out in their drought plan. UU forecast that trigger 4 (set at 14.67% storage) will be reached on the 8th September 2025 assuming minimum historic inflows (a repeat of the worst drought on record). If granted, the drought order would be expected to be implemented at trigger 4.

The drought order, if granted, will ensure lower, but sustainable compensation flows are maintained that minimise the impacts on the ecology in the reservoir and downstream along the receiving watercourses during prolonged dry weather whilst preserving stocks in the reservoir itself. A reduced drawdown level in the reservoir will also accelerate the recovery of water levels in the reservoir and a return to normal flows within the river.

The order would be in force for up to 6 months, potentially starting in August/September 2025 if granted, however if the water resource situation improves the drought powers may be lifted earlier. A return to the licensed compensation flow of 9 Ml/d would resume once there is sufficient confidence that water levels in Belmont Reservoir can fully recover – a joint incident review between UU and the EA would be undertaken to ensure that a risk-based decision is made, considering recent and predicted rainfall.

If granted, it is expected that the drought order would be implemented at Drought Trigger 4.

2.2.1 Cumulative and in-combination effects

This application EAR only considers the impacts of a single drought order application for a six-month period, and not the cumulative effects if a second application were needed directly afterwards. If this situation were to arise, cumulative impacts would need to be considered in further detail at the time of the second application.

There is also the potential for UU to apply for a drought permit at neighbouring Jumbles Reservoir which would reduce the compensation flow from 19 Ml/d to 12 Ml/d. The implementation of a Belmont drought order at the same time as a Jumbles drought permit also has the potential to cause 'in-combination' effects downstream of the River Tonge (Eagley Brook) / Bradshaw Brook confluence. This report therefore assesses the impact of the following two drought permit scenarios:

1. Belmont Reservoir drought order alone, compensation flow reduction from 9 Ml/d to 4.5 Ml/d (Scenario 1).
2. Belmont 4.5 Ml/d drought order in-combination with a Jumbles Reservoir drought permit compensation flow reduction from 19 to 12.0 Ml/d (Scenario 2).

2.3 Geographical extent of study

The zone of influence of a Belmont drought order implemented on its own was previously scoped as the Eagley Brook to its confluence with the Astley Brook, at which point it becomes the River Tonge (Amec, 2013). The analyses contained in this EAR however defined the zone of influence to be the Eagley Brook (from Belmont Reservoir outflow to the confluence with the Tonge) and the Tonge, from its confluence with the Eagley Brook to its confluence with the River Croal, at which point the difference between baseline flows and drought order scenario flows drop below 10%.

In combination scenarios with a Belmont drought order were assessed as part of the Jumbles drought permit shelf copy EAR (APEM 2025b). The geographical extent of the study area was determined by comparing the proposed drought order compensation flow changes to statistics based on long term gauged flow data from EA gauging stations. The geographical extent of the study was defined as the point at which the proposed drought order change in compensation flow was small (<10% of the measured Q95) in comparison with total river flows. Even during periods of low flow, downstream of the confluence between the River Croal and the River Irwell, the combined proposed drought order/permit reductions at Belmont and Jumbles are small in comparison with total river flows.

The geographical extent of the Environmental Assessment with regards Scenario 2 was therefore defined as the River Irwell at Kearsley gauging station, which is a short distance downstream of the Irwell's confluence with the River Croal. As a result, the assessment covered Belmont Reservoir (not a WFD water body) plus a total of four WFD surface water bodies (water body ID in brackets):

- Eagley Brook (GB112069064570)
- River Tonge (GB112069064530).
- River Croal (including Blackshaw Brook) (GB112069064550).
- Irwell (Croal to Irk) (GB112069061451).

Only the first two of these water bodies (Eagley Brook and River Tonge) are relevant to the Belmont drought order if implemented alone (Scenario 1).

Only the last three of these water bodies (River Tonge, River Croal and River Irwell) are affected by the in-combination scenario (Scenario 2) of a Belmont drought order and a Jumbles drought permit implemented at the same time. The Bradshaw Brook, flowing from Jumbles Reservoir, joins the River Tonge shortly upstream of its confluence with the River Croal.

A map of the study area is presented in Figure 2-1.

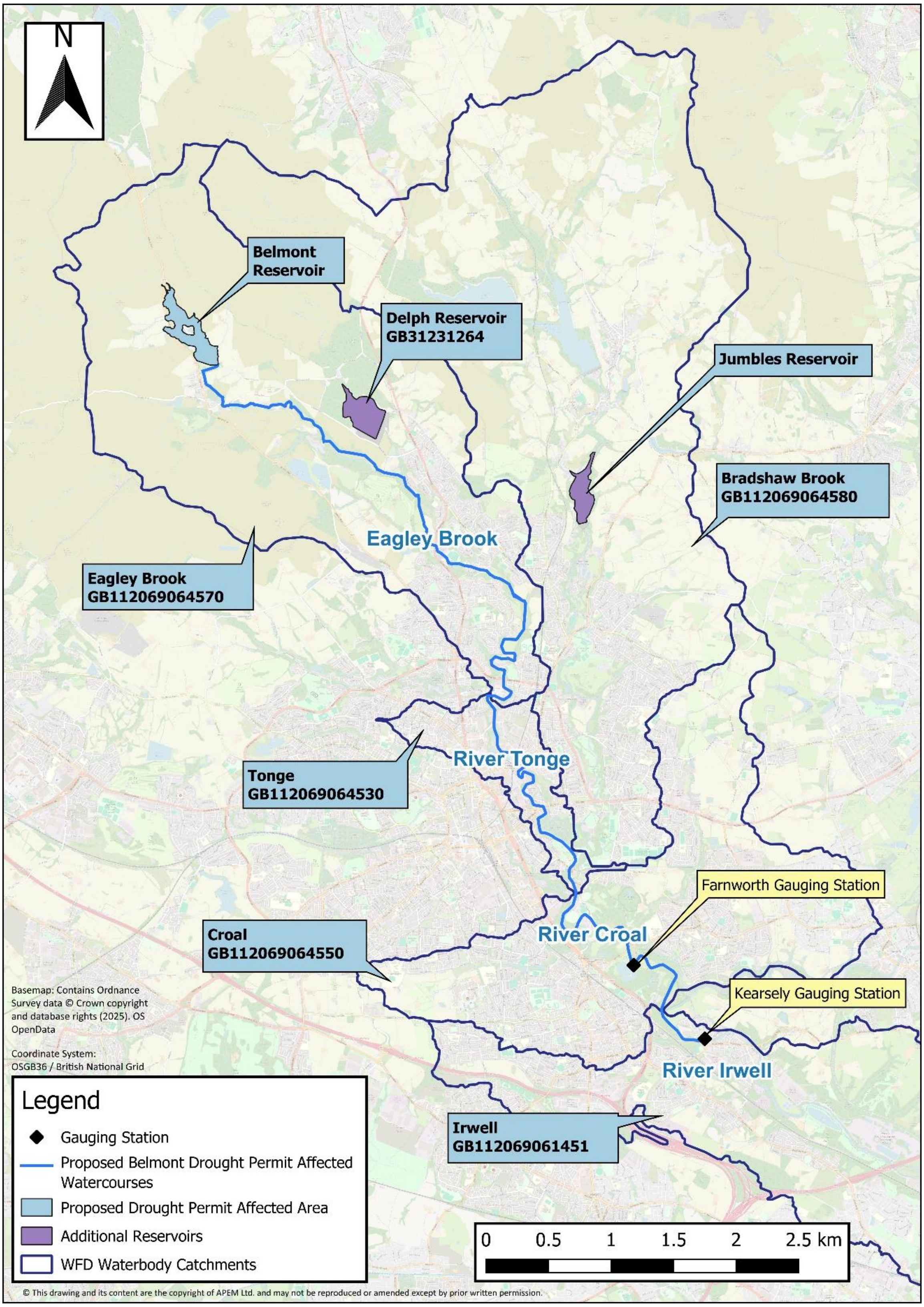

Figure 2-1 Belmont drought order study area[2]

2.4 Water Framework Directive status

A summary of current WFD classification status for Eagley Brook, River Tonge, River Croal and River Irwell are shown in Table 2-2, Table 2-3, Table 2-4 and Table 2-5 (based on 2019 and 2022 Cycle 3 classification data[3] (EA, Catchment Data Explorer, accessed 10/07/2025)).

The water bodies of interest for this study are classed as Heavily Modified Water Bodies (HMWBs) and therefore have a target of achieving Good Ecological Potential (GEP) or Moderate Ecological Potential (MEP) rather than Good Ecological Status (GES) or Moderate Ecological Status (MES).

The Eagley Brook, River Tonge, River Croal (including Blackshaw Brook) and River Irwell (Croal to Irk) water bodies are at MEP according to the 2019 and 2022 Cycle 3 classifications, where available.

The Cycle 3 classification data indicate at least Good status for all physico-chemical elements with the exception of phosphate in Eagley Brook and River Croal in 2019 (Moderate), and phosphate in the River Irwell in 2019 and 2022 (Moderate). The classification for invertebrates was Moderate in Eagley Brook (2019 data only), River Croal and River Irwell, and Good for the Tonge water body (2019 and 2022). Fish are considered to be at Moderate status in the Eagley Brook and River Tonge water bodies, and at Poor status in the River Croal. The combined macrophytes and phytobenthos status is considered to be Good within the Eagley Brook and Croal water bodies but Moderate in the River Tonge water body. No classifications were presented for the fish or macrophytes and phytobenthos elements for the Irwell (Croal to Irk) water body.

[2] United Utilities will not accept any liability for any damage caused by the actual positions being different from those shown. This plan is based upon the Ordnance Survey Map with the sanction of the Controller of H.M Stationery Office. Crown and United Utilities copyrights are reserved. Unauthorised reproduction will infringe these copyrights. Licence Number: 100022432.

[3] 2022 interim WFD classifications are the most recently published by the Environment Agency.

Table 2-2 Summary of Cycle 3 WFD classification status and objectives for the Eagley Brook water body (GB112069064570)

Classification	Water body ID	Water body Name	Ecological Potential	Invertebrates	Fish	Phytobenthos and Macrophyte *	Ammonia	Dissolved Oxygen	pH	Phosphate	Temp
2019 (Cycle 2)	GB112069064570	Eagley Brook	MEP	M	M	G	H	H	H	M	H
2022 (Cycle 3)	GB112069064570	Eagley Brook	NA	NA	NA	NA	NA	NA	NA	NA	NA
Objectives	GB112069064570	Eagley Brook	GEP 2027	G 2015	G 2027	G 2015	G 2015	G 2015	G 2015	G 2027	G 2015

NA= not assessed H=High, G=Good, M=Moderate, GEP=Good Ecological Potential, MEP=Moderate Ecological Potential.
*The macrophytes and phytobenthos elements are combined for Cycle 2.

Table 2-3 Summary of Cycle 3 WFD classification status and objectives for the River Tonge water body (GB112069064530)

Classification	Water body ID	Water body Name	Ecological Potential	Invertebrates	Fish	Phytobenthos and Macrophytes*	Ammonia	Dissolved Oxygen	pH	Phosphate	Temp
2019 (Cycle 3)	GB112069064530	Tonge	MEP	G	M	M	H	H	H	G	H
2022 (Cycle 3)	GB112069064530	Tonge	MEP	G	M	M	H	H	H	G	H
Objectives	GB112069064530	Tonge	GEP 2027	G 2015	M 2021	G 2027	G 2015	G 2015	G 2015	G 2015	G 2015

NB G=Good, M=Moderate GEP=Good Ecological Potential, MEP=Moderate Ecological Potential
*The macrophytes and phytobenthos elements are combined for Cycle 2

Table 2-4 Summary of Cycle 3 WFD classification status and objectives for the River Croal water body (including Blackshaw Brook) (GB112069064550)

Classification	Water body ID	Water body Name	Ecological Potential	Invertebrates	Fish	Phytobenthos and Macrophytes*	Ammonia	Dissolved Oxygen	pH	Phosphate	Temp
2019 (Cycle 3)	GB112069064550	River Croal	MEP	M	P	G	G	H	H	M	H
2022 (Cycle 3)	GB112069064550	River Croal	MEP	M	P	G	H	H	H	G	H
Objectives	GB112069064550	River Croal	MEP 2015	G 2027	G 2027	G 2015	G 2015	G 2015	G 2015	G 2027	G 2015

NB H=High, G=Good, M=Moderate, P=Poor, MEP=Moderate Ecological Potential
*The macrophytes and phytobenthos elements are combined for Cycle 2

Table 2-5 Summary of Cycle 3 WFD classification status and objectives for the River Irwell (Croal to Irk) water body (GB112069061451)

Classification	Water body ID	Water body Name	Ecological Potential	Invertebrates	Fish	Phytobenthos and Macrophytes*	Ammonia	Dissolved Oxygen	pH	Phosphate	Temp
2019 (Cycle 3)	GB112069061451	Irwell (Croal to Irk)	MEP	M	-		M	H	H	M	H
2022 (Cycle 3)	GB112069061451	Irwell (Croal to Irk)	MEP	M	-		M	H	H	M	H
Objectives	GB112069061451	Irwell (Croal to Irk)	MEP 2015	G 2027	-	-	G 2027	G 2015	G 2015	M 2027	G 2015

NB H=High, G=Good, M=Moderate, P=Poor MEP=Moderate Ecological Potential
*The macrophytes and phytobenthos elements are combined for Cycle 2

The WFD requires ‘no deterioration’ in the ecological status of water bodies. Extreme natural events such as drought are recognised within the WFD, with temporary deterioration allowances covered by Article 4.6. This allows for temporary deterioration as a 'result of circumstances of natural cause which are exceptional or could not reasonably have been foreseen, in particular extreme floods and prolonged droughts'. This applies to situations where it is necessary to make use of the water environment in ways that result in a temporary deterioration of status (e.g. supplying the public with drinking water during prolonged drought).

When assessing impacts on WFD elements, it is necessary to consider whether the impacts are temporary, whether the water body will recover quickly and without the need for restoration measures and the extent to which the impact is a result of natural causes versus anthropogenic management practices.

2.5 Designated sites

A search was conducted for statutory environmental designations within the Belmont study area including Areas of Outstanding Natural Beauty (AONB), local and national nature reserves, national parks, Ramsar sites, Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSIs). Local Wildlife Site designations were requested and obtained from the relevant local records centres. These are summarised in Table 2-6, Table 2-7 and Figure 2-2.

Belmont Reservoir and the upper reaches of the Eagley Brook sit within the large West Pennine Moors SSSI (SD 686 183), which supports an extensive mosaic of upland and upland-fringe habitats. It is of special interest for a number of nationally important habitat features.

Gale Clough and Shooterslee Wood SSSI (SD 700 141) is located to the west of Eagley Brook and is the best example of a clough woodland on acid soils in Greater Manchester. It runs most of the length of the Gale Brook which flows from Dingle Reservoir and joins Eagley Brook just upstream of its confluence with Delph Brook.

The Tonge River Section SSSI (SD 725 095), is located on the west bank of Eagley Brook, it is a geological SSSI, designated due to its Carboniferous rock formation.

Nob End (SD 749 063) SSSI is located on the outskirts of the village of Little Lever at the confluence of the rivers Croal and Irwell. The site comprises of a flat-topped, steep-sided tip of alkali waste produced as a by-product of the Leblanc process for the making of sodium carbonate and supports a rich establishment of calcicolous vegetation for which it is designated. The plateau of the tip is approximately 10 m above the level of the rivers.

Ashclough SSSI (SD 760 063), is located approximately 5 km south east of Bolton. The site comprises two sections of the south bank of the River Irwell and is designated for its geology which represents the best available exposures for showing the Ashclough Marine Band and its associated strata.

In addition, five Local Nature Reserves were identified (Table 2-6) as well as 23 local wildlife sites (Table 2-7). Designated sites are further discussed in Section A4.

Table 2-6 Statutory designated sites within study area

Site Name	Designation	Grid reference	Water body
West Pennine Moors	SSSI	SD 686 183	Eagley Brook
Gale Clough and Shooterslee Wood	SSSI	SD 700 141	Eagley Brook
Eagle Valley	LNR	SD 721 130	Eagley Brook
Tonge River Section	SSSI	SD 725 095	River Tonge
Leverhulme Park	LNR	SD 735 085	River Tonge
Moses Gate	LNR	SD 742 065	River Croal
Nob End	SSSI; LNR	SD 749 063	River Croal
Clifton County Park	LNR	SD 775 040	River Irwell

Table 2-7 Local wildlife sites within the Belmont study area

Site name	Water body	LNR	Grid reference	Reason for designation
Belmont Barn Inbye	Belmont Reservoir	N	SD669166	Flowering Plants and Ferns (Ff4b); Birds (Av9)
Higher Pasture House Inbye	Belmont Reservoir	N	SD675169	Birds (Av9)
Belmont Reservoir	Belmont Reservoir	N	SD672170	Birds (Av8e, Av5, Av4, Av3, Av1)
Belmont Gorge	Eagley Brook	N	SD 675161	Woodland (Wd10, Wd11, Wd12); Grassland (Gr4); Swamp, fen and reedbed (Fe7); Rock habitats (Ro2); Artificial habitats (Ar3)
Lower Whittaker Pastures	Eagley Brook	N	SD677162	Grassland (Gr3, Gr1)
Upper Longworth Clough	Eagley Brook	N	SD688158	Woodland and Scrub (Wd1); Habitat Mosaics (Hm2); Birds (Av8j)
Hampsons Flushes & scrub	Eagley Brook	N	SD695148	Swamp and Fen (Fe1)
Eagley Brook Field	Eagley Brook	N	SD703147	Grassland (Gr3)
Longworth Clough	Eagley Brook	N	SD705146	Woodland (Wd1)
Dunscar reservoirs & Longworth Lane Pastures	Eagley Brook	N	SD709138	Woodland (Wd1); Grassland (Gr2); Ponds & Small Lodges (Fw2)

Site name	Water body	LNR	Grid reference	Reason for designation
Gale Clough & Shooterslee Wood	Eagley Brook	N	SD705138	Woodland (Wd1); Grassland (Gr2)
Bank Top	Eagley Brook	Y	SD725124	Woodland (Wd1) Amphibians (Am1)
Leverhulme Park	River Tonge	Y	SD 735 085	Plantation Woodland (Wd2); Grassland (Gr2)
Smith Road Reservoirs & Raikes Clough	River Croal	N	SD 733 072	Woodland (Wd1)
Bull Hill	River Croal	N	SD 738 071	Calcareous Grassland (Gr3); Open Water (Fw3)
Moses Gate	River Croal	Y	SD 742 065	Pond & Small Lodges (Fw2); Birds (Br6 & Br7)
Manchester Bolton and Bury Canal (West)	River Croal	N	SD 744 071 – SD 761 056	Canal (Fw3)
Nob End	River Croal	Y	SD 749 063	Calcareous Grassland (Gr3); Scrub (Wd3)
Woodland near Ringley Bridge	River Irwell	N	SD 761 057	Ancient Woodland (Wd1)
Ringley Woods	River Irwell	N	SD 773 047	Ancient Woodland (Wd1)
Rhodes Farm Sewage Works	River Irwell	N	SD 785 039	Open water (Fw3); Swamp (Fw1); Birds
Clifton County Park	River Irwell	Y	SD 775 040	Woodland (Wd1) Ponds & Lodges (Fw2) Birds (Br6 & WB1)
Unity Brook	River Irwell	N	SD 765 042	Woodland (Wd1)

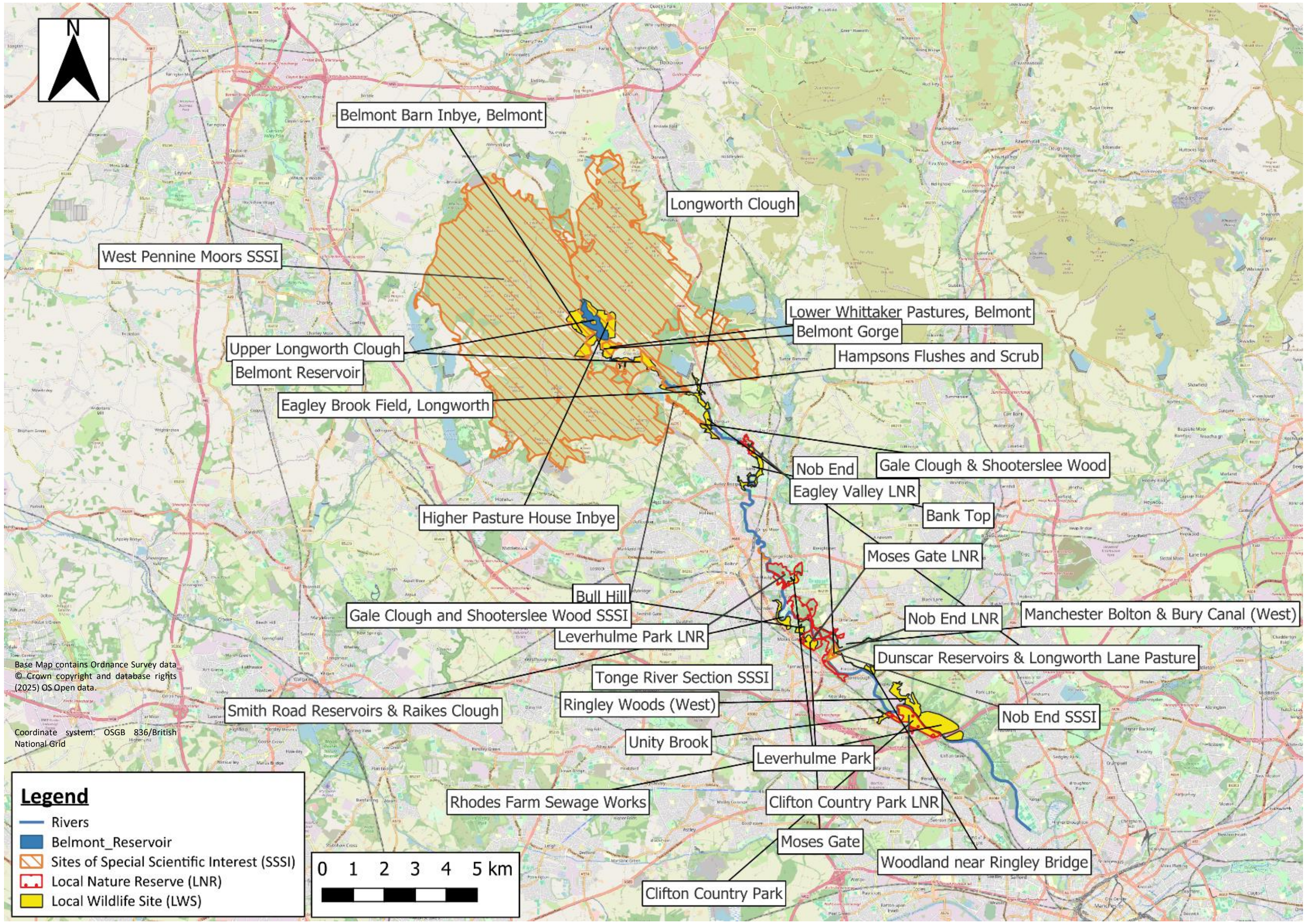

Figure 2-2: Map showing designated sites within study area

3. Assessment of pre-mitigation impacts

This Chapter:

- explains the methodology used to complete this environmental assessment (section 3.1);
- demonstrates how assessment of the proposed drought order is in line with expectations set out in relevant legislation (Sections 3.1 and Appendices 2, 3 and 4);
- justifies the level of effort/resource used to assess the drought order;
- describes the baseline environmental conditions (Sections 3.2 and 3.3 and Appendices 2, 3 and 4);
- summarises the hydrological impacts of drought order implementation (Section 3.2 and Appendix 2);
- summarises the sensitivity of environmental features to this action (Section 3.3 and Appendices 3 and 4);
- assesses the likely impacts on: ecological and other receptors, designated sites, priority species and habitats; the risk of spreading invasive non-native species; the likelihood of the impacts being temporary or permanent; the potential for cumulative effects (Section 3.3 and Appendices 3 and 4);
- considers the likely impact on water body status or potential and risk of deterioration (Sections 3.2 and 3.3 and Appendices 2, 3 and 4);
- allocates a level of confidence to the environmental assessments (Sections 3.2 and 3.3 and Appendices 2, 3 and 4); and
- identifies sources of uncertainty in the assessment and sets out plans to reduce these (Sections 3.2 and 3.3 and Appendices 2, 3 and 4).

Full details of the environmental assessment are provided in Appendix 2 (pathways), Appendix 3 (ecological receptors) and Appendix 4 (other receptors).

3.1 Environmental assessment methodology

Figure 3-1 summarises the process used to describe and categorise the impact of the drought order on each receptor. The process is consistent with the latest EA guidance on Environmental Assessment for Water Company Drought Planning (EA, 2025) and draws on industry good practice for undertaking ecological impact assessments (CIEEM, 2018 updated 2024) and on NRW technical guidance for Water Company Drought Plans (NRW, 2024).

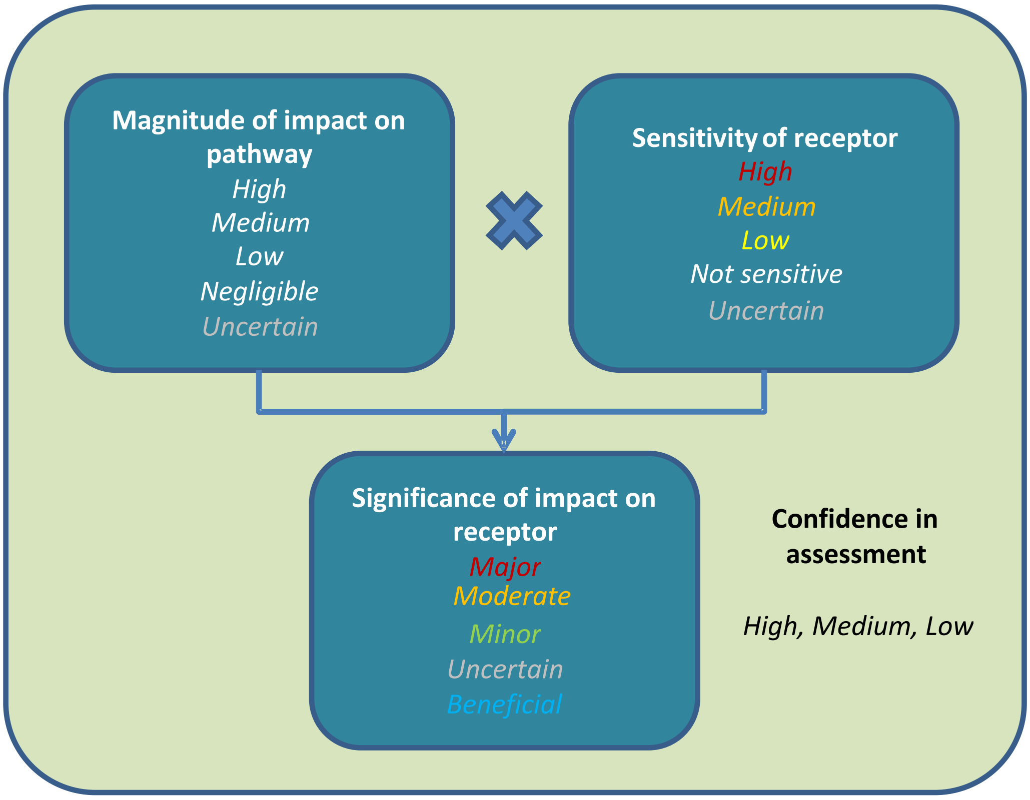

Figure 3-1 Flow chart outlining the environmental assessment process

The first step is to assess **magnitude of impact on each pathway**. We have chosen to categorise these impacts on a five-point scale: High, Medium, Low, Negligible, or Uncertain. These categories and associated definitions are provided in Table 3-1.

Table 3-1 Magnitude categories

Category	Definition
High	A large, extensive, long-term and/or very frequent change.
Medium	A medium-sized, substantial, medium-term and/or frequent change.
Low	A small, localised, short-term and/or infrequent change.
Negligible	A change unlikely to be noticeable / measurable.
Uncertain	Insufficient information is available to judge the magnitude of impact.

Following NRW (2024) and CIEEM (2018, updated 2024) guidance, the assessment of magnitude takes into account some or all of the following factors (as necessary to understand the resulting impact on receptors):

- Severity – the degree of change, relative to the baseline (large, medium, small);
- Extent – the area over which the impact occurs (extensive, substantial, localised);

- Duration (and reversibility)– the time for which the impact occurs (short-, medium-, long-term) and whether or not recovery from impact is possible within a reasonable timescale; and
- Frequency – how often the impact may occur (very frequent, frequent, infrequent).

Where relevant, the specific location and timing of any impacts is also described. Impacts on pathways may translate into positive or negative impacts on receptors, so whilst the direction of change is important (e.g. increase of decrease), impacts on pathways are not described as being positive or negative.

Next, the **sensitivity of each receptor** is categorised as High, Medium, Low, Not Sensitive, or Uncertain, in accordance with EA draft guidance (EA, 2025) and NRW guidance (NRW, 2024). Definitions are provided in Table 3-2.

Table 3-2 Sensitivity categories

Category	Definition
High	Receptor is highly sensitive to changing environments due to inability to tolerate and recover from changes.
Medium	Receptor is sensitive to changing environments due to limited ability to tolerate and/or recover slowly from the environmental change.
Low	Receptor is relatively insensitive to changing environments due to ability to tolerate and/or recover quickly from the environmental change.
Not sensitive	Receptor is not sensitive due to high tolerance to environmental change and/or ability to recover rapidly.
Uncertain	Insufficient information is available to judge the sensitivity of the receptor.

Sensitivity is a function of the receptor's capacity to accommodate change and its ability to recover if it is affected. A receptor may be more sensitive to changes in certain pathways than others. The assessment of sensitivity takes into account some or all of the following factors (EA, 2025):

- resistance (ability to remain unchanged by disturbance);
- redundancy (ability to avoid critical impairment (e.g. in ecosystem functioning) despite undergoing change);
- recovery capacity (ability to recover to baseline/avoid irreversible change); and
- recovery rate/resilience (time this recovery takes).

The conservation value of ecological receptors is also a factor to consider.

The magnitude of impact is combined with the sensitivity of receptor to assess the **significance of impact on each receptor**, as shown in Table 3-3 (adapted from NRW, 2017). In accordance with EA guidance (EA, 2025), impacts on receptors are categorised as: Major, Moderate, Minor, or Uncertain. Impacts on receptors can be positive as well as negative, however, so we have also included a fifth category – **Beneficial** – to identify any positive impacts. Definitions, adapted from NRW (2017), are provided in Table 3-4.

Table 3-3 Determining the significance of impacts on receptors

Magnitude of impact on pathway	Sensitivity of receptor				
	High	Medium	Low	Not sensitive	Uncertain
High	Major	Major	Moderate	Minor	Uncertain
Medium	Major	Moderate	Minor	Minor	Uncertain
Low	Moderate	Minor	Minor	Minor	Uncertain
Negligible	Minor	Minor	Minor	Minor	Uncertain
Uncertain	Uncertain	Uncertain	Uncertain	Uncertain	Uncertain

Table 3-4 Significance categories

Category	Definition
Major	Very large or large change in environmental or socio-economic conditions, which, if lost, cannot be replaced or relocated. The impacts are generally, but not exclusively associated with features and sites of national to regional importance because they contribute to achieving national / regional objectives. The impacts are likely to result in exceedance of statutory objectives and/or breaches of legislation (e.g. Likely Significant Effects or deterioration of WFD status).
Moderate	Intermediate change in environmental or socio-economic conditions. The impacts are likely to affect important considerations at a regional and local level. The impacts are unlikely to affect key decision-making processes (e.g. statutory objectives). Nevertheless, the cumulative effect of such impacts may lead to an increase of overall effect on a particular area or on a particular feature.
Minor	Small or negligible change in environmental or socio-economic conditions. These effects may be raised as local issues but are unlikely to be of importance in the decision-making process.
Uncertain	Insufficient information is available to judge the impact significance.
Beneficial	Any significant, moderate or minor change predicted to have a net positive effect on environmental or socio-economic conditions.

Impact significance provides a consistent means of expressing impacts which, in turn, inform the need for mitigation measures to offset the impacts. The determination of impact significance, both pre and post mitigation, also provides a transparent means for regulators to understand the impacts of a drought order.

In practice, determining the significance of impact carries a degree of subjectivity and requires expert judgement. This may be because of limited evidence/ data on the sensitivity of the receptors and/ or the complexity of interactions that require assessment to determine the magnitude of change. For example, receptors may experience direct impacts because of changes in pathways, but also indirect impacts as a secondary response to changes in other receptors. If a receptor is subject to different impacts via different pathways, then the combined effect of the different pathways is integrated to assess the overall significance of impact.

Finally, in accordance with EA guidance (EA, 2025) and NRW guidance (NRW, 2024), the **degree of confidence** in the assessment of impact significance is categorised as **High, Medium** or **Low**. Definitions are provided in Table 3-5. Key sources of uncertainty are identified and used to inform the design of the EMP.

Table 3-5 Confidence categories

Category	Definition
High	Judgments based on high-quality, robust information, and/or the nature of the impact makes it possible to render a solid judgement.
Medium	Credibly sourced and plausible information, but not of sufficient quality or corroboration to warrant a higher level of confidence.
Low	The information available is too fragmented or poorly corroborated to make solid analytic inferences, or significant concerns or problems with information sources exist.

The assessment has also considered the legislative requirements of:

- Conservation of Habitats and Species Regulations 2017.
- Fisheries legislation: Salmon and Freshwater Fisheries Act 1975 and the Eel (England and Wales) Regulations 2009.
- Water Environment (Water Framework Directive) Regulations 2017 including the objectives set out in river basin management plans.
- Section 40 and 41 of the Natural Environment and Rural Communities Act 2006 (NERC) (related to the duty to conserve biodiversity and priority habitats and species).
- Legislation covering INNS.
- Other non-statutory requirements (local wildlife sites etc.).
- Protected areas designated under international agreements (incl. Ramsar & European sites).
- Protected areas designated under national legislation (SSSIs), nationally protected species and habitats - Wildlife and Countryside Act 1981 and other locally important sites.

3.2 Impact on pathways

Table 3-6 and Table 3-7 summarise the likely impacts of the proposed Belmont drought order (alone (Scenario 1) and in-combination with a Jumbles drought permit (Scenario 2)) on hydrogeology, hydrology, habitats, geomorphology and water quality. Full details of the assessment are provided in Appendix 2 (Section A2).

Table 3-6 Summary of pre-mitigation impacts on physical pathways: proposed Belmont Reservoir drought order of 4.5 Ml/d (alone, Scenario 1)

Pathway	Water body	Description	Magnitude of impact	Confidence level
Hydrology	Belmont Reservoir	Since the proposed drought order will slow the rate of drawdown, it is predicted to have a beneficial negligible effect on reservoir water level and exposure.	**Negligible**	**Uncertain**. Lack of detailed bathymetric survey of the reservoir prevents assessment of shoreline exposure under drought order.
	Eagley Brook - GB112069064570	River flows are predicted to be reduced by approximately 64% compared to baseline flows at Q95.	**Medium**	**Low.** Limited measured flow data.
	Tonge - GB112069064530	River flows are predicted to be reduced by approximately 23% compared to baseline flows at Q95 upstream of the confluence with Bradshaw Brook, diminishing to a reduction of 11% downstream of the confluence with Bradshaw Brook.	**Low**	**Low.** Limited measured flow data.
	Croal - GB112069064550	River flows are predicted to be reduced by approximately 10% compared to baseline flows at Q95.	**Low**	**Low.** Conclusions depend upon untested extrapolation to the relevant flows but gauged data are available.
	Irwell (Croal to Irk) - GB112069061451	River flows reduced by less than 10% compared to baseline flows at Q95.	**Negligible**	**Low.** Conclusions depend upon untested extrapolation to the relevant flows but gauged data are available.
Sedimentation	Eagley Brook - GB112069064570	Mean and maximum flow velocities are predicted to decrease, which may increase the propensity for fine-grained suspended sediment deposition. However, an increase in deposition under drought order conditions is	**Medium**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.

Pathway	Water body	Description	Magnitude of impact	Confidence level
		unlikely to have a significant impact on the sediment composition of the bed, given the likelihood that deposition occurs under normal low flow conditions		
	Tonge - GB112069064530	Flow velocity remains sufficient to transport fine (suspended) sediment meaning that the risk of substantial sedimentation is low, although marginal deposition is likely to occur under both baseline and drought order scenarios	**Low**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.
In stream habitat	Eagley Brook - GB112069064570	Risk of the bed substrate becoming exposed, which in turn would limit the area of submerged habitat available	**Medium**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.
	Tonge - GB112069064530	Changes in hydraulic parameters are small and the risk of marginal exposure is expected to be low. As a result, there is likely to be a low magnitude change in habitat area.	**Low**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.

Pathway	Water body	Description	Magnitude of impact	Confidence level
Water quality	Eagley Brook - GB112069064570	A temporary, small increase in BOD and nitrate concentrations, with a WFD status change for BOD from High to Good. Potential for a temporary increase in ammonia with a WFD status change from High to Moderate immediately downstream of Belmont STW. A temporary increase in phosphate concentration, with a WFD status change from Moderate to Poor immediately downstream of Belmont STW, and from Good to Moderate further downstream. A temporary decrease in dissolved oxygen concentration, but with no impact on aquatic life. Risk of failing to meet 99%ile standards for ammonia.	**BOD, nitrate, DO: Low.** **Ammonia, phosphate: Medium**	The level of confidence is **Medium** because the PR24 SIMCAT models have been improved compared to previous models. The PR24 SIMCAT model contains updated data for sewage treatment works.
	River Tonge - GB112069064530	A temporary, small increase in total ammonia and nitrate concentrations, but no change in WFD status. A temporary increase in BOD and phosphate concentrations, with a WFD status change from High to Good at one site (BOD) or from Good to Moderate at both sites (phosphate). A temporary decrease in dissolved oxygen concentration, but with no impact on aquatic life.	**Low**	The level of confidence is **Medium** because the PR24 SIMCAT models have been improved compared to previous models. The PR24 SIMCAT model contains updated data for sewage treatment works.

Table 3-7 Summary of impacts on physical pathways: Proposed Belmont 4.5 Ml/d drought order in-combination with a Jumbles Reservoir drought permit of 12.0 Ml/d (Scenario 2)

Pathway	Water body / month	Description	Magnitude of impact	Confidence level
Hydrology	Tonge - GB112069064530	River flows predicted to be reduced by approximately 21% downstream of the Bradshaw Brook confluence compared to baseline flows at Q95.	**Medium**	**Low.** Limited measured flow data.
	Croal - GB112069064550	River flows predicted to be reduced by approximately 18% compared to baseline flows at Q95.	**Medium**	**Low.** Conclusions depend upon untested extrapolation to the relevant flows but gauged data are available.
	Irwell (Croal to Irk) - GB112069061451	River flows reduced by less than 10% compared to baseline flows at Q95.	**Negligible**	**Low.** Conclusions depend upon untested extrapolation to the relevant flows but gauged data are available.
Sedimentation	Tonge - GB112069064530	Cross-sectional averaged flow velocity is predicted to remain sufficient to transport fine suspended sediment, although marginal deposition is likely to occur.	**Low**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.
	Croal - GB112069064550	Cross-sectional averaged flow velocity is predicted to remain sufficient to transport fine suspended sediment, although marginal deposition is likely to occur.	**Low**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.
	Irwell (Croal to Irk) - GB112069061451	Cross-sectional averaged flow velocity is expected to remain sufficient to maintain the transport of suspended sediment.	**Negligible**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying

Pathway	Water body / month	Description	Magnitude of impact	Confidence level
				transects at low flows.
In-stream habitat	Tonge - GB112069064530	The risk of marginal exposure is slightly increased under the in-combination scenario but no substantial impact on wetted area or aquatic habitat availability is expected.	**Low**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.
	Croal - GB112069064550	The risk of marginal exposure is slightly increased under the in-combination scenario but no substantial impact on wetted area or aquatic habitat availability is expected.	**Low**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.
	Irwell (Croal to Irk) - GB112069061451	No contraction of habitat area or marginal exposure is expected.	**Negligible**	**Low** - Conclusions depend upon untested extrapolation to the relevant flows, but the degree of extrapolation has been minimised through surveying transects at low flows.
Water quality	Tonge - GB112069064530 and Croal - GB112069064550	A temporary, small increase in ammonia and nitrate concentrations, but no change in WFD status. A temporary small decrease in dissolved oxygen concentration, but with no impact on aquatic life. A temporary increase in BOD with no WFD status change in the River Tonge, and a temporary change from High to Good in the River Croal. A temporary increase in phosphate concentration River Tonge assessment sites, with WFD status change from Good to Moderate in	**Low**	The level of confidence is **Medium** because the PR24 SIMCAT models have been improved compared to previous models. The PR24 SIMCAT model contains updated data for sewage treatment works.

Pathway	Water body / month	Description	Magnitude of impact	Confidence level
		the River Tonge.		

3.3 Impact on receptors

Table 3-8 summarises the likely impacts of the proposed drought order on relevant ecological and other receptors. Full details of the assessment are provided in Appendix 2 (Section A2) and Appendix 3 (Section A3).

As the proposed drought order will slow the rate of reservoir drawdown and is predicted to have a beneficial but negligible effect on reservoir water level and exposure, it is concluded that there will be no subsequent negative impacts on receptors within Belmont Reservoir. Thus, the impacts of the proposed drought order on Belmont Reservoir are not considered further within this report, with the exception of the impacts on invasive non-native species (INNS).

Table 3-8 Summary of impacts on receptors: proposed Belmont drought order alone (Scenario 1) and in combination with a Jumbles drought permit (Scenario 2) (impacts apply across all scenarios unless otherwise stated)

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
Macrophytes and diatoms	All water bodies (except Irwell (Croal to Irk))	**Low**. The baseline datasets reflect communities with low sensitivity to reductions in flow and so resilience to small changes in depth and marginal/shallow habitat area.	Hydrological, habitat, geomorphological, and water quality analysis suggest up to medium magnitude of change resulting from implementation of the drought order, but macrophytes and diatoms are considered to be resilient to short-term changes in habitat area and water depth.	**Negligible**, but categorised as **Minor**	**Medium** due to the limited temporal resolution of the available macrophyte and phytobenthos data. Available macrophyte and diatom data for the water bodies of interest contains gaps and has limited coverage during and following dry/low flow periods.
	Irwell (Croal to Irk) - GB112069061451	**Low**. The baseline datasets reflect communities with low sensitivity to reductions in flow and so resilience to small changes in depth and marginal/shallow habitat area.	Very small hydraulic and water quality changes predicted on the Irwell water body and no effects on its macrophyte and phytobenthos community are predicted.	**Negligible**, but categorised as **Minor**	**Low** due to the absence of suitable monitoring locations within the geographical scope on this water body.

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
Macroinvertebrates	All water bodies (except Irwell (Croal to Irk))	**Low.** From the available data, there is no indication that macroinvertebrate communities in the water bodies of interest have been impacted adversely by previous dry periods/periods of lower flows.	Habitat, geomorphological, and water quality analysis suggest up to a medium magnitude of change resulting from implementation of the drought order, but macroinvertebrates are considered to be resilient to short-term periods of low flow.	**Negligible**, but categorised as **Minor**	**Medium** due to the limited temporal resolution of the available sampling data. The available macroinvertebrate data for the water bodies of interest contains gaps and has limited coverage during and following dry/low flow periods.
	Irwell (Croal to Irk) - GB112069061451	**Low.** From the available data, there is no indication that macroinvertebrate communities in the water bodies of interest have been impacted adversely by previous dry periods/periods of lower flows.	Very small hydraulic and water quality changes predicted on the Irwell water body and no effects on its macroinvertebrate community are predicted.	**Negligible**, but categorised as **Minor**	**Low** due to the absence of macroinvertebrate monitoring location within the geographic extent of this water body.

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
Fish – brown trout	Eagley Brook – GB112069064570	**High** (Spawning & egg incubation)**-** Spawning typically occurs in shallow to moderate depths and often in channel margins, leading to high sensitivity to water level reduction. Once deposited, eggs and early stage fry are largely immobile, preventing relocation to alternative habitat, if subject to dewatering. **Medium** (Juvenile & Adults).	The overall quality of habitat for fish species present on Bradshaw Brook is expected to remain unchanged, though the area of suitable wetted habitat is anticipated to contract.	**Moderate** (Spawning & egg incubation) **Minor** (Juveniles) **Negligible**, but categorised as **Minor** (Adults).	**Medium**
	Tonge - GB112069064530 Croal - GB112069064550	**High** (Spawning & egg incubation)**-** Spawning typically occurs in shallow to moderate depths and often in channel margins, leading to high sensitivity to water level reduction. Once deposited, eggs and early stage fry are largely immobile, preventing relocation to alternative habitat, if subject to dewatering.	Impacts on available wetted habitat are limited to slight reductions in overall depth and a small reduction in overall marginal habitat.	**Minor** (Spawning & egg incubation) (Scenario 1). **Moderate** (Spawning & egg incubation) (Scenario 2). **Negligible**, but categorised as **Minor** (Juvenile & Adult).	**Medium**

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
		Medium (Juvenile & Adults).			
	Irwell (Croal to Irk) - GB112069061451	**High** (Spawning & egg incubation)**-** Spawning typically occurs in shallow to moderate depths and often in channel margins, leading to a high sensitivity to water level reduction. Once deposited, eggs and early stage fry are largely immobile, preventing relocation to alternative habitat, if subject to dewatering. **Medium** (Juvenile & Adults)	Modelled changes suggest the water body is substantially unchanged from baseline conditions.	**Minor** (Spawning & egg incubation) **Negligible**, but categorised as **Minor** (juveniles & adults)	**Medium**
Fish – Bullheads	Eagley Brook – GB112069064570	**High** (Spawning & egg incubation **Medium** (Juvenile & Adults)	Bradshaw Brook considered to provide suitable habitat for all life stages of bullhead (though elevated velocities may exclude adults).	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Negligible**, but categorised as **Minor** (Juvenile & Adult)	**Medium**

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
	Tonge - GB112069064530 Croal - GB112069064550	**High** (Spawning & egg incubation **Medium** (Juvenile & Adults)	Impacts on available wetted habitat are limited to slight reductions in overall depth and a small reduction in overall marginal habitat.	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Moderate** (Spawning & egg incubation) (Scenario 2) **Minor** (Juveniles) **Negligible**, but categorised as **Minor** (Adults)	**Medium**
	Irwell (Croal to Irk) - GB112069061451	**High** (Spawning & egg incubation **Medium** (Juvenile & Adults)	Modelled changes suggest the water body is substantially unchanged from baseline conditions.	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Negligible**, but categorised as **Minor** (Juveniles & adults)	**Medium**

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
Fish - rheophilic coarse fish	Eagley Brook – GB112069064570	**High** (Spawning & egg incubation **Medium** (Juvenile & Adults)	Eagley Brook likely to provide suitable habitat for all life stages of both rheophilic and eurytopic / minor coarse fishes, with the exception of adults (likely excluded by the shallow water depths under baseline conditions.	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Minor** (Juvenile & Adult)	**Medium**
	Tonge - GB112069064530 Croal - GB112069064550	**High** (Spawning & egg incubation) **Medium** (Juvenile & Adults)	Impacts on available wetted habitat are limited to slight reductions in overall depth and a small reduction in overall marginal habitat.	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Negligible**, but categorised as **Minor** (Juvenile & Adult)	**Medium**
	Irwell (Croal to Irk) - GB112069061451	**High** (Spawning & egg incubation) **Medium** (Juvenile & Adults)	Modelled changes suggest the water body is substantially unchanged from baseline conditions.	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Negligible**, but categorised as **Minor** (Juvenile &	**Medium**

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
				Adult)	
Fish - Eurytopic / minor coarse fish	Eagley Brook – GB112069064570	**Medium** (all life stages)	Eagley Brook likely to provide suitable habitat for all life stages of both rheophilic and eurytopic / minor coarse fish, with the exception of adults (likely excluded by the shallow water depths under baseline conditions.	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Minor** (all other life stages)	**Medium**
	Tonge - GB112069064530 Croal - GB112069064550 Irwell (Croal to Irk) - GB112069061451	**Medium** (all life stages)	Impacts on available wetted habitat for the Tonge and Croal are limited to slight reductions in overall depth and a small reduction in overall marginal habitat. Modelled changes to Irwell, suggest the water body is substantially unchanged from baseline conditions.	**N/A (**Spawning & egg incubation period not in the drought order implementation window) **Negligible**, but categorised as **Minor** (all other life stages)	**Medium**
Angling groups	All water bodies	**Low**	Modelled changes in hydraulic parameters are minor or very minor, leading to a negligible impact magnitude on life stages of species targeted by anglers.	**Negligible**, but categorised as **Minor**.	**Medium**

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
Protected species – bats, otters, water voles, great crested newts, common toad, reptiles, white-clawed Crayfish.	All water bodies	**Low** (Common amphibians, reptiles). **Medium** (Bats, otters, great crested newts). **High** (Water voles, white-clawed Crayfish). Available data suggest that these protected species are reasonably tolerant to changes in habitat and geomorphology and water quality.	Habitat, geomorphological, and water quality analysis suggest a negligible to low magnitude of change resulting from implementation of the drought order; however, the predicted changes are considered to be within the tolerance ranges of these receptors.	**Negligible**, but categorised as **Minor.**	**Medium,** the available data currently have gaps; except: **Low** (White-clawed Crayfish) – limited survey data.
Protected species – wading birds, wildfowl and gulls, riverine birds	All water bodies. Breeding and non-breeding season	**Low.** Data indicate that these species tolerate small changes in water levels. Their main sensitivity is in relation to available food source, e.g. fish and macrophytes, neither of which are anticipated to be significantly impacted as a result of the proposed drought order.	Habitat, geomorphological, and water quality analysis suggest a negligible to low magnitude of change resulting from implementation of the drought order however, the predicted changes are considered to be within the tolerance ranges of these receptors.	Negligible, but categorised as **Minor**.	**Medium,** the available data currently have gaps.

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
Invasive non-native species – 12 priority species identified out of 60 in the study area.	Belmont Reservoir (study area), Eagley Brook, River Croal, River Tonge, River Irwell	**Variable – Not Sensitive to High.** INNS receptor sensitivities are categorised at the species or taxonomic group level, by each pathway impact.	The reduction in compensation flow from the reservoir is expected to reduce the capacity for INNS to spread from the reservoir. Reduction in downstream river flow may influence the ability for INNS to disperse upstream and / or downstream. Reduction in downstream wetted area may influence density of INNS and suitable habitat for colonisation. Change in water quality may have variable impacts upon INNS.	Varies between species, water body, and scenario - summarised as **Minor, beneficial** (risk of temporary negative environmental impacts)	Variable between INNS – summarised as **Low**.
Socio-economics	All water bodies	**Low.** Previous experience of drought measures show that impacts are usually only likely to occur with drought measures to regulate demand, rather than those to support the environment.	The proposed drought order is aimed at securing water for the environment in the event of a drought, which will be of benefit to the regional population.	**Beneficial**	**High**. Sufficient data with limited gaps.
Tourism and recreation	Belmont Reservoir	**Low.** Previous experience of drought measures show that impacts are usually only likely to occur with drought measures to regulate demand, rather than those	The proposed drought order will result in more water being retained in Belmont Reservoir, which would be expected to have a positive impact on tourism and recreational activities, e.g. sailing.	**Beneficial**	**High**. Sufficient data with limited gaps.

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
		to support the environment.			
Tourism and recreation	Eagley Brook, River Tonge, River Croal, River Irwell	**Low.** Previous experience of drought measures show that impacts are usually only likely to occur with drought measures to regulate demand, rather than those to support the environment.	The hydrological and habitat and geomorphological impacts are expected to be of up to Medium magnitude depending on location; however, most tourism and recreational activities occur on lower reaches where there is predicted to be limited impact.	Negligible, but categorised as **Minor**.	**High**. Sufficient data with limited gaps.
Aesthetics & Landscape	Belmont Reservoir	**Low**. Impacts would be short-term.	The drought order will result in more water being retained in Belmont Reservoir, which would be expected to have a positive impact on aesthetics.	**Beneficial**	**High.**
Aesthetics & Landscape	Eagley Brook, River Tonge, River Croal, River Irwell	**Low**. Impacts would be short-term.	The hydrological and habitat and geomorphological impacts are expected to be of up to Medium magnitude depending on location. The drought order aims to maintain water in the downstream water courses for longer, which would be expected to have a positive impact on aesthetics.	Negligible, but categorised as **Minor**.	**Medium**. Uncertainty relates to hydrology and habitat and geomorphology data uncertainties.
Archaeology and cultural heritage	All water bodies	**Not sensitive.** No definitive pathways of impact have been identified.	No definitive pathways of impact have been identified.	N/A	**High**.

Receptor	Water body / month	Sensitivity	Description of impact	Significance of impact	Confidence level
Designated sites	All water bodies	**Low.** Features present at the sites identified are thought to be tolerant to small changes in water level.	The hydrological and habitat and geomorphological impacts are expected to be of up to Medium magnitude depending on location, but only for a short duration.	Negligible, but categorised as **Minor**.	**Low.** Uncertainties outlined for hydrology and habitat and geomorphology are compounded by the lack of data as regards a number of the identified sites.
Other abstractors	Eagley Brook	**High –** Downstream of Belmont prior to major confluence	Potential for flow reduction at abstraction point	**Uncertain.**	**Uncertain.**
	Eagley Brook	**High –** Downstream of Belmont prior to major confluence	Potential for flow reduction at abstraction point	**Uncertain.**	**Uncertain.**
	Eagley Brook	**Moderate –** Downstream of Belmont prior to major confluence	Potential for flow reduction at abstraction point	**Uncertain.**	**Uncertain.**

4. Mitigation measures

This Chapter sets out mitigation measures to minimise the environmental impact of the drought order.

Where significant negative impacts (defined for this report as those of at least Moderate significance (receptors), or Uncertain) are identified during the environmental assessment process, mitigation measures have been identified in order to avoid, reduce or mitigate for any impacts.

With the exception of **Moderate** impacts on brown trout spawning and egg incubation in the Eagley Brook and Croal water bodies, only **Minor/Negligible** or **Beneficial** significance impacts are predicted on ecological and other receptors in all water bodies.

A range of precautionary mitigation measures have been developed, in the event that environmental monitoring during the implementation of the proposed drought order identifies that unexpected impacts are occurring.

It should be noted that not all of the mitigation measures described below may be required or appropriate. If unexpected impacts are found to be occurring, potential mitigation measures will be discussed and agreed with the EA. Mitigation measures will be implemented to reduce the impacts of the proposed drought order and not the impacts of the drought itself.

4.1 Measures to mitigate environmental impacts identified by monitoring during drought order implementation

A number of mitigation measures could be implemented depending on feasibility, should monitoring during the proposed drought order indicate that significant impacts are occurring (Table 4-1).

- Increase compensation flow from Belmont Reservoir temporarily, or return to normal compensation flow, in the event of a pollution incident, or if there is evidence of ecological distress, or if reduced flows are considered to be having serious detrimental environmental consequences on affected water bodies.
- Supply of freshets in November to aid upstream trout migration. Subject to water availability and need as agreed with EA.
- Fish rescue and relocation should fish become trapped above or below river structures or other barriers to connectivity during drought permit implementation. This may be less appropriate during the winter months and would be discussed and agreed with the EA if required.

It may not be necessary to implement any of these mitigation measures if significant negative impacts are not observed to be occurring. Implementation of the mitigation measures will take place should monitoring during the proposed drought order indicate that significant impacts are being experienced.

Table 4-1 Proposed mitigation measures

Environmental Impact	Trigger for action (including any links to environmental monitoring)	Proposed mitigation action	Timing and duration of action
Pollution incident and/or ecological distress	If observed from during-drought water quality monitoring and habitat walkovers	Increase compensation flow	As required
Trout upstream migration	Start of trout run, if concerns observed from habitat walkovers	Supply of freshets	Throughout November, until end of trout run
Fish trapped by structures	If observed from habitat walkovers	Fish rescue and relocation	As required.

5. Environmental monitoring plan

This Chapter:

Sets out an environmental monitoring plan covering the baseline, in-drought and post-drought (recovery) monitoring that will be carried out to:

- understand the actual environmental impact of implementing the drought order;
- improve the confidence of the environmental assessment; and
- assess the effectiveness of the mitigation measures detailed in Section 4.

5.1 Introduction

An EMP has been developed which includes, pre-drought order implementation, during-drought order implementation and post-drought order implementation monitoring.

The environmental features to be monitored are detailed in Section 5.2, together with the agreed monitoring locations. It is important to note that the level of monitoring is risk-based. The environmental assessment indicates that, relative to the baseline, the proposed drought order presents a low risk to the environment: negligible/minor negative impacts are predicted for most receptors in most water bodies, with the exception of some negative impacts (of moderate significance) on brown trout spawning and egg incubation, principally in the Eagley Brook and River Croal water bodies. Given the uncertainties inherent in some of the assessments undertaken, monitoring has been recommended, to check the predicted degree of impact, and identify any unexpected impacts in order to trigger mitigation measures, if needed.

5.1.1 Pre-drought order implementation monitoring

Pre-implementation monitoring should be triggered by drought order preparations and undertaken prior to implementation of a Belmont drought order. Pre-implementation data can be important to demonstrate the precise baseline conditions ahead of the proposed changes to the compensation flow regime.

5.1.2 During-drought order monitoring

In-drought order monitoring is required to assess any impacts from the implementation of the proposed drought management action and for the management of mitigation measures during a drought, should these be needed (as noted in Section 4 this is considered unlikely).

5.1.3 Post-drought order monitoring

Post-drought order monitoring will aim to assess recovery and to check that there are no long-term effects on any environmental features. It will also be used to feed back into the assessment of sensitivity and likely impact to inform the management of future drought actions.

Post drought order monitoring will cover the period of recovery and be carried out in consultation with the regulator. The exact duration of monitoring will depend on how long the order was implemented for and whether any impacts were identified during implementation.

5.2 Belmont Environmental Monitoring Plan

The Belmont EMP, covering the Eagley Brook, River Tonge, River Croal and River Irwell water bodies is presented in Table 5-1 to Table 5-3.

5.2.1 Flow / in-river habitat

Spot flow gauging will be undertaken at eight locations on one occasion pre-drought order implementation, and one occasion within two weeks of the implementation of the proposed drought order, with the need for additional surveys to be reviewed thereafter. The locations include all 6 of the sites used in Atkins (2008) and a site used by the EA in 2011 (EA Belmont site 2), all on the Eagley Brook. Gauging is recommended at a further site which should be located between the confluence of the Eagley Brook with the Barley Brook, and the confluence of the Eagley Brook with the Tonge. A tentative location for this site is SD 72226 11044, however the precise location should be confirmed following a walkover because dense tree cover seen on aerial imagery prevents an accurate assessment of that location.

Habitat transects will be undertaken to reduce uncertainty in the assessment of effects on habitat under low flow/ drought order conditions. Habitat transects will be co-located at 5 of the Atkins (2008) spot flow gauging sites (Site 1 and sites 3-6). Atkins (2008) Site 2 will not be used as it is only 300 m downstream of Site 1. Habitat transects should also be undertaken at EA Belmont Site 2 and another at the proposed new spot flow measurement location near the confluence with the Tonge. In addition, if in-combination with a Jumbles drought permit, and as previously described in APEM (2025b), habitat transects will be undertaken at one location on the River Tonge, one location on the River Croal and one location on the River Irwell) subject to access. Measurements of wetted width and water depth at all these transects are also recommended on one occasion during drought order implementation to validate predictions.

Walkover surveys of at least four stretches of river along Eagley Brook and the River Tonge are recommended, with locations to be agreed with the EA. It is recommended that they are undertaken prior to drought order implementation and during drought order implementation including a visual assessment of bed sediment to identify any adverse impacts at sensitive locations (e.g. problems with fish passage past river structures, problems associated with poor water quality, signs of establishment and or expansion of INNS although the latter is not anticipated).

5.2.2 Water quality

Modelling of point source and diffuse inputs predicted a low magnitude impact on water quality in most cases, with some risk of temporary changes to WFD status predicted for Eagley Brook, the River Tonge and the River Croal but no permanent changes to status predicted. Medium magnitude impacts were predicted within Eagley Brook for ammonia and phosphate, including temporary changes in WFD status. Given this, some water quality monitoring is recommended during drought order implementation.

Specifically, spot measurements of ammonia, dissolved oxygen, water temperature and pH, should be undertaken using a hand-held probe at the same time as the walkover surveys described in Section 5.2.1 to highlight any need for further monitoring. From these data, concentrations of unionised ammonia should also be calculated and assessed. If storm conditions are forecast during implementation of the proposed drought order, it should be attempted to schedule one or more of the weekly walkover surveys to take place immediately following the storm event to monitor the potential impact from intermittent discharges. It is recommended that one of the walkover survey sites targets the reach on Eagley Brook which is immediately downstream of the discharge from Belmont STW. In addition, one of the recommended spot monitoring locations is the Croal @ Farnworth Recorder Stn U/S Weir, which is located just upstream of a weir on the River Croal and is included due to the risk of reduced DO in a low velocity area (such as upstream of weirs).

It is also recommended that up to three continuous water quality monitoring sondes are installed during drought order implementation along Eagley Brook to monitor the effects of any intermittent discharges, should rainfall events occur.

It is further recommended that pre and during drought order implementation sampling is undertaken at the EA monitoring points, described below in Table 5-1. This should include the WFD physico-chemical parameters as described in Table 5-1. One of these EA monitoring points should be sampled for dissolved iron, dissolved manganese, dissolved organic carbon (DOC) and dissolved calcium, due to an uncertain risk from a discharge of groundwater to Eagley Brook.

5.2.3 INNS

Attention should be paid to the INNS present within downstream water bodies whilst undertaking the walkover surveys as described in Section 5.2.1. This should be undertaken with the intention of verifying the baseline INNS data used within the assessment, and monitoring the distribution and abundance of INNS with a particular focus on those identified to benefit as a result of the drought order (Section A3.5.5).

Table 5-1 Belmont Environmental Monitoring Plan – Pre-implementation monitoring

Feature of Interest	Location (NGR)	Control or impact	Method and relevant standard	Details of 'Pre-implementation' monitoring (frequency, timing, responsibility)
Spot flow gaugings	1. Eagley Brook at Atkins Site 1 (SD 67560 16032) 2. Eagley Brook at Atkins Site 2 (SD 67560 16032) 3. Eagley Brook at Atkins Site 3 (SD 67560 16032) 4. Eagley Brook at Atkins Site 4 (SD 67560 16032) 5. Eagley Brook at Atkins Site 5 (SD 67560 16032) 6. Eagley Brook at Atkins Site 6 (SD 67560 16032) 7. Eagley Brook at EA Belmont Site 2 (SD 67560 16032) 8. Eagley Brook, approx. location SD 72226 11044 9. River Tonge at SD 73323 08591 10. River Croal near Burnden (SD7319307594) 11. River Irwell d/s River Croal (existing site) (SD 75298 05617)	Control	Monitor locations including field notes and fixed-point photographs from RHB and LHB. Including measurement of: water level, water depth, velocity, wetted width, wetted area.	UU: One low flow occasion (pre-drought order)
Habitat transects	As above but excluding Atkins Site 2.	Control	Monitor locations including field notes and fixed-point photographs from RHB and LHB. Including measurement of: water level, water depth, velocity, wetted width, wetted area.	UU: One low flow occasion (pre-drought order)
Walkover surveys - fish and water quality, and INNS	At least 4 stretches of river, to be agreed with the EA, along the Eagley Brook,River Tonge and River Croal. One of the surveys should include the reach on Eagley Brook which is immediately downstream of the discharge from Belmont STW.	Control	Walkover surveys, looking for signs of fish in distress (e.g. gasping, trapped, dead fish), fine sediment accumulation, plus *ad hoc* spot measurement of ammonia, dissolved oxygen, water temperature and pH using a hand-held probe. Check for signs of aquatic and riparian INNS present in or around the survey locations. Record location (NGR), photographs, and (where necessary) abundance.	UU: Once, immediately prior to drought order implementation

Feature of Interest	Location (NGR)	Control or impact	Method and relevant standard	Details of 'Pre-implementation' monitoring (frequency, timing, responsibility)
			Visual assessment of bed sediment at sensitive locations, documented with photos	
Water quality	Existing EA sampling locations: 1. Eagley Brook Upstream of Belmont Etw (SD 68301 15759) 2. Eagley Bk Below Charles Turner U/S Delph (SD 70204 14746) 3. Eagley Brook at Hough Lane (SD 71928 13115) 4. Eagley Brook Above Conf With Astley Brk (SD 72057 11109) 5. River Tonge @ Metro Engineering F/Bridge (SD 72525 09877) 6. Croal at Farnworth Recorder Stn u/s Weir (SD 74343 06831)	Control	Spot measurement of ammonia, dissolved oxygen, water temperature and pH using a calibrated hand-held probe, on the same day as the walkover surveys.	Once, immediately prior to drought order implementation
Water quality	Existing EA sampling locations: 1. Eagley Brook Upstream of Belmont Etw (SD 68301 15759) 2. Eagley Bk Below Charles Turner U/S Delph (SD 70204 14746) 3. Eagley Brook at Hough Lane (SD 71928 13115) 4. Eagley Brook Above Conf With Astley Brk (SD 72057 11109) 5. River Tonge @ Metro Engineering F/Bridge (SD 72525 09877) 6. Croal at Farnworth Recorder Stn u/s Weir (SD 74343 06831)	Control	Spot sampling for WFD physico-chemical parameters: acid neutralising capacity, total ammonia as N and soluble reactive phosphorus, on the same day as the walkover surveys.	Once, immediately prior to drought order implementation. In discussion with the EA as some sites are monitored under their sampling programme.
Water quality	Eagley Bk Below Charles Turner U/S Delph (SD 70204 14746)	Control	Spot sampling for: dissolved iron, dissolved manganese, DOC and dissolved calcium, on the same day as the walkover surveys.	Once, immediately prior to drought order implementation.

Table 5-2 Belmont Environmental Monitoring Plan – In-drought monitoring

Feature of Interest	Location (NGR)	Control or impact	Method and relevant standard	Details of 'In-drought' monitoring (frequency, timing, responsibility)
Spot flow gauging	As above (11 locations)	Impact	As above	UU: Once, within two weeks of drought order implementation, then review based on data collected to date and information from the walkovers.
Habitat transects	As above (10 locations)	Impact	Monitor transect locations including field notes and fixed-point photographs from RHB and LHB. Depth profile at each location.	UU: Once during order implementation, to validate predictions of depth, wetted width / area, then review based on data collected to date and information from the walkovers.
Walkover surveys - fish and water quality	As above (4 locations)	Impact	As above	UU: Weekly (or twice weekly if feasible) for the first two weeks of drought order implementation, then frequency to be reviewed and agreed with the EA following review of data.
Water quality	As above (6 locations)	Impact	Spot measurements, as above	UU: Weekly for first two weeks then review. In discussion with the EA, one of these visits could be scheduled where possible to follow a forecast storm event.
Water quality	As above (6 locations)	Impact	Spot sampling, as above	UU: Twice monthly. In discussion with the EA as some sites are monitored under their sampling programme.
Water quality	Eagley Bk Below Charles Turner U/S Delph	Impact	Spot sampling, as above	UU: Twice monthly. In discussion with the EA as some sites are monitored under their sampling programme.
Water quality	Three locations in Eagley Brook, to be confirmed in discussion with the EA	Impact	Installation of continuous water quality monitoring sonde, to measure the following: ammonia, DO, temperature, pH.	UU: throughout implementation of drought order, with particular emphasis on wet weather events (risk of intermittent discharges) and salmonid spawning period.

Table 5-3 Belmont Environmental Monitoring Plan – Post-drought monitoring

Feature of Interest	Location (NGR)	Control or impact	Method and relevant standard	Details of 'Post-drought' monitoring (frequency, timing, responsibility)
Walkover surveys – fish, water quality and INNS.	As above (4 locations)	Impact	As above	UU: Once, in the first week after cessation of drought order implementation.
Water quality	As above (6 locations)	Impact	Spot measurements, as above	UU: Once, in the first week after cessation of drought order implementation
Water quality	As above (6 locations)	Impact	Spot sampling, as above	UU: Once, in the first week after cessation of drought order implementation
Water quality	Eagley Bk Below Charles Turner U/S Delph	Impact	Spot sampling, as above	UU: Once, in the first week after cessation of drought order implementation

6. Conclusions and recommendations

The Belmont drought order is predicted to have a **Medium** magnitude effect on flows in Eagley Brook, and an effect of **Medium** magnitude on in-stream habitat within Eagley Brook. In-combination with a Jumbles drought permit, impacts of **Medium** magnitude on flows in the rivers Tonge and Croal could also occur. In all other water bodies, impacts on flow and in-stream habitat are predicted to be **Low** or **Negligible**.

The Belmont drought order (alone and in-combination with a Jumbles drought permit) is predicted to have a **Low** magnitude impact on water quality in most cases, with some risk of temporary changes to WFD status predicted for Eagley Brook, the River Tonge and the River Croal but no permanent changes to status predicted. Impacts of **Medium** magnitude were predicted within Eagley Brook for ammonia and phosphate, including temporary changes in WFD status and a possible risk of failing to achieve 99th percentile standards for ammonia in some parts of Eagely Brook, if intermittent discharges were to occur due to rainfall events during drought order implementation.

This would translate to principally **Minor** negative impacts on ecological and other receptors within the affected area, in comparison with the baseline scenario, both alone and in-combination with Jumbles drought permit. The exception to this is **Moderate** impacts predicted for brown trout spawning and egg incubation in Eagley Brook (and in the River Croal in-combination with a Jumbles drought permit). The pre-mitigation potential impacts on receptors are summarised as follows:

Scenario	Impact Significance	Receptors
Belmont drought order (Eagley Brook water body) (Scenario 1)	Moderate impacts	Brown trout spawning and egg incubation
Belmont drought order in-combination with a possible Jumbles drought permit (12 Ml/d) (Croal water body) (Scenario 2)	Moderate impacts	Brown trout spawning and egg incubation
Belmont drought order (all other water bodies) (Scenario 1)	Minor impacts	All other receptors
Belmont drought order in-combination with a possible Jumbles drought permit (12 Ml/d) (all other water bodies) (Scenario 2)	Minor impacts	All other receptors

Where impacts of moderate significance have been identified during the environmental assessment process, a range of mitigation measures have been identified in order to avoid or reduce any impacts, in the event that environmental monitoring during the proposed drought order identifies that impacts are occurring (Section 4). These include increasing compensation flow from Belmont Reservoir temporarily, or a return to normal compensation flow, supply of freshets in November to aid upstream trout migration, and fish rescue.

Monitoring has been recommended in order to capture any changes before, during and after implementation of the proposed drought order (see Section 5). This includes checking for signs of ecological stress including: potential effects on flow and water quality; inhibition of movement of fish past river structures or other barriers; habitat availability for adult and juvenile life stages (including spawning/ nursery areas); concentration of fish in restricted areas/ pools which could increase susceptibility to predation; and evidence of presence or expansion of INNS.

It should be noted that mitigation measures proposed may not be required or appropriate. If unexpected impacts are found to be occurring, potential mitigation measures will be discussed and agreed with the EA. Mitigation measures would be implemented to reduce the impacts of the proposed drought order and not the impacts of the drought itself.

7. References

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Atkins (2008) Eagley Brook Compensation Survey. Final report. Report to Environment Agency. 5058167/DG/70/003. 60pp.

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CIEEM (2018) Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland. Chartered Institute of Ecology and Environmental Management, v1.3, updated September 2024.

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Natural Resources Wales (2024) Water Company Drought Plan Technical Guidance. v.2, July 2024.

United Utilities (2022) Final Drought Plan 2022.

A1. Consultation with Environment Agency

A draft version of the EAR was provided to the EA for review on 16/07/2025. Written comments were received from the EA between 23/07/2025 and 31/07/2025. A final version of the report, addressing all comments on the draft report, was shared with the EA on 14/08/2025.

A2. Assessment of impacts on pathways

A2.1 Hydrology

A2.1.1 Background

This part of the assessment reviews the hydrological effects of the proposed drought order on Belmont Reservoir, Eagley Brook, the River Tonge, the River Croal and the River Irwell.

Catchment description

Eagley Brook is a small river that rises at the confluence of several smaller watercourses in the West Pennine Moors, north of the town of Bolton. The brook feeds Belmont Reservoir and flows downstream of its outfall for approximately 11 km in a southeasterly direction to its confluence with the River Tonge on the northern edge of Bolton.

The Eagley Brook catchment is approximately 31.5 km^2 in area and is typified in the upstream reaches by moorland and agricultural land (pasture), downstream of which the land becomes increasingly urbanised towards Bolton. The valley form transitions from a vee-shaped valley in the upstream reaches to a broad valley with a symmetrical or asymmetrical floodplain as it reaches its confluence with the River Tonge. Further downstream, the river flows through Bolton, where the land use of the catchment draining to the River Croal is predominantly urbanised.

Figure A2-1 schematises the River Croal catchment, including UU compensation release points from Belmont, Delph, and Jumbles Reservoirs, and EA river gauging stations at Bradshaw Tennis Club (Bradshaw Brook), Farnworth (River Croal) and Kearsley (River Irwell).

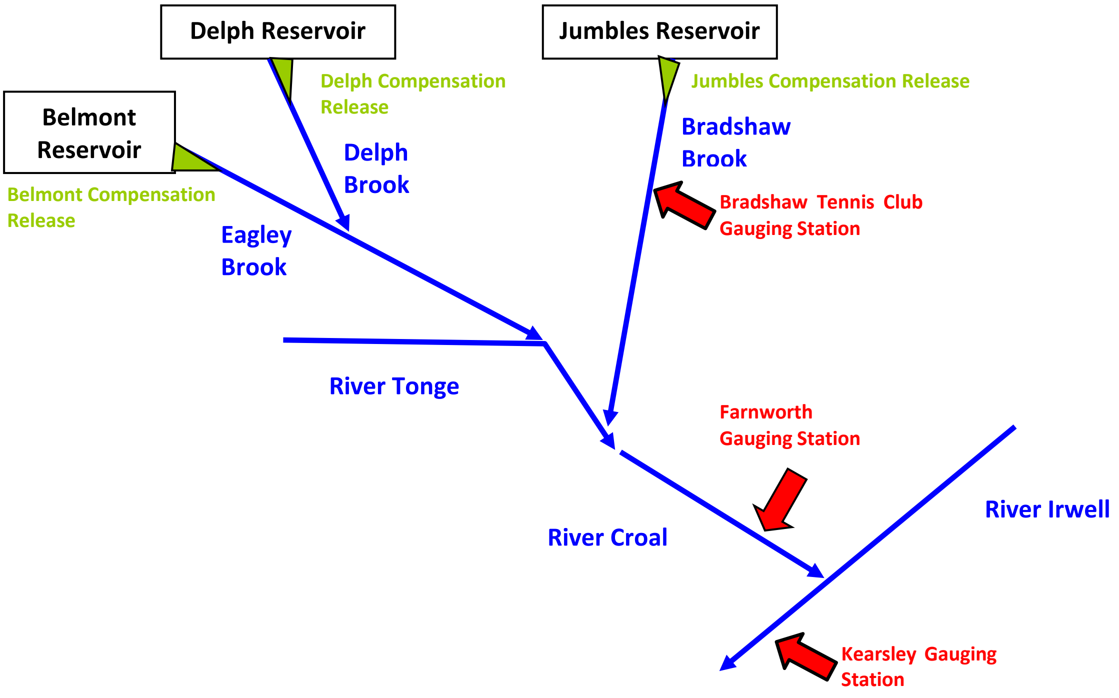

Figure A2-1 Reservoir compensation releases and flow gauging sites in the Eagley Brook, River Croal, and River Irwell catchments.

A compensation flow is released from Belmont Reservoir to Eagley Brook, from Delph Reservoir to Delph Brook, and from Jumbles Reservoir to Bradshaw Brook in the River Croal catchment. The closest river flow gauging station directly downstream of Belmont Reservoir is at Farnworth on the River Croal (this gauging station is also downstream of Jumbles and Delph reservoirs). There is also a gauging station downstream of Jumbles Reservoir on Bradshaw Brook at Bradshaw Tennis Club. Further downstream, there is a gauging station at Kearsley on the River Irwell. There are several non-UU abstractions in the catchment upstream of the Bradshaw Brook confluence, but there are none downstream of the Bradshaw Brook confluence (i.e. none that could potentially be affected by in-combination effects of a Jumbles drought permit).

Flow scenarios

Table A2-1 presents the two scenarios considered in this assessment. Scenario 1 represents the proposed Belmont Reservoir drought order, under which the compensation flow released into Eagley Brook is reduced from 9 Ml/d to 4.5 Ml/d. Scenario 2 also represents this proposed drought order at Belmont Reservoir, but in combination with a potential drought permit at Jumbles Reservoir, under which the compensation flow is reduced from 19.9 Ml/d to 12 Ml/d.

Table A2-1 Drought order/permit scenarios

Drought Order/Permit Scenario		Compensation Flow Release (Ml/d)	Affected Water Bodies
1	Belmont drought order reduced to 4.5Ml/d	4.5	• Belmont Reservoir • Eagley Brook – GB112069064570 • Tonge – GB112069064530
2	Belmont 4.5 Ml/d drought order in combination with a Jumbles 12 Ml/d drought permit	Belmont = 4.5 Jumbles = 12.0	• Belmont Reservoir* • Eagley Brook – GB112069064570* • Tonge – GB112069064530 • Croal (including Blackshaw Brook) – GB112069064550) • Irwell (Croal to Irk) – GB112069061451

*In-combination effects with Jumbles drought permit are only relevant to the Tonge downstream of the Bradshaw Brook confluence, the River Croal and the River Irwell.

Belmont Reservoir

Belmont Reservoir is located approximately 9 km to the northwest of the town of Bolton. It was originally constructed in 1826 to supply water to the town but no longer provides water for public supply, hence being categorised as a Compensation only Reservoir (CoR). The reservoir provides opportunities for recreational sailing and fishing. The impoundment licence includes a requirement to discharge a compensation flow to Eagley Brook downstream. As is typical of upland reservoirs in the northwest of England, Belmont Reservoir is surrounded by both moorland and agricultural land.

Eagley Brook

Downstream of Belmont Reservoir, Eagley Brook (ID GB112069064570) flows in a southeasterly direction for approximately 11 km to its confluence with the River Tonge (ID GB112069064530) on the northern edge of the town of Bolton.

Eagley Brook is also referred to as Belmont Brook in the EA's Detailed River Database and on the OS's Water Network Map, and a short reach immediately downstream of the outfall of Belmont Reservoir is recorded as being an unnamed secondary river. For the purposes of this report, Eagley Brook refers to the WFD waterbody which flows downstream from the outlet of Belmont Reservoir to its confluence with the River Tonge.

River Tonge, the River Croal and the River Irwell

After approximately 3.8 km the River Tonge is joined by Bradshaw Brook. Bradshaw Brook and hence the lowest 0.8 km of the River Tonge are therefore also downstream of Jumbles Reservoir, an additional impounding reservoir within UU's drought plan where a drought permit may be implemented, leading to the potential for in-combination effects with a Belmont drought order. A short distance downstream of the confluence between the River Tonge and Bradshaw Brook is the confluence with the River Croal (ID GB112069064550) which in turn flows into the River Irwell at Kearsley. The River Irwell then continues as the Irwell (Croal to Irk) water body (GB112069061451) towards Salford Quays.

A2.1.2 Potential routes of impact

Under the proposed Belmont drought order, reducing the compensation flow released to Eagley Brook will retain more water within the reservoir. This will help to maintain reservoir levels, but will result in lower flows in downstream water bodies relative to the baseline condition. A reduction in compensation flow under a drought order will affect flow in all downstream waterbodies, but will be most noticeable at low flows close to the reservoir, where compensation releases contribute a larger proportion of the total flow.

Superficial geology within the catchment is variable: boulder clay provides some coverage but is not uniform in lithology and the thickness is variable. In any areas where boulder clay is absent there could be greater surface water / groundwater connectivity depending on groundwater levels. Other higher permeability deposits include:

- glaciolacustrine material;
- alluvium;
- glaciofluvial sheet deposits; and
- river terrace deposits.

There is significant coverage of these deposits along stretches of the River Tonge, River Croal and River Irwell which may indicate potential for surface water / groundwater hydraulic connectivity. Impacts of the reduction in compensation flow from Belmont Reservoir on hydrogeology are expected to be negligible and are not considered further within this assessment. However, given the lack of data, evidence or knowledge on surface / groundwater interactions in this catchment the certainty of impact is considered uncertain but low risk. Spot gauging during drought order implementation has been recommended to confirm predicted hydrological effects on surface waters (Section 5).

A2.1.3 Sources of information and methods

Belmont Reservoir

Long-term measured daily mean water level data for Belmont Reservoir were provided by UU for the period between 2011-2025. A depth-storage conversion table was also provided by UU, which enabled the storage capacity of the reservoir during this period to be calculated. These data were used to establish baseline reservoir conditions.

River flows – Eagley Brook, River Tonge, River Croal and River Irwell

Compensation flow data from Belmont Reservoir to Eagley Brook were provided by UU for the period between 2016-2025. These data were used to establish the baseline compensation flow release regime.

The EA provided historical data for licenced surface water and groundwater abstractions, and licenced discharges, for each of the four river catchments considered in this assessment. Hands-off Flow (HoF) information was not provided as part of this dataset.

On Eagley Brook, there is an EA water level monitoring station at Threadfold Way (SD 71790 13132). No stage-discharge relationships are available for this station.

On four days in 2007 and 2008, Atkins (2008) obtained spot flow measurements at six sites along Eagley Brook between the compensation release from Belmont Reservoir and Eagley village. At present, these twenty measurements are the only available flow data for this watercourse.

On the River Croal at Farnworth, and the River Irwell at Kearsley, daily mean flow data were obtained from the EA (https://environment.data.gov.uk/hydrology/landing) for the following flow gauging stations:

- River Croal (Farnworth (690408), period of record 1976-2023).
- River Irwell (Kearsley gauging station (690503), period of record 2003-2023).

The Farnworth and Kearsley flow gauging stations are downstream of the confluence with Bradshaw Brook and therefore receive flow from Belmont, Delph, and Jumbles reservoirs.

The EA also provided Environmental Flow Indicator (EFI) data for the Q95 flows on Eagley Brook, the River Tonge, and the River Croal. The EFI is used to indicate where abstraction pressures may start to cause undesirable effects on river habitats and species.

Two different approaches were adopted to evaluate the hydrological effects of the Belmont drought order (Scenario 1), and the Belmont drought order in-combination with a potential drought permit at Jumbles Reservoir (Scenario 2).

For both scenarios, the impact assessments adopted the approach to categorisation adopted for the Hydroecology Decision Support Tool (HEDS)[4]., focusing on habitat size and character and assessing uncertainty based on the accuracy, repeatability, and representativeness of the data and analytical methods.

Proposed Belmont drought order alone (4.5 Ml/d)

To quantify the impact of the proposed drought order on flow accretion downstream of Belmont Reservoir, 1 m resolution LiDAR-derived DTM tiles were obtained from the EA

4 APEM & WRC, 2019. Hydro-Ecological Decision Support Tool (HEDS) Technical Manual. November 2019.

(https://environment.data.gov.uk/survey). These elevation data were used to delineate ten subcatchments within the WFD-defined catchment boundaries of the four watercourses of interest (Figure A2-2). These subcatchments deliberately omitted the area draining to Belmont, Delph, and Jumbles reservoirs, because the flow into the subcatchments immediately downstream of their outfalls was known from the compensation flow data provided by UU (Figure A2-2).

The outlets of each of these ten subcatchments were defined using flow accumulation and flow direction analysis, in combination with the spot flow measurement sites, and significant features such as river confluences.

The outlets of each of the first six subcatchments were specified according to the location of the six spot flow measurements on Eagley Brook, and in all cases were located within 20 m of the location reported by Atkins (2008) (Figure A2-2). The outlet of the seventh subcatchment was defined as the confluence of Eagley Brook with the River Tonge, as determined by the flow accumulation and flow direction analysis (Figure A2-2)

Further south, the outlet of the eighth subcatchment was on the River Tonge, downstream of the confluences with Eagley Brook and Astley Brook (Figure A2-2). The outlet of the ninth subcatchment was also on the River Tonge, upstream of the confluence with Bradshaw Brook, and the outlet of the tenth subcatchment was downstream of this confluence, thus accounting for the contribution from Jumbles Reservoir (Figure A2-2).

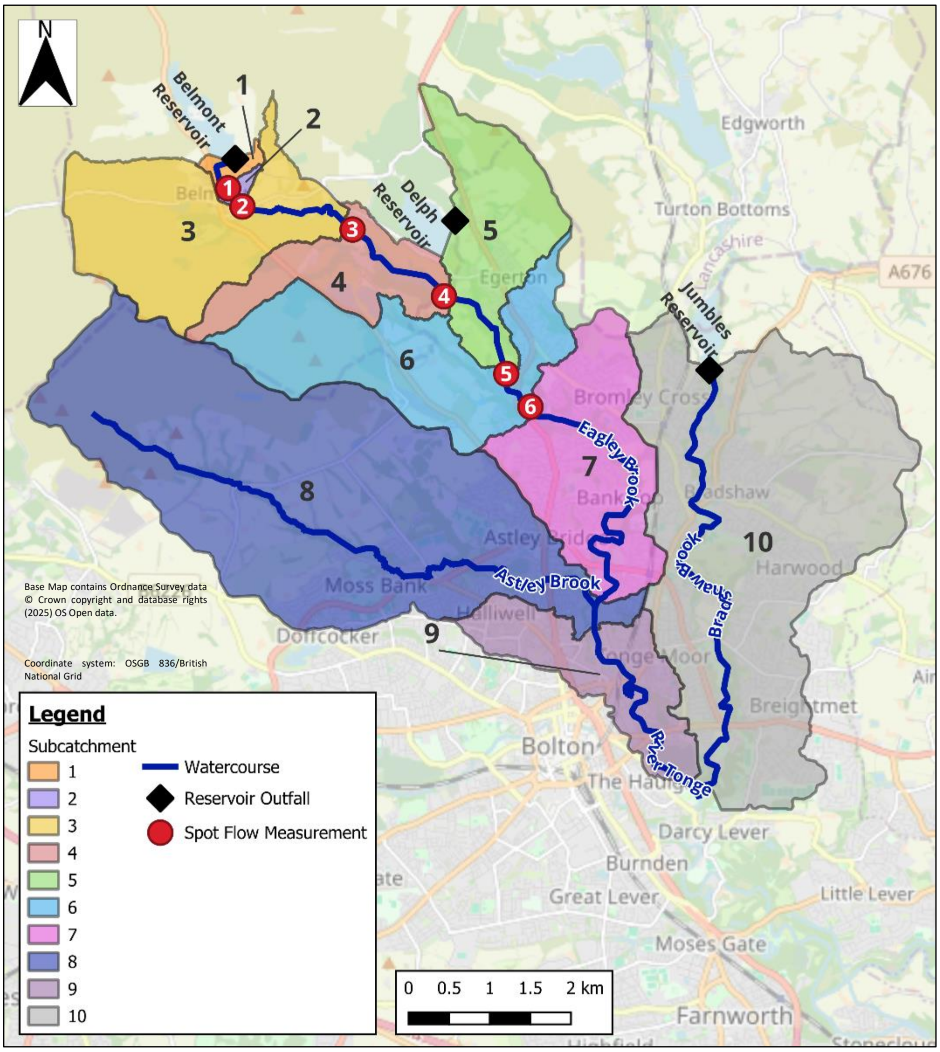

Figure A2-2: Ten subcatchments used to perform the flow accretion assessment along Eagley Brook and the River Tonge for Scenario 1

Naturalised Q95 flow estimates were then generated for each of the ten delineated subcatchments using the LowFlows2[5] software (Young *et al.,* 2003). As the area of catchment draining to Belmont, Delph, and Jumbles Reservoirs was not included in the analysis, the natural Q95 flow at the base of each reservoir was assumed to be zero. The difference between the Q95 estimates for each subcatchment was then calculated to give an estimate of natural accretion down the reaches of interest. Licenced surface water and groundwater abstractions, and licenced discharges (including the normal reservoir compensation flows), were then accounted for in each subcatchment to derive estimates of the artificially influenced Q95 flow.

In the absence of daily flow data for Eagley Brook and the River Tonge in any of the ten subcatchments considered, it was not possible to calibrate the natural Q95 estimates.

[5] https://www.hydrosolutions.co.uk/software/lowflows2/in-depth/

Instead, a sense-check was performed using gauged data from a natural site; Eastburn Beck at Crosshills (Station ID: 27084). Although this gauging station is located some distance from Eagley Brook on the eastern side of the Pennine watershed, it is the closest Pennine headwater catchment considered by the National River Flow Archive to be natural to within 10% of measured flow. This natural gauge was used to estimate the flow percentiles for each of the twenty spot flow measurements obtained on Eagley Brook.

Proposed drought order (4.5 Ml/d) in-combination with a Jumbles drought permit (12 Ml/d)

In the case of Scenario 2, where the proposed Belmont drought order was considered in-combination with a potential drought permit at Jumbles Reservoir, a different methodology was adopted.

Flow accretion was assessed within the Bradshaw Brook, River Tonge, River Croal and River Irwell water bodies, starting at the downstream end of Jumbles Reservoir and progressing in a downstream direction.

A combination of gauged flow data (spot gauging data collected by APEM in 2023) and estimates of natural flow were then used to generate estimates of low flow and catchment accretion. Qn95 flow estimates were generated upstream and downstream of major tributaries, third party discharges and catchment gauging stations using the LowFlows2™ software. The area of catchment draining to the reservoir was not included in these calculations and so the Qn95 at the base of the reservoir was again assumed to be zero. The difference between the Qn95 estimates at the above locations was then calculated to give an estimate of natural accretion down the reaches of interest. Artificial discharges (including the normal reservoir compensation flows) were then added to the accretion estimates to give the artificially influenced Q95 flow.

The difference between the estimated and calibration values was redistributed proportionally throughout the study area. Post calibration, baseline low flow accretion estimates therefore converge on the calibration values at the calibration points. The calibrated accretion assessment was then validated against measured spot gauging data collected by APEM and the EA under baseline conditions. The proposed drought order flow reductions (including reductions under the in-combination drought permit scenario) were then subtracted from the calibrated and validated flow accretion estimates for the watercourses of interest to this assessment. This provided estimates of likely low flow accretion for the proposed Belmont drought order in combination with the potential drought permit at Jumbles Reservoir.

A2.1.4 Baseline

Belmont Reservoir level and exposure

Historic measured reservoir water level data, and back-calculated storage capacity data for selected dry years are presented alongside the current year in Figure A1-3 and Figure A1-4, respectively.

Figure A2-3 and Figure A2-4 demonstrate that in recent dry years; some of them being notable droughts, the reservoir drawdown typically occurred between March and May, with refilling occurring by December. However, in 2025, drawdown commenced in February, and by May was more advanced than in the previous years shown, reaching a storage volume of approximately 1227 Ml by mid-May (Figure A2-4).

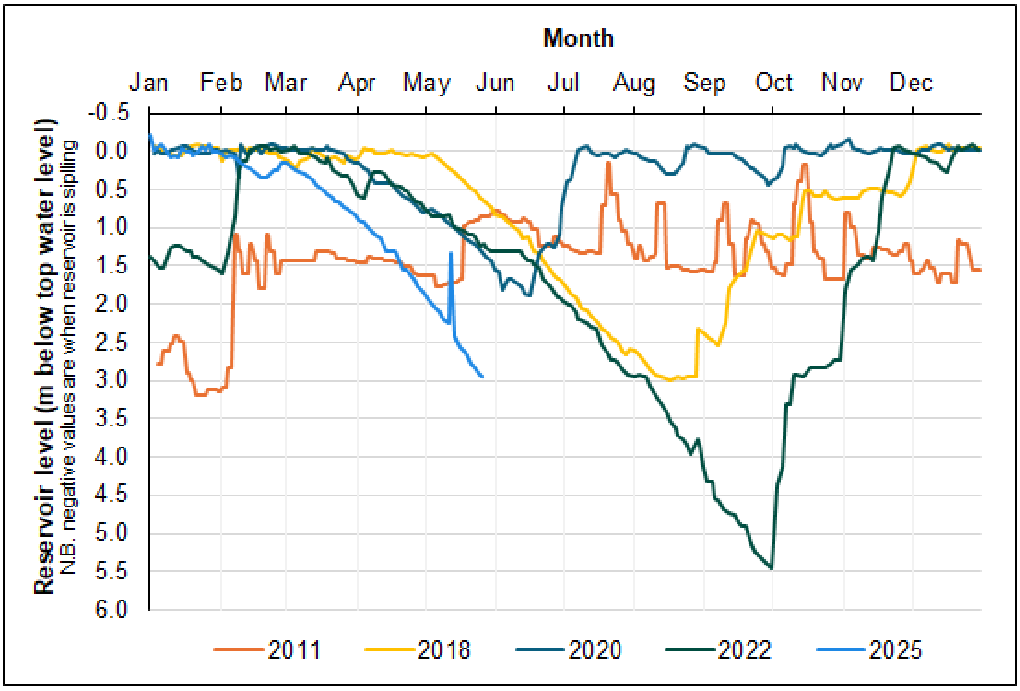

Figure A2-3 Reservoir level hydrograph for Belmont Reservoir during selected dry years (2011, 2018, 2020, and 2022), and the current year (2025)

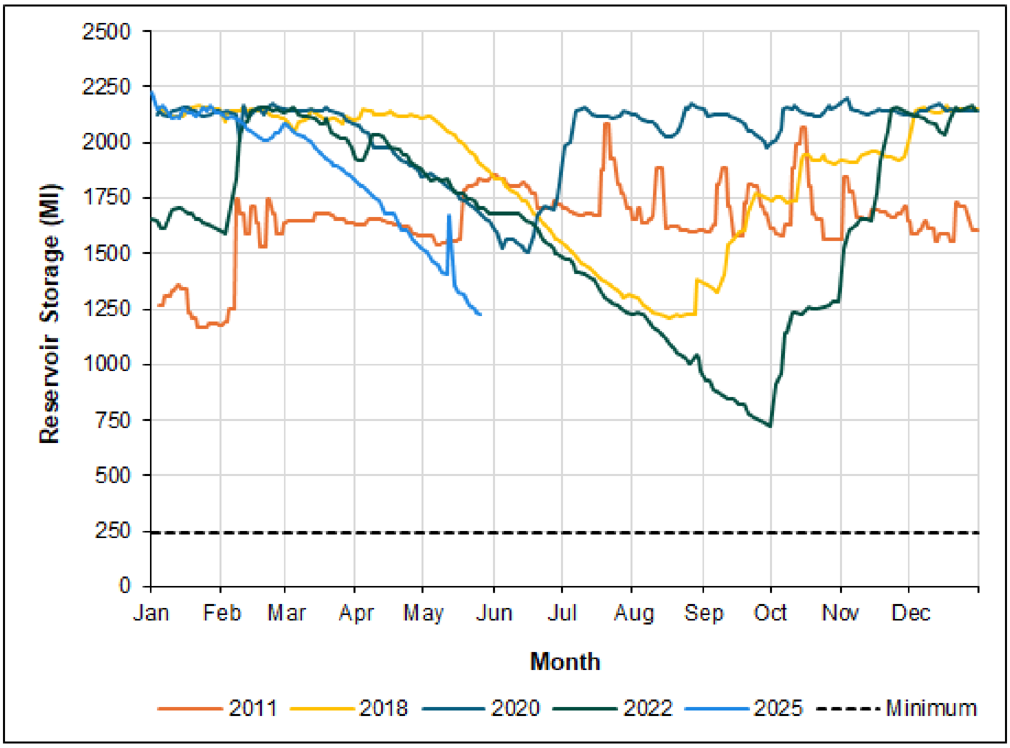

Figure A2-4 Reservoir level hydrograph for Belmont Reservoir during a typical dry year (2013), selected years (2018 and 2022), and the current year (2025)

Figure A2-5 shows both the full period and seasonal water level exceedance percentile curves for 2011-2024 inclusive. Figure A2-6 shows the same data, but with a base-10 log-scaled y-axis. These curves can be used to identify the percentage of time for which a given water level in Belmont Reservoir was exceeded. The graphs were also used to generate a table of key level statistics for the period 2011-2024 inclusive (Table A2-2).

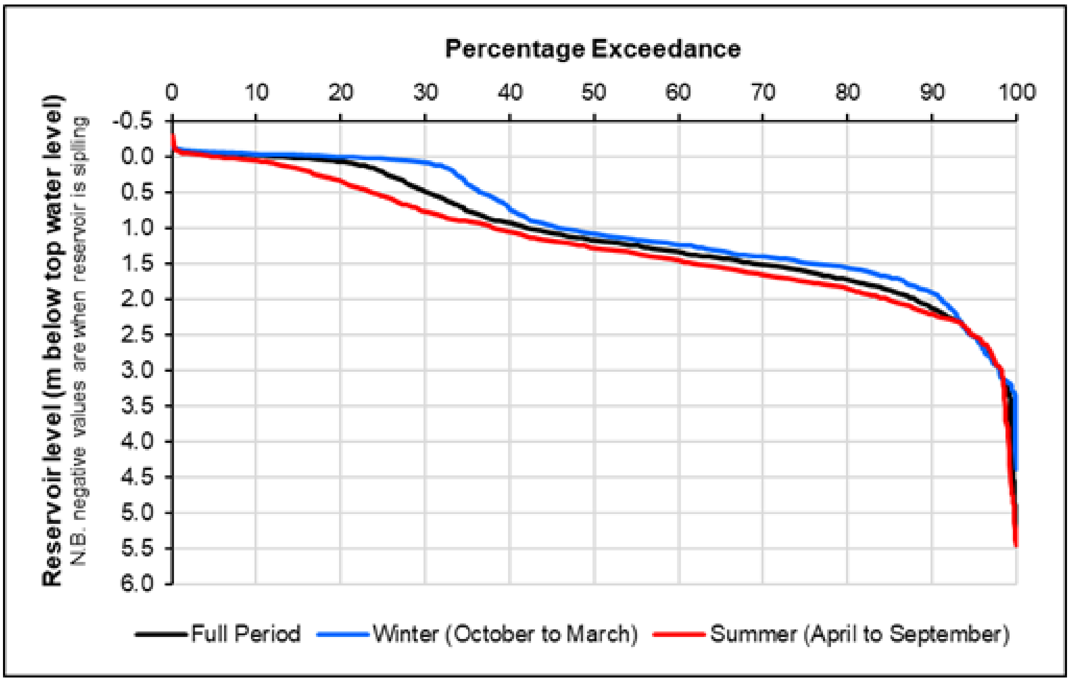

Figure A2-5 Reservoir level curve for Belmont Reservoir for the full period between 2011-2024 inclusive, and the winter and summer months during this period

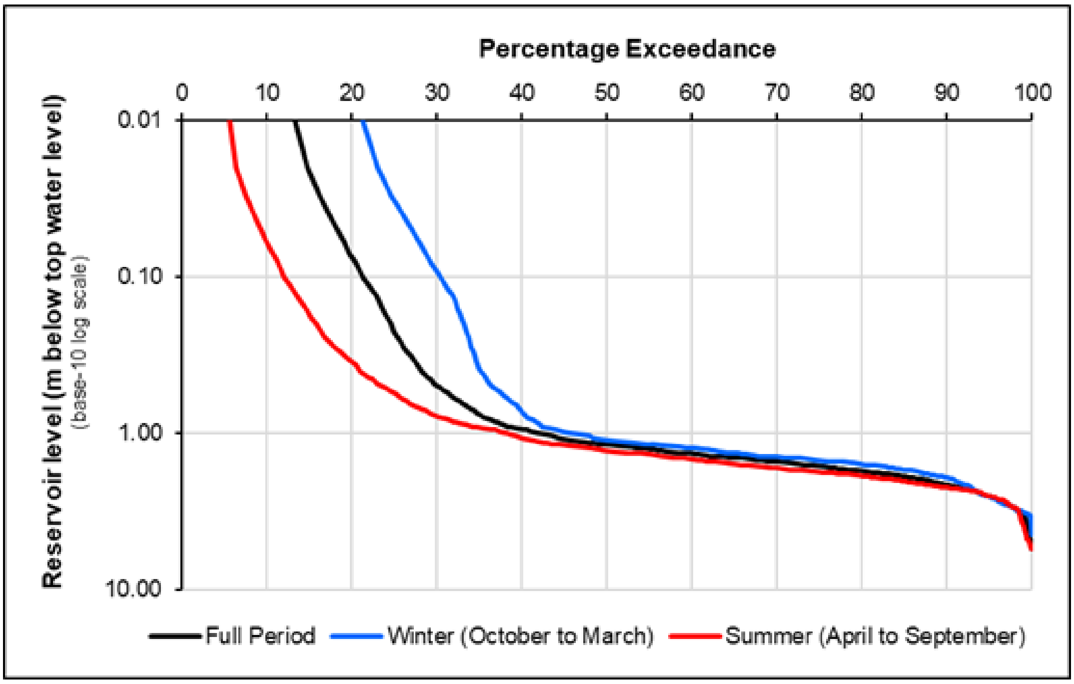

Figure A2-6 Reservoir level curve for Belmont Reservoir for the full period between 2011-2024 inclusive, and the winter and summer months during this period, with a base-10 log scale

Table A2-2 Key level percentiles for Belmont Reservoir

Percentage of time level exceeded	Reservoir level (m below top water level) N.B. Negative values indicate that the reservoir is spilling		
	Winter	Summer	Full Period
Maximum reservoir level	-0.16	-0.28	-0.28
10% (high level)	-0.04	0.06	-0.02
50%	1.1	1.3	1.18
80%	1.56	1.86	1.72
90%	1.92	2.22	2.12
95% (low level)	2.52	2.52	2.52
99% (very low level)	3.18	3.84	3.28
Minimum reservoir level	4.38	5.46	5.46

It is understood that the maximum depth of Belmont Reservoir is approximately 13.4 m, with a maximum gross volume of 2142 Ml. The summary data in Table A2-2 demonstrates that between 2011-2024, the reservoir level typically varied over a range of 5.74 m (between approximately -0.28 m and 5.46 m below the top water level). Notably, however, the low reservoir levels during the winter period varied little from those during the summer; in fact, at the 95th percentile, the reservoir level during both the winter and summer period was 2.52 m. This is likely because the reservoir storage effects carried the low summer water levels into the winter period.

At the time of writing on 24th July 2025, the reservoir level is 4.02 m below the top water level, which for the full period of record is equivalent to an exceedance probability of approximately 99.5%, and for the summer period is equivalent to an exceedance probability of approximately 99.1%. This indicates that the reservoir level is currently 'Very Low' (Table A2-2), and will likely continue to decline towards the minimum level if the current dry conditions persist.

River flows - Eagley Brook, River Tonge, River Croal and River Irwell

Historical catchment flows

On four days in 2007 and 2008 (one during the winter and three during the summer), Atkins (2008) measured the flow along Eagley Brook at six sites (Table A2-3). At present, these twenty measurements represent the only available recorded flow data for this watercourse.

Table A2-3 Spot flow measurements obtained by Atkins (2008) along Eagley Brook during 2007 and 2008

Site	NGR	Reported Distance from Belmont Reservoir (km)	Flow (Ml/d)			
			30/10/2007	12/05/2008	15/05/2008	22/05/2008
1	SD 67560 16032	0.4	12.79	10.37	9.68	8.29
2	SD 67737 15807	0.7	17.80	12.36	12.36	11.49
3	SD 69093 15524	2.1	49.16	16.07	15.21	17.97
4	SD 70218 14702	3.5	50.54	18.32	16.59	20.56
5	SD 70985 13747	4.8	65.66	19.96	19.87	18.58
6	SD 71283 13343	5.3	77.85	17.80	19.96	18.66

As expected, Table A2-3 demonstrates that along the surveyed reach of Eagley Brook, the downstream accretion of flow was gradual when the catchment was dry during the summer measurement period (12/05/2008-22/05/2008). The marked increase in flow downstream of Site 2 (Table A2-3) on all measurement days is likely to be due to the flow contribution from Ward's Brook.

The flow gauging station on the Eastburn Beck at Crosshills (Station ID: 27084) was used to determine the flow conditions under which the gaugings on Eastley Brook were taken (

Table A2-4 and Table A2-5). As previously stated, although this gauging station is located some distance from Eagley Brook on the eastern side of the Pennine watershed, it is the closest Pennine headwater catchment considered by the National River Flow Archive to be natural to within 10% of measured flow. The gauging station data suggested that on the days of interest, the flows on the Eastburn Beck at Crosshills were stable, receding from spates a few days prior to the gaugings. On the four days of interest, flow percentiles for the Eastburn Beck at Crosshills varied between Qn61 and Qn66, and averaged Qn65, suggesting that flows were not particularly low, or varied, at the time of gauging (

Table A2-4 and Table A2-5).

Table A2-4 Spot flow measurements on Eagley Brook on 30/10/2007 and 12/05/2008 compared to the gauged flows on Eastburn Beck at Crosshills on the same day

Site	NGR of Spot Flow Measurement	30/10/2007			12/05/2008		
		Spot Flow on Eagley Brook (Ml/d)	Gauged Flow at Crosshills (Ml/d)	Gauged Flow Percentile at Crosshills	Spot Flow on Eagley Brook (Ml/d)	Gauged Flow at Crosshills (Ml/d)	Gauged Flow Percentile at Crosshills
1	SD 67560 16032	12.79	23.33	61%	10.37	21.08	64%
2	SD 67737 15807	17.80			12.36		
3	SD 69093 15524	49.16			16.07		
4	SD 70218 14702	50.54			18.32		
5	SD 70985 13747	65.66			19.96		
6	SD 71283 13343	77.85			17.80		

Table A2-5 Spot flow measurements on Eagley Brook on 15/05/2008 and 22/05/2008 compared to the gauged flows on Eastburn Beck at Crosshills on the same day

Site	NGR of Spot Flow Measurement	15/05/2008			22/05/2008		
		Spot Flow on Eagley Brook (Ml/d)	Gauged Flow at Crosshills (Ml/d)	Gauged Flow Percentile at Crosshills	Spot Flow on Eagley Brook (Ml/d)	Gauged Flow at Crosshills (Ml/d)	Gauged Flow Percentile at Crosshills
1	SD 67560 16032	9.68	19.44	66%	8.29	20.56	65%
2	SD 67737 15807	12.36			11.49		
3	SD 69093 15524	15.21			17.97		
4	SD 70218 14702	16.59			20.56		
5	SD 70985 13747	19.87			18.58		
6	SD 71283 13343	19.96			18.66		

Further downstream on the River Croal and River Irwell, historic flow data from EA gauging stations were available. The resultant hydrographs are presented in Figure A2-7 and Figure A2-8 for the River Croal, and Figure A2-9 and Figure A2-10 for the River Irwell.

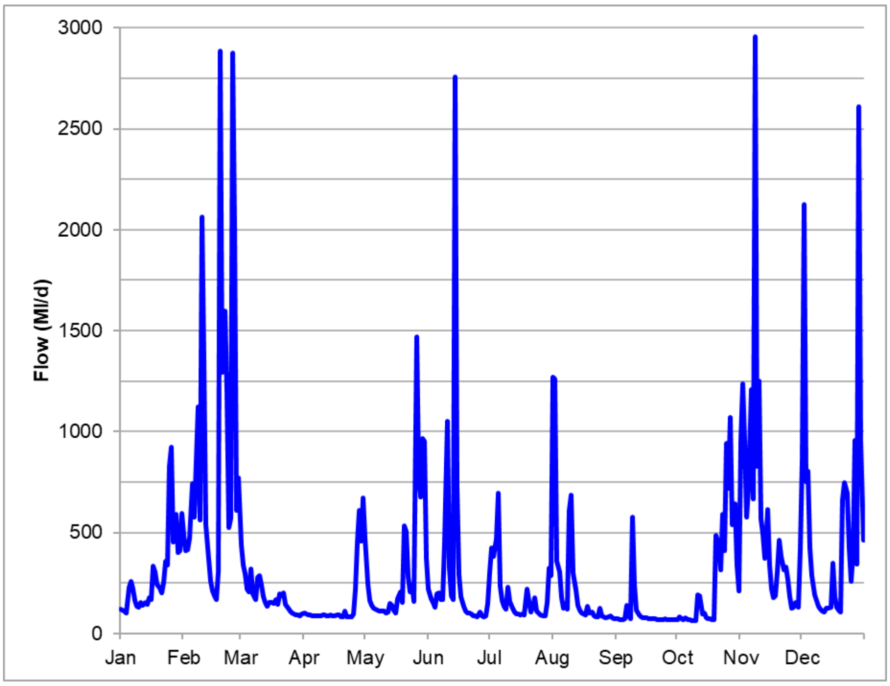

Figure A2-7 Measured flow data at Farnworth gauging station on the River Croal during a typical year (2002)

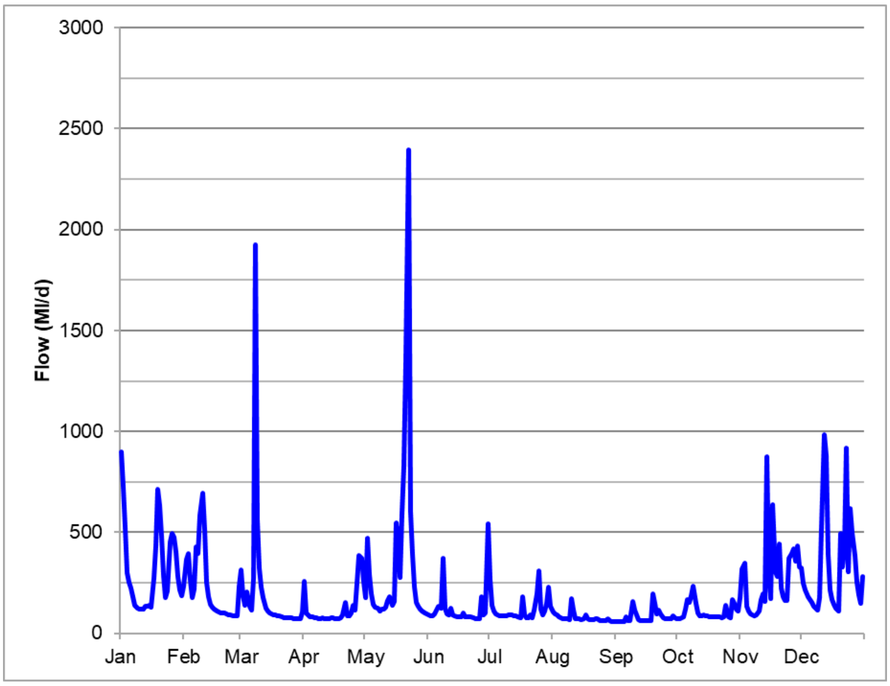

Figure A2-8 Measured flow data at Farnworth gauging station on the River Croal during a dry year (2003)

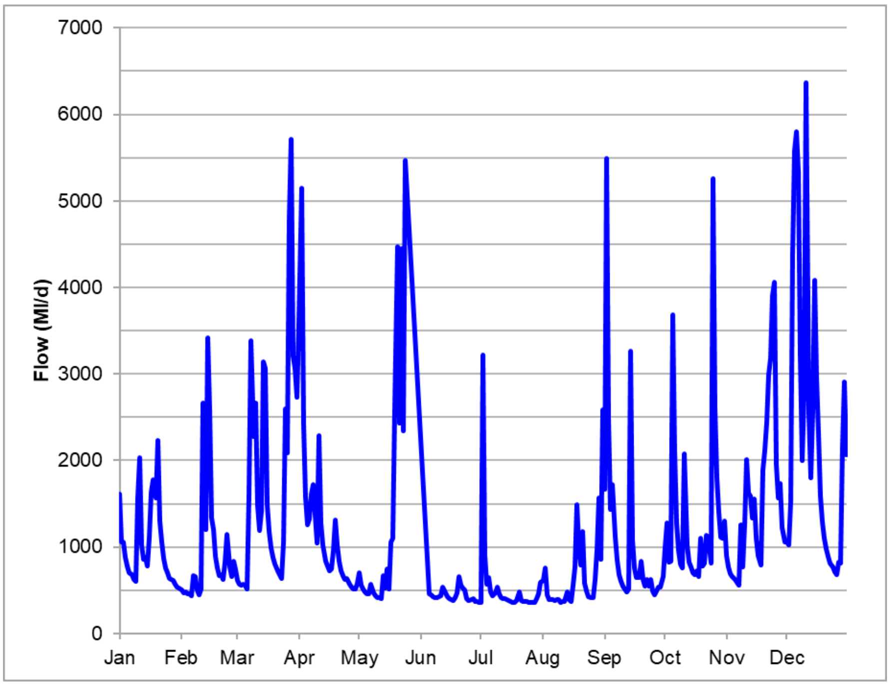

Figure A2-9 Measured flow data at Kearsley gauging station on the River Irwell during a typical year (2006)

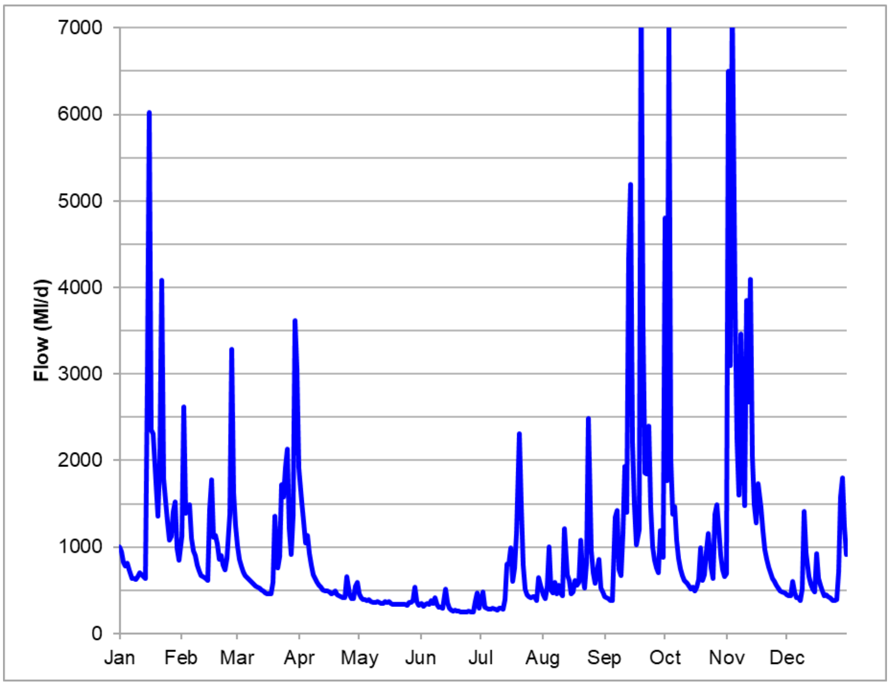

Figure A2-10 Measured flow data at Kearsley gauging station on the River Irwell during a dry year (2010)

These hydrographs demonstrate that, although influenced to a degree by abstraction, impoundment and effluent discharges, the flow regimes at the gauging stations on the rivers Irwell and Croal share the broad characteristics of a natural regime; baseflow minima occur during the late summer and early autumn, with higher baseflows during the winter months. There is also a propensity for spate flows throughout the year, although in general, higher magnitude flows are recorded during the winter. The flow regime immediately downstream of Belmont Reservoir is likely to be more stable over the late spring to late autumn period, with spate events restricted to periods of full reservoir storage.

Flow duration curves are presented in Figure A2-11 for Farnworth gauging station on the River Croal, and in Figure A2-12 for the River Irwell at Kearsley.

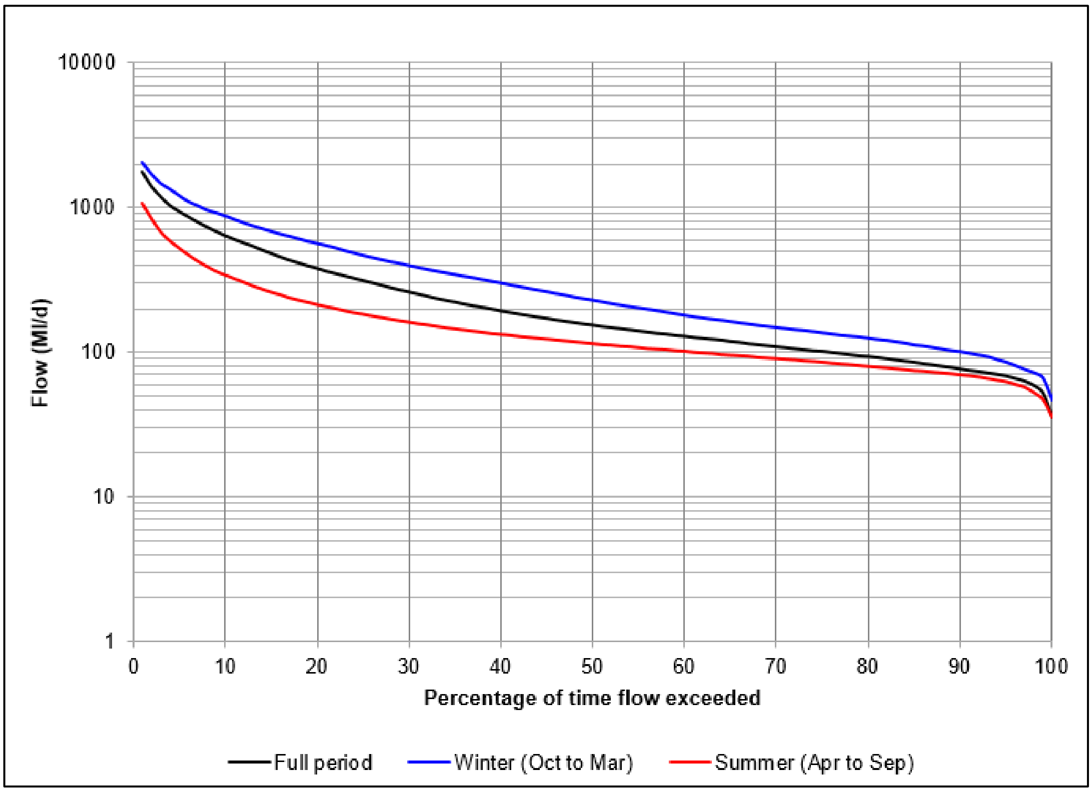

Figure A2-11 Flow-duration curve for Farnworth gauging station on the River Croal (full period between 1977-2023, winter, and summer)

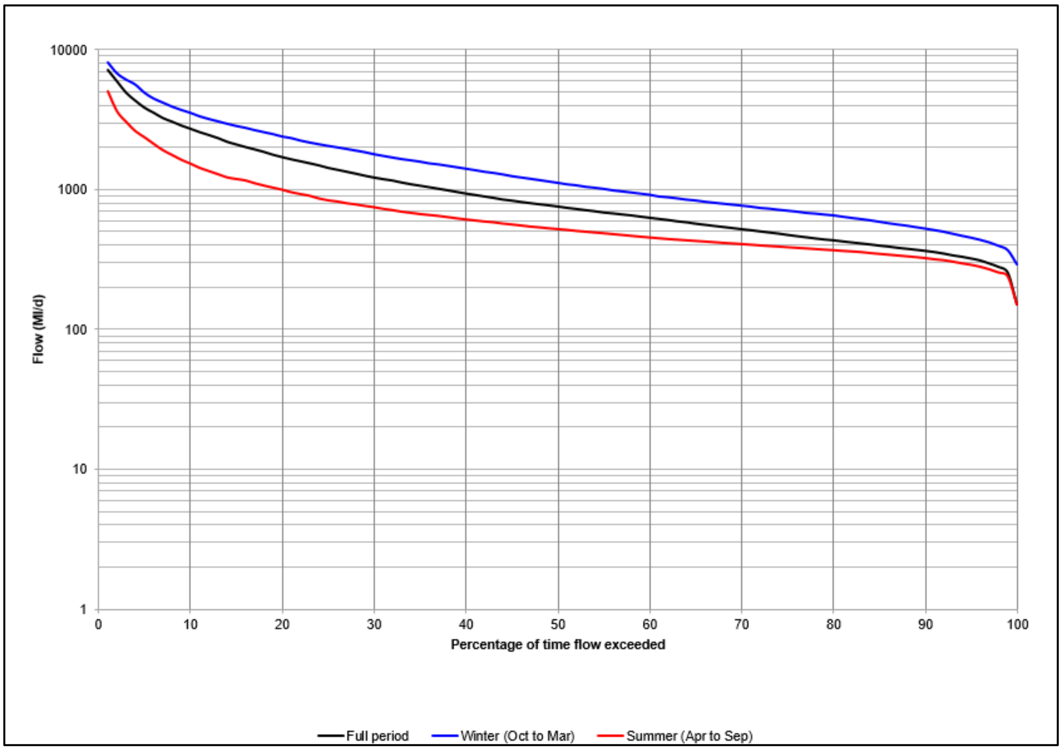

Figure A2-12 Flow-duration curve for Kearsley gauging station on the River Irwell (full period between 2003-2023, winter and summer)

Table A2-6 shows selected flow percentiles at Farnworth gauging station on the River Croal, and Table A2-7 shows selected flow percentiles at Kearsley gauging station on the River Irwell. Both flow gauging stations are located downstream of Jumbles, Delph, and Belmont reservoirs. If a drought order were implemented at Belmont Reservoir, and a drought permit were implemented at Jumbles Reservoir, there would be potential for in-combination effects on river flows on the River Croal and River Irwell (as well as the lower section of the River Tonge below the Bradshaw Brook confluence).

Table A2-6 Key flow percentiles at Farnworth gauging station on the River Croal downstream of Jumbles, Delph and Belmont reservoirs (full period between 1977-2023)

Percentage of time flow exceeded	Discharge (Ml/d)		
	Winter	Summer	Full Period
Maximum flow	5866.6	4605.1	5866.6
10% (high flow)	872.6	335.7	637.7
50%	228.1	112.3	152.1
80%	124.4	78.3	91.6
90%	101.1	68.5	75.3
95% (low flow)	85.7	61.4	67.2
99% (very low flow)	66.7	46.7	51.9
Minimum flow	46.8	35.3	35.3

Table A2-7 Key flow percentiles at Kearsley gauging station on the River Irwell downstream of Jumbles, Delph and Belmont Reservoirs (full period between 2004-2023)

Percentage of time flow exceeded	Discharge (Ml/d)		
	Winter	Summer	Full Period
Maximum flow	27509.8	19846.1	27509.8
10% (high flow)	3462.0	1497.1	2700.8
50%	1087.8	514.3	741.2
80%	636.6	362.0	425.2
90%	511.2	318.7	356.2
95% (low flow)	442.2	291.3	314.2
99% (very low flow)	326.3	258.6	267.5
Minimum flow	250.2	211.3	211.3

Accretion assessment

Eagley Brook and the River Tonge, downstream of Belmont Reservoir

Table A2-8 shows the estimated natural (column I) and baseline (column J) flow accretion downstream of Belmont Reservoir. The LowFlows2™ software was used to calculate both the influenced Q65 baseline flow for each of the ten subcatchments (not presented), in addition to the influenced Q95 baseline flow presented in Table A2-8 (column J). The subcatchments referenced in column A relate to those previously presented in Figure A2-2.

Table A2-8 Flow accretion assessment table for Eagley Brook and the River Tonge, downstream of Belmont Reservoir

A	B	C	D	E	F	G	H	I	J	K	L
								Natural	Baseline	Scenario 1	
Subcatchment	ID Number	Grid Reference	Distance From Belmont Reservoir Outfall	Description	Cumulative Catchment Area	Abstraction Amount	Discharge Amount	Q95 Flow Estimated Using LowFLows2 Methodology	Influenced Q95 Flow	Influenced Q95 Flow with Belmont Compensation Flow at 4.5 Ml/d	Reduction Between Baseline and Scenario 1
			(km)		(km²)	(Ml/d)	(Ml/d)	(Ml/d)	(Ml/d)	(Ml/d)	(%)
1	1	-	-	Belmont Reservoir Compensation Flow	-	-	9.000	-	-	-	-
1	2	-	-	SWABS (2569003014) - Belmont Bleaching and Dyeing	-	2.046	-	-	-	-	-
1	3	SD 67560 16032	0.59	**SPOT 1 - Upstream of Belmont Coarse Fishery/Downstream of Waterfall**	**0.219**	-	-	**0.086**	**7.041**	**2.541**	**63.91**
2	4	SD 67737 15807	0.89	**SPOT 2 - Belmont Village Downstream of Belmont Coarse Fishery**	**0.34**	-	-	**0.086**	**7.041**	**2.541**	**63.91**
3	5	-	-	DIS (16950031) - Belmont Sewage Treatment Works	-	-	0.103	-	-	-	-
3	6	-	-	SWABS (2569003018) - Belmont Bleaching and Dyeing	-	0.020	-	-	-	-	-
3	7	SD 69093 15524	2.64	**SPOT 3 - Upstream of Confluence with Three Nooked Shaw Brook**	**5.077**	-	-	**1.728**	**8.765**	**4.265**	**51.34**
4	8	-	-	DIS (NPSWQD006635) - Springside Mills	-	-	0.007	-	-	-	-
4	9	-	-	GWABS (2569003072) - United Utilities	-	1.430	-	-	-	-	-
4	10	SD 70218 14702	4.18	**SPOT 4 - Dunscar Golf Course**	**7.346**	-	-	**2.5056**	**8.119**	**3.619**	**55.42**
5	11	SD 70356 15632	-	Delph Reservoir Compensation Flow	-	-	3.700	-	-	-	-
5	12	-	-	GWABS (2569003079) - Dunscar Golf Club	-	0.012	-	-	-	-	-
5	13	SD 70985 13747	5.62	**SPOT 5 - Reservoirs Upstream of Dunscar Bridge**	**10.58**	-	-	**2.8512**	**12.153**	**7.653**	**37.03**
6	14	-	-	GWABS (2569003080) - Agriculture	-	0.005	-	-	-	-	-
6	15	SD 71283 13343	6.21	**SPOT 6 - Downstream of Dunscar Bridge**	**15.43**	-	-	**3.8016**	**13.097**	**8.597**	**34.36**
7	16	-	-	SWABS (2569003075) - Turton Golf Club	-	0.026	-	-	-	-	-
7	17	SD 72137 10974	10.78	**Eagley Brook/River Tonge Confluence**	**19.84**	-	-	**4.4064**	**13.676**	**9.176**	**32.90**
8	18	-	-	GWABS (2569003071) - Agriculture	-	0.010	-	-	-	-	-
8	19	SD 72068 10600	11.18	**River Tonge Downstream of Eagley Brook and Astley Brook**	**34.62**	-	-	**9.5904**	**18.850**	**14.350**	**23.87**
9	20	-	-	GWABS - 2569003096R01 - Total Fitness Health Clubs	-	0.085	-	-	-	-	-
9	21	SD 73245 08691	14.40	**River Tonge Upstream of Bradshaw Brook**	**37.34**	-	-	**10.7136**	**19.888**	**15.388**	**22.63**
10	22	-	-	Jumbles Reservoir Compensation Flow	-	-	19.900	-	-	-	-
10	23	-	-	GWABS (2569003083) - Agriculture	-	0.003	-	-	-	-	-
10	24	-	-	GWABS (2569003066) - Agriculture	-	0.009	-	-	-	-	-
10	25	SD 73352 08550	14.58	**River Tonge Downstream of Bradshaw Brook**	**50.49**	-	-	**13.1328**	**42.195**	**37.695**	**10.66**

Legend
GWABS - Licenced groundwater abstraction
SWABS - Licenced surface water abstraction
DIS - Licenced discharge
SPOT - Spot flow measurement location

The percentage change in downstream flow accretion was broadly comparable for the estimated influenced Q95 and Q65 baseline flows at each of the six spot flow measurement sites on Eagley Brook. The 65th percentile was selected for comparison because the flows on the same day at the natural flow gauge on the Eastburn Beck at Crosshills were representative of the Q65 flow at this location.

The changes for the three most representative surveys conducted during the summer are presented in Table A2-9. This table demonstrates that the change in downstream flow accretion along Eagley Brook is broadly comparable to the change in the estimated influenced Q65 Baseline flow (Table A2-9). By extension, this supports use of the LowFlows2™-derived Qn95 estimates in this assessment. The negative changes in flow accretion in Table A2-9 can be associated with abstractions in the catchment.

It should be noted, however, that although this Q65 and Q95 flow check made best use of the little gauged data available, there are uncertainties associated with this approach. Specifically, the natural flow gauge on the Eastburn Beck at Crosshills was located far from Belmont Reservoir on the eastern flank of the Pennines, and the spot flow measurements obtained in 2007 and 2008 may have been subject to different artificial influences than the present day. It is therefore advisable that more flow data be collected along Eagley Brook to constrain the estimated flow accretion with greater confidence.

Table A2-9 Percentage change in flow accretion downstream for each spot flow measurement site on Eagley Brook

Site	NGR of Spot Flow Measurement	Change in flow accretion downstream (%)			
		Influenced Q65 Baseline Flow	Spot Flow on Eagley Brook (12/05/2008)	Spot Flow on Eagley Brook (15/05/2008)	Spot Flow on Eagley Brook (22/05/2008)
1	SD 67560 16032	-	-	-	-
2	SD 67737 15807	1.2	16.1	21.7	27.8
3	SD 69093 15524	37.0	23.1	18.8	36.1
4	SD 70218 14702	4.7	12.3	8.3	12.6
5	SD 70985 13747	32.1	8.2	16.5	-10.7
6	SD 71283 13343	15.3	-12.1	0.4	0.5

Table A2-10 shows the estimated natural, baseline, and Scenario 1 flows, and the change between them, at the outlets of each of the 10 subcatchments when the catchment area draining to Belmont, Delph, and Jumbles Reservoirs is also considered in the flow accretion assessment. This differs to Table A2-8, in which this upstream contributing area was omitted. Table A2-10 therefore enables an assessment of EFI band compliance at Q95 flows.

Table A2-10 demonstrates that the baseline flows are consistently greater than natural at Q95, likely due to the compensation flow releases from Belmont, Delph, and Jumbles Reservoirs. The Scenario 1 flows are also consistently greater than the natural flows at Q95, despite the lower compensation flow release from Belmont Reservoir under the proposed drought order. Data also suggest that low flows exceed the EFI at the downstream extent of Eagley Brook (the outlet of subcatchment 7) and at the downstream extent of the River Tonge (the outlet of subcatchment 10). This suggests that the proposed drought order at Belmont Reservoir would not change the EFI band compliance at low flows. However, it is anticipated that there would be higher baseline effects in mid-range flows, as is typical in reservoir-influenced catchments.

Table A2-10 Natural, Baseline, and Scenario 1 Q95 flows when the catchment area draining to the relevant reservoirs is considered.

Subcatchment	ID Number from Accretion Table	Cumulative Catchment Area* (km²)	Natural	Baseline	Scenario 1	Change Between Natural and Baseline (%)	Change Between Baseline and Scenario 1 (%)	Change Between Natural and Scenario 1 (%)
			Q95 Flow Estimated Using LowFLows2 Methodology* (Ml/d)	Influenced Q95 Flow* (Ml/d)	Influenced Q95 Flow* with Belmont Compensation Flow at 4.5 Ml/d (Ml/d)			
1	3	11.91	3.80	10.76	6.26	182.9	-41.8	64.6
2	4	12.03	3.89	10.84	6.34	178.9	-41.5	63.1
3	7	16.77	5.44	12.48	7.98	129.3	-36.1	46.6
4	10	19.04	6.31	11.92	7.42	89.0	-37.8	17.7
5	13	22.27	7.95	17.25	12.75	117.0	-26.1	60.4
6	15	27.13	9.76	19.06	14.56	95.2	-23.6	49.1
7	17	31.53	10.80	20.10	15.60	86.1	-22.4	44.4
8	19	46.31	13.22	22.50	18.00	70.2	-20.0	36.2
9	21	49.46	14.95	24.15	19.65	61.6	-18.6	31.5
10	25	96.46	28.94	58.03	53.53	100.5	-7.8	85.0

* Including the catchment area draining to the relevant reservoirs

Bradshaw Brook, River Tonge, River Croal and River Irwell, downstream of Jumbles Reservoir

Baseline estimates of catchment accretion downstream of Jumbles Reservoir are shown in Figure A2-13 to support assessment of in-combination effects of a Belmont drought order in-combination with a Jumbles drought permit, on the River Tonge (downstream of Bradshaw Brook), River Croal and River Irwell.

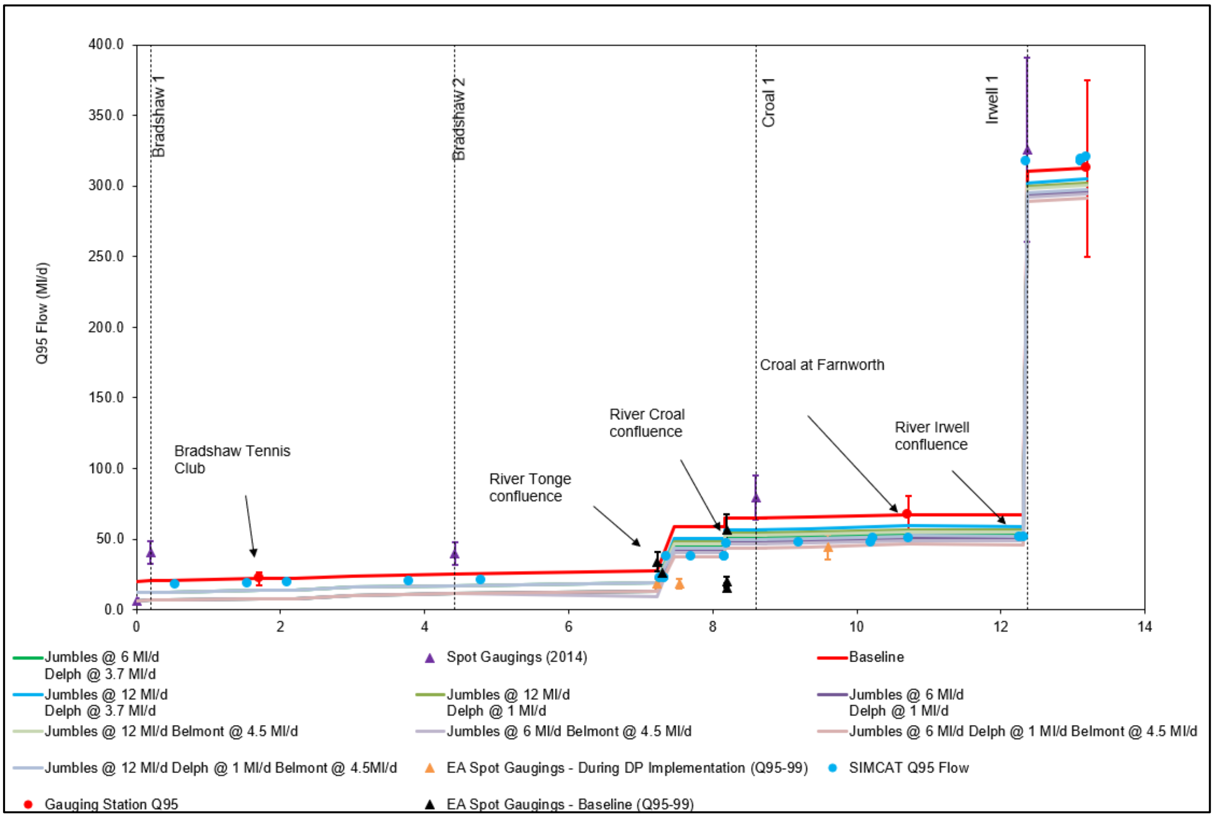

Figure A2-13 Bradshaw Brook, River Tonge, River Croal and River Irwell Q95 Growth (Accretion) Curves (Ml/d). Uncertainty band of +/- 20% indicated for gauging station and spot gauging flows.

A2.1.5 Impact assessment - Proposed Belmont drought order alone (4.5 Ml/d)

Belmont Reservoir level and exposure

The proposed drought order is intended to retain more water within Belmont Reservoir to delay the total drawdown of the reservoir, and thereby maintain the ability to release compensation flow to Eagley Brook for longer. This will also ensure that opportunities for recreational sailing and fishing in the reservoir are maintained. During a drought, with a drought order in place, the rate of drawdown would be lower than if the normal compensation flow were released from the reservoir. This means that the exposure of marginal habitat would be slower, and a higher proportion of open water habitat would be available for longer.

In the absence of AQUATOR output with which to simulate changes in reservoir levels arising from the proposed drought order, the effect of a reduction in compensation flow release from the reservoir has been estimated for 2022 by assuming an increase in storage of 4.5 Ml/d (the difference between the baseline and Scenario 1 conditions) in the reservoir from 1st August 2022 until the maximum storage capacity was reached (in Figure A2-14). This assumes no changes to the operation of the reservoir and does not account for evaporation losses.

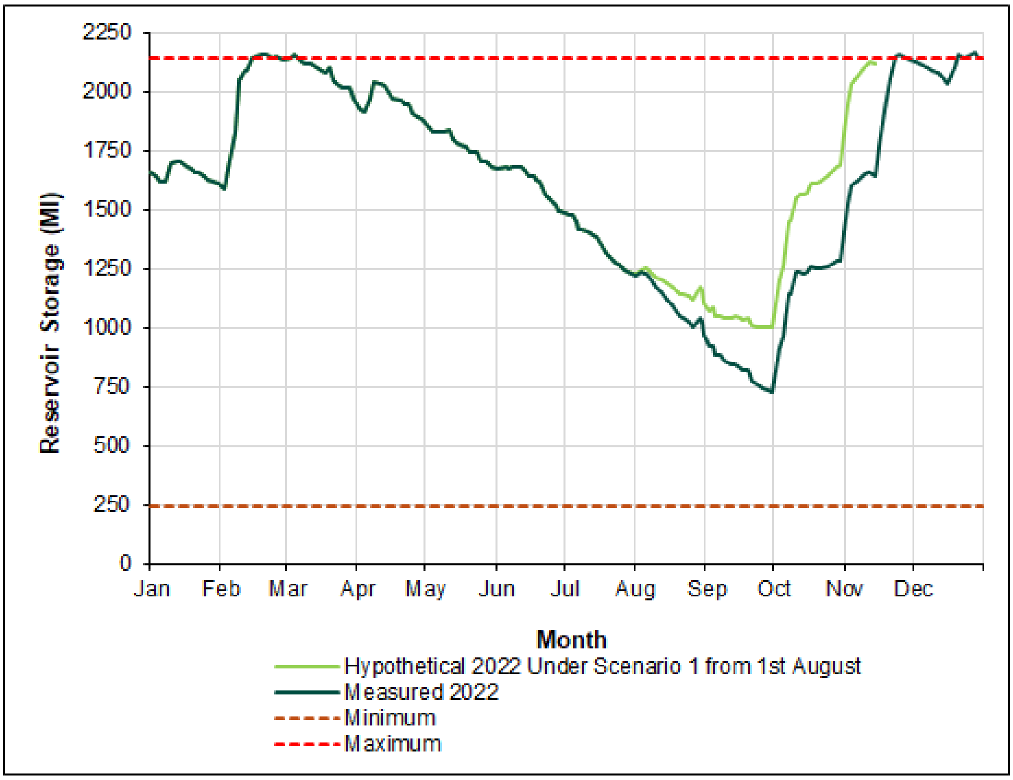

Figure A2-14 Measured reservoir storage at Belmont Reservoir during 2022 versus the hypothetical reservoir storage during that year, had an additional 4.5 Ml/d been retained from 1st August until the maximum storage capacity was reached

Table A2-13 demonstrates that had the Scenario 1 drought order conditions been implemented at Belmont Reservoir on 1st August 2022, the minimum measured reservoir storage of 724 Ml on 30/09/2022 would have been 38% higher, at 998 Ml. If the drought order conditions persisted, the maximum reservoir storage of 2142 Ml would have been reached on 14/11/2022, 11 days before the recorded maximum occurred that year.

It should be noted that the estimated reservoir storage volume for the hypothetical 2022 year under the Scenario 1 drought order conditions reached a minimum of 998 Ml on 30th September (Figure A2-14). However, the reservoir storage reported at the time of writing on 24th July 2025 was 993 Ml. The current reservoir storage is therefore lower than this hypothetical minimum, and has occurred over two months earlier. Furthermore, the reservoir storage is continuing to decline. River flows – Eagley Brook, the River Tonge, the River Croal and the River Irwell

The results of the flow accretion assessment are presented in Table A2-8. In this table, columns I-L show the estimated:

i. Natural Q95 flow accretion with no artificial influences (column I).
ii. Influenced Q95 flow accretion, which accounts for the impact of licenced surface water and groundwater abstractions, and licensed discharges, on the natural flow (baseline) (column J).
iii. Influenced Q95 flow accretion for the drought order conditions, whereby the compensation flow from Belmont Reservoir is reduced to 4.5 Ml/d (Scenario 1) (column K).
iv. Percentage reduction in flow between the baseline and Scenario 1 conditions (column L).

The flow accretion assessment for the Belmont drought order scenario (Scenario 1) suggests that the zone of influence extends from the outfall of Belmont Reservoir to the confluence of the River Tonge and River Croal, after which point the difference in flow between the baseline and Scenario 1 is less than 10%.

Eagley Brook – GB112069064570

Under the proposed drought order, the reduction in compensation flow from Belmont Reservoir from 9 Ml/d to 4.5 Ml/d is estimated reduce the influenced baseline Q95 flow on Eagley Brook by 64% within the first kilometre of the outfall (Table A2-8; column L; row 4).

Further downstream, at the confluence of Eagley Brook and the River Tonge, the reduction in the influenced baseline Q95 flow diminishes to 33% (Table A2-8; column L; row 17), primarily due to the contribution of the compensation flow released from Delph Reservoir (Table A2-8; column H; row 11).

Tonge – GB112069064530

Approximately 14.4 km downstream of the Belmont Reservoir outfall, the proposed drought order is estimated to reduce the influenced baseline Q95 flow on the River Tonge upstream of Bradshaw Brook by 23% (Table A2-8;; column L; row 21). A short distance downstream of the confluence of Bradshaw Brook, into which the compensation flow from Jumbles Reservoir is released, the reduction in flow on the River Tonge is estimated to diminish to 11% (Table A2-8; column L; row 25).

Croal – GB112069064550

The impacts of the proposed drought order on the flow beyond 14.58 km downstream of the Belmont Reservoir outfall have not been considered, given that approximately 0.75 km further downstream, at the confluence of the River Tonge and River Croal, the additional input of flow from the latter watercourse would reduce impacts on low flows to below 10%.

A2.1.6 Impact assessment - Proposed drought order (4.5Ml/d) in-combination with a Jumbles drought permit (12Ml/d)

Should a Jumbles Reservoir 12 Ml/d drought permit be implemented concurrently with a Belmont Reservoir 4.5Ml/d drought order, there are potential in-combination effects downstream of the confluence between Bradshaw Brook and the River Tonge. Under this scenario, flows on the River Croal at Farnworth gauging station are predicted to be 18% lower than the influenced baseline Q95 flow, decreasing to 4% lower downstream of the River Irwell confluence at Kearsley.

Belmont Reservoir level and exposure

The impact of the proposed Belmont Reservoir drought order on water level and shoreline exposure in the reservoir would be the same regardless of implementation of a drought permit at Jumbles Reservoir. The effects under this in-combination scenario would therefore be same as those described above.

River flows – Eagley Brook, the River Tonge, the River Croal and the River Irwell

The impacts of a reduction in compensation flow released from Jumbles Reservoir to 12 Ml/d, and from Belmont Reservoir to 4.5 Ml/d, are outlined by water body as follows.

Eagley Brook – GB112069064570

Eagley Brook is located upstream of the confluence of the River Tonge and Bradshaw Brook, into which the compensation flow from Jumbles Reservoir is released. Consequently, the impacts of the in-combination scenario are the same for this watercourse as those previously described in relation to the Belmont Reservoir drought order alone.

Tonge – GB112069064530

Under a Jumbles Reservoir 12 Ml/d drought permit, in combination with a Belmont Reservoir 4.5 Ml/d drought order, the influenced baseline Q95 flow is estimated to reduce by approximately 23% upstream of the Bradshaw Brook confluence (i.e. no change vs the impacts predicted for Belmont drought order alone) and 21% downstream of the Bradshaw Brook confluence (i.e. approx. 0.8 km of River Tonge upstream of the Croal confluence).

Croal (including Bradshaw Brook) – GB112069064550

Under a Jumbles Reservoir 12 Ml/d drought permit, in combination with a Belmont Reservoir 4.5 Ml/d drought order, the influenced baseline Q95 flow on the River Croal at Farnworth gauging station is estimated to reduce by approximately 18%.

Irwell (Croal to Irk) – GB112069061451

Under a Jumbles Reservoir 12 Ml/d drought permit, in combination with a Belmont Reservoir 4.5 Ml/d drought order, the influenced baseline Q95 flow on the River Irwell at Kearsley gauging station is estimated to reduce by approximately 4%.

A2.1.7 Summary

EA guidance (EA, 2025) on preparing environmental assessments for drought plans suggests categorising the magnitude of hydrological impact but these categories are not quantitatively defined. In the absence of quantitative categories, a qualitative approach to classification of impact magnitude has been undertaken for each WFD water body using a methodology consistent with the Hydroecology Decision Support Tool. This takes into consideration the:

- magnitude of change in compensation flow release;
- distance downstream from the compensation flow release; and
- inflows from natural accretion and artificial discharges (where present).

Proposed Belmont 4.5 Ml/d order alone

Table A2-11 summarises the predicted hydrological effects of the proposed Belmont drought order scenario (Scenario 1).

Table A2-11 Summary of potential impacts on hydrology for the proposed Belmont Reservoir 4.5 Ml/d drought order alone (Scenario 1)

Impact	Water body / feature	Magnitude of impact	Confidence level
Change in reservoir level	Belmont Reservoir	Negligible	Uncertain
Change in river flow	Eagley Brook - GB112069064570	Medium	Low
	Tonge - GB112069064530	Low	Low

Since the proposed drought order will slow the rate of reservoir drawdown and is predicted to have a beneficial but negligible effect on reservoir water level and exposure, it is concluded that there will be no subsequent impacts on receptors within Belmont Reservoir. Consequently, the impacts of the proposed drought order on Belmont Reservoir are not considered further within this assessment.

The hydrological impacts of a proposed drought order vary with increasing distance downstream from the compensation flow release point. The impacts of a reduction in compensation flow are at their greatest on Eagley Brook (a **Medium** magnitude of impact), particularly in the first kilometre, becoming progressively less downstream of the confluence with the River Tonge (a **Low** magnitude of impact), and becoming **Negligible** downstream of the confluence with the River Croal. The impacts downstream of the confluence of the River Tonge and River Croal were not assessed because the difference in predicted flow between the baseline and Scenario 1 conditions is expected to diminish below 10%.

An initial assessment has also demonstrated that the proposed drought order at Belmont Reservoir is not anticipated to change the EFI band compliance at the very lowest flows on Eagley Brook and the River Tonge, although further analysis would be required to determine any change at higher flows.

Proposed Belmont drought order (4.5 Ml/d) in combination with a Jumbles drought permit (12 Ml/d)

Table A2-12 summarises the predicted hydrological effects of the Belmont drought order, in-combination with a Jumbles drought permit (Scenario 2).

Table A2-12 Summary of potential impacts on hydrology – Proposed Jumbles drought permit (12 Ml/d) a Belmont drought order (4.5 Ml/d)

Impact	Water body/ feature	Magnitude of impact	Confidence level
Change in reservoir level	Belmont Reservoir	Negligible	Uncertain
Change in river flow	Tonge - GB112069064530	Medium	Medium
	Croal - GB112069064550	Medium	Medium
	Irwell (Croal to Irk) - GB112069061451	Negligible	Medium

Should a Belmont drought order be implemented concurrently with a Jumbles drought permit, the magnitude of impact on river flows in the River Tonge downstream of the Bradshaw Brook confluence is considered to be **Medium**. Similarly impacts on flows in the River Croal are predicted to be of **Medium** magnitude. The magnitude of impacts downstream of the confluence with the Irwell are considered to be **Negligible**.

Uncertainties

Estimates of natural flow accretion have been derived from LowFlows2™ software. This is the EA's standard tool for estimating natural flows in ungauged catchments, and is most accurate in areas of moderate or lower permeability, where drainage corresponds well to the surface catchment. This method of catchment accretion assessment is based on catchment descriptors as opposed to gauged flows, and overall, uncertainties associated with these estimates are likely to be modest.

Artificial influences have been assessed by their licenced volumes. The most likely source of is operational departures from these licenced or consented conditions, although licenced values are considered to provide a conservative assessment.

Although a check was performed on the estimated flow accretion under the proposed drought order conditions at Belmont Reservoir, the estimates were not calibrated using measured flows given the absence of such data. The reference natural flow gauge used for comparisons was also located far from Belmont Reservoir on the eastern flank of the Pennines, and the spot flow measurements obtained in 2007 and 2008 may have been subject to different artificial influences vs the present day.

In the impact assessment considering both the Belmont drought order in-combination with a Jumbles drought permit, uncertainties were present within the data used to validate the flow accretion profile. Specifically, uncertainties in the flows recorded at the gauging stations are usually in the order of 10% magnitude at low flows, and uncertainties in the spot gauging flows presented in Figure A1-13 were quantified as +/- 20%.

Reduction in uncertainties may be primarily achieved through the use of spot flow gauging to verify predicted baseline and influenced flow accretion as part of the environmental monitoring plan.

A2.1.8 References

APEM & WRC, 2019. Hydro-Ecological Decision Support Tool (HEDS) Technical Manual. November 2019.

Atkins (2008) Eagley Brook Compensation Survey Final Report, Document Reference 5058167/DG/70/003, pp. 1-60.

Environment Agency (2025) Water company drought plan guideline, 2025, published 16 June 2025.

Young A. R., Grew R. and Holmes M.G.R. (2003) Low Flows 2000: A national water resources assessment and decision support. Water Science and Technology, 48 (10).

A2.2 Habitat and geomorphology

A2.2.1 Background

This part of the assessment reviews the impacts of a Belmont drought order alone (Scenario 1), and potential in-combination impacts with a Jumbles drought permit (Scenario 2), on the physical habitat and geomorphology of Eagley Brook, the River Tonge, River Croal, and River Irwell. Any such impacts must be understood in the context of other pressures, in particular barriers to water and sediment transmission, and morphological changes to river channels.

Physical habitat impacts may include changes to habitat availability through changes in flow depth, wetted width, and wetted perimeter, and changes to habitat character, diversity and connectivity as a result of altered flow velocity. As drought orders and drought permits are implemented during periods of exceptionally dry weather and low river flows, drought order implementation is likely to result in habitat constriction through reductions in depth and wetted width, and a tendency to lower velocity of flow. Changes in these parameters will depend on the magnitude of the flow reduction and the geometry of the channel, and thus they vary along and between river reaches.

Geomorphological effects principally relate to changes in rates of sediment erosion and (more likely at low flows) deposition, which are caused by changes to the competence of the flow to entrain and transport sediment. The greatest geomorphological risk arising from drought order implementation arises from increased rates of fine sediment deposition (for this assessment, considered to be particles finer than 0.062 mm in diameter - i.e. silt and clay). Fine sediment deposition can have detrimental impacts on aquatic habitat through clogging the spaces between coarser grains in the bed and reducing oxygenation of the bed material. However, this mechanism relies on substantial volumes of fine sediment being carried in suspension prior to drought order implementation and resultant flow reductions. Altered rates of geomorphological processes can also feed back into changes in habitat type, quality and availability by, for instance, driving changes in channel geometry (width and depth), and/or substrate composition. However, any surficial fine sediment deposition is likely to be removed when flows increase after drought order implementation, so any impacts are likely to be short-lived.

A2.2.2 Sources of information and methods

River Habitat Surveys

Expert review of RHS (Raven *et al.*, 1997) data has been undertaken to inform the assessment of geomorphology and physical habitat. RHS provides information on river forms, but is less useful for describing underlying geomorphological processes (i.e. sediment erosion, transport and deposition). Therefore, RHS data have been used primarily to describe the baseline habitat characteristics of the potentially affected reaches.

RHS data have been collected at 12 verifiable locations on Eagley Brook between 1995 and 2014, at 3 locations on the River Croal between 1995 and 2013, and at 2 locations on the River Irwell near Kearsley in 1994 and 2008. Details are presented in Table A2-13.

Table A2-13 River Habitat Survey locations along Eagley Brook, River Croal, and River Irwell (ordered from upstream to downstream)

WFD water body	Site ID	River name	Site NGR	Survey date
Eagley Brook – GB112069064570	19717	Eagley Brook	SD6760016001	06/09/2006
	26525	Eagley Brook	SD6760115996	15/07/2014
	16474	Eagley Brook	SD6775315743	03/07/2003
	2730	Eagley Brook	SD6860015700	03/05/1995
	26514	Eagley Brook	SD6898615588	22/07/2014
	16475	Eagley Brook	SD6917015498	03/07/2003
	16476	Eagley Brook	SD7025414696	16/07/2003
	16477	Eagley Brook	SD7108613534	21/07/2003
	14101	Eagley Brook	SD7130013300	23/06/2000
	24366	Eagley Brook	SD7133613269	28/04/2008
	14100	Eagley Brook	SD7180013100	23/06/2000
	14099	Eagley Brook	SD7220012900	23/06/2000
Croal (including Blackshaw Brook) – GB112069064550	2750	River Croal	SD7390007400	08/06/1995
	26138	River Croal	SD7453006832	13/08/2013
	4402	River Croal	SD7480006700	18/06/1996
Irwell (Croal to Irk) – GB112069061451	330	River Irwell	SD7480005800	13/06/1994
	22262	River Irwell	SD7559705591	28/04/2008

RHS yields a wide variety of scores and subscores. For this assessment, Habitat Quality Assessment (HQA) scores and Habitat Modification Class (HMC) are used. The HQA score is a numerical expression of habitat quality (or diversity) based on the extent and variety of natural features, with higher HQA scores indicating more diverse sites. HQA scores typically range from 10-90, although scores vary depending on river type. For instance, steep, upland rivers might be expected to exhibit greater physical habitat diversity over the scale of an RHS survey than large lowland rivers. HQA scores are totalled from individual subscores, which for the purposes of this assessment have been assigned to channel and bank characteristics.

The HMC is derived from Habitat Modification Scores (HMS), which quantifies the degree of modification to the channel based upon the type and extent of artificial features present, with higher values representing more highly modified sites. Habitat Modification Class (HMC) ranges between 1 (near-natural) and 5 (severely modified) (Table A2-14). HMS scores can be caused by point (e.g. fords) or linear features (e.g. bank reinforcement), which may differ in the likely extent of their effect within and beyond the surveyed reach.

Table A2-14 Habitat Modification Class details

Habitat Modification Class	Habitat Modification Class description	Habitat Modification Score
1	Pristine/semi-natural	0-16
2	Predominantly unmodified	17-199
3	Obviously modified	200-499
4	Significantly modified	500-1399
5	Severely modified	>1400

Hydraulic Parameters

Proposed Belmont 4.5 Ml/d order alone

In order to predict hydraulic parameters under influenced baseline Q95 flow conditions and drought order conditions, a series of simple regression equations developed and reported by Atkins (2008) were employed. These equations describe the relationship between the discharge and a range of flow depth and velocity parameters, and were derived using the four spot flow measurements obtained at each of the six sites on Eagley Brook in 2007 and 2008. Given the limited number of flow measurements obtained, Aktins (2008) determined that a small number of parameters at certain sites could not be predicted, and therefore did not report the equations for these cases.

Proposed Jumbles drought permit (12 Ml/d in combination with a Belmont drought order (4.5 Ml/d))

In order to derive predictions of hydraulic parameters under baseline low flow (Q95) and drought permit conditions, a Manning's approach was adopted. Sub-reaches of up 20 metres were identified at each location and three evenly spaced transects surveyed within each sub-reach as follows:

- upstream;
- central; and

- downstream.

Survey of an upstream and downstream transect allowed for the calculation of local bed slope (and hence energy slope assuming a normal depth) for use within Manning's equation. Estimates of Manning's *n* for within bank flow only (a reasonable assumption for use within a low flow situation where flows are not expected to exceed bank full) were undertaken using published literature values (Chow, 1959). For the transects of interest within this study, Manning's *n* values have been applied as detailed in Table A2-15.

Table A2-15 Manning's n values assigned to transects

Transect	Manning's *n*	Description
Croal 1	0.045	Natural stream – clean, winding, some pools and shoals with some weeds and more stones.
Irwell 1	0.045	Natural stream – clean, winding, some pools and shoals with some weeds and more stones.

The Q95 flow for use within the Manning's equation was calculated at the transect locations for both the baseline and potential drought order/permit scenarios. For consistency of application, HEC-RAS (USACE, 2018) was used as a Manning's *n* solver. Potential changes in habitat availability were assessed based on changes in flow depth, wetted width and wetted perimeter, while flow intensity, described by the Froude number (*F*)[6] was used to assess potential changes in habitat type. Biotope types, which in practice exist along a continuum, have been categorised based on *F* values (Entwistle *et al*., 2019):

- Pool: $0 < F \geq 0.04$
- Glide: $0.04 < F \geq 0.15$
- Run: $0.15 < F \geq 0.245$
- Riffle: $0.245 < F \geq 0.49$
- Cascade/ rapid: $0.49 < F > 1$

To assess drought order/permit effects on geomorphological processes, calculated values of flow velocity and shear stress have been considered. Flow velocity calculated using Manning's equation at each transect has been compared with the settlement velocity of coarse silt (0.062 mm diameter) calculated using Stokes' law. Calculated values of transect averaged shear stress are presented to provide an indication of the potentially mobile grain sizes in the bed under both baseline and drought order/permit scenarios.

In the absence of regulatory guidelines and evidence in the literature, the magnitude of

6 F is the ratio of inertial forces to gravity forces and provides an indication of flow state, i.e. whether flow is fast and shallow (supercritical, F > 1) or slow and deep (subcritical, F < 1). , F has been shown to be associated with the distribution of benthic macroinvertebrates (Demars et al., 2012; Jowett, 1993, 2003; Hill et al., 2008; Reid and Thoms, 2008) and has been used as a hydraulic delimiter to support the existence and ecological relevance of biotopes (Wadeson and Rowntree, 1998; Padmore, 1998; Newson et al., 1998; Newson and Newson, 2000; Clifford et al., 2006; Harvey et al., 2008).

impacts presented are based upon qualitative judgement, in a manner consistent with the Hydroecology Decision Support Tool. This considers the:

- distance from source (i.e. the compensation flow release points);
- marginal / marginal shelf exposure;
- contraction of wetted area;
- reduction in velocity, particularly where velocities may drive fine sediment deposition; and
- changes in habitat character as identified using the Froude number.

Qualitative assessments of these points are presented for each water body under the two drought order/permit scenarios. As per the conclusions of the hydrological assessment, the relative contribution of the drought order reduction to river flows is calculated for low flows, which are more common in summer and early autumn.

River structures

Information on the presence of potential barriers to migration was obtained from CaBA's River Obstacles database[7], last updated in 2024.

Whilst the structures are likely to exert an adverse impact on connectivity under the baseline conditions (e.g. during low flows without a drought order or permit in place), connectivity may be exacerbated during the implementation of a drought order/permit. For example, low flow conditions may increase the hydraulic head across a structure and/or reduce pool depths on the approach, thereby reducing the passability of individual structures.

The impacts of barriers on geomorphological processes between baseline dry conditions and the proposed drought order is expected to be negligible. Although reduced flows during drought conditions may increase the risk of fine sediment deposition in the impounded reaches, such reaches are in any case often characterised by a high proportion of fine sediment because of low flow velocities under normal conditions. As such, increased fine sediment deposition is unlikely to have a substantial impact on bed material composition or, therefore, physical habitat. Assessments of barriers in terms of their impact on geomorphology have therefore been considered unnecessary, although potential compounding effects of these features in preventing movement along watercourses has been factored into the assessment of drought order effects on fish.

[7] https://data.catchmentbasedapproach.org/datasets/theriverstrust::river-obstacles-3/about

A2.2.1 Baseline

Structures

Structures of relevance to the Belmont drought order alone and in-combination with a Jumbles drought permit implementation are presented in Figure A2-15.

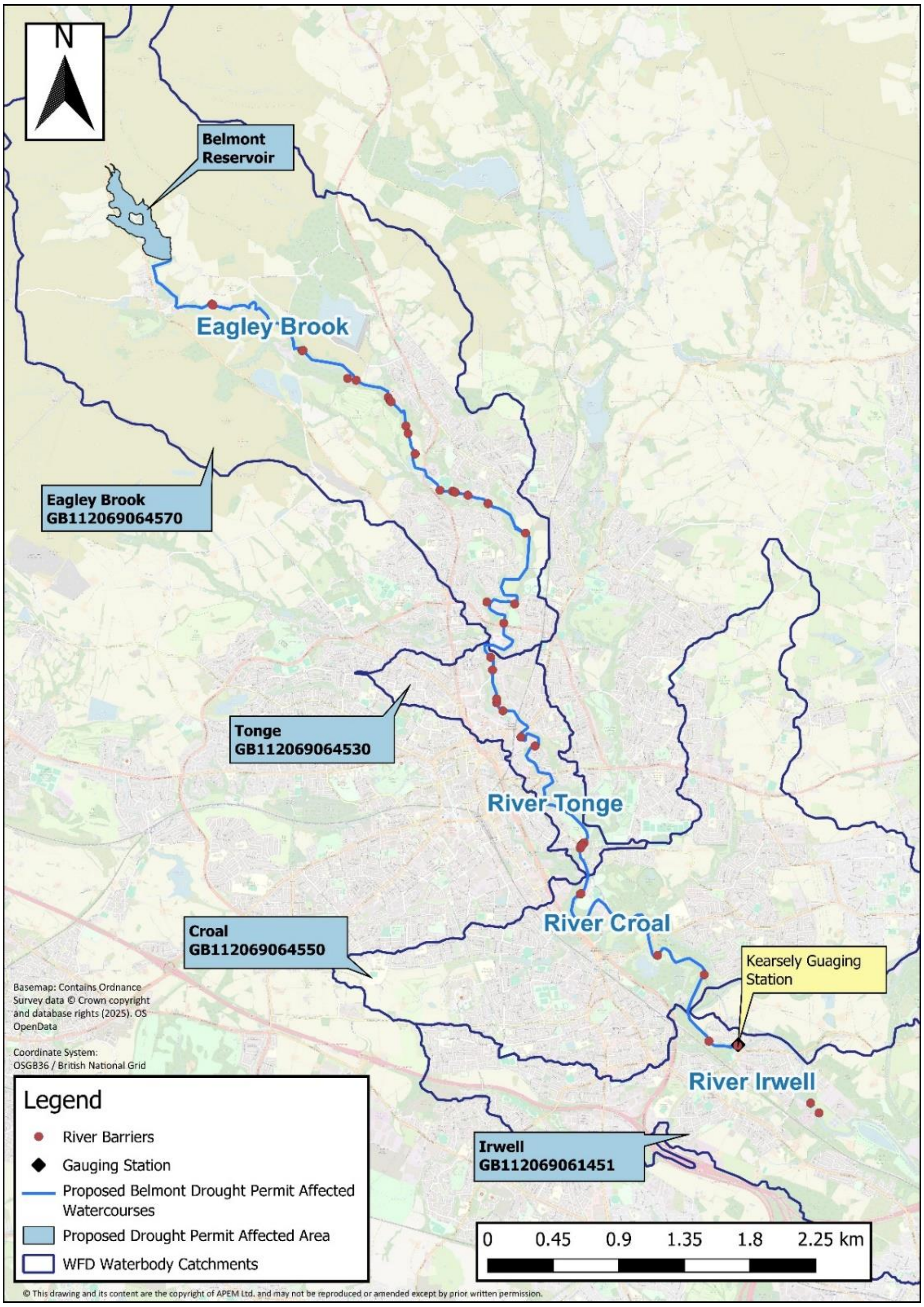

Figure A2-15 An overview of the spatial extent of barriers within the study area based on data from the CABA (updated 2024) barrier database[8]

8 https://data.catchmentbasedapproach.org/datasets/theriverstrust::river-obstacles-3/about

River Habitat Survey

A summary of the available RHS data (see Figure A2-16) is presented in Table A2-16, including HQA scores and the HMC. This table highlights a variety of valley forms in each of the three catchments for which RHS data were available, but generally shows a transition from vee-shaped valleys in the upstream reaches to broad valleys with symmetrical or asymmetrical floodplains further downstream.

HQA scores and the number of pools and riffles in the upper reaches of Eagley Brook, where the watercourse flows through moorland and pasture, suggests a high degree of habitat diversity (Table A2-16). Further downstream, where the catchment is urbanised, habitat diversity declines and HMC increases (Table A2-16). On the River Croal and River Irwell, habitat diversity is also low.

Except for along its middle reaches, Eagley Brook is generally considered to be significantly or severely modified, with sites 38715, 30003, 37435, and 23109 all being assigned modification scores in excess of 1400. Further downstream, the highest modification scores were recorded on the River Croal, particularly sites 16478, 16481, and 2750. The most commonly recorded modifications were outfalls or flow deflectors, bridges, and bed and bank reinforcement and resectioning. There was no obvious correlation between HQA and HMC, which suggests that the observed physical modifications were not the primary control on habitat quality.

Table A2-16 Summary of River Habitat Survey data (locations ordered from upstream to downstream)

WFD Water Body	Site ID	River Name	Valley Form	No. Pools	No. Riffles	HQA Channel	HQA Bank	HQA Total	HMC
Eagley Brook – GB112069064570	19717	Eagley Brook	Deep vee	1	4	30	28	58	5
	26525	Eagley Brook	Deep vee	0	2	23	33	56	4
	16474	Eagley Brook	Shallow vee	9	17	39	32	71	3
	2730	Eagley Brook	-	2	2	34	37	71	2
	26514	Eagley Brook	Deep vee	1	5	22	34	56	2
	16475	Eagley Brook	Shallow vee	14	18	39	30	69	2
	16476	Eagley Brook	Deep vee	14	12	35	33	68	4
	16477	Eagley Brook	Shallow vee	8	8	32	28	60	5
	14101	Eagley Brook	Symmetrical floodplain	0	9	26	22	48	4
	24366	Eagley Brook	Concave or bowl	0	4	31	21	52	5
	14100	Eagley Brook	Asymmetrical valley	0	6	24	23	47	5
	14099	Eagley Brook	Asymmetrical valley	0	6	32	26	58	3
	2750	River Croal	Deep vee	0	0	25	28	53	5

WFD Water Body	Site ID	River Name	Valley Form	No. Pools	No. Riffles	HQA Channel	HQA Bank	HQA Total	HMC
Croal (including Blackshaw Brook) – GB112069064550	26138	River Croal	Concave or bowl	0	2	35	33	68	4
	4402	River Croal	Shallow vee	0	1	28	26	54	4
Irwell (Croal to Irk) – GB112069061451	330	River Irwell	Asymmetrical valley	0	0	10	16	26	4
	22262	River Irwell	Concave or bowl	0	0	26	18	44	4

Transect surveys

The locations of transect surveys are shown in Figure A2-16 and Table A2-17. In the subsequent sections, representative site photographs are also presented for each transect.

Table A2-17 Surveyed transects

Notation	Grid Reference	WFD water body	Description
Tonge 1	SD 73350 08550	Tonge – GB112069064570	River Tonge downstream of confluence with Bradshaw Brook
Croal 1	SD7310007600	Croal – GB112069064550	River Croal near Burnden
Irwell 1	SD7475006000	Irwell (Croal to Irk) – GB112069061451	River Irwell downstream of confluence with River Croal

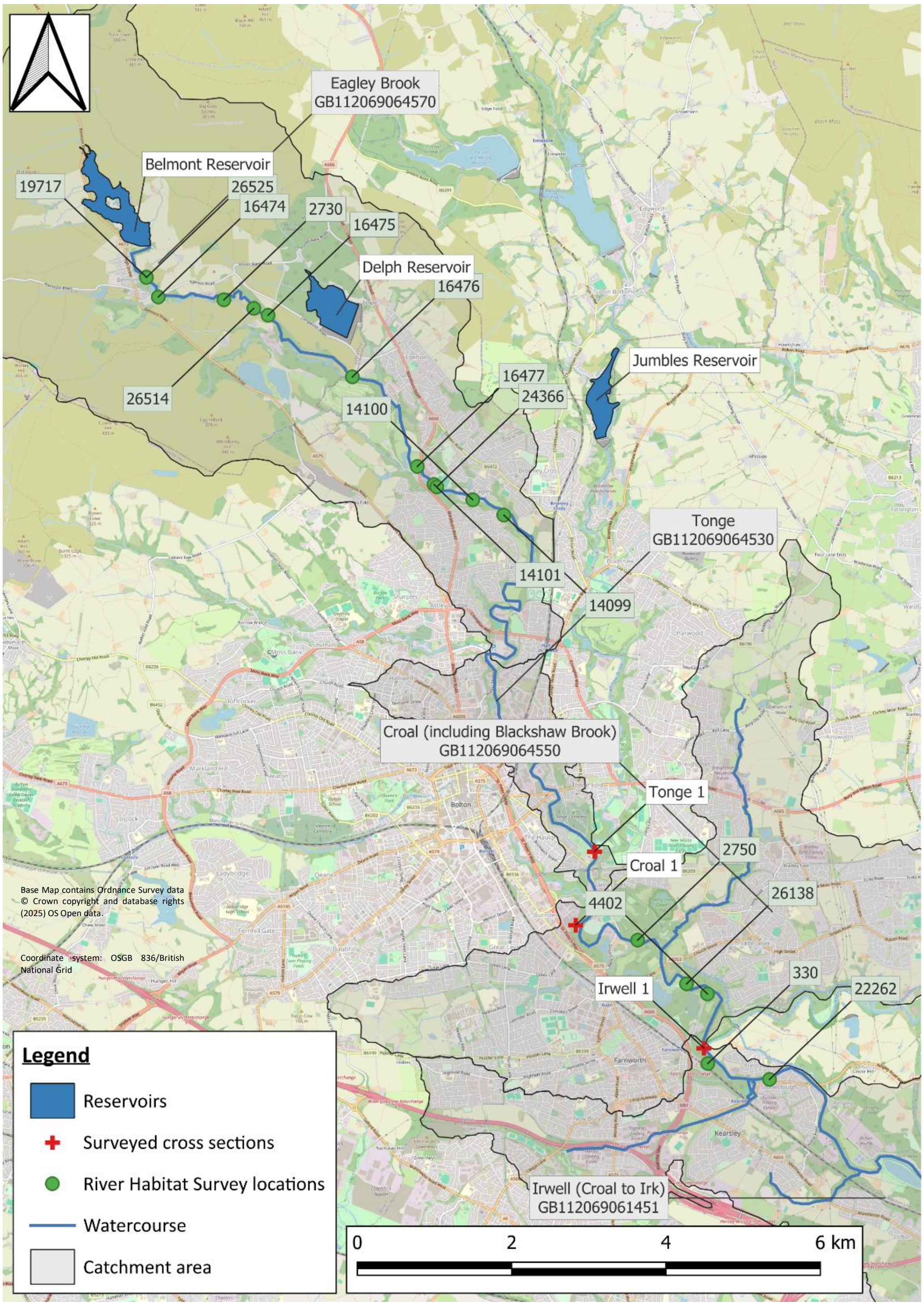

Figure A2-16 Transect and RHS locations

Tonge – GB112069064530

Transect Tonge 1 on the River Tonge (downstream of Bradshaw Brook) (Figure A2-17) was approximately 20 m wide, shallow and partially confined by a steep right bank. The left bank was much gentler in slope and the bank height much lower. The bed was comprised of coarse gravel and cobble sediment. The transect was taken on an asymmetrical cross-section forming a glide immediately downstream of a riffle. An unvegetated gravel side bar was present along the left bank.

Figure A2-17 Site photograph of the Tonge 1 transect on the River Tonge

Croal (including Blackshaw Brook) – GB112069064550)

Transect Croal 1 on the River Croal near Burnden (Croal 1, Figure A2-18) is characterised by an asymmetric cross-sectional geometry, with a triangular low flow channel located towards the right-hand bank where flow depths are at their greatest. A gravel bar is present on the left bank and this feature may be vulnerable to increased exposure during drought order/permit implementation. The right bank is reinforced with block stone revetment which constrains the flow and prevents natural processes of bank erosion from operating. This reinforcement may have contributed to bed scour and the creation of a locally deeper and narrower cross-sectional geometry.

Figure A2-18 Site photograph of the Croal 1 transect on the River Croal

Irwell (Croal to Irk) – GB112069061451

Transect Irwell 1 on the River Irwell (Figure A2-19) is considerably wider than the transects on the River Tonge and River Croal. The transect is broadly rectangular and the channel exhibits minimal habitat diversity which is representative of the reach of the River Irwell potentially affected by drought order/permit implementation. Flow is slightly deeper on the left bank and, consequently, there is a risk of marginal exposure on the right bank in the event that a drought permit was implemented.

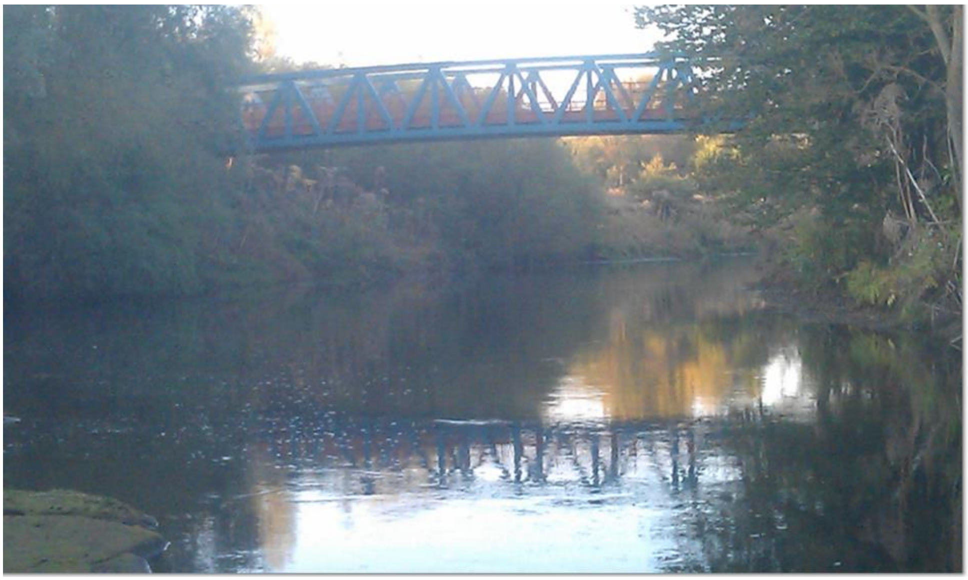

Figure A2-19 Site photograph of the Irwell 1 transect on the River Irwell

A2.2.2 Impact assessment - Proposed drought order (4.5 Ml/d) alone

Eagley Brook - (GB112069064570)

Table A2-18 shows the predicted effects of the Belmont drought order on three flow velocity parameters at the six spot flow measurement sites on Eagley Brook. Table A2-19 shows the predicted effects on three flow depth parameters at the same sites. As previously discussed, the parameter values were derived from regression equations developed by Atkins (2008), and for those site-parameter combinations for which an equation was not reported, a hash sign is used in Table A2-18 and Table A2-19.

The effect of the Belmont drought order on the velocity-related hydraulic parameters is spatially variable, with mean velocities along Eagley Brook predicted to decrease by between 20.7% and 46.3% (Table A2-18). The average decrease in mean velocity across all six sites is 34.8%. Similarly, maximum velocities are predicted to decrease by between 10.4% and 65.3% (Table A2-18). The average decrease in maximum velocity across the four sites for which regression equations were available is 38.1%.

The predicted reduction in flow velocity may increase the propensity for fine-grained suspended sediment to deposit on the bed of Eagley Brook. However, as previously discussed, watercourses typified by such sediment tend to experience sediment deposition during normal low flow conditions, and an increase in deposition under drought order conditions is also likely to be temporary. Therefore, the change in flow is considered unlikely to have a minor impact on the sediment composition of the bed of Eagley Brook.

The impact of the Belmont drought order on the depth-related hydraulic parameters is also spatially variable, with mean flow depths along Eagley Brook predicted to decrease by between 14% and 35% (Table A2-19). The average decrease in mean depth across the four sites for which regression equations were available is 26%. Similarly, maximum flow depths are predicted to decrease by between 9% and 50% (Table A2-19). The average decrease in maximum depth across all six sites is 29%.

The predicted reduction in flow depth will reduce the wetted perimeter of the channel and increase the risk of exposing the bed substrate. Consequently, there is also the potential for a reduction in the area of submerged habitat available for macrophytes and fish along Eagley Brook.

Table A2-18 Impacts of Belmont drought order on Eagley Brook flow velocity parameters at spot flow measurement sites

	Baseline	Scenario 1									
Spot Flow Site	Influenced Q95 Flow (m^3/s)	Influenced Q95 Flow with Belmont Drought Order (m^3/s)	Mean Velocity			Median Velocity			Maximum Velocity		
			B (m/s)	S1 (m/s)	D (%)	B (m/s)	S1 (m/s)	D (%)	B (m/s)	S1 (m/s)	D (%)
1	0.08	0.03	0.14	0.08	46	0.14	0.06	56	#	#	#
2	0.08	0.03	0.16	0.06	63	0.21	0.12	41	0.30	0.11	65
3	0.10	0.05	0.20	0.15	29	0.03	0	92	0.73	0.65	10
4	0.09	0.04	0.30	0.23	23	0.26	0.18	30	0.72	0.58	19
5	0.14	0.09	0.14	0.10	28	0.14	0.10	28	#	#	#
6	0.15	0.10	0.17	0.13	21	0.12	0.07	47	0.26	0.11	58

Legend

B	Baseline
S1	Scenario 1
D	Decrease between Baseline and Scenario 1
#	Unsuitable regression equation

Table A2-19 Impacts of Belmont drought order on Eagley Brook flow depth parameters at spot flow measurement sites

	Baseline	Scenario 1									
Spot Flow Site	Influenced Q95 Flow (m^3/s)	Influenced Q95 Flow with Belmont Drought Order (m^3/s)	Mean Depth			Median Depth			Maximum Depth		
			B (m)	S1 (m)	D (%)	B (m)	S1 (m)	D (%)	B (m)	S1 (m)	D (%)
1	0.08	0.03	0.14	0.11	22	0.15	0.11	26	0.22	0.12	43
2	0.08	0.03	#	#	#	#	#	#	0.20	0.15	24
3	0.10	0.05	0.06	0.04	35	0.07	0.05	34	0.15	0.11	26
4	0.09	0.04	0.06	0.04	35	0.06	0.03	44	0.17	0.14	21
5	0.14	0.09	#	#	#	#	#	#	0.140	0.07	50
6	0.15	0.10	0.12	0.10	14	0.13	0.11	15	0.27	0.24	9

Legend

B	Baseline
S1	Scenario 1
D	Decrease between Baseline and Scenario 1
#	Unsuitable regression equation

Tonge – GB112069064530

The impact of the Belmont drought order on flow hydraulics on the River Tonge at transect Tonge 1, downstream of the confluence with Bradshaw Brook, are summarised in Figure A2-20 and Table A2-20. At this location, all hydraulic parameters considered are predicted to be slightly lower under Scenario 1 relative to the baseline condition, with the percentage change between the two scenarios ranging between -2% and -8%, depending on the hydraulic parameter. A particularly notable change at this location is that the reduction in mean flow velocity under Scenario 1 relative to the baseline condition necessarily reduces the Froude number, which in turn reclassifies the flow type from cascade/rapid to riffle.

Calculations of water surface elevation indicate that there is minimal risk of increased exposure of bed substrate under this drought order scenario. Average flow velocity across the transect remains substantially above the fall velocity of silt suggesting that large scale fine sediment deposition is unlikely during drought order implementation, although lower than average velocities in the channel margins may drive some deposition under both baseline and drought order scenarios.

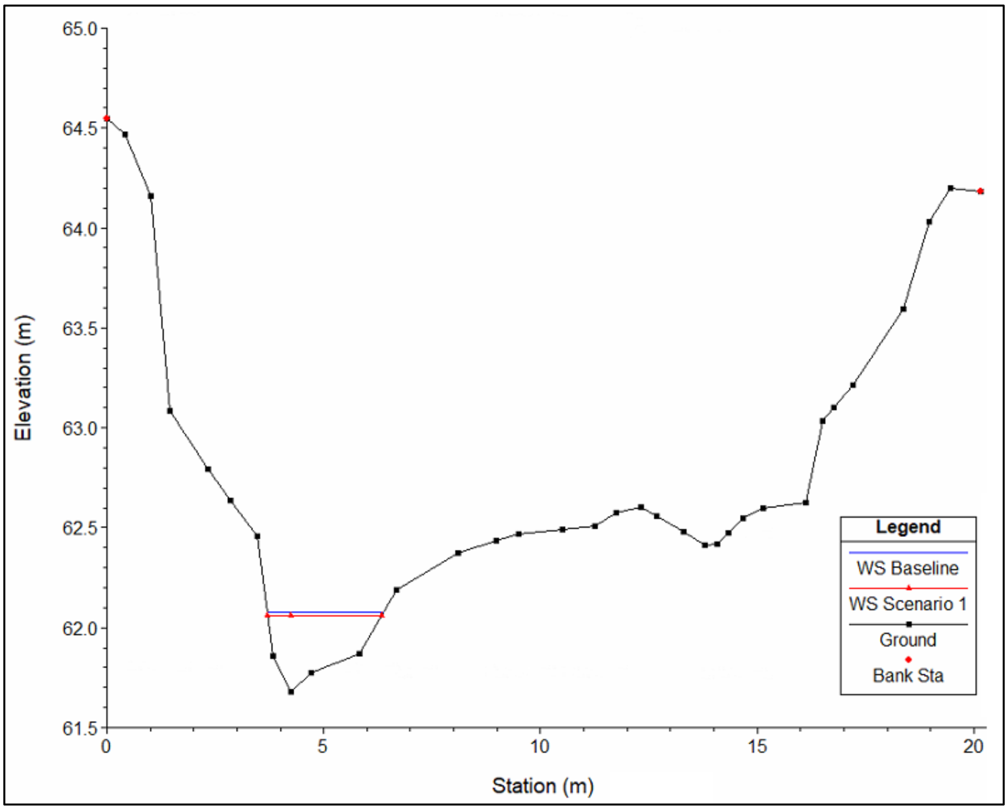

Figure A2-20 Water level profile at Tonge 1 on the River Tonge downstream of the confluence with Bradshaw Brook

Table A2-20 Hydraulic impact at Tonge 1 on the River Tonge downstream of confluence with Bradshaw Brook

Hydraulic Parameter	Baseline	Scenario 1	Percentage Change
Flow (Ml/d)	42.34	38.02	-10.20
Mean Velocity (m/s)	0.76	0.72	-5.26
Maximum Depth (m)	0.40	0.38	-5.00
Mean Depth (m)	0.24	0.23	-4.17
Wetted Width (m)	2.69	2.64	-1.86
Wetted Perimeter (m)	2.90	2.84	-2.07
Froude Number	0.50 (Cascade/Rapid)	0.48 (Riffle)	-3.23
Shear Stress (N/m^2)	18.71	17.20	-8.07

As noted in Section A2.1, the difference between the baseline and Scenario 1 flows was predicted to diminish to less than 10% on the River Tonge, a short distance downstream of the confluence of Bradshaw Brook. Consequently, the impacts of the proposed drought order on the River Croal and River Irwell further downstream were not considered in the Scenario 1 impact assessment.

A2.2.3 Impact assessment – Proposed drought order (4.5 Ml/d) in-combination with a Jumbles drought permit (12 Ml/d)

Eagley Brook - (GB112069064570)

Eagley Brook is located upstream of the confluence of the River Tonge and Bradshaw Brook, into which the compensation flow from Jumbles Reservoir is released. Consequently, the impacts of the in-combination scenario are the same for this watercourse as those previously described in relation to the Belmont Reservoir drought order alone.

Tonge – GB112069064530

At transect Tonge 1 on the River Tonge downstream of confluence with Bradshaw Brook, the hydraulic effects of a Jumbles Reservoir (12 Ml/d) drought permit, in combination with the proposed Belmont Reservoir (4.5 Ml/d) drought order are summarised in Figure A2-21 and Table A2-21.

Maximum depth, wetted width and wetted perimeter are lower under the drought order/permit scenario than under the baseline scenario. Mean velocity, Froude number and shear stress are lower under the drought order/permit scenario. Percentage change in calculated parameters is between -2% and -22%.

Calculations of water surface elevation indicate that there is minimal risk of increased exposure of bed substrate under this scenario. Transect averaged flow velocity remains substantially above the fall velocity of silt suggesting that large scale fine sediment deposition is unlikely during drought order/permit implementation, although lower than average velocities in the channel margins may drive some deposition under both baseline and drought order/permit scenarios.

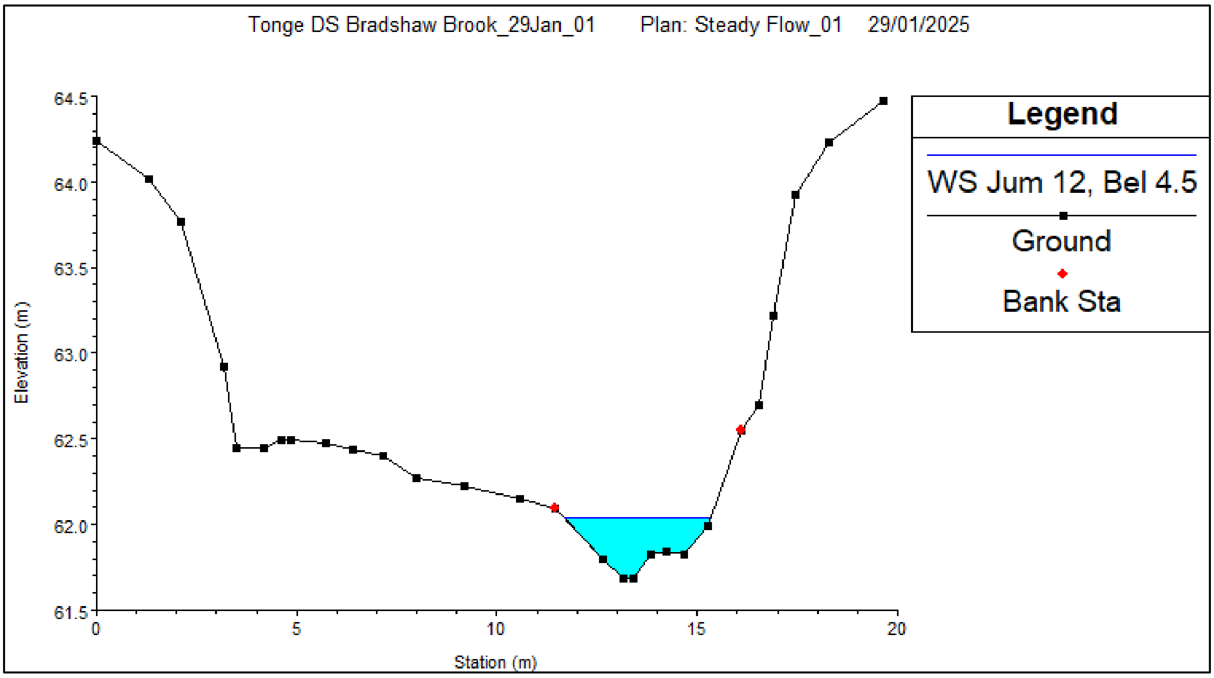

Figure A2-21 Water level profiles at Tonge 1 downstream of confluence with Bradshaw Brook

Table A2-21 Hydraulic impact at River Tonge downstream of confluence with Bradshaw Brook

Hydraulic Parameter	Baseline	Scenario 1	Change (%)
Flow (Ml/d)	58.75	45.79	-22
Mean Velocity (m/s)	0.80	0.74	-8
Maximum Depth (m)	0.39	0.35	-10
Mean Depth (m)	0.22	0.20	-9
Wetted Width (m)	3.83	3.64	-5
Wetted Perimeter (m)	3.95	3.74	-5
Froude Number	0.54 (Cascade/Rapid)	0.53 (Cascade/Rapid)	-2
Shear Stress (N/m^2)	21.09	18.87	-11

Croal (including Blackshaw Brook) – GB112069064550)

The hydraulic effects of a potential Jumbles 12 Ml/d drought permit in combination with a drought order at Belmont on flow hydraulics at the Croal 1 transect are summarised in Figure A2-22 and Table A7-22. All calculated parameters are lower under the drought order/permit scenario than under the baseline scenario, except mean velocity, Froude number and shear stress which are higher but substantially unchanged. Percentage change in calculated parameters is generally less than ±13%.

Calculations of water surface elevation indicate that there is a slightly increased risk of exposure of marginal areas of the gravel bar on the left bank under this drought order/permit scenario. In contrast, the greater flow depth near the right bank makes this part of the channel less sensitive to flow reductions. Transect averaged flow velocity remains substantially above the settlement velocity of silt suggesting that large-scale fine sediment deposition is unlikely during drought order/permit implementation, although lower-than-average velocities in the channel margins, particularly on the left bank, may drive some deposition under both baseline and drought order/permit scenarios.

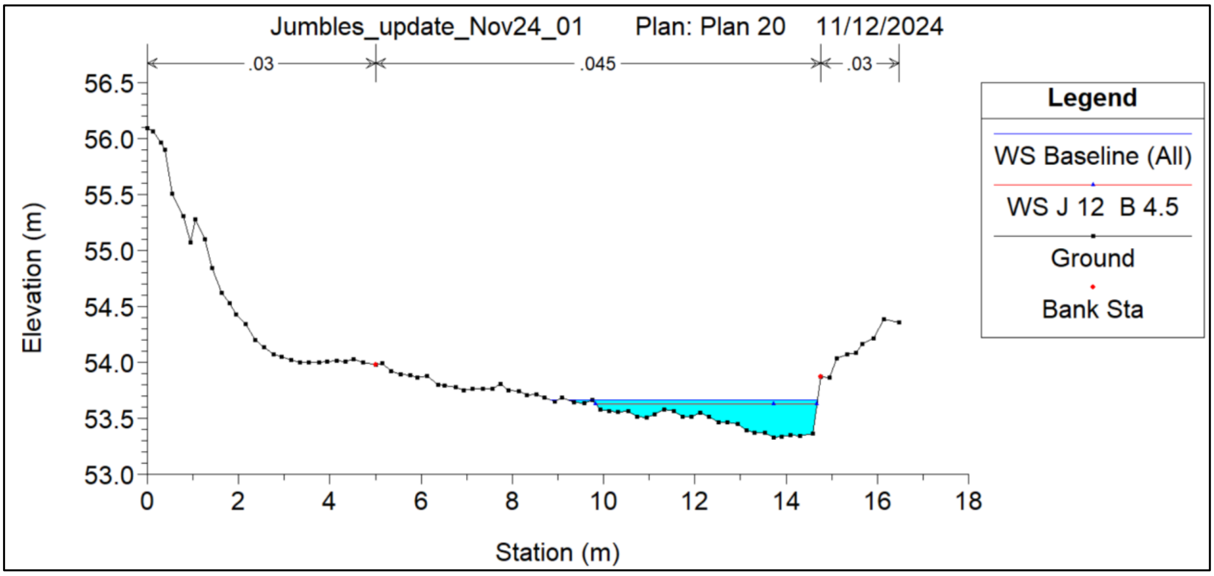

Figure A2-22 Water level profiles at Croal 1 – River Croal near Burnden

Table A7-22 Hydraulic impact at Croal 1

Hydraulic Parameter	Baseline	Scenario 1	Change (%)
Flow (Ml/d)	64.56	52.16	-19
Mean Velocity (m/s)	0.80	0.81	1
Maximum Depth (m)	0.33	0.30	-9
Mean Depth (m)	0.17	0.15	-12
Wetted Width (m)	5.57	4.85	-13
Wetted Perimeter (m)	5.86	5.10	-13
Froude Number	0.63 (Cascade/Rapid)	0.66 (Cascade/Rapid)	5
Shear Stress (N/m^2)	23.77	24.68	4

Irwell (Croal to Irk) – GB112069061451

At the Irwell 1 transect, the hydraulic effects of a potential Jumbles 12 Ml/d drought permit in combination with a potential drought order at Belmont are summarised in Figure A2-23 and Table A2-23. All calculated parameters are substantially unchanged between the drought order/permit scenario and the baseline scenario, with percentage changes generally predicted to be less than ±5%. This is because flow from Jumbles and Belmont contributes a relatively small proportion of the total discharge of the River Irwell, so discharge would not be substantially reduced as result of a drought order being implemented at Belmont and a drought permit being implemented at Jumbles.

Calculations of water surface elevation indicate that there is unlikely to be exposure of the channel bed in the relatively shallower right-hand portion of the Irwell 1 transect, and the greater flow depth near the left bank makes this part of the channel less sensitive to flow reductions. Transect averaged flow velocity remains substantially above the settlement velocity of silt suggesting that large-scale fine sediment deposition is unlikely during drought order/permit implementation, although lower-than-average velocities in the channel margins may drive some deposition under both baseline and drought order/permit scenarios

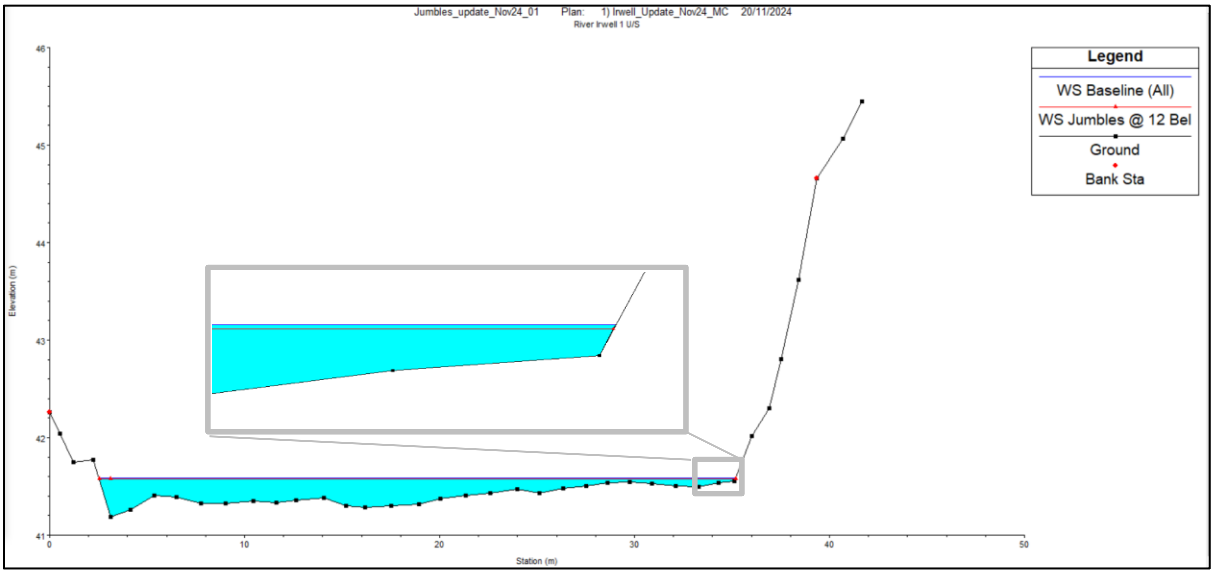

Figure A2-23 Water level profiles at Irwell 1 – River Irwell downstream of Croal confluence

Table A2-23 Hydraulic impact at Irwell 1

	Statutory Compensation Flow	Drought permit Compensation Flow	Percentage Change
Flow (Ml/d)	311.78	299.38	-3.98
Mean Velocity (m/s)	0.61	0.60	-1.64
Maximum Depth (m)	0.40	0.40	0.00
Mean Depth (m)	0.19	0.18	-5.26
Wetted Width (m)	31.90	31.90	0.00
Wetted Perimeter (m)	32.51	32.49	-0.06
Froude Number	0.45	0.45	0.00
Shear Stress (N/m^2)	12.94	12.73	-1.62

A2.2.4 Summary

Proposed drought order (4.5 Ml/d) alone

The assessment is summarised for all water bodies in Table A2-24.

Table A2-24 Summary of potential impacts on habitat and geomorphology – Belmont drought order alone (Scenario 1)

Impact	Water body	Magnitude of impact	Confidence level
Change in sedimentation	Eagley Brook – GB112069064570	Medium	Low
	Tonge – GB112069064530	Low	Low
Change in in-stream habitat	Eagley Brook – GB112069064570	Medium	Low
	Tonge – GB112069064530	Low	Low

Eagley Brook - (GB112069064570)

The impacts of the Belmont drought order on sedimentation and in-stream habitat are likely to be **Medium** on average on Eagley Brook, but additional monitoring is recommended to confirm this (Section 5).

At low flows, mean and maximum flow velocities are predicted to decrease quite markedly, and this may increase the propensity for fine-grained suspended sediment deposition. However, fine sediment accumulations are likely to be temporary, particularly in the absence of significant sediment supply due to the impoundment upstream. The mean and maximum flow depths are also predicted to decrease, which may increase the risk of the bed substrate becoming exposed, which in turn would limit the area of submerged habitat available for macrophytes and fish.

Tonge - GB112069064530

Owing to its increased distance downstream of Belmont Reservoir, hydrological impacts on the Tonge water body are predicted to be less substantial than those on Eagley Brook. Consequently, changes in hydraulic parameters are small and the risk of marginal exposure is low. There is likely to be a negligible change in habitat area.

Average flow velocity across the section remains sufficient to transport fine (suspended) sediment meaning that the risk of substantial sedimentation is also low, although marginal deposition is likely to occur under both baseline and drought order scenarios. Consequently, the impact on both in-stream habitat and sedimentation is considered to be **Low** under the Belmont drought order on the Tonge water body.

The impacts downstream of the confluence of the River Tonge and River Croal were not assessed because the difference in predicted flow between the baseline and Scenario 1 conditions is expected to diminish below 10%.

Proposed Belmont drought order (4.5 Ml/d) in-combination with a Jumbles drought permit (12 Ml/d)

The assessment is summarised for all relevant water bodies in Table A2-25.

Table A2-25 Summary of potential impacts on habitat and geomorphology – Belmont drought order in-combination with a Jumbles 12 Ml/d drought permit

Impact	Water body	Magnitude of impact	Confidence level
Change in sedimentation	Tonge – GB112069064530	Low	Low
	Croal – GB112069064550	Low	Low
	Irwell (Croal to Irk) – GB112069061451	Negligible	Low
Change in in-stream habitat	Tonge – GB112069064530	Low	Low
	Croal – GB112069064550	Low	Low
	Irwell (Croal to Irk) – GB112069061451	Negligible	Low

Eagley Brook - GB112069064570

Eagley Brook is located upstream of the confluence of the River Tonge and Bradshaw Brook, into which the compensation flow from Jumbles Reservoir is released. Consequently, the impacts of the in-combination scenario are the same for this watercourse as those previously described in relation to the Belmont drought order alone. Consequently, this watercourse is not included in Table A2-25.

Tonge - GB112069064530

The impact of a potential Jumbles Reservoir 12 Ml/d drought permit operating in-combination with the proposed drought order at Belmont Reservoir on the Tonge water body is considered to be **Low**. The risk of marginal exposure is slightly increased under the in-combination scenario, but is still considered **Low**, and no substantial impact on wetted area or aquatic habitat availability is expected. Average flow velocity is predicted to remain sufficient to transport fine suspended sediment, meaning that the risk of substantial sedimentation is **Low**, although marginal deposition is likely to occur. Consequently, the impact on both in-stream habitat and sedimentation is considered to be **Low** on the Tonge water body under a potential Jumbles Reservoir 12 Ml/d drought permit in combination with the proposed Belmont Reservoir drought order.

Croal - GB112069064550

The impact of a potential Jumbles Reservoir 12 Ml/d drought permit operating in-combination with the proposed Belmont Reservoir drought order on the Croal water body is considered to be **Low**. The risk of marginal exposure is considered to be **Low**, and no substantial impact on wetted area or aquatic habitat availability is expected. Flow velocity is predicted to remain sufficient to transport fine suspended sediment, meaning that the risk of substantial sedimentation is **Low**, although marginal deposition is likely to occur. Consequently, the impact on both in-stream habitat and sedimentation is considered to be **Low** on the Croal water body under a potential Jumbles Reservoir 12 Ml/d drought permit in combination with the proposed Belmont Reservoir drought order.

Irwell (Croal to Irk) - GB112069061451

The impact of a potential Jumbles Reservoir 12 Ml/d drought permit operating in-combination with the proposed Belmont Reservoir drought order on the Irwell water body is considered to be **Negligible**, owing to the limited impact on hydrology and hydraulics at the assessment location. Specifically, no contraction of habitat area or marginal exposure is expected, and flow velocity is expected to remain sufficient to maintain the transport of suspended sediment.

Uncertainties

Scales of change are not necessarily monotonically linked to the magnitude of impact when considering hydraulic parameters and variations in the distribution of hydraulic habitat under flow change scenarios. Similar magnitude flow changes can have very different impacts on hydraulic parameters and in-channel habitat depending on channel configuration and cross-sectional geometry.

For the impact assessment for Scenario 1, physical habitat effects on the Eagley Brook were estimated using regression equations developed from a small number of spot flow measurements at a few sites. All gaugings were also undertaken nearly 20 years ago, at higher flows than might be expected to prevail under a severe drought. Consequently, the assessment relies upon extrapolation – from 2007 to the 2020s, from a few transects to characterise broader reach-scale responses, and from moderate flows to low flows. The assessment in the reach is therefore considered Uncertain. Updated surveys undertaken at low flows would reduce this uncertainty and are recommended, in particular given the potential for larger hydraulic effects on the Eagley Brook.

In the context of the impact assessment for Scenario 2, in which the Rivers Tonge, Croal, and Irwell were considered, the latter two watercourses were surveyed in 2009. Given the size and relatively stable bed and bank geometry of these watercourses, it was not considered necessary to resurvey them. Indeed, the transects were selected to be representative of flow-sensitive habitat in the relevant reaches and more broadly. Consequently, they have been taken as representative of the type of habitat occurring on the river reaches concerned. The level of uncertainty is considered acceptable in the context of relatively modest changes to river discharge and the risk-based approach taken to the assessment of drought order/permit implementation.

The magnitudes of impact and the associated confidence levels of the proposed drought order/permit scenarios were determined in a manner consistent with the Hydroecology Decision Support Tool. Although this method is qualitative, it provides guidance on different degrees of change to wetted habitat size and character, and for the accuracy, repeatability, and representativeness of the data and methods used in the assessment, controlling to some extent for the subjectivity inherent in use of expert judgement.

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A2.3 Water quality

A2.3.1 Background

This section assesses the significance of impacts on water quality within the study area as a result of the proposed drought order. The aim of the water quality impact assessment was to model and compare concentrations of a number of parameters at the current (baseline) and proposed drought order flows. Having established the baseline, potential changes in water quality resulting from implementation of the proposed drought order have been assessed using a modelling approach or expert judgement.

The water bodies included in the study area range from relatively fast flowing and narrow channels to wider, lower velocity stretches downstream. There are a number of significant stressors affecting water quality, particularly in the River Croal, including diffuse source pollution from farms, roads and urban areas (EA Catchment Data Explorer)[9].

A2.3.2 Potential routes of impact

The proposed drought order will reduce the quantity of water released from Belmont Reservoir into Eagley Brook which could in turn affect water quality in downstream water bodies via reduced dilution for point and diffuse inputs.

Where there are sewage treatment works (STWs) discharging directly into the affected river reaches the proposed drought order could impact water quality by reducing the dilution of these discharges, as well as small sewage discharges such as those from septic tanks and private sewage treatment plants. This could result in an increase in biochemical oxygen demand (BOD), suspended solids, ammonia and orthophosphate concentrations. Lower flows could also reduce the dilution of intermittent discharges from combined sewer overflows (CSOs) if heavy rainfall events were to occur during implementation of a drought order.

From an EA review of catchment information, there is a discharge of what is understood to be groundwater, between Belmont WwTW and Delph Brook, which can naturally contain elevated concentrations of iron and manganese. Reduced dilution of this discharge could result in an increase in concentrations of iron and manganese.

The impact from any pollution incidents could be more severe due to the reduced volume of the river available for dilution. The impact of this would depend on the nature and severity of the pollution incident.

Conversely, given the likelihood of reduced rainfall associated with a drought, there could be concurrent reductions in diffuse pollution inputs which are driven by rainfall. This could result in a reduction in nutrient and suspended solids concentrations.

9 https://environment.data.gov.uk/catchment-planning/

Water temperature could increase during the proposed drought order, leading to increases in ammonia in the form of un-ionised ammonia (UIA) which is toxic to fish and other aquatic life.

A2.3.3 Sources of information and methods

Assessment water bodies

Three WFD water bodies were of interest:

- Eagley Brook (GB112069064570).
- River Tonge (GB112069064530).
- River Croal (including Blackshaw Brook) (GB112069064550).

There are two STWs discharging directly to Eagley Brook, including Belmont STW (approximately 1.5 km downstream of Belmont Reservoir) and Longworth STW (approximately 4 km downstream of Belmont Reservoir).

Physico-chemical data review

Physico-chemical data used to describe the historical water quality baseline of the water bodies affected by the proposed drought order were downloaded from the water quality data archive[10].

Sampling sites of interest to this assessment are listed in Table A2-26.

10 https://environment.data.gov.uk/water-quality/view/landing

Table A2-26 Details of water bodies included in the study and locations of data collection

Water body	Water quality data	Description of sampling site
Eagley Brook (GB112069064570)	EA sampling site: 88002254 2020-2022	Eagley Brook Upstream of Belmont Etw
	EA sampling site: 88002256 2014-2022	Eagley Bk Below Charles Turner U/S Delph
	EA sampling site: 88023290 Jan-Nov 2014	Eagley Brook at Hough Lane
	EA sampling site: 88002263 2014-2024	Eagley Brook Above Conf With Astley Brk
Tonge (GB112069064530)	EA Sampling site 88002269 2014-2022	River Tonge at Metro Engineering F/Bridge
Croal (Including Blackshaw Brook) (GB112069064550)	EA Sampling site 88002316 2008, 2013-2024	Croal at Farnworth Recorder Stn u/s Weir

The physico-chemical parameters of interest for this assessment were: water temperature, dissolved oxygen (DO), pH, BOD, suspended solids, nitrate, ammonia (as nitrogen (N)), UIA and orthophosphate.

Where available, up to 10 years' of data (2014-2024) were presented and reviewed for historical trends and any obvious fluctuations during previous dry years (2018, 2020 and 2022). The physico-chemical data were compared against the relevant WFD environmental quality standards (EQS) for each parameter. No standards for nitrate are proposed in the WFD, therefore, nitrate data were compared to the Nitrate Vulnerable Zone (NVZ) standard for indicative purposes only. There are also no WFD standards for suspended solids or UIA, and so data were compared to the EC Freshwater Fish Directive (FFD) (78/659/EEC) guidelines (although this Directive has been repealed, the WFD requires equivalent levels of protection to the FFD).

SIMCAT modelling

Water quality impact assessment was undertaken using the EA SIMCAT model. All water quality modelling was carried out using SIMCAT version 15.7. Two updated versions of the EA SIMCAT model for the Ribble Mersey catchment were received from UU in November 2024:

- RM273b.
- RMAtPermit1207.

Both models were developed to support PR24 and therefore include the latest information regarding water quality improvements undertaken by UU during AMP7. The first model is a 'baseline' model and the second is an 'at-permit' model. The differences between the two are as follows:

- the baseline model contains actual monitoring data for any STW final effluent discharges within the catchments of interest, in terms of both effluent flow rates and effluent quality i.e. the baseline model is based on measured data; and
- the 'at-permit' model contains permit data for any STW final effluent discharges within the catchments of interest, in terms of both effluent flow rates and effluent quality i.e. the 'at-permit' model is based on the permit requirements for effluent flow and quality.

The 'at-permit' model represents expected conditions at the end of AMP7 when various improvements at STWs are scheduled to be completed. Nevertheless, it is important to note that STW effluent flow rates are typically lower and effluent quality is typically better than that represented in the 'at-permit' model, hence the 'at-permit' model represents a pessimistic estimate of future water quality.

To generate the data for the water quality impact assessment, the models provided by the EA were modified to reflect the drought order flow scenarios to be assessed i.e. a reduced compensation flow from the reservoir causing reduced flows in the watercourses downstream, including any in-combination effects with other drought permit/order compensation flow reductions.

Table A2-27 shows the drought order scenarios for Belmont Reservoir, as well as the scenarios reflecting potential in-combination effects with a potential drought permit at Jumbles Reservoir.

Table A2-27 Drought order scenarios and models

Drought order scenarios		SIMCAT model
Baseline	Baseline Belmont Reservoir compensation flow at 9.0 Ml/d – no change	Baseline
1BL	Belmont Reservoir compensation flow change from 9.0 Ml/d to 4.5 Ml/d.	Baseline
1AP	Belmont Reservoir compensation flow change from 9.0 Ml/d to 4.5 Ml/d.	At-permit
2BL	Belmont drought order at 4.5 Ml/d in combination with a Jumbles Reservoir drought permit (compensation flow 12 Ml/d)	Baseline
2AP	Belmont drought order at 4.5 Ml/d in-combination with a Jumbles Reservoir drought permit (compensation flow 12 Ml/d)	At-permit

During implementation of a drought order it would be expected that the reservoir would be drawn down and therefore that rainfall-induced spills would be unlikely, therefore flow immediately downstream of the reservoir would be limited to the constant compensation flow at the drought order rate.

To represent this within the models a large mean abstraction was added to the Features section of the model (using code 7), to cause a constant flow downstream of the reservoir equal to the drought order compensation flow, i.e. for the Belmont drought order the flow immediately downstream of the reservoir needed to be 4.5 Ml/d. The SIMCAT models were adjusted via this additional abstraction so that the flow met the required values. No other modifications were made to the models apart from these changes in compensation flow from the reservoirs.

The SIMCAT models were run using the 90%ile mode to generate data for total ammonia, BOD and dissolved oxygen (dissolved oxygen results are expressed as 10%ile values). The mean mode was used to generate data for nitrate and phosphate.

Data from these model runs were collated for a number of assessment sites within the area of influence of the drought order (plus the area of influence for any in-combination effects) (Figure A2-24). These assessment sites were based on those used for the Delph and Jumbles drought permit EAR updates in 2024-25, which were agreed in advance with the EA; an additional assessment site was included downstream of Belmont STW, within the Eagley Brook water body, and another additional assessment site was included on the River Tonge, upstream of the confluence with Bradshaw Brook. The assessment end point for the Belmont drought order alone was the River Tonge confluence with the River Croal; for the Belmont drought order in-combination with the Jumbles drought permit, the assessment end point was the River Croal at the confluence with the River Irwell.

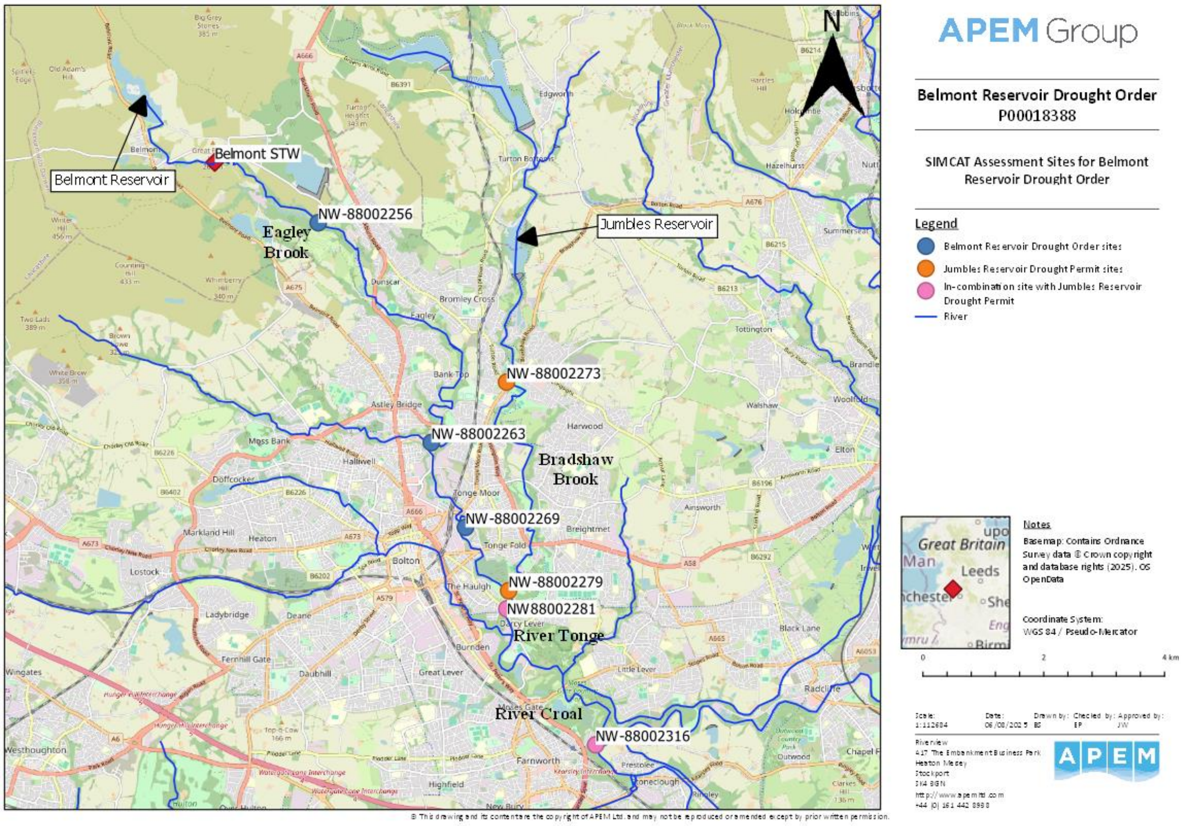

Figure A2-24 Water quality assessment sites for the Belmont Reservoir drought order impact assessment (including in-combination assessment sites)

The difference between the results from the baseline and the scenarios representing the drought order at Belmont was used to predict water quality impacts of the drought order downstream of the reservoir, including any in-combination effects with the Jumbles drought permit. The results were compared against calculated site-specific EQS . The WFD Good status EQS for the assessment sites in this report are shown in Table A2-28.

Table A2-28 WFD Good status environmental quality standards

Reservoir name	River name	Assessment sites	Total ammonia (90%ile, mg/l)	BOD (90%ile, mg/l)	Phosphate (mean, mg/l)
Belmont	Eagley Brook	Belmont STW	0.3	4.0	0.028
		NW-88002256	0.3	4.0	0.028
		NW-88002263	0.3	4.0	0.039
	River Tonge	NW-88002269	0.6	5.0	0.043
		NW-88002281	0.6	5.0	0.047
Jumbles (in-combination sites)*	River Croal	NW-88002316	0.6	5.0	0.054

* Sites are outside of the zone of influence of the Belmont drought order alone but data is presented to show any possible in-combination effects with a drought permit at Jumbles Reservoir.

Unionised ammonia assessment

Water temperature could increase during the proposed drought order, leading to increases in ammonia in the form of UIA which is toxic to fish and other aquatic life. However, SIMCAT is not able to model UIA. As a very high-level review, historical data on water temperature and pH were therefore used to calculate the UIA concentrations which could be recorded under the drought order options, based on the ammonia concentrations predicted by the SIMCAT modelling.

Dissolved oxygen assessment

DO is of potential concern during the reduced flow associated with drought orders, particularly in areas of permanently reduced flow such as upstream of weirs. However, within the Eagley Brook water body there are no weirs present[11] and there were no suitable data available to assess weirs on the River Tonge. Measured data were only available from one suitable location upstream of a weir on the River Croal: Croal @ Farnworth Recorder Stn U/S Weir.

Hazardous substances review

The impact of the proposed drought order on WFD Specific Pollutants, Priority Substances and Priority Hazardous Substances was considered in accordance with drought planning supplementary guidance (EA, 2025). A qualitative assessment of the potential impact was made to assess the impact of Belmont STW and Longworth STW, as well as a groundwater discharge which enters Eagley Brook between Belmont STW and Delph Brook. There were no CIP data available for Belmont STW or Longworth STW and therefore only a high level qualitative assessment has been provided.

Modelling of Intermittent discharges

UU conducted a Duflow assessment of the proposed Belmont drought order in-combination with a possible drought permit at Jumbles. This covered Eagley Brook, the River Tonge and the River Croal. Of these, Eagley Brook and the River Tonge may be impacted by the proposed drought order at Belmont, and the Rivers Tonge and Croal may be impacted by the possible drought permit at Jumbles.

The baseline condition used was the end AMP7 Scenario with the AMP7 Croal UIDs Solutions implemented. The Duflow assessment modelled a reduction in flow from Belmont Reservoir from 9 Ml/d to 4.5 Ml/d and a reduction from 19 Ml/d to 12 Ml/d for Jumbles Reservoir. The

11 A weir was removed from Eagley Brook in October 2019 (https://naturalcourse.co.uk/2019/10/23/restoring-rivers-the-natural-course-way/)

flow reduction was applied each year for the 6-month period 8th September to 8th March, and the model was run for 10 years (2000-2009, so the reduction was applied from 1st January 2000 to 8th March 2000 initially). Belmont STW was modelled at its permit limit of 40mg/l BOD and 20mg/l Ammonia.

A2.3.4 Baseline

According to the latest WFD classifications (Section 2.4), all water bodies of interest are at MEP. In Eagley Brook, all physico-chemical elements were at High status except phosphate which was at Moderate status. Chemical status was not assessed in 2022, however in 2019 status for priority hazardous substances was Fail due to polybrominated diphenyl ethers (PBDE) and mercury and its compounds. Priority substances were indicative of Good status. The physico-chemical data in the baseline section below is consistent with the SIMCAT modelling baseline scenario at the assessment sites that were used for total ammonia, BOD and orthophosphate.

Physico-chemical data: Eagley Brook

Physico-chemical data for Eagley Brook water body for the years 2014 to 2024 are presented in Figure A2-25 and Figure A2-26. The data were reviewed to highlight chronic and intermittent water quality issues and any obvious effects associated with dry years: 2018, 2020 and 2022.

In the Eagley Brook water body there were no apparent issues with water temperature, DO, pH, nitrate or UIA with all results indicative of High status or below their indicative guideline limits.

BOD was generally indicative of High or Good status at all sites. There was a one-off elevated reading indicative of Moderate status at Eagley Brook Upstream of Belmont ETW (88002254) in April 2022. BOD was indicative of Poor status on one occasion at Eagley Brook at Hough Lane (88023290) in November 2014 and once at the Eagley Brook above Confluence with Astley Brook (88002263) in June 2023. Of these, only one exceedance was associated with a dry year (Eagley Brook Upstream of Belmont ETW (88002254) in April 2022).

Suspended solids concentrations were elevated on two occasions at Eagley Brook Below Charles Turner U/S Delph (88002256) and Eagley Brook at Hough Lane (88023290), and on one occasion at Eagley Brook upstream of Belmont ETW (88002254). Of these, only one exceedance was associated with a dry year (Eagley Brook below Charles Turner U/S Delph (88002256) in February 2020).

Ammonia concentrations were low and typically below the limit of detection (0.03 mg/l) or indicative of High status. There was one reading indicative of Moderate status at Eagley Brook below Charles Turner U/S Delph (88002256) in February 2022.

Orthophosphate concentrations were consistently indicative of Good or High status at Eagley Brook upstream of Belmont ETW (88002254). However, they were intermittently elevated at the other sites with several readings indicative of Moderate status in both dry and non-dry years. Concentrations were indicative of Poor status at Eagley Brook below Charles Turner U/S Delph (88002256) in July 2014 and August 2019[12].

12 Note that Figure A2-26 shows orthophosphate exceedance at Eagley Brook above Confluence with Astley Brook (88002263) in October 2016; however, the graph only shows the most stringent site-specific orthophosphate standards. This is not an exceedance when compared to the site-specific standards for this site only.

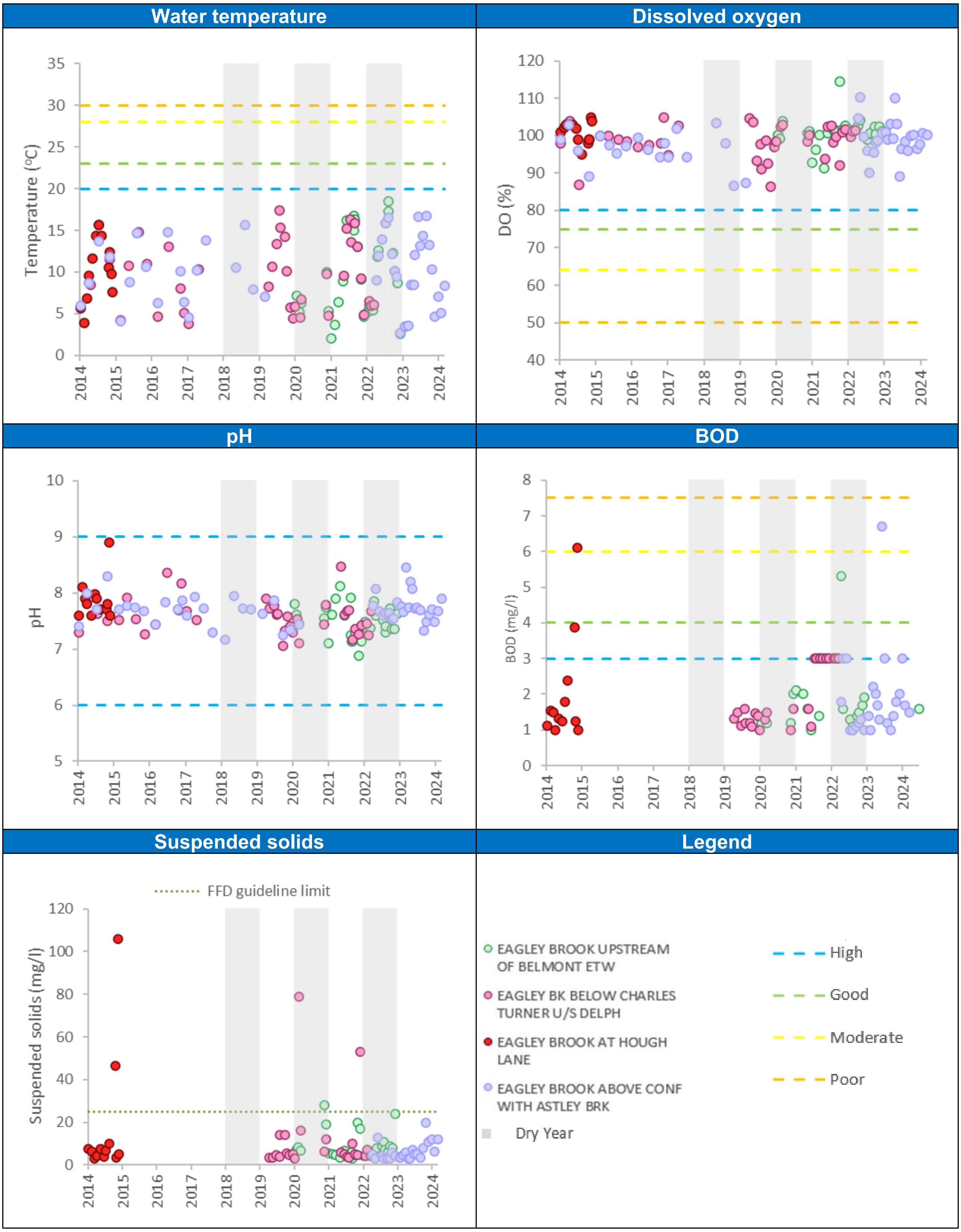

Figure A2-25 Physico-chemical parameters recorded at EA monitoring locations within the Eagley Brook water body (GB112069064570)

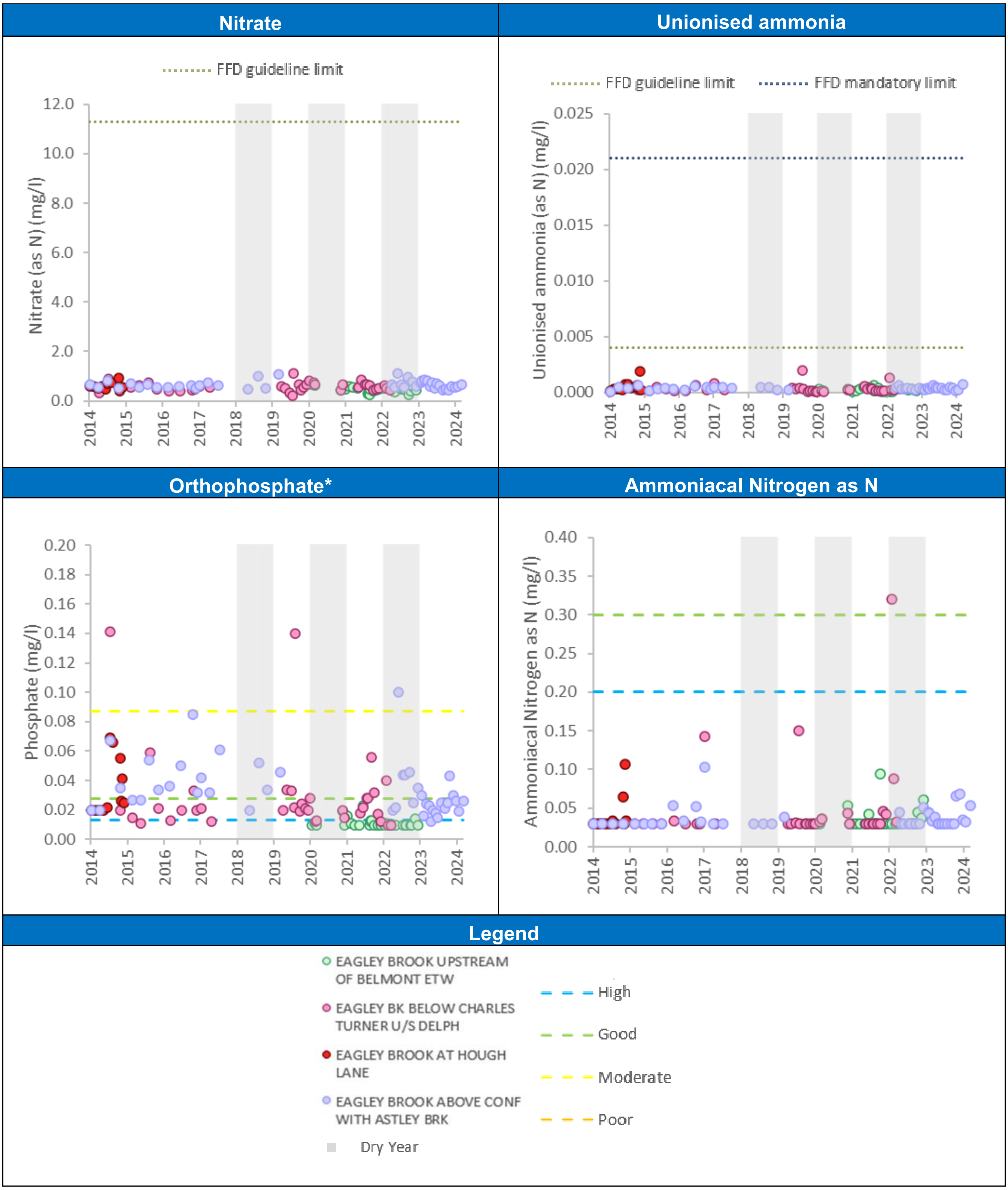

Figure A2-26 Nutrient parameters recorded at EA sampling sites within the Eagley Brook water body (GB112069064570)

*Note only the most stringent site-specific standards are shown for orthophosphate.

Physico-chemical data: River Tonge and River Croal

Physico-chemical data for the years 2008 to 2024 are presented in Figure A2-27 and Figure A2-28. The data were reviewed to highlight chronic and intermittent water quality issues and any obvious effects associated with recent dry years.

In the River Tonge water body, there were no apparent issues with water temperature, DO, pH, nitrate, ammonia and UIA with all results indicative of High status or below their indicative guideline limits. BOD was only measured on two occasions and was indicative of High status. Likewise, suspended solids were only measured on two occasions and were below the guideline limit. Orthophosphate concentrations were indicative of Good or Moderate status throughout the period for which data were available. It is important to note that the EA data obtained for the River Tonge are limited to the periods 2014-2017 and 2022.

In the Croal water body there were no apparent issues with water temperature, pH and nitrate with all results indicative of High status or below their indicative guideline limits. DO readings were generally indicative of High status, however, one DO reading in August 2022 was indicative of Good status. There were two BOD concentrations indicative of Moderate status in July 2018 and August 2019. Suspended solids concentrations were elevated on four occasions in 2023. Unionised ammonia concentrations were predominantly below the FFD guideline limit although this was exceeded on four occasions in October 2016, September 2018, August 2019 and September 2023. All results were below the mandatory limit of 0.021 mg/l. Ammonia concentrations were elevated above Good status on one occasion at Moderate and once at Poor status but otherwise were largely indicative of High status. Orthophosphate concentrations were largely indicative of Good or Moderate status. There were two concentrations indicative of Poor status in October 2016 and May 2017.

Figure A2-27 Physico-chemical parameters recorded at EA monitoring locations within the Rivers Tonge and Croal (including Blackshaw Brook) water bodies (GB112069064530 and GB112069064550)

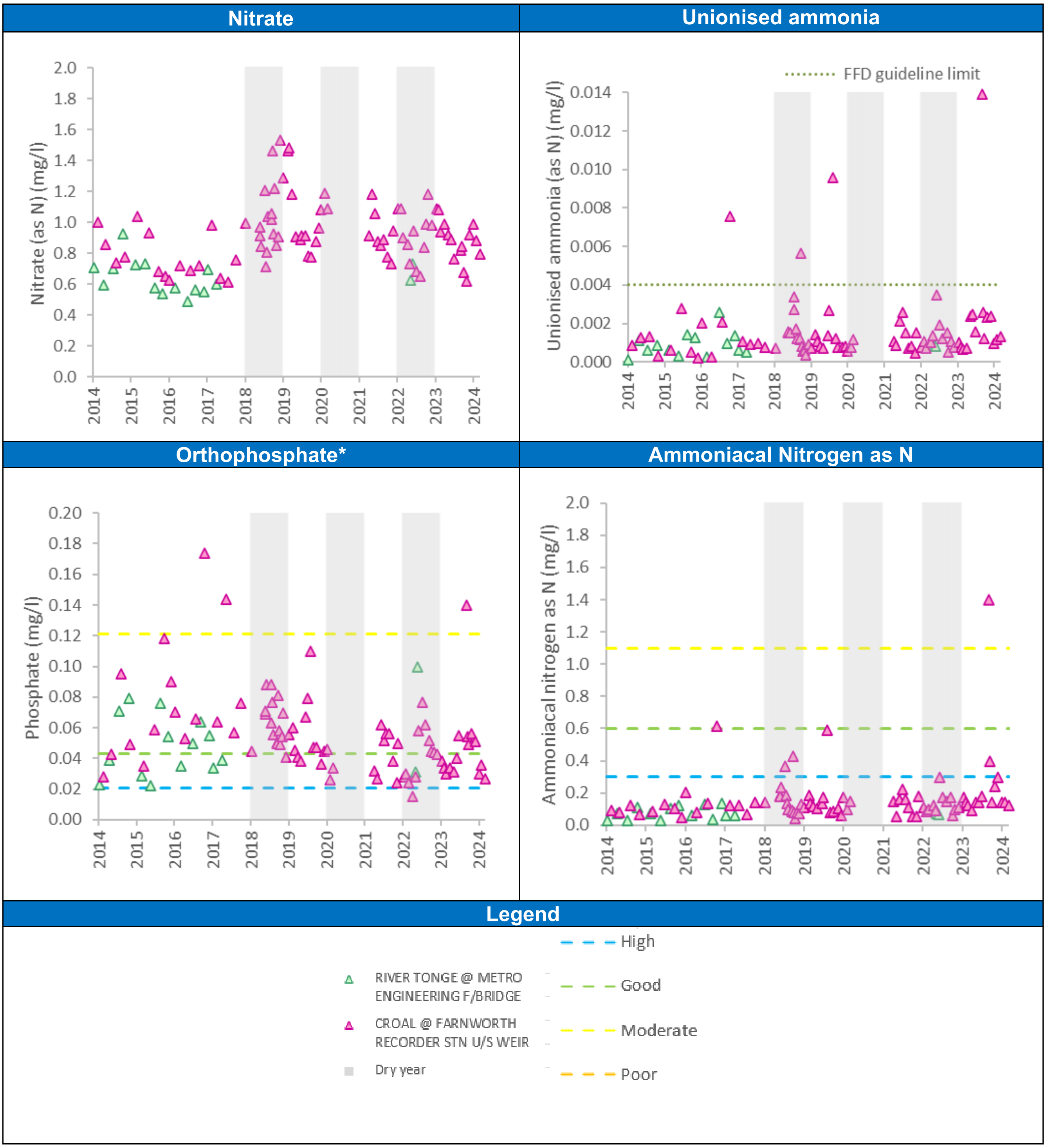

Figure A2-28 Nutrient parameters recorded at EA sampling sites within the Rivers Tonge and Croal (including Blackshaw Brook) water bodies (GB112069064530 and GB112069064550)

*Note only the most stringent site-specific standards are shown for orthophosphate.

A2.3.5 Impact assessment

The data presented Table A2-30 to Table A2-34 summarise SIMCAT model predicted water quality changes under the drought order scenarios compared to the baseline data for the following parameters: total ammonia, BOD, nitrate, phosphate and dissolved oxygen. The physico-chemical data in the baseline section is consistent with the SIMCAT modelling baseline scenario at the assessment sites that were used for total ammonia, BOD and orthophosphate. The tables have been colour coded to highlight which WFD status class each data point would fall into as per the categories in Table A2-29. Note: there are no WFD standards for nitrate or dissolved oxygen expressed in mg/l.

Table A2-29 WFD status

WFD status
High
Good
Moderate
Poor

SIMCAT modelling results - total ammonia

For the Belmont Reservoir drought order alone (Scenario 1 compared to the Baseline) an increase in ammonia concentration is predicted at the Belmont STW assessment site with a predicted temporary change in WFD status from High to Moderate. A smaller increase in ammonia is predicted at the Eagley Brook and River Tonge assessment sites but no changes in WFD status are predicted for these sites. Ammonia is predicted to be slightly higher under at-permit conditions.

For the in-combination scenarios with Jumbles Reservoir Drought Permit (Scenario 2 compared to Baseline) an increase in ammonia concentration is predicted on the River Tonge and the River Croal, but no change in WFD status is predicted. There is no difference between the at-permit and baseline model results.

The largest increase is predicted to be at the Belmont STW assessment site, from 0.09 mg/l (Baseline) to 0.48 mg/l under the Belmont drought order in at-permit conditions.

It is noted that the effect of an increase in ammonia concentrations to the permit limit in the discharge from Belmont STW, is not fully represented due to the values for final effluent concentration which have been included in the EA at-permit model. There is therefore some uncertainty around the results for ammonia under at-permit conditions.

Results are presented in Table A2-30.

Unionised ammonia assessment

The calculation of UIA used the highest concentration of total ammonia from the SIMCAT modelling impact assessment (0.48 mg/l), the highest pH value recorded from any of the water quality sampling sites for the period 2008 and 2024 (8.9), and the highest recorded temperature from the same sites and for the same period (18.5°C). The resultant UIA was 0.128 mg/l as NH_3.

The highest value for total ammonia from the SIMCAT modelling impact assessment (0.48 mg/l) was for the Belmont STW SIMCAT assessment site for the Belmont drought order, at-permit scenario (Scenario 1AP). The highest pH value (8.9) was recorded at the EA monitoring site, EAGLEY BROOK AT HOUGH LANE on 14/11/2014. The highest temperature value (18.5°C) was recorded at EAGLEY BROOK UPSTREAM OF BELMONT ETW on 15/08/2022.

Table A2-30 Water quality data and status – total ammonia (90%ile, mg/l) and WFD status colour-coded as in Table A2-29

Assessment sites	Drought Order/Permit Scenarios (please see Table A2-27 for description)				
	Baseline	1BL	1AP	2BL	2AP
Belmont drought order	No	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d
Jumbles drought permit	No	No	No	12 Ml/d	12 Ml/d
SIMCAT model	Baseline	Baseline	At-permit	Baseline	At-permit
Belmont STW	0.09	0.37	0.48	NA	NA
Eagley Brook NW-88002256	0.07	0.14	0.17	NA	NA
Eagley Brook NW-88002263	0.03	0.04	0.05	NA	NA
River Tonge NW-88002269	0.08	0.10	0.11	NA	NA
River Tonge NW88002281	0.08	0.09	0.09	0.13	0.13
River Croal NW-88002316*	0.18	0.20	0.20	0.24	0.24

NA = the Jumbles Reservoir drought permit cannot affect Eagley Brook and the upper part of the River Tonge (NW-88002269).

SIMCAT modelling results - Biochemical oxygen demand (BOD)

For the Belmont Reservoir drought order alone (Scenario 1 compared to the Baseline) an increase in BOD is predicted at the assessment sites on Eagley Brook (Belmont STW, NW-88002256and NW-88002263). This would result in a temporary change in WFD status from High to Good at all three assessment points under at-permit conditions, and from High to Good at NW-88002263 under baseline conditions. On the River Tonge, an increase in BOD is predicted at NW-88002269 which would result in a temporary WFD status change from High to Good. Further downstream on the River Tonge, at NW-88002281, a very small increase in BOD is predicted but there is no predicted change in WFD status at this site. For all assessment sites, BOD is predicted to be slightly higher under at-permit conditions.

For the in-combination scenarios with Jumbles Reservoir Drought Permit (Scenario 2 compared to Baseline) an increase in BOD concentration is predicted at the River Tonge and River Croal sites. At the River Tonge assessment site, no WFD status change is predicted. At the River Croal assessment site, the predicted increase would result in a temporary WFD status change from High to Good. The largest increase is predicted to be from 3.56 mg/l to 4.48 mg/l at the River Croal assessment site under at-permit conditions.

It should be noted that BOD is not used for WFD classification purposes.

Results are presented in Table A2-31.

Table A2-31 Water quality data and status – biochemical oxygen demand (BOD) (90%ile, mg/l) and WFD status colour-coded as in Table A2-29

Assessment sites	Drought Order/Permit Scenarios (please see Table A2-27 for description)				
	Baseline	1BL	1AP	2BL	2AP
Belmont drought order	No	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d
Jumbles drought permit	No	No	No	12 Ml/d	12 Ml/d
SIMCAT model	Baseline	Baseline	At-permit	Baseline	At-permit
Belmont STW	2.84	2.90	3.81	NA	NA
Eagley Brook NW-8802256	2.69	2.77	3.06	NA	NA
Eagley Brook NW-88002263	2.73	3.23	3.34	NA	NA
River Tonge NW-88002269	3.72	4.49	4.56	NA	NA
River Tonge NW88002281	2.67	2.73	2.77	3.68	3.68
River Croal NW-88002316*	3.56	3.72	3.75	4.46	4.48

NA = the Jumbles Reservoir drought permit cannot affect Eagley Brook and the upper part of the River Tonge (NW-88002269)

SIMCAT modelling results - nitrate

For the Belmont Reservoir drought order alone (Scenario 1 compared to the Baseline) an increase in nitrate concentration is predicted at all Eagley Brook and River Tonge assessment sites. The largest predicted increase is from 0.31 mg/l (Baseline) to 1.63 mg/l (Belmont drought order, 1BL and 1AP) at the Belmont STW assessment site. There is no difference between the at-permit and baseline model results.

For the in-combination scenario with Jumbles Reservoir (Scenario 2 compared to Baseline) an increase in the concentration of nitrate is predicted. There is no difference between the at-permit and baseline model results.

There is no WFD standard or status boundary for nitrate, however, compared to the Nitrates Directive standard of 11.3 mg/l the predicted values are well below this limit for all scenarios.

Results are presented in Table A2-32.

Table A2-32 Water quality data and status – nitrate (mean, mg/l)

Assessment sites	Drought Order/Permit Scenarios (please see Table A2-27 for description)				
	Baseline	1BL	1AP	2BL	2AP
Belmont drought order	No	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d
Jumbles drought permit	No	No	No	12 Ml/d	12 Ml/d
SIMCAT model	Baseline	Baseline	At-permit	Baseline	At-permit
Belmont STW	0.31	1.63	1.63	NA	NA
Eagley Brook NW-8802256	0.31	0.97	0.97	NA	NA
Eagley Brook NW-88002263	0.31	0.58	0.58	NA	NA
River Tonge NW-88002269	0.29	0.42	0.42	NA	NA
River Tonge NW88002281	0.42	0.50	0.50	0.62	0.62
River Croal NW-88002316*	0.57	0.65	0.65	0.78	0.78

NA = the Jumbles Reservoir drought permit cannot affect Eagley Brook and the upper part of the River Tonge (NW-88002269).

SIMCAT modelling results - Phosphate

For the Belmont Reservoir drought order alone (Scenario 1 compared to the Baseline) an increase in the concentration of phosphate is predicted at all assessment sites. There would be a temporary WFD status change from Moderate to Poor for the Belmont STW assessment site and from Good to Moderate for the remaining Eagley Brook assessment sites and both River Tonge assessment sites.

For the in-combination scenario with Jumbles Reservoir Drought Permit (Scenario 2 compared to Baseline) an increase in the concentration of phosphate is predicted which would result in a temporary WFD status change from Good to Moderate status for the lower of the two Tonge assessment sites (NW-88002281). There is no difference between the at-permit and baseline model results under each of the drought order/drought permit scenarios.

Results are presented in Table A2-33.

Table A2-33 Water quality data and status – phosphate (mean, mg/l) and WFD status colour-coded as in Table A2-29

Assessment sites	Drought Permit Scenarios (please see Table A2-27 for description)				
	Baseline	1BL	1AP	2BL	2AP
Belmont drought order	No	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d
Jumbles drought permit	No	No	No	12 Ml/d	12 Ml/d
SIMCAT model	Baseline	Baseline	At-permit	Baseline	At-permit
Belmont STW	0.033	0.170	0.170	NA	NA
Eagley Brook NW-8802256	0.030	0.094	0.094	NA	NA
Eagley Brook NW-88002263	0.039	0.073	0.073	NA	NA
River Tonge NW-88002269	0.037	0.054	0.054	NA	NA
River Tonge NW-88002281	0.040	0.048	0.048	0.060	0.060
River Croal NW-88002316*	0.061	0.069	0.069	0.084	0.084

NA = the Jumbles Reservoir drought permit cannot affect Eagley Brook and the upper part of the River Tonge (NW-88002269).

SIMCAT modelling results - Dissolved oxygen

For the Belmont Reservoir drought order alone (Scenario 1 compared to the Baseline) there is predicted to be a decrease in the concentration of dissolved oxygen at the sites on Eagley Brook, but the concentration of dissolved oxygen is not predicted to decrease to a level which would cause a serious impact to aquatic life. The largest predicted decrease is from 8.24 mg/l to 6.97 mg/l at the Belmont STW assessment site. A slight decrease in the concentration of dissolved oxygen is predicted on the River Tonge. There is little or no difference between at-permit and baseline model results.

For the in-combination scenario with Jumbles Reservoir Drought Permit (Scenario 2 compared to Baseline) there is predicted to be a decrease in the concentration of dissolved at the River Tonge and River Croal assessment sites. There is little or no difference between the at-permit and baseline model results.

Overall, the concentration of dissolved oxygen is not predicted to decrease to a level which would cause a serious impact to aquatic life. It should be noted that SIMCAT results for dissolved oxygen are expressed in mg/l and therefore the results are not directly comparable to WFD status boundaries which are expressed as % saturation.

Results are presented in Table A2-34.

Table A2-34 Water quality data and status – dissolved oxygen (10%ile, mg/l)

Assessment sites	Drought Order/Permit Scenarios (please see Table A2-27 for description)				
	Baseline	1BL	1AP	2BL	2AP
Belmont drought order	No	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d	4.5 Ml/d
Jumbles drought permit	No	No	No	12 Ml/d	12 Ml/d
SIMCAT model	Baseline	Baseline	At-permit	Baseline	At-permit
Belmont STW	8.24	6.97	6.97	NA	NA
Eagley Brook NW-8802256	8.14	7.03	6.96	NA	NA
Eagley Brook NW-88002263	8.16	7.29	7.27	NA	NA
River Tonge NW-88002269	8.36	8.02	8.01	NA	NA
River Tonge NW88002281	8.62	8.36	8.35	8.03	8.02
River Croal NW-88002316*	8.49	8.32	8.32	7.92	7.91

NA = the Jumbles Reservoir drought permit cannot affect Eagley Brook and the upper part of the River Tonge (NW-88002269).

Dissolved oxygen assessment upstream of weirs

DO is of potential concern during the reduced flow associated with drought permits, particularly in areas of low velocity such as upstream of weirs. It was agreed with the EA that historical DO data would be reviewed, where available, at such locations. Within the water bodies associated with this drought order, measured data were only available from one suitable location upstream of a weir: Croal @ Farnworth Recorder Stn U/S Weir for which DO monitoring data was available from 2014 to 2024 (Figure A2-29).

A clear seasonal pattern was evident, with lower DO observed in the summer months, as expected. Percentage saturation only dropped below 70% on one occasion in 2022. During 2018 and 2022 dry years lower levels were recorded but remained at High status. However, similarly lower levels were also recorded in 2019 which is not recorded as a dry year. A reduction in compensation flow has not been implemented at Belmont Reservoir since 1999 nor a drought permit at Jumbles Reservoir since 1995/6, so there is no empirical evidence to indicate the effect of very low flows on DO. Monitoring is therefore recommended at this location during implementation of a drought order (see Section 5.2.2).

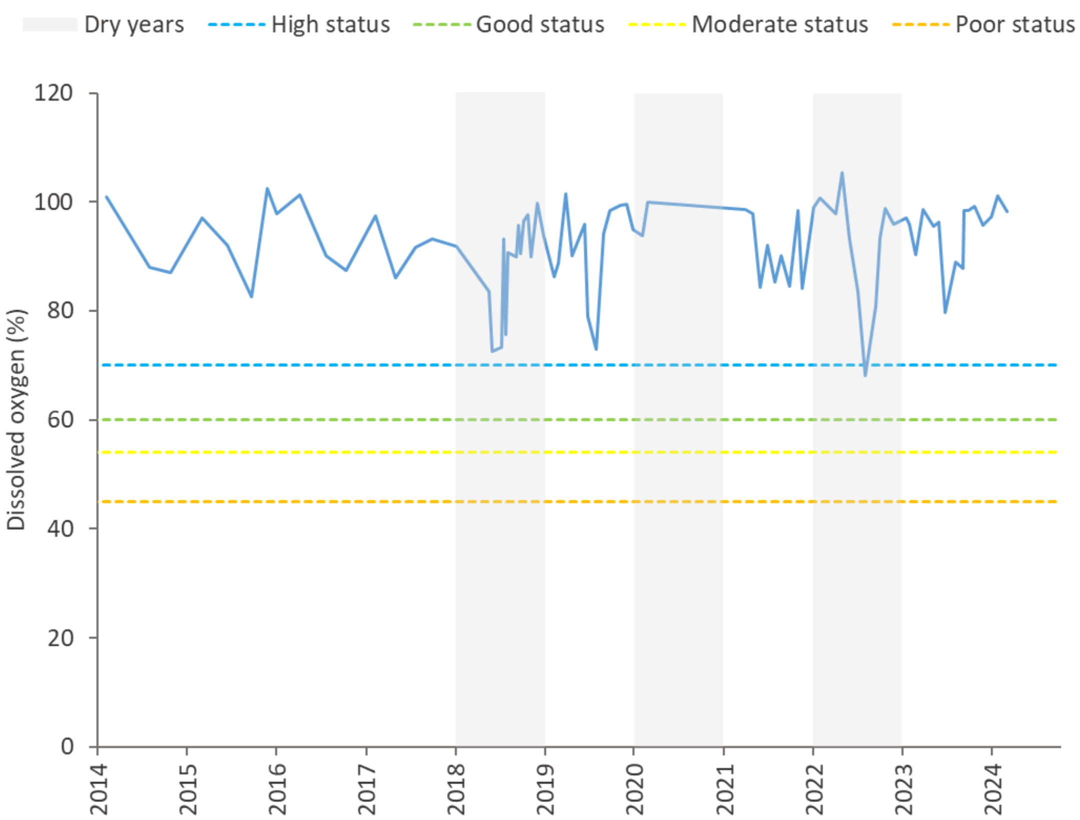

Figure A2-29 Dissolved oxygen (percentage saturation) upstream of the weir on the Croal @ Farnworth Recorder Stn U/S Weir.

Hazardous substances assessment

Eagley Brook is currently classed as failing the WFD priority hazardous substances classification (Section A2.3.4). Within Eagley Brook, Belmont STW is situated approximately 1.5 km downstream of Belmont Reservoir and Longworth STW is approximately 4 km downstream of Belmont Reservoir. These treatment works have the potential to cause an impact during drought periods; however, there are no available CIP data for either STW, therefore potential changes in water quality under the drought order are assessed with regard to changes in dilution only, and cannot be quantified.

The reduced flow in Eagley Brook during the drought order could impact the water quality where the STWs are discharging, as the dilution would be reduced and therefore could result in an increase in pollutant concentrations in the reaches immediately downstream of Belmont and Longworth STWs. Increased concentrations of hazardous substances could potentially result in temporary exceedance of standards.

The risk of changes in concentration of hazardous substances downstream of STW, during implementation of the Belmont drought order, is considered to be low, however the level of confidence in this conclusion is low due to lack of information.

As noted in section A2.3.2, there is a discharge of what is understood to be groundwater, between Belmont STW and Delph Brook, which can naturally contain elevated concentrations of the specific pollutants, iron and manganese. Reduced dilution of this discharge could result in an increase in concentrations of iron and manganese in Eagley Brook. This is not considered to be a high risk with a reduced compensation flow, however given uncertainties in the concentrations and flow of discharge into Eagley Brook, monitoring of iron and manganese concentrations is recommended downstream of this discharge (see Section 5).

Intermittent discharges assessment

The Duflow assessment modelled a reduction in flow from Belmont Reservoir from 9 Ml/d to 4.5 Ml/d and a reduction from 19 Ml/d to 12 Ml/d for Jumbles Reservoir. The model results are summarised in Table A2-35.

There was no overall change in FIS compliance predicted for unionised ammonia, with no additional exceedances predicted under the drought order scenario compared to the baseline. For DO, the assessment predicted FIS compliance (with no exceedances) except under the salmonid spawning ground assessment, where the model predicted an increase in the number of exceedances at several locations on Eagley Brook under the drought order scenario, with all sites remaining within the number of permitted exceedances and therefore compliant with FIS.

The assessment of 99th percentiles predicted a small increase in BOD of up to 6.9% under the drought order scenario, with the largest increases predicted in the middle reaches of Eagley Brook. No exceedances of the 99th percentile standard for BOD were predicted under the baseline or drought order scenario. Larger increases of up to 22% were predicted for ammonia, again with the greatest increases predicted in the middle reaches of Eagley Brook under the drought order scenario. The model predicted an exceedance of the ammonia standard under the drought order scenario, at eleven locations in Eagley Brook (see Table A2-36).

Table A2-35 Summary of Duflow modelled changes in intermittent discharges

Parameter	Standard	Pass/ Fail Baseline	Pass/ Fail Drought order scenario	Notes
DO	FIS (summer assessment May to September)	Pass	Pass	No exceedances modelled
DO	FIS – salmonid spawning ground (winter assessment November to March)	Pass	Pass	Additional exceedances predicted in Eagley Brook, within the permitted number of exceedances.
Unionised ammonia	FIS (summer assessment May to September)	Pass	Pass	No additional exceedances predicted under the drought order scenario compared to the baseline.
Unionised ammonia	99 percentile	Pass	Pass	Additional exceedances predicted in Eagley Brook, within the permitted number of exceedances.
BOD	99 percentile	Pass	Pass	Additional exceedances predicted in Eagley Brook, River Tonge and River Croal, within the permitted number of exceedances.
Total ammonia	99 percentile	Pass	Fail	Additional exceedances predicted in Eagley Brook and River Tonge, leading to failure at 11 locations on Eagley Brook.

Table A2-36 Duflow model predicted exceedances of 99th percentile ammonia under the drought order scenario

Permitted 99%ile Exceedances	876	Ammonia - baseline			Ammonia - drought order scenario		
Water Body	Description	Simulated 99%ile	WFD Threshold	WFD Hours exceeded	Simulated 99%ile	WFD Threshold	WFD Hours exceeded
Eagley Brook	**D/S CSO29b (BOL0176)**	0.67	0.7	823	0.77	0.7	1151
Eagley Brook	D/S SW29a & Sub29-E	0.64	0.7	722	0.72	0.7	1024
Eagley Brook	U/S Sub29-F	0.64	0.7	710	0.73	0.7	997
Eagley Brook	D/S Sub29-F	0.63	0.7	703	0.72	0.7	987
Eagley Brook	U/S SW29b	0.64	0.7	701	0.72	0.7	991
Eagley Brook	D/S SW29b	0.63	0.7	644	0.71	0.7	937
Eagley Brook	U/S CSO29c	0.63	0.7	649	0.71	0.7	936
Eagley Brook	**D/S CSO29c (BOL0073)**	0.66	0.7	729	0.73	0.7	1017

Permitted 99%ile Exceedances	876	Ammonia - baseline			Ammonia - drought order scenario		
Water Body	Description	Simulated 99%ile	WFD Threshold	WFD Hours exceeded	Simulated 99%ile	WFD Threshold	WFD Hours exceeded
Eagley Brook	U/S SW29c, SW29ci & Sub29-G	0.65	0.7	727	0.72	0.7	997
Eagley Brook	D/S CSO29d	0.64	0.7	661	0.70	0.7	904
Eagley Brook	U/S SW29d & SW29di	0.64	0.7	666	0.71	0.7	911

*Grey highlighted cells indicate exceedances above the permitted number under the drought order.

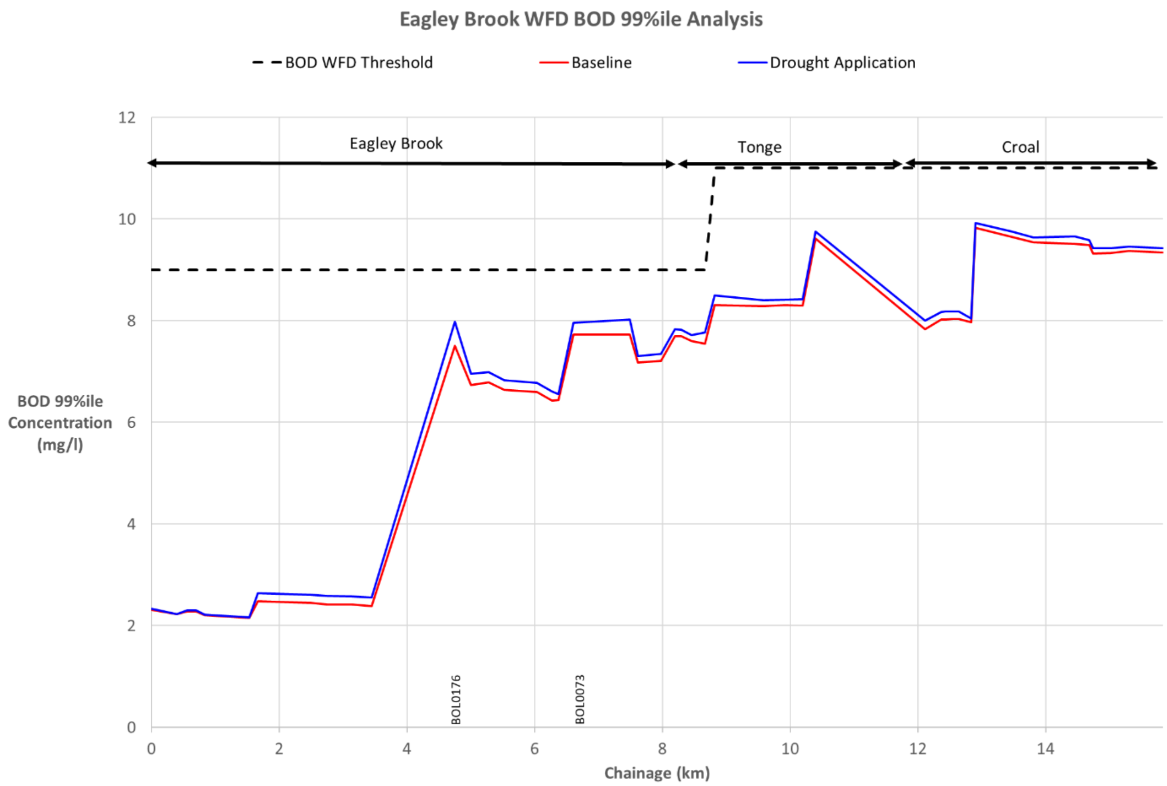

Figure A2-30 Modelled influence of intermittent discharges on 99th percentile BOD downstream of Belmont Reservoir

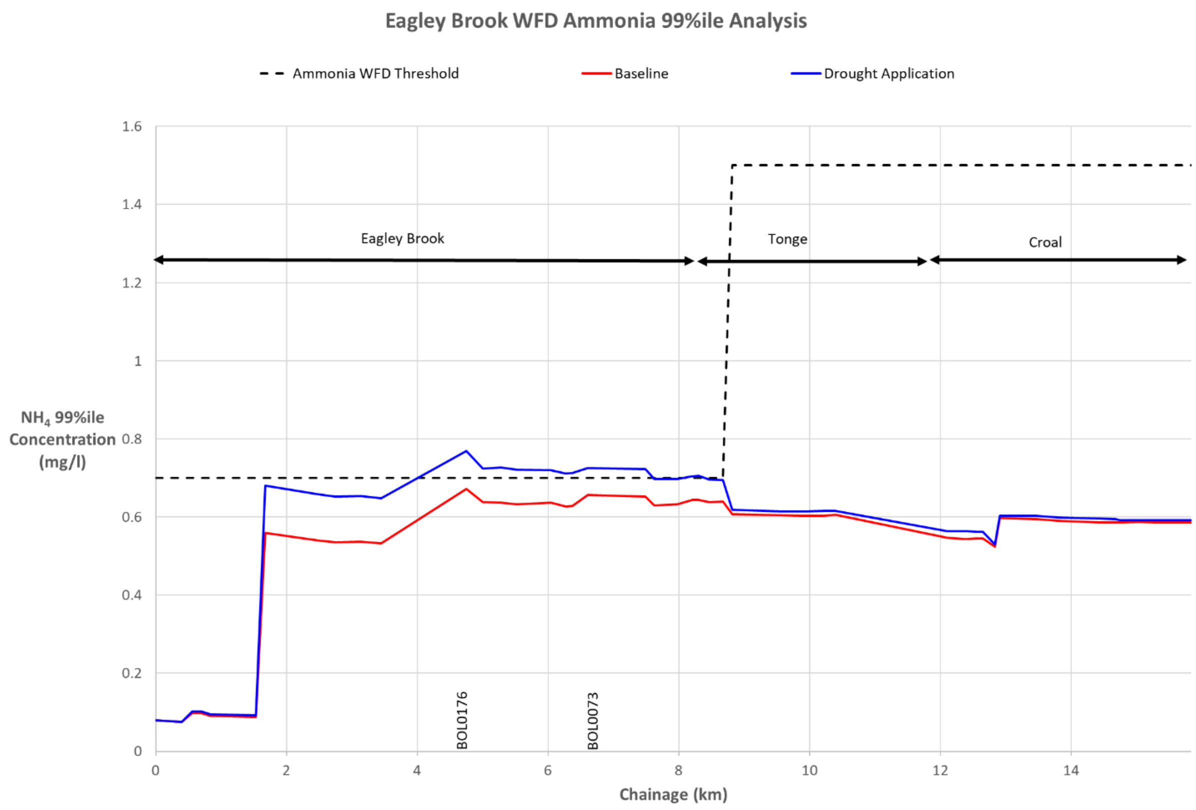

Figure A2-31 Modelled influence of intermittent discharges on 99th percentile ammonia downstream of Belmont Reservoir

A2.3.6 Summary

The impact assessment results indicate that the magnitude of the predicted changes on water quality are not large and would be temporary.

The SIMCAT modelling shows that predicted changes to water quality would be quite variable between parameters and assessment points. A reduction in dissolved oxygen is predicted at all assessment sites, and reductions are more likely to occur in low velocity areas which should be checked during drought order implementation (see Section 5). Risks of any changes in concentration of hazardous substances are considered low. Modelling of intermittent discharges indicates negligible risk of impacts on DO, UIA, ammonia and BOD in the Rivers Tonge and Croal. However, the modelling predicts a possible risk in some parts of Eagely Brook of exceeding the 99th percentile standards for ammonia, if spills were to occur due to rainfall events during drought order implementation. Continuous water quality monitoring is therefore recommended in Eagley Brook as a precaution, with detail provided in Section 5.

The impact magnitude on water quality of drought order implementation at Belmont is considered to be generally Low for Eagley Brook and the River Tonge as the predicted changes are relatively small and temporary. A Medium impact magnitude is predicted for ammonia immediately downstream of Belmont STW, where a temporary change in WFD status from

High to Moderate has been predicted, and a Medium impact magnitude is predicted for phosphate at the assessment sites in Eagley Brook.

In-combination with the Jumbles drought permit, the impact magnitude is considered to be Low for all assessment sites in the River Tonge and River Croal.

The overall level of confidence is Medium because the PR24 SIMCAT models have been improved compared to previous SIMCAT models. The PR24 SIMCAT model contains updated data for sewage treatment works.

Water temperature could increase during the proposed drought order, leading to increases in ammonia in the form of UIA which is toxic to fish and other aquatic life. However, it is not possible to quantify this potential impact with any certainty. Therefore, this is not considered in the magnitude of effects above. Based on the maximum water temperature and pH recorded over the baseline data period in each water body, as well as ammonia concentrations predicted under some of drought order scenarios, there is a risk that UIA concentrations could exceed 0.021 mg/l, the level which may be a concern. However, as water temperature and pH are expected to change during a drought order, and because these can't be quantified, the predicted UIA concentrations cannot be determined. This risk will therefore be mitigated by careful monitoring of UIA levels during implementation of a drought order.

Summary of potential impacts – Belmont drought order alone (Scenario 1)

The predicted changes to water quality as a result of the Belmont Reservoir drought order alone are summarised below. Overall impacts on water quality of Scenario 1 are deemed to be **Low to Medium.**

- A temporary increase in total ammonia concentration and a WFD status change from High to Moderate status immediately downstream of Belmont STW, with a smaller increase in ammonia concentration and no WFD status change elsewhere in Eagley Brook and the River Tonge.
- Small temporary increase in BOD with a WFD status change from High to Good on Eagley Brook and the River Tonge. It is noted that BOD is not used for WFD classification purposes.
- A temporary increase in nitrate concentration throughout Eagley Brook and the River Tonge, but levels are predicted to remain well within the Nitrates Directive guideline limit.
- A temporary increase in phosphate concentration and WFD status change from Moderate to Poor status immediately downstream of Belmont STW, and from Good to Moderate at NW-88002256 and NW-88002263 on Eagley Brook and on the River Tonge..
- A temporary decrease in dissolved oxygen, but the concentration is not predicted to decrease to a level which would cause a serious impact to aquatic life. The largest

decrease is predicted to be from 8.24 mg/l to 6.97 mg/l, immediately downstream of Belmont STW.

- A possible risk from intermittent discharges in some parts of Eagely Brook relating to ammonia, if spills were to occur due to rainfall events during drought order implementation.

Summary of potential impacts – Belmont drought order in combination with a Jumbles 12 Ml/d drought permit (Scenario 2)

For the in-combination scenario with the Jumbles drought permit, predicted changes are summarised below and would all be temporary in nature, for the duration of drought order/permit implementation. Overall impacts on water quality of Scenario 2 are deemed to be **Low.**

- A temporary small increase in total ammonia concentration but no WFD status change.
- A temporary increase in BOD and a WFD status change from High to Good on the River Croal, noting that BOD is not used for WFD classification purposes.
- A temporary increase in nitrate concentration but levels are predicted to remain well within the Nitrates Directive guideline limit.
- A temporary increase in phosphate concentration and WFD status change from Good to Moderate status at the River Tonge assessment site (NW-88002281).
- A temporary small decrease in dissolved oxygen at all sites, but the concentration is not predicted to decrease to a level which would cause a serious impact to aquatic life.

Uncertainties

The data used in the compilation of this report was presumed to be accurate and reliable. A benefit of SIMCAT assessment is that diffuse pollution sources are taken into account. The quality of the data provided means that predictions will be relatively accurate in the context of the historical data, providing profound, rapid increases in diffuse pollution and pollution incidents do not occur. Overall, the SIMCAT modelling results are considered to be of **Medium** confidence, with the exception of ammonia modelled under at-permit conditions which is considered to be of **Low** confidence. As described above (Section A2.3.5), the effect of an increase in ammonia concentrations to the permit limit in the discharge from Belmont STW, is not fully represented due to the values for final effluent concentration which have been included in the EA at-permit model. The uncertainty around potential increases in ammonia concentration downstream of Belmont STW is to be addressed through during-drought order monitoring (see Section 5).

A2.3.7 References

Amec (2013) Belmont Reservoir Drought Order Scoping and Data Gap Analysis Report. Report to Environment Agency. 33670 D13147i2. July 2013. 95pp.

APEM (2025b) Jumbles Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

EA (2025) Environmental assessment for water company drought planning supplementary guidance. Published March 2025.

UKTAG (2008) UK Technical Advisory Group on the Water Framework Directive. UK Environmental Standards and Conditions (Phase 1). Final report. April 2008 (SR1 – 2006). Available at: https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/Environmental%20standards%20phase%201_Finalv2_010408.pdf

UKTAG (2014) UK Technical Advisory Group on the Water Framework Directive. UKTAG River Assessment Method Phosphorus. River Phosphorus Standards. July 2014. ISBN: 978-1-906934-54-5. Available at: https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/River%20Phosphorus%20UKTAG%20Method%20Statement.pdf

A3. Appendix 3: Assessment of impact on ecological receptors

A3.1 Macrophytes and diatoms

A3.1.1 Background

This assessment focusses on potential effects of the proposed Belmont drought order on the macrophyte and phytobenthos (diatom) communities associated with the Eagley Brook (GB112069064570), Tonge (GB112069064530) and Croal (including Blackshaw Brook) (GB112069064550) water bodies including consideration of potential effects on WFD status. The geographical extent of the study also included part of the Irwell (Croal to Irk) (GB112069061451) water body, however, there were no macrophyte and phytobenthos monitoring locations identified on the water body between its confluence with the Croal and Kearsley gauging station

The WFD combined macrophyte and phytobenthos element is intended to reflect the ecological significance of nutrient status of a given water body. Under low alkalinity conditions macrophytes provide an unreliable assessment of eutrophication pressure and phytobenthic communities (diatoms) are used instead. Eagley Brook, River Tonge, River Croal bodies are considered to be of low – moderate alkalinity, with river mean alkalinity values of 38.7, 72.8 and 95.9 mg/l $CaCO_3$, respectively. The current WFD classifications are therefore based on diatom data.

A3.1.2 Potential pathways to impact

Potential effects on macrophytes attributable to changes in flow, wetted width and water quality due to operation of the proposed drought order are:

- siltation, leading to smothering of plant and diatom communities or impacts on plant rooting ability and sediment nutrient levels, with resultant changes in plant and diatom community type;
- desiccation and stranding of plant communities (in particular riparian communities);
- invasion of river margins by bankside terrestrial species;
- increases in nutrients leading to modifications of plant and diatom communities;
- alteration of in-channel flow velocity resulting in shift in plant and diatom assemblages; and
- other factors including changes in wave action and temperature also have the potential to modify aquatic plant and diatom assemblages.

A3.1.3 Sources of information and methods

Referring to the predicted magnitude and duration of habitat alteration presented in Section A2, potential impacts on macrophytes and phytobenthos were assessed qualitatively, based upon expert opinion and available data. The impact assessment was conducted in accordance with Guidelines for Ecological Evaluation and Assessment (CIEEM, 2018, updated 2024) and NRW technical guidance for Water Company Drought Plans (NRW, 2017, 2024) and is consistent with the latest EA guidance on environmental assessment for water company drought planning (EA, 2025) as outlined in Section 3.1. EA data were sourced from the Ecology & Fish Data Explorer[13], using the date range of 2005 to 2025.

A3.1.4 Baseline

A baseline description of the macrophyte and diatom communities present in the water bodies relevant to this study is summarised below in Table A3-1.

No deterioration in status of the macrophyte and phytobenthos element has occurred since 2015 for the Eagley Brook (GB112069064570) water body (Good status), River Tonge (GB112069064530) water body (Moderate status) or the River Croal (including Blackshaw Brook) (GB112069064550) water body (Good status). No status for the macrophyte and phytobenthos combined element is given for the downstream River Irwell (Croal to Irk) water body (GB112069061451). Because of the low alkalinity nature of the water bodies, indicative WFD classifications should be treated with caution and are for guidance only.

Table A3-1 Water Framework Directive status of the Eagley Brook, Tonge, Croal (including Blackshaw Brook) and Irwell (Croal to Irk) water bodies. Classifications are given for Cycle 3 (2019-2022)

Water body	Water body ID	Overall ecological potential	Ecological Status	Phytobenthos and Macrophytes Status	Overall Objectives
Eagley Brook	GB112069064570	Moderate	Moderate	Good	Good by 2027
Tonge	GB112069064530	Moderate	Moderate	Moderate	Good by 2027
Croal (incl Blackshaw Brook)	GB112069064550	Moderate	Moderate	Good	Moderate by 2015
Irwell (Croal to Irk)	GB112069061451	Moderate	Moderate	Not classified	Moderate by 2015

Macrophytes

A baseline description of the macrophyte communities present in the river water bodies relevant to this study are summarised below.

[13] https://environment.data.gov.uk/ecology/explorer/

The EA surveyed one location on the Eagley Brook once in 2006, one on the Tonge once in 2005, one location on the River Croal (incl. Blackshaw Brook) water body several times between 2013 – 2019, and one other location once in 2012. No monitoring locations occur on the River Irwell (Croal to Irk) water body within the study area.

Site details and indicative EA WFD status are given in Table A3-2.

Table A3-2 Macrophyte indicative WFD status for the Eagley Brook, Tonge and Croal (including Blackshaw Brook) water bodies

Water body ID	Site ID	Survey Date	NGR	Indicative WFD Status	Confidence in Achieving at least Good Status
Eagley Brook GB112069064570	68779	06/09/2006	SD6773915813	N/A	N/A
River Tonge GB112069064530	67391	27/07/2005	SD7315108776	N/A	N/A
Croal (incl Blackshaw Brook)GB112069064550	66809	13/08/2013	SD7437506921	Poor	0.1%
		31/07/2014		Good	88.6%
		09/07/2018		Good	87.6%
		18/07/2019		Moderate	37.5%
	159788	21/08/2012	SD7447406925	N/A	N/A

Only 5 taxa were recorded in the Eagley Brook in 2006 (liverworts and mosses) while 3 taxa were recorded in 2005 at the River Tonge location (mosses and algae). The prevalence of bryophytes is characteristic of upland streams and suggests this watercourse is fast flowing and likely shaded for much of its length. On the River Croal (incl. Blackshaw Brook) water body, 13 taxa were recorded in 2019. Bryophytes and flowering plants were infrequent whereas *Cladophora glomerata/Rhizoclonium hieroglyphicum* (alga) was the most abundant taxon recorded. Invasive non-native Himalayan balsam (*Impatiens glandulifera*), Japanese Knotweed (*Fallopia Japonica*), and Giant Hogweed (*Heracleum mantegazzianum*) were recorded at monitoring location 66809 in 2018 and 2019.

Overall, macrophyte presence and abundance in the Eagley Brook, River Tonge and River Croal (incl. Blackshaw Brook) water bodies were sparse and limited mainly to marginal bryophytes and in-channel algae, with invasive species also present on the banksides and within the channel in the River Croal. These data did not indicate flow sensitivity in the water bodies of interest, and a large majority of the taxa recorded were bryophytes. Many bryophytes have adapted to water stress by colonizing hydric (moist) or heavily shaded ecological niches or growing in short, dense clusters that limit moisture loss. As the species assemblages in both water bodies largely consist of bryophytes, the macrophyte communities will likely have a low sensitivity to reductions in flow, as bryophyte species are resilient to small changes in depth and marginal/shallow habitat area.

Phytobenthos

Diatom data were available for three EA monitoring locations on the Eagley Brook. While location 67339 (2007 – 2014) is close to Belmont Reservoir outflow, location 68779 (2008 – 2019) lies between the reservoir and the confluence with Delph Brook and location 68894 (2014 – 2023) is just upstream of the confluence with the Astley Brook. Diatom data were also available for one EA monitoring location on the Tonge water body between 2005 – 2014 (67391), and one on the Croal (incl. Blackshaw Brook) water body between 2014 – 2019 (66809).

Table A3-3 EA phytobenthos (diatom) sampling location information for the Eagley Brook, Tonge and Croal (including Blackshaw Brook) water bodies

Water body	Location ID	NGR
Eagley Brook - GB1120690645780	67339	SD7198011112
	68779	SD6773915813
	68894	SD6914415527
Tonge - GB112069064530	67391	SD7315108776
Croal (incl Blackshaw Brook) - GB112069064550	66809	SD7437506921

The metric used to classify phytobenthos in rivers is the trophic diatom index (TDI). Diatom taxa are each assigned a score from 1 (nutrient sensitive) to 5 (nutrient tolerant) and the computed total TDI scores range from 0 (very low nutrients) to 100 (very high nutrients) (UKTAG, 2014b). The TDI EQR is calculated based on observed data and predicted reference values, resulting in an overall EQR representing an ecological status class.

Indicative EA WFD status for each monitoring location is given in Table A3-4.

Table A3-4 Calculated diatom indicative WFD scores for the Eagley Brook, Tonge, and Croal (incl Blackshaw Brook) water bodies

Water Body	Location ID	Year	Observed TDI	Expected TDI	O/E	EQR	Indicative WFD Status	Confidence in Achieving at least Good Status
Eagley Brook - GB112069064570	67339	2007	57.53	41.64	1.38	0.58	Moderate	38.03%
		2010	67.03	41.64	1.61	0.45	Moderate	
		2014	48.93	41.64	1.18	0.70	Good	
	68779	2006	26.76	25.51	1.05	0.79	Good	98.66%
		2013	22.99	25.51	0.90	0.83	High	
		2014	36.22	25.51	1.42	0.68	Good	
		2017	33.24	25.51	1.30	0.72	Good	
		2018	40.16	25.51	1.57	0.64	Good	
		2019	29.46	25.51	1.16	0.76	Good	
	68894	2013	34.73	37.21	0.93	0.83	High	72.69%
		2014	47.82	37.21	1.29	0.66	Good	
		2019	49.12	37.21	1.32	0.65	Good	
		2020	53.29	37.21	1.43	0.60	Moderate	
		2021	55.93	37.21	1.50	0.56	Moderate	
		2023	61.12	37.21	1.64	0.50	Moderate	
Tonge - GB112069064530	67391	2005	67.78	41.64	1.63	0.44	Moderate	1.78%
		2010	67.40	41.64	1.62	0.45	Moderate	
		2014	60.04	41.64	1.44	0.55	Moderate	
Croal (incl Blackshaw Brook) - GB112069064550	66809	2014	55.25	46.24	1.19	0.67	Good	16.57%
		2019	72.38	46.24	1.57	0.41	Moderate	

There was good temporal and spatial representation of phytobenthos data on the Eagley Brook water body, with data ranging from 2006 to 2022 across three monitoring locations. Indicative WFD status ranged from Moderate to High status, and there were no clear and consistent temporal trends. Monitoring location 68779 has, however, consistently achieved Good status or above between 2006 and 2019, resulting in a confidence in achieving at least Good status of 98.66%.

In comparison, the phytobenthos survey data from the Croal water body is temporally limited with surveys only completed in 2014 and 2019 at one monitoring location. The most recent TDI score, and associated EQRs, from monitoring location 66809 indicated an elevation in nutrient pressure in the Croal watercourse since the previous survey in 2014, and indicative WFD status declined from Good to Moderate between these years. It should be noted that the data for the Tonge water body is temporally limited.

A3.1.5 Impact assessment

Predicted changes in water depth, wetted perimeter and velocity have the potential to affect sensitive members of macrophyte and diatom communities and consequently the overall ecological status of a water body. Assessment of the macrophyte and diatom community using historical datasets allows the sensitivity of the community to be assessed in the context of the predicted changes due to implementation of the proposed drought order. The following assessment of impacts discusses the predicted changes outlined in Appendix 2 of this report and relates them to the expected changes in macrophyte and diatom communities.

The hydrological / hydromorphological effects of the proposed drought order are of greatest significance during the season of peak macrophyte / phytobenthos growth (approximately June to September, inclusive) when macrophytes / phytobenthos naturally would be present in greatest abundance. As the species assemblages in all water bodies largely consist of bryophytes, the in-channel macrophyte communities will likely have a low sensitivity to reductions in flow, as bryophyte species are resilient to small changes in depth and marginal/shallow habitat area.

Proposed Belmont drought order alone (4.5 Ml/d)

No impacts are expected on the macrophyte and diatom communities of Belmont Reservoir as a consequence of the proposed drought order, since the proposed drought order will slow the rate of reservoir drawdown and is predicted to have a beneficial but negligible effect on reservoir water level and exposure (Section A2). Consequently, a **Minor** (in the absence of a **Negligible** category) impact significance is anticipated for the macrophyte and phytobenthos communities of Belmont Reservoir.

Hydrological modelling identified varying impacts, with impact magnitudes decreasing with distance downstream. Habitat and geomorphological assessments identified that under the proposed Belmont drought order alone, fine-grained suspended sediment deposition may increase, though it is unlikely that this would have a significant impact on the substrate composition. Mean and maximum flow depths are expected to decrease, therefore, increasing the risk of bed substrate exposure and a possible reduction in the submerged habitat available for macrophytes and diatoms. Based on the data presented, the impact magnitude on in-instream habitats and sedimentation is **Medium** and **Low** on the Eagley Brook and Tonge water bodies, respectively. Water quality assessments of the proposed Belmont drought order alone identified a **Low** impact magnitude within both the Eagley Brook and Tonge water bodies for most parameters (Medium for ammonia and phosphate in Eagley Brook).

Based on the data presented, a **Negligible** (classified as **Minor** in the absence of a negligible category) impact significance is anticipated for the macrophyte and phytobenthos communities of the Eagley Brook and River Tonge water bodies.

Proposed Belmont drought order (4.5 Ml/d) in combination with a Jumbles drought permit (12 Ml/d)

Belmont Reservoir and Eagley Brook are located upstream of the confluence of the River Tonge and Bradshaw Brook, into which the compensation flow from Jumbles Reservoir is released. Consequently, the impacts of the in-combination scenario are the same as the Belmont drought order alone.

Under the in-combination scenario, hydrological modelling identified that flows downstream of the confluence of Bradshaw Brook and the River Tonge are expected to decrease. The magnitude of impact of the proposed in-combination scenario on in-stream habitat and sedimentation is expected to be **Low** on the Tonge and Croal water bodies, and **Negligible** on the Irwell (Croal to Irk) water body. Water quality assessments of the proposed in combination scenario identified a **Low** impact magnitude within the assessed water bodies for most parameters (Medium for ammonia and phosphate in Eagley Brook).

The impact significance of the in-combination scenario is predicted to be **Negligible** (classified as **Minor** in the absence of a negligible category) for phytobenthos and macrophytes in the Tonge, Croal (including Bradshaw Brook) and Irwell (Croal to Irk) water bodies.

A3.1.6 Summary

The macrophyte community of the Eagley Brook, River Tonge and Croal (including Blackshaw Brook) water body was characteristic of an upland stream community with few in-stream macrophytes present.

The macrophyte and diatom communities of Eagley Brook, River Tonge, River Croal (including Blackshaw Brook) and River Irwell (Croal to Irk) are considered to be of low sensitivity. Given this, the impact significance of the drought order is considered to be **Minor** both alone and in-combination with a Jumbles drought permit. A summary of the predicted impacts on macrophytes and diatoms, under the proposed drought order is presented in Table A3-5.

Table A3-5 Summary of predicted impacts on macrophytes and diatoms

Scenario	Water body	Sensitivity	Significance of impact	Confidence level
Proposed Belmont drought order alone (4.5 Ml/d)	Belmont Reservoir	Low	Minor *	Medium
	Eagley Brook - GB112069064570	Low	Minor *	Medium
	Tonge - GB112069064530	Low	Minor *	Medium
Proposed Belmont drought order (4.5 Ml/d) in combination with a	Belmont Reservoir	Low	Minor *	Medium
	Eagley Brook - GB112069064570	Low	Minor *	Medium

Scenario	Water body	Sensitivity	Significance of impact	Confidence level
Jumbles drought permit (12 Ml/d)	Tonge - GB112069064530	Low	Minor *	Medium
	Croal (including Blackshaw Brook) - GB112069064550	Low	Minor *	Medium
	Irwell (Croal to Irk) Water Body - GB112069061451	Low	Minor*	Low

* Impact significance predicted to be negligible, but categorised as Minor in the absence of a negligible category.

Uncertainties

The confidence of the assessment is considered to be **Medium** due to the limited temporal resolution of the available macrophyte and phytobenthos sampling data. The available data for the water bodies of interest contains gaps and has limited coverage during and following dry/low flow periods. The confidence of assessment for the Irwell (Croal to Irk) water body is **Low** due to the absence of suitable monitoring locations within the geographical scope on this water body.

A3.1.7 References

Amec (2013) Belmont Reservoir Drought Order Scoping and Data Gap Analysis Report. Report to Environment Agency. 33670 D13147i2. July 2013. 95pp.

APEM (2025b) Jumbles Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

CIEEM (2019) Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland. Chartered Institute of Ecology and Environmental Management, v1.2, April 2022.

EA (2025) Environmental assessment for water company drought planning supplementary guidance. Published March 2025.

Natural Resources Wales (2017) Water Company Drought Plan Technical Guidelines, December 2017.

Natural Resources Wales (2024) Water Company Drought Plan Technical Guidance. v.2, July 2024.

A3.2 Macroinvertebrates

A3.2.1 Background

This assessment focusses on potential effects of implementation of the proposed drought order on macroinvertebrate communities associated with the Eagley Brook (GB112069064570), River Tonge (GB112069064530) and River Croal (including Blackshaw Brook) (GB112069064550) water bodies including consideration of potential effects on WFD status and identification of notable species. Whilst a short section of the Irwell (Croal to Irk) (GB112069061451) water body, between its confluence with the Croal and Kearsley gauging station is included within the geographical extent of the study, no suitable macroinvertebrate monitoring locations were found within this reach on this water body.

A3.2.2 Potential pathways of impact

The proposed drought order could cause changes in water depth, wetted perimeter and velocity, alter the quantity and quality of available habitat, and cause changes in water quality. In turn, these impacts could affect sensitive macroinvertebrate species and alter the structure and composition of the macroinvertebrate community.

A3.2.3 Sources of information and methods

Macroinvertebrate data were available for five EA monitoring locations in the water bodies of interest (Table A3-6). Data covered the period (1995-2025). Note, that whilst the geographical extent of the study includes part of the River Irwell, to Kearsley gauging station, no macroinvertebrate monitoring locations exist within this reach.

Table A3-6 Macroinvertebrate data for monitoring locations within the Eagley Brook, Tonge and Croal water bodies, in upstream to downstream order

Water body and ID	EA Site ID	NGR	Data period	Number of samples	Data used in Cycle 3	Included in assessment
Eagley Brook GB112069064570	66949	SD6740016200	1989-1996	3	N	N
	68779	SD6773915813	1988-2020	74	Y	Y
	68894	SD6914415527	1987-2014	70	N*	Y
	64102	SD6930015200	1994	1	N	N

Water body and ID	EA Site ID	NGR	Data period	Number of samples	Data used in Cycle 3	Included in assessment
	64111	SD6930015200	1994	1	N	N
	65940	SD7020014700	1987-1994	12	N	N
	102687	SD7021314728	2005-2013	17	N	N
	66797	SD7105913528	1987-2013	55	N	Y
	164423	SD7192813115	2013-2024	18	N*	Y
	64850	SD7220011500	1987-1990	10	N	N
	67339	SD7198011112	1987-2014	39	N*	N
Tonge GB112069064530	68502	SD7230010200	1987-1993	17	N	N
	67391	SD7315108776	1987-2014	37	N*	Y
	67671	SD7336408044	1987 - 2014	30	N*	Y
Croal (including Blackshaw Brook) GB112069064550	66809	SD7437506921	1996 - 2014	30	Y	Y
	66895	SD7360007500	1987-1990	12	N	N
	68009	SD7470006100	1987-1995	24	N	N

*Used in Cycle 2

Assessment of impacts on the macroinvertebrate community during the operation of the proposed drought order was made in the context of the baseline condition and effect of previous droughts, using a suite of diagnostic biotic indices designed to detect the biological effects of water pollution, low flows and sedimentation.

- Whalley Hawkes Paisley Trigg (WHPT) method (UKTAG 2014) is an index of overall biological quality using macroinvertebrates similar to the previous Biological Monitoring Working Party (BMWP) index. WHPT responds to the same environmental pressures as BMWP though unlike BMWP it is abundance-sensitive and it can detect moderate changes in water quality that would previously have been undetected. WHPT NTAXA also responds to the same environmental pressures as BMWP NTAXA. WHPT and WHPT NTAXA are the current indices used to determine WFD status during classifications for macroinvertebrates and are useful for distinguishing the direct effects of water abstraction from the effects of water pollution.
- Lotic Invertebrate index for Flow Evaluation (LIFE; Extence *et al.*, 1999) is the average of abundance-weighted flow groups that indicate the preferences of each taxon for higher water velocities and clean gravel/cobble substrata or slow/still water velocities and finer substrata. LIFE is used to index the effect of flow variations on macroinvertebrate communities.
- Proportion of Sediment-sensitive Invertebrates (PSI; Extence *et al.,* 2011) gives further insight into potential impacts associated with fine sediment inputs and is considered potentially useful in describing the baseline condition of the river.

To gauge the potential sensitivity of the macroinvertebrate communities to changes in habitat and water quality under drought conditions, a visual assessment was undertaken of the biotic indices detailed above in relation to both WFD standards and the possible impacts of previous dry periods.

A3.2.4 Baseline

The Eagley Brook, Tonge, Croal (including Blackshaw Brook) and Irwell (Croal to Irk) water bodies are all currently classed as being heavily modified water bodies and as being at Moderate Ecological Potential (2022 Cycle 3; see Table A3-7).

The macroinvertebrate biological element for the Eagley Brook water body is currently classed as being at Moderate status (2022 Cycle 3). Bradshaw Brook was previously classed as being at Good status (2019 Cycle 2) for the macroinvertebrate biological element and had been since 2015. The macroinvertebrate biological element for the Tonge water body is currently classed as being at Good status (2022 Cycle 3) and has been since 2014. The macroinvertebrate biological element for the Croal (including Blackshaw Brook) water body is currently classed as being at Moderate status (2022 Cycle 3) and has been since 2009. The Reasons for Not Achieving Good (RNAG) status given by the EA are intermittent sewage discharge (source – water industry) and urbanisation (source – urban and transport). Downstream on the Irwell (Croal to Irk) water body, the macroinvertebrate qualifying element is currently assessed as Moderate (2022 Cycle 3), and has been since 2019, prior to which it was assessed as Poor. The RNAG ascribed to this water body included point source pollution from trade/industry discharge and intermittent and continuous sewage discharge associated with the water industry, diffuse pollution from urbanisation and physical modifications related to flood protection structures.

Table A3-7 WFD status of the Eagley Brook, Tonge and Croal (including Blackshaw Brook) water bodies. Classifications are given for Cycle 3

Water body	Water body ID	Overall Status	Ecological Status	Invertebrate Status	Overall Objectives
Eagley Brook	GB112069064570	Moderate	Moderate	Moderate	Good by 2027
Tonge	GB112069064530	Moderate	Moderate	Good	Good by 2027
Croal (incl Bradshaw Brook)	GB112069064550	Moderate	Moderate	Moderate	Moderate by 2015
Irwell (Croal to Irk)	GB112069061451	Moderate	Moderate	Moderate	Good by 2027

WHPT ASPT

WHPT ASPT O/E ratios are given in Figure A3- and Figure A3-2. WHPT ASPT O/E ratios were frequently indicative of Good and High status at Eagley Brook u/s Belmont Bleach Works and Eagley Brook u/s Charles Turner monitoring locations, respectively, indicating to the absence or limited presence of water quality pressures. There were no clear relationships between WHPT ASPT O/E ratios and dry years at these monitoring locations. Further downstream at Dunscar Bridge, the dataset was temporally limited. WHPT ASPT O/E ratios improved over time from Poor/Moderate status to Good/High status. Ratios were indicative of Bad status during and immediately following the 2003 dry year, indicating that the macroinvertebrate community may have been impacted by poor water quality. At Eagley Brook Hough Lane monitoring location, WHPT ASPT O/E ratios were generally of Good status, indicating that water quality pressures were unlikely. There were no clear relationships between WHPT ASPT O/E ratios and dry years at this monitoring location.

WHPT ASPT O/E ratios were lower at Tonge PTC middle Bk monitoring location, with the macroinvertebrate community indicating possible impacts of poor water quality. WHPT ASPT O/E ratios appeared to improve over time as Good status was indicated on three occasions. Relationships with dry years could not be assessed due to poor temporal data representation.

The Farnworth Recording Station location (EA Site ID 66809) is sited on the River Croal downstream of the confluence of Bradshaw Brook and the River Tonge. Data indicated that the macroinvertebrate community at this location was impacted by poor water quality with WHPT ASPT O/E ratios indicative of Poor/Moderate status. Data collection has been sporadic since 2007, therefore, the current status at this location is uncertain. Suppressed scores were present during the 1996, 2003 and 2010 dry years, however, any historic relationship with dry years was somewhat ambiguous, with suppressed scores occurring in both dry and non-dry years.

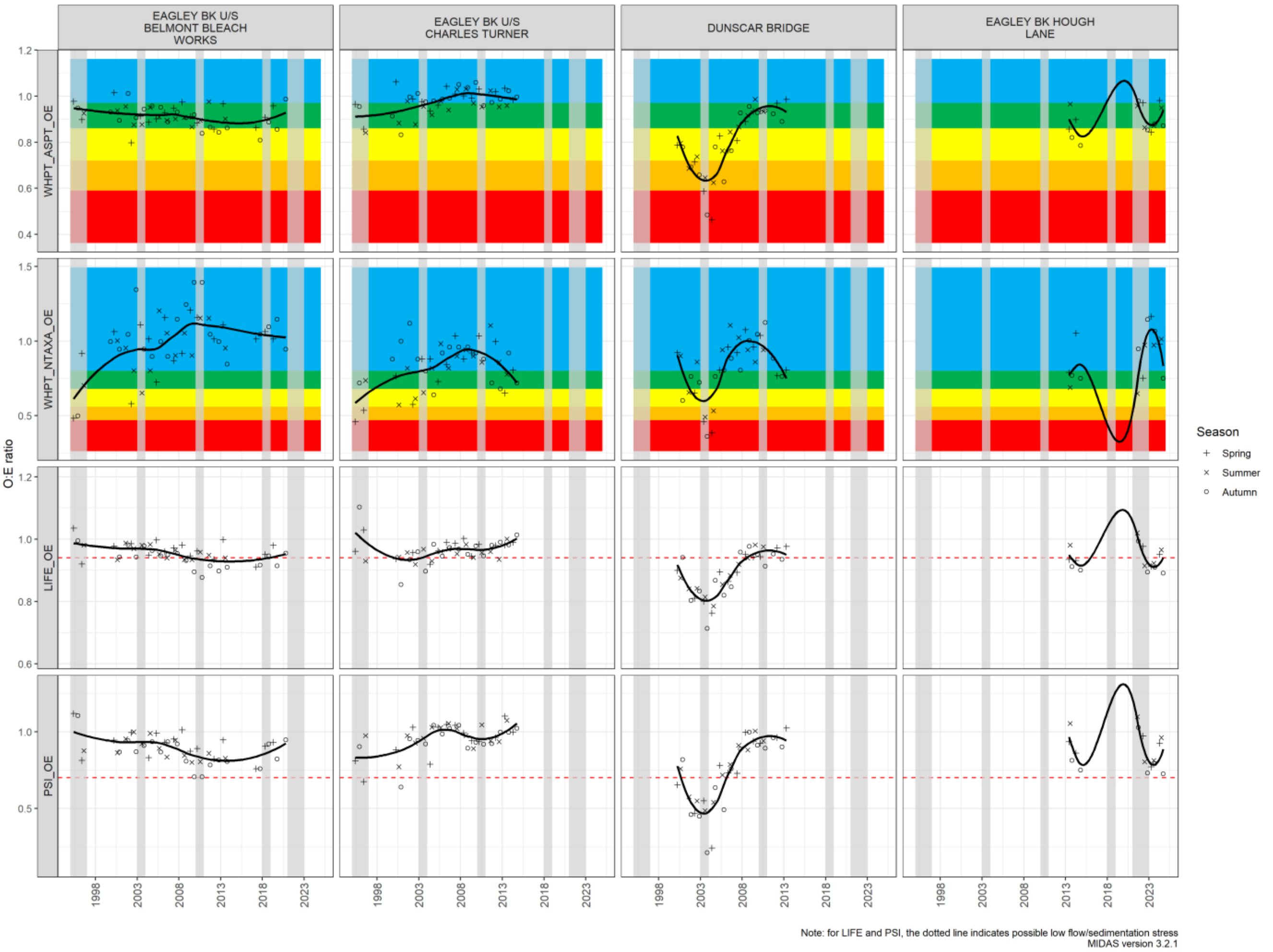

Figure A3-1 WHPT-ASPT, WHPT_NTAXA, LIFE and PSI O/E ratios for locations on Eagley Brook

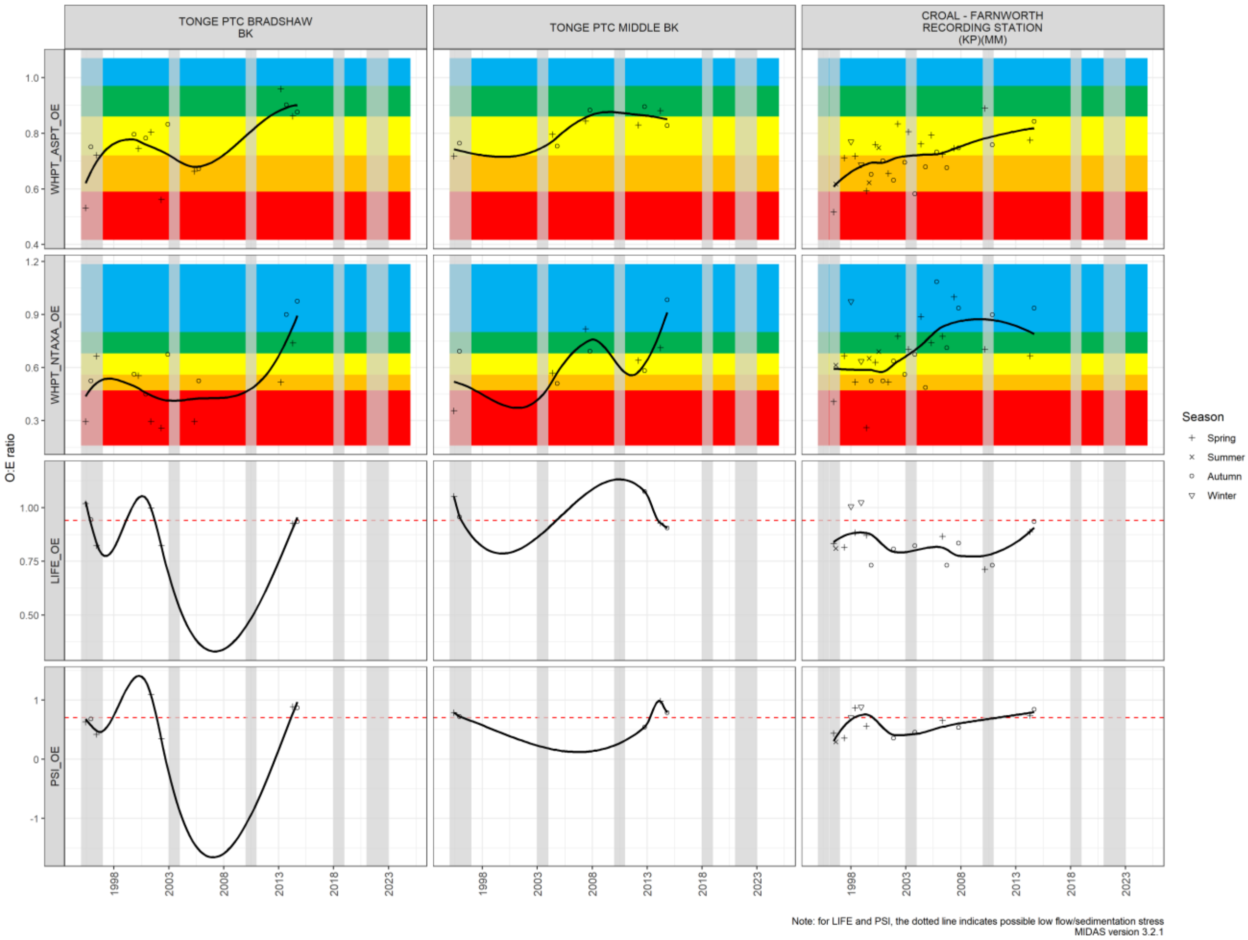

Figure A3-2 WHPT-ASPT, WHPT_NTAXA, LIFE and PSI O/E ratios for locations on the River Tonge and River Croal water bodies

WHPT NTAXA

WHPT NTAXA O/E ratios are given in Figure A3- and Figure A3-2. WHPT NTAXA O/E ratios improved over time and became mostly indicative of High status at the monitoring locations situated on the Eagley Brook water body. Ratios were indicative of Bad and Poor status during and immediately following the 2003 dry year at Dunscar Bridge monitoring locations, though WHPT ASPT O/E, LIFE and PSI O/E ratios were also low, indicating the presence of confounding pressures.

Downstream on the Tonge water body, WHPT NTAXA O/E ratios were lower and frequently indicated less than Moderate status. Higher than Moderate status was indicated on three occasions, though the current status of this water body could not be assessed due to poor temporal data representation. Relationships with dry years could also not be assessed due to poor temporal data representation.

WHPT NTAXA O/E ratios at the Farnworth Recording Station location were indicative of Good/High status since 2004. Prior to which data suggested that pressures (i.e. poor habitat, inorganic pollution) were present at this location. Data collection was sporadic post-2007, and therefore the current status at this location is uncertain. Any historic relationship with dry years was somewhat ambiguous, with suppressed scores occurring in both dry and non-dry years where data were available.

LIFE

Species LIFE O/E ratios are given in Figure A3- and Figure A3-2. LIFE O/E ratios indicated that pressures associated with low flows were mostly unlikely at the two most upstream monitoring locations on the Eagley Brook water body. Although several data points were borderline. LIFE O/E ratios improved over time at Dunscar Bridge monitoring location, though recent data are not available at this location. Furthermore, LIFE O/E ratios suggested an impacted flow regime during and immediately following the 2003 dry year.

Species LIFE O/E ratios at the Farnworth Recording Station location were indicative of a poor/impacted flow regime. Data collection has been sporadic since 2007 with recent data available for the years 2010 and 2014 only and therefore the current status at this location is uncertain. No historic relationship with dry years is evident, with suppressed scores occurring in both dry and non-dry years.

PSI

Species PSI O/E ratios are given in Figure A3- and Figure A3-2. PSI O/E ratios at the Farnworth Recording Station location historically indicated possible impacts of excessive deposition of fine sediment. Data collection has been sporadic since 2007 with recent data available for the years 2010 and 2014 only and therefore the current status at this location is uncertain although an improvement in PSI O/E ratios occurred in 2014. No historic relationship with dry years were evident, with suppressed scores occurring in both dry and non-dry years.

PSI O/E ratios at the Farnworth Recording Station location historically indicated possible impacts of excessive deposition of fine sediment. Data collection has been sporadic since 2007 with recent data available for the years 2010 and 2014 only and therefore the current status at this location is uncertain although an improvement in PSI O/E ratios occurred in 2014. No historic relationship with dry years were evident, with suppressed scores occurring in both dry and non-dry years.

Rare species

Notable taxa recorded at the monitoring locations included within this assessment included the Red listed (least concern) and nationally scarce mayfly *Paraleptophlebia cincta* and stonefly *Amphinemura standfussi*, the Red listed (data deficient) and nationally scarce stonefly *Protonemura montana*, and the Red listed (least concern) Henslow's Pea Mussel *Euglesa henslowana*. Other notable taxa included the non-native freshwater shrimp *Crangonyx pseudogracilis* and New Zealand mudsnail *Potamopyrgus antipodarum*.

Summary

In riverine habitats, shallow groundwater-fed and upland watercourses are regarded as more ecologically sensitive to low flows than deeper lowland systems. In all riverine situations, however, macroinvertebrate communities are typically resilient to single-season low flow periods, recovering rapidly from any negative impacts of low flows. From the available data, there is no indication that macroinvertebrate communities in the water bodies of interest have been impacted adversely by previous dry periods/periods of lower flows, and so macroinvertebrates have been categorised as **Low** sensitivity.

A3.2.5 Impact assessment

Proposed Belmont drought order alone (4.5 Ml/d)

The proposed drought order will mean greater water retention within Belmont Reservoir and is expected to slow the rate of reservoir drawdown and maintain compensation flow releases. It is predicted to have a beneficial but **Negligible** magnitude of impact on reservoir water level and exposure (Appendix 2). Regarding macroinvertebrates, Abrahams (2005) reports that a number of macroinvertebrate species appear to be adapted to fluctuating water levels, possibly even benefiting from regular drawdown. Even where there are negative effects on unadapted aquatic species, recolonisation can be rapid. Studies have shown that recolonisation of a re-flooded shoreline takes about three months and after recovery the inundated zones can contain higher invertebrate numbers and biomass than they did before drawdown (Langford, 1983).

Any impacts on macroinvertebrates in the reservoir is predicted to be **Negligible** but categorised as **Minor** in the absence of a negligible category for impact significance.

Hydrological modelling identified impacts on river flow, with impact magnitudes decreasing with distance downstream. The impact magnitude of the proposed Belmont drought order is greatest on Eagley Brook (**Medium**), particularly within the first kilometre, and decreases to a **Low** impact magnitude on the Tonge water body before becoming **Negligible** downstream of the confluence with the River Croal. Habitat and geomorphological assessments identified that under the proposed Belmont drought order alone, fine-grained suspended sediment deposition may increase, though it is unlikely that this would have a significant impact on the substrate composition. Mean and maximum flow depths are expected to decrease, therefore, increasing the risk of bed substrate exposure and a possible reduction in in-stream habitat. Based on the data presented, the impact magnitude on in-instream habitats and sedimentation is **Medium** and **Low** on the Eagley Brook and Tonge water bodies, respectively. Water quality assessments of the proposed Belmont drought order alone identified a **Low** impact magnitude within both the Eagley Brook and Tonge water bodies for most parameters (Medium for ammonia and phosphate in Eagley Brook).

Based on the data presented, a **Negligible** (classified as **Minor** in the absence of a Negligible category) impact significance is anticipated for macroinvertebrates in the assessed water bodies.

Proposed Belmont drought order (4.5 Ml/d) in combination with a Jumbles drought permit (12 Ml/d)

Belmont Reservoir and Eagley Brook are located upstream of the confluence of the River Tonge and Bradshaw Brook, into which the compensation flow from Jumbles Reservoir is released. Consequently, the impacts of the in-combination scenario are the same as the Belmont drought order alone.

Under the in-combination scenario, hydrological modelling identified that flows downstream of the confluence of Bradshaw Brook and the River Tonge are expected to decrease. The magnitude of impact of the proposed in-combination scenario on in-stream habitat and sedimentation is expected to be **Low** on the Tonge and Croal water bodies, and **Negligible** on the Irwell (Croal to Irk) water body. Water quality assessments of the proposed in-combination scenario identified a **Low** impact magnitude within both the assessed water bodies for most parameters (Medium for ammonia and phosphate in Eagley Brook).

The impact significance of the in-combination scenario is predicted to be **Negligible** (classified as **Minor** in the absence of a Negligible category) for macroinvertebrates in the Tonge, Croal (including Bradshaw Brook) and Irwell (Croal to Irk) water bodies.

A3.2.6 Summary

The overall ecological potential is consistent across the four water bodies within the study area, all being indicative of Moderate ecological potential. The macroinvertebrate status was indicative of Good status in the Tonge water body and Moderate status in the Eagley Brook, Croal (including Blackshaw Brook) and Irwell (Croal to Irk) water bodies.

The macroinvertebrate communities of these water bodies are expected to be resilient to low flow periods of the magnitude and duration predicted under the proposed Belmont drought order. Therefore, the sensitivity of macroinvertebrates as a receptor is considered **Low**.

Impacts of changes in flow attributable to the implementation of the Belmont drought order and the in-combination scenario with Jumbles decrease with increasing distance downstream. Impacts of changes in sediment and in-stream habitat attributable to implementation of the proposed drought order ranged from **Negligible** to **Medium** depending on location.

The overall impact significance of the proposed Belmont drought order on aquatic macroinvertebrates has therefore been assessed as **Negligible** (classified as **Minor** in the absence of a Negligible category) (as summarised in Table A3-8).

Consistent and clear relationships with notable dry years were not observed in the macroinvertebrate data and the macroinvertebrate community is considered to be of low sensitivity to environmental change. Based on the known resilience of macroinvertebrate communities to short-term periods of low flow this assessment is of **Medium** confidence.

Table A3-8 Summary of predicted impacts on macroinvertebrates

Scenario	Water body	Sensitivity	Significance of impact	Confidence level
Proposed Belmont drought order alone (4.5 Ml/d)	Belmont Reservoir	Low	Minor *	Medium
	Eagley Brook - GB112069064570	Low	Minor	Medium
	Tonge - GB112069064530	Low	Minor	Medium
Proposed Belmont drought order (4.5 Ml/d) in combination with a Jumbles drought permit (12 Ml/d)	Belmont Reservoir	Low	Minor *	Medium
	Eagley Brook - GB112069064570	Low	Minor	Medium
	Tonge - GB112069064530	Low	Minor	Medium
	Croal (including Blackshaw Brook) - GB112069064550	Low	Minor	Medium
	Irwell (Croal to Irk) Water Body - GB112069061451	Low	Minor*	Low

* Impact predicted to be negligible, but categorised as Minor in the absence of a negligible category.

Uncertainties

The confidence of the assessment is considered to be **Medium** due to the limited temporal resolution of the available macroinvertebrate sampling data. The available data for the water bodies of interest contains gaps and has limited coverage during and following dry/low flow periods. Furthermore, the confidence of assessment for the Irwell (Croal to Irk) water body is **Low** due to the absence of macroinvertebrate monitoring location within the study area.

A3.2.7 References

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Langford T. E. (1983) Electricity Generation and the Ecology of Natural Waters. Liverpool University Press, Liverpool.

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A3.3 Fish

A3.3.1 Background

The following section provides an overview of fish communities present within Belmont Reservoir and the rivers downstream (namely Eagley Brook, and parts of the River Tonge, River Croal and River Irwell) to inform the focus for the assessment. The assessment uses modelled changes to hydraulic parameters and predicted changes to water quality during the proposed drought order. Comparing these changes against baseline conditions allows consideration of how implementation of the proposed drought order may impact habitat availability and migration for individual life stages and species of fish, in addition to angling activity.

A3.3.2 Potential pathways of impact

Potential impacts to fish and fisheries in the reservoir and downstream rivers during implementation of the proposed drought order may occur via a number of routes, including:

- modification of habitat (through changes in wetted area, flow characteristics, temperature, water quality, fine sediment deposition and production; with consequences for fish distribution, feeding, predation, growth and survival of juvenile and resident brown trout and coarse fish species);
- disruption of migration in rivers downstream of Belmont Reservoir;
- disruption of spawning in Belmont Reservoir and rivers downstream; and
- disruption of angling quality and value in Belmont Reservoir and rivers downstream (through changes in availability or accessibility of fish, flow changes and resultant fishing opportunity and demand).

A3.3.3 Sources of information and methods

The potential effects of the proposed drought order on fish populations have been assessed by considering the combined outputs from the water quality and habitat analyses. The habitat analysis approach focusses on targeted hydraulic assessment to predict changes in physical habitat parameters (e.g. wetted width, velocity and depth) under alternative flow scenarios, i.e. the flows under the proposed drought order. These physical parameters are key determinants of habitat suitability, functionality and typology for the fish species present within the affected reaches.

Referring to the predicted magnitude and duration of habitat alteration highlighted in Section A2.2, potential impacts on relevant fish species were assessed qualitatively, based on habitat requirements and known periods of sensitivity for key species and life stages recorded in the reservoir and relevant sections of river catchment, along with expert judgement. Potential additive effects of other environmental variables such as water temperature and low dissolved oxygen concentration were also considered, together with changes in the passability of river structures to upstream and downstream migrating fish.

A3.3.4 Baseline

Fish populations and recruitment

To assess the impact of the proposed drought order it is first necessary to establish a baseline of the fish communities which either reside within the impacted reach or use the habitat within it as a migratory conduit or to fulfil certain life stage requirements such as spawning, nursery and feeding habitats. The approach taken here has been to examine existing fisheries data pertaining to sites, ideally within the reaches where transect data have been collected, or failing this, from surrogate sites which are considered to best represent the fish communities within the area of study.

It is understood that Belmont Reservoir is stocked with numerous coarse fish species, including bream (*Abramis brama*), carp (*Cyprinus carpio*), golden orfe (*Leuciscus idus*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), rudd (*Scardinius erythrophthalmus*) and tench (*Tinca tinca*). However, further details on the most recent stocking event and stocking densities were not available.

The available fisheries data for the water bodies downstream of Belmont Reservoir are from routine EA electric-fishing surveys. A summary of the name and location of the survey sites, the total number of surveys and dates are summarised in Table A3-9 and the fish species historically captured at each site are presented in Table A3-10. The survey locations are presented graphically in Figure A3-3. These datasets form the baseline information on fish populations used to assess the potential impacts resulting from the proposed drought order.

Within the geographical extent of the environmental assessment, Eagley Brook has the greatest number of survey sites (9), mostly characterised by a low number (1-5) of survey events, followed by the River Tonge (2), the River Croal (1) and the River Irwell (1). With the exception of the River Tonge (2023) and the River Croal (2022), all survey data is from 2016 or earlier. Nonetheless, the surveys provide useful data to characterise the fish populations of the water bodies and are considered sufficient for the purpose of informing the target species for the impact assessment.

The fisheries community of Eagley Brook appears to be quite poor in diversity, with a maximum of 6 species recorded at any site. Brown / sea trout (*Salmo trutta*) have been recorded at all but one site on Eagley Brook, suggesting a well-established population and the presence of good spawning and juvenile habitat, supported by the presence of rheophilic species such as bullhead (*Cottus gobio*) and gudgeon (*Gobio gobio*). Sites on the River Tonge and River Croal share a similar species assemblage, both supporting brown / sea trout, bullhead, minnow (*Phoxinus phoxinus*), stone loach (*Barbatula barbatula*) and three-spined stickleback (*Gasterosteus aculeatus*). The single site on the River Irwell supports a much larger number of coarse fish species, including dace (*Leuciscus leuciscus*) and perch.

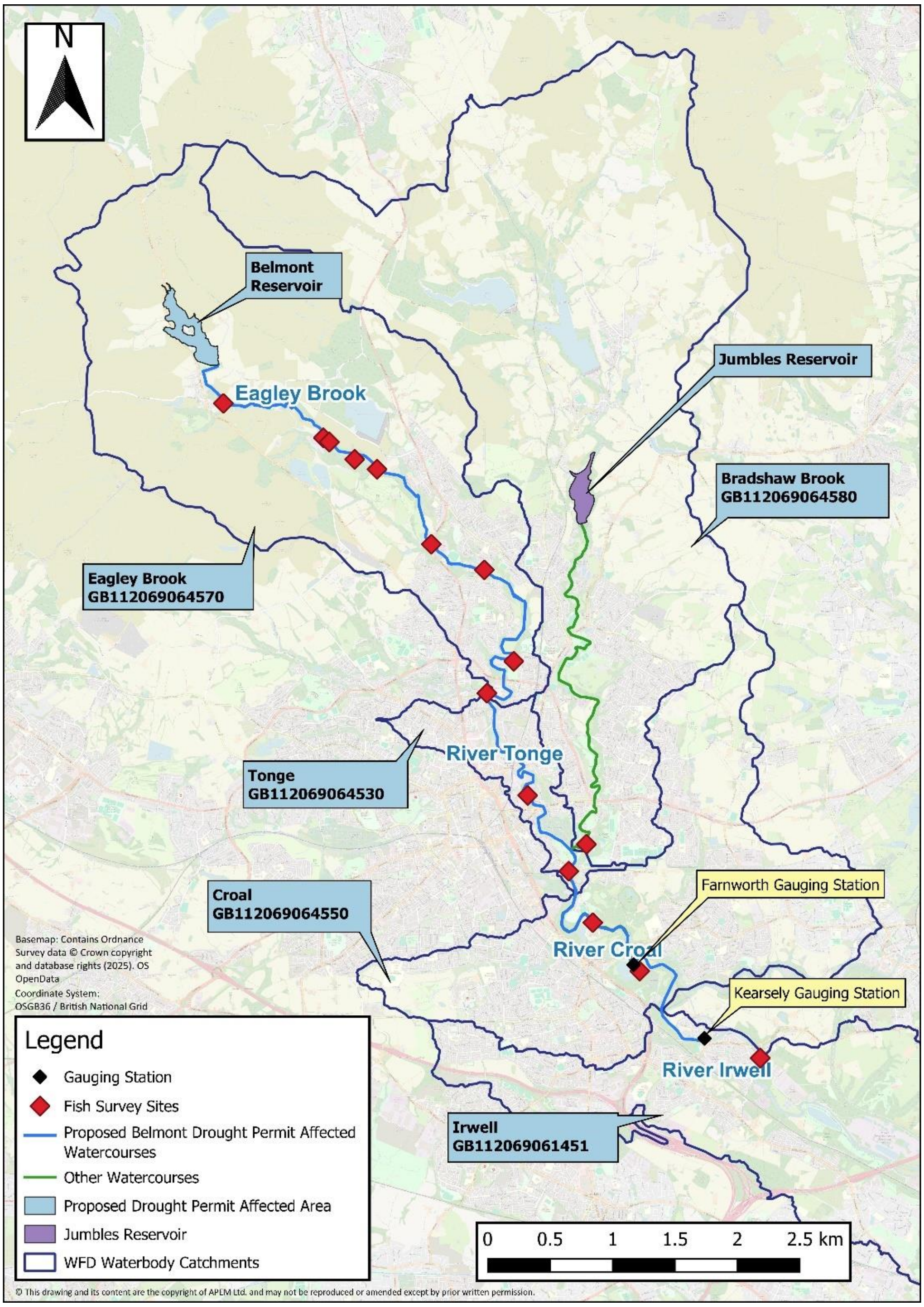

Figure A3-3 An overview of the historic EA electrofishing survey locations within the assessment area

Table A3-9 Summary of EA electrofishing survey locations within the assessment area

Water body	Site name	Site ID	Site NGR	No. surveys	First survey	Last survey
Eagley Brook (GB112069064570)	EA01	6470	SD6773315789	20	21/06/1996	08/09/2010
	EA02	6471	SD6983514893	5	21/06/1996	20/05/2002
	EA03	6472	SD7019314734	14	21/06/1996	02/08/2013
	EA04	6473	SD7106213533	14	30/10/1996	02/08/2016
	EA05	6474	SD7191113122	2	30/11/1996	02/08/2013
	EA06	6475	SD7238311662	1	30/10/1996	30/10/1996
	EA07	6476	SD7195511149	1	23/10/1996	23/10/1996
	EA01.5	22087	SD6933715237	1	20/09/2006	20/09/2006
	EA01.7	22106	SD6943215171	1	20/09/2006	20/09/2006
River Tonge (GB112069060830)	CRTO05	13348	SD7260509513	1	29/06/2004	17/05/2023
	CRTO10	13349	SD7326208299	2	28/06/2004	07/06/2005
Croal (GB112069064550)	CRCR05	13347	SD7364807475	4	01/07/2004	08/08/2022
Irwell (Croal to Irk) (GB112069061451)	IWIR20	10411	SD7853006835	5	07/07/2003	07/05/2014

Table A3-10 Summary data of species captured during EA electrofishing surveys within the assessment area

Water body	Site name	Site ID	Fish species captured
Eagley Brook (GB112069064570)	EA01	6470	Brown / sea trout, ten-spined stickleback, three-spined stickleback.
	EA02	6471	Brown / sea trout, three-spined stickleback.
	EA03	6472	Brown / sea trout, bullhead, chub, roach, three-spined stickleback.
	EA04	6473	Brown / sea trout, minnow, roach, three-spined stickleback.
	EA05	6474	Brown / sea trout, chub, gudgeon.
	EA06	6475	Brown / sea trout, three-spined stickleback.
	EA07	6476	Bullhead, chub, gudgeon, stone loach, three-spined stickleback.
	EA01.5	22087	Brown / sea trout, chub, minnow, three-spined stickleback.
	EA01.7	22106	Brown / sea trout.
River Tonge (GB112069060830)	CRTO05	13348	Brown / sea trout, bullhead, minnow, stone loach, three-spined stickleback.
	CRTO10	13349	Brown trout, bullhead, minnow, roach, stone loach and three-spined stickleback.
River Croal (GB112069064550)	CRCR05	13347	Brown trout, bullhead, minnow, roach, stone loach and three-spined stickleback.
River Irwell (GB112069061451)	IWIR20	10411	Brown / sea trout, bullhead, chub, dace, gudgeon, minnow, perch, roach, stone loach, three-spined stickleback.

Based on the data from previous EA surveys summarised above, a total of 16 fish species have been recorded across the study area, comprising bream, brown / sea trout, bullhead, carp, chub (*Squalius cephalus*), dace, gudgeon, minnow, golden orfe, perch, roach, rudd, stone loach, tench, ten-spined stickleback and three-spined stickleback. It should be noted that carp and golden orfe are not native species to the UK but have been afforded consideration within the assessment given the potential amenity value they provide through angling activity in Belmont Reservoir.

There are evident changes in the species assemblage of individual water bodies, driven by changes in factors such as channel width, altitude and bed gradient. Despite these differences, a number of the fish species display very similar ecological requirements and life history characteristics and can therefore be grouped into distinct 'functional guilds' for the purpose of the ecological assessment. With regards to coarse fish, the majority of species can be defined as either rheophilic or eurytopic in nature. Rheophilic fishes display a preference for areas of moderate to fast flowing water; spawning habitat for these species is therefore typically associated with coarse gravel and cobble substrate and moderate water depths. In contrast, eurytopic fish species display a much wider preference range with regards to habitat requirements, although optimal habitat is typically characterised by areas of static or low velocity water, with a greater mean depth. The majority of coarse fish species have been assigned to one of these functional guilds on the basis of information provided in EA (2004) and Fieseler and Wolter (2006).

There are a number of species which could be categorised within one of these two assessment groups that have instead been considered separately due, for example, to differing sensitivity or increased conservations status. Bullhead, for example, is typically defined as a rheophilic species, although it has been assessed separately due to its higher sensitivity, whilst the same also applies to brown / sea trout.

Abundant and widespread species such as minnow and three-spined stickleback have been grouped into a 'minor coarse fish species' assessment group, which is consistent with the approach taken to define these species within the EA's FCS2 assessment model (and ultimately WFD Fish status outputs).

The final fish species list used to inform the drought order assessment is therefore as follows:

- Brown / sea trout;
- Bullhead;
- Rheophilic coarse fishes (comprising chub, dace, gudgeon, golden orfe and stone loach);
- Eurytopic coarse fishes (comprising bream, carp, perch, pike, roach, tench, ten-spined stickleback and three-spined stickleback); and
- Minor coarse fishes (comprising minnow).

Fishing/angling groups

The fish baseline data identified a number of key angling species, including brown trout, chub and carp. All four rivers and Belmont Reservoir are fished to some extent, although the overall intensity of angling is relatively limited. Fishing rights on Belmont Reservoir are believed to be owned by Belmont Valley Fishery; whilst rights on Eagley Brook, the River Tonge, the River Croal and the River Irwell are owned by a number of entities including the Canal & River Trust and the EA.

A3.3.5 Habitat requirements

Impacts on each fish species will vary according to the critical seasonal sensitivity of individual life stages in relation to the proposed timings of the drought order implementation, in addition to species-specific habitat use. Critical periods of sensitivity for individual species/life stages are summarised in Table A3-11.

Table A3-11 An overview of key seasonal sensitivity periods for individual fish species/life stages under consideration in the assessment

Species	Life stage	J	F	M	A	M	J	J	A	S	O	N	D
Brown trout	Spawning & egg incubation	■	■								■	■	■
	Juvenile	■	■	■	■	■	■	■	■	■	■	■	■
	Adults	■	■	■	■	■	■	■	■	■	■	■	■
Bullhead	Spawning & egg incubation			■	■	■	■						
	Juvenile	■	■	■	■	■	■	■	■	■	■	■	■
	Adults	■	■	■	■	■	■	■	■	■	■	■	■
Eurytopic/minor coarse fish	Spawning & egg incubation			■	■	■	■	■					
	Juvenile	■	■	■	■	■	■	■	■	■	■	■	■
	Adults	■	■	■	■	■	■	■	■	■	■	■	■
Rheophilic coarse fish	Spawning & egg incubation			■	■	■	■	■					
	Juvenile	■	■	■	■	■	■	■	■	■	■	■	■
	Adults	■	■	■	■	■	■	■	■	■	■	■	■

Similarly, it is necessary to establish the ecological requirements of individual species/species groups to determine whether predicted changes arising from implementation of the proposed drought order (e.g. hydraulic changes in depth or velocity in the channels) are likely to result in an adverse impact on fish populations. An overview of preference ranges for each species/species group is provided in Table A3-12.

Table A3-12 Depth and velocity preference ranges for species/species groups under consideration in the assessment based on data summarised from EA (2004)

Species	Life stage	Water depth requirements	Velocity requirements
Brown trout	Fry	<60 cm	0 - <30 cm/s
	Parr	30 - 75 cm preferred	~20 - 30 cm/s preferred
	Adult	40 - 75 cm preferred	~25 cm/s preferred
	Spawning	25 - 50 cm	~20 - 50 cm/s preferred
Bullhead	Juvenile	Shallow	Elevated
	Adult	>5 - 40 cm	10 - >40 cm/s
	Spawning	>5 cm	-*
Eurytopic/minor coarse fish	Larvae	5 - 150 cm	<5 cm/s
	Juvenile	5 - 150 cm	< 20 cm/s
	Adult	20 – 150 cm	0 – 30 cm/s
	Spawning	10 – 45 cm	20-30 cm/s
Rheophilic coarse fish	Larvae	2 – 50 cm	<5 cm/s
	Juvenile	<50 cm	Still – elevated
	Adult	20 – 100 cm	10 – 50 cm/s
	Spawning	>0 – 128 cm	<5 – 75 cm/s

**no value provided*

To inform the impact assessment a receptor sensitivity has been assigned to each individual species/life stage under consideration. Eggs and early-stage fry/alevins of all species typically occupy moderate to shallow habitats and are largely immobile in nature and thus do not have the ability to relocate to alternative areas of suitable habitat when exposed to reduced water levels or dewatering. This life stage has therefore been assigned a **High** sensitivity for all assessment species, with the exception of eurytopic and minor coarse fish. In comparison, juvenile and adult life stages of all species are more mobile in nature and typically display a broader range of hydraulic preferences; as such a **Medium** sensitivity has been assigned for these life stages across all species.

A3.3.6 Impact assessment

The following section considers potential impacts on fish populations in Belmont Reservoir and water bodies downstream: Eagley Brook, the River Tonge, the River Croal and the River Irwell, based on predicted hydraulic changes during the proposed drought order compared to conditions under a baseline low flow period (Section A2.1) and anticipated changes in water quality (SectionA2.3).

Scenario 1 - Proposed Belmont (4.5 Ml/d) drought order alone

Belmont Reservoir

Because the drought order will serve to maintain levels at Belmont Reservoir, no negative impacts are expected for fish communities.

Eagley Brook (GB112069064570)

Potential impacts on fish populations in Eagley Brook were assessed based on predicted hydraulic changes at six spot flow measurement sites, with model parameter values derived from regression equations developed by Atkins (2008).

Eagley Brook displays a mixed fish species assemblage, with several coarse fish species (e.g. chub, gudgeon and roach), in addition to populations of brown trout and bullhead throughout. Sites on Eagley Brook have not been surveyed since 2006, and this assessment has therefore been made on the most recent available data.

Modelled impacts on Eagley Brook indicate **Moderate** reductions in mean velocity and mean depth under the proposed drought order. In addition to localised reductions in available wetted habitat for fish, these reductions in velocity and depth may increase the rate of deposition of fine-grained sediment, which may reduce the quality of aquatic habitat. However, it is important to note that this is likely to be similar to conditions in Eagley Brook under baseline low flow events, during which similar fine sediment deposition would naturally occur.

Under baseline flows, water depths at the six spot flow measurement sites ranged from 0.06 to 0.27m, whilst flow velocities ranged from 0.14 to 0.73 m/s. These conditions are unlikely to offer suitable habitat for parr and adult fish, but overlap marginally with preferred spawning conditions. As flows within Eagley Brook are likely to be supplemented by increased run-off (e.g. from groundwater sources) during spawning activities (October to February), Eagley Brook may offer suitable habitat during these months for spawning brown trout. Impacts on spawning and juvenile brown trout are anticipated to be of **Low** magnitude, equating to a **Moderate** impact significance for spawning and a **Minor** impact significance for juveniles. Impacts on all other brown trout life stages are anticipated to be of **Negligible** magnitude, equating to a **Negligible** (categorised as **Minor**) impact significance.

Baseline conditions are likely to offer suitable habitat for all life stages of bullhead. Whilst some contraction in wetted habitat is likely to occur under the proposed drought order, this would likely be characterised by localised reductions in wetted width and depth and would not cause a sufficient loss of wetted habitat to displace bullhead from Eagley Brook. Impacts on all bullhead life stages are therefore anticipated to be of **Low** magnitude, equating to a **Minor** impact significance for juveniles and adults. The drought order implementation period (August/September to January/February) is outside of the bullhead spawning and incubation period (March to June), therefore there is no pathway of impact on this life stage.

Baseline conditions in Eagley Brook are likely to offer suitable habitat for all life stages of coarse fish (both eurytopic / minor and rheophilic species). Consequently, impacts on all species and life stages of coarse fish are anticipated to be of **Low** magnitude, equating to a **Moderate** impact significance for spawning rheophilic coarse fish, and a **Minor** impact significance on all other coarse fish species and life stages. The drought order implementation period (August/September to January/February) is outside of the spawning and incubation period for these groups, therefore there is no pathway of impact on this life stage.

Tonge (GB112069064530)

Potential impacts on fish populations in the River Tonge were assessed based on the predicted hydraulic changes at the Tonge 1 cross-section, which was deemed to be representative of the wider reaches.

The River Tonge displays a mixed fish species assemblage, characterised by high abundance of minor coarse fish species (e.g. minnow and stone loach), in addition to populations of brown trout and bullhead.

Modelled impacts on the River Tonge indicate **Low** magnitude reductions in mean velocity and mean depth under the proposed drought order. Changes in wetted habitat are therefore likely to be small and localised and are unlikely to result in large-scale impacts on local fish populations.

The River Tonge is likely to provide suitable habitat for all life stages of brown trout and bullhead, and impacts on these species are therefore anticipated to be of **Negligible** magnitude, equating to a **Minor** impact significance for spawning brown trout and bullhead, and a **Negligible** (categorised as **Minor**) impact significance for all other brown trout and bullhead life stages.

Similarly, the River Tonge is likely to provide suitable habitat for all species and life stages of coarse fish, and impacts on these species are therefore anticipated to be of **Negligible** magnitude, equating to a **Minor** impact significance for spawning rheophilic coarse fish, and a **Negligible** (categorised as **Minor**) impact significance for all other coarse fish life stages.

The drought order implementation period (August/September to January/February) is outside of the spawning and incubation period for Bullhead and rheophilic and eurytopic coarse fish, therefore there is no pathway of impact on this life stage.

Croal (including Blackshaw Brook) (GB112069064550)

The River Croal displays a mixed fish species assemblage, characterised by high abundance of minor coarse fish species (e.g. minnow and stone loach), in addition to populations of brown trout and bullhead.

As the difference between baseline flows and those under the proposed drought order was predicted to diminish to less than 10% on the River Tonge, impacts of the proposed drought order on the River Croal were not considered further. Impacts on all fish species and life stages on the River Croal are therefore anticipated to be of **Negligible** magnitude, equating to a **Negligible** (categorised as **Minor**) impact significance.

Irwell (Croal to Irk) (GB112069061451)

The River Irwell displays a mixed fish species assemblage, characterised by a diverse range and high abundance of coarse fish species (e.g. minnow and stone loach), in addition to populations of brown trout and bullhead.

As the difference between baseline flows and those under the proposed drought order was predicted to diminish to less than 10% on the River Tonge, impacts of the proposed drought order on the River Irwell were not considered further. Impacts on all fish species and life stages on the River Irwell are therefore anticipated to be of **Negligible** magnitude, equating to a **Negligible** (categorised as **Minor**) impact significance.

Proposed Belmont (4.5 Ml/d) drought order in-combination with a Jumbles (12 Ml/d) drought permit

Eagley Brook (GB112069064570)

As Eagley Brook is located upstream of the confluence between the River Tonge and Bradshaw Brook (into which the compensation flow from Jumbles Reservoir is released), impacts on all fish species and life stages under a Belmont drought order in-combination with a Jumbles drought order would be the same as under the proposed Belmont drought order alone.

Tonge (GB112069064530)

Modelled assessments of the Belmont drought order in-combination with a Jumbles (12 Ml/d) drought permit, concluded that there would be minimal risk of increased exposure of substrate compared to the Belmont drought order alone, with minimal further changes in wetted width and flow velocity.

Impacts on all fish species and life stages under a proposed Belmont drought order in-combination with a Jumbles drought permit are therefore anticipated to be the same as under the Belmont drought order alone.

Croal (including Blackshaw Brook) (GB112069064550)

The River Croal and the downstream catchment benefits from a notable degree of natural accretion during baseline conditions. Predicted changes in mean velocity nd mean water depth associated with the proposed drought order are minor, though some reduction in wetted width is anticipated. Despite this, the V- / W-shaped profile of the channel means that this reduction in wetted width is likely to result in only small losses of aquatic habitat suitable for fish.

Velocities in the River Croal under baseline conditions are outside the preferred range for all life stages of brown trout with the exception of spawning, and impacts on this species are anticipated to be of **Low** (spawning) or **Negligible** (all other life stages) magnitude, equating to a **Moderate** (spawning) or **Negligible** (categorised as **Minor**) (all other life stages) impact significance.

Similarly, velocities are also outside the preferred range for adult bullhead, though the River Croal is likely to provide suitable habitat for juveniles and spawning. Impacts on bullhead are therefore anticipated to be of **Low** magnitude, equating to a **Minor** impact significance for all life stages). The drought order implementation period (August/September to January/February) is outside of the bullhead spawning and incubation period (March to June), therefore there is no pathway of impact on this life stage.

Given the wider range of habitats coarse fish species can occupy, the River Croal is likely to provide habitat for a range of eurytopic / minor and rheophilic coarse species, as indicated by historic surveys. However, given the very minor changes in hydraulic parameters under the in-combination drought order, impacts on all species and life stages of both eurytopic / minor and rheophilic coarse fish are anticipated to be of **Negligible** magnitude, equating to a **Negligible** (categorised as **Minor**) impact significance. The drought order implementation period (August/September to January/February) is outside of the spawning and incubation period for these groups, therefore there is no pathway of impact on this life stage.

Irwell (Croal to Irk) (GB112069061451)

Modelled assessments of the Belmont drought order in-combination with a Jumbles (12 Ml/d) drought permit, concluded that impacts on the Irwell (Croal to Irk) would be substantially unchanged compared to the baseline scenario. Impacts on all fish species and life stages on the River Irwell (Croal to Irk) are therefore anticipated to be of **Negligible** magnitude, equating to a **Negligible** (categorised as **Minor**) impact significance.

Angling

Impacts on fish within the water bodies under assessment ranged from **Negligible** to **Moderate** impact significance, with **Moderate** impact significance limited to spawning brown trout in Eagley Brook (Belmont drought order alone) and the River Croal (in-combination scenario only).

Based on the relatively minor impacts predicted for adult life stages (i.e. those targeted by anglers), reductions in the density of fish targeted by anglers are considered unlikely. However, contraction of wetted width and modelled reductions in overall wetted habitat (predominantly in but not limited to the River Croal under the in-combination scenario) may cause a shift in areas targeted by anglers (i.e. as adult fish move in response to localised changes in flow and habitat availability). Accordingly, a **Negligible** impact magnitude is predicted for angling across all of the assessment water bodies, equating to a **Negligible** overall impact significance (but categorised as **Minor** in the absence of a negligible category).

Water quality

The water quality assessment concluded that all proposed scenarios were considered to be unlikely to cause major impacts on any receptors under consideration. Modelled changes in water quality were predicted to be of Low magnitude (Medium for ammonia and phosphate in Eagley Brook), temporary, and within the threshold of recoverability with regard to fish. The magnitude of effect on fish populations in all assessed water bodies and under all proposed drought order scenarios is therefore considered to be of **Negligible** magnitude, resulting in a **Negligible** impact significance (but categorised as **Minor** in the absence of a negligible category).

A3.3.7 Summary

On Eagley Brook, contractions in available wetted habitat are anticipated, associated with Moderate reductions in flow velocity, mean water depth and wetted width, resulting in impacts ranging from Negligible (categorised as Minor) to Moderate (limited to spawning and egg incubation life stages of brown trout).

Table A3-13 Summary of impacts on fish populations within the Eagley Brook (GB112069064570) water body – all scenarios

Receptor	Life stage	Impact magnitude	Receptor sensitivity	Impact significance	Confidence level
Brown trout	Spawning & egg incubation	Low	High	Moderate	Medium
	Juvenile	Low	Medium	Minor	Medium
	Adults	Negligible	Medium	Minor*	Medium
Bullhead	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Rheophilic coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Low	Medium	Minor	Medium
	Adults	Low	Medium	Minor	Medium
Eurytopic / minor coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Low	Medium	Minor	Medium
	Adults	Low	Medium	Minor	Medium
Angling	n/a	Negligible	Low	Minor*	Medium

* Impact predicted to be negligible, but categorised as Minor in the absence of a negligible category.

On the Tonge, Croal and Irwell (Table A3-14 to Table A3-15), impacts on fish populations associated with the proposed drought order are likely to be relatively localised in nature and restricted to changes in the quality or extent of habitat available. Impacts overall range from **Negligible** to **Moderate**, though **Moderate** impacts are restricted to spawning and egg incubation life stages of brown trout on the River Croal, during the in-combination drought order scenario only.

Table A3-14 Summary of impacts on fish populations within the Tonge (GB112069064530) water body (all scenarios) and the Croal (GB112069064550) water body (Belmont drought order only)

Receptor	Life stage	Impact magnitude	Receptor sensitivity	Impact significance	Confidence level
Brown trout	Spawning & egg incubation	Negligible	High	Minor	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Bullhead	Spawning & egg incubation	N/A	N/A	N/A	Medium

Receptor	Life stage	Impact magnitude	Receptor sensitivity	Impact significance	Confidence level
	Juvenile	Negligible	Medium	Minor	Medium
	Adults	Negligible	Medium	Minor*	Medium
Rheophilic coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Eurytopic / minor coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Angling	n/a	Negligible	Low	Minor*	Medium

* Impact predicted to be negligible, but categorised as Minor in the absence of a negligible category.

Table A3-15 Summary of impacts on fish populations within the Croal (GB112069064550) water body – (Belmont drought order in-combination with Jumbles drought permit)

Receptor	Life stage	Impact magnitude	Receptor sensitivity	Impact significance	Confidence level
Brown trout	Spawning & egg incubation	Low	High	Moderate	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Bullhead	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Low	Medium	Minor	Medium
	Adults	Negligible	Medium	Minor*	Medium
Rheophilic coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Eurytopic / minor coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Angling	n/a	Negligible	Low	Minor*	Medium

* Impact predicted to be negligible, but categorised as Minor in the absence of a negligible category.

Table A3-16 Summary of impacts on fish populations within the Irwell (Croal to Irk) (GB112069061451) water body – all scenarios

Receptor	Life stage	Impact magnitude	Receptor sensitivity	Impact significance	Confidence level
Brown trout	Spawning & egg incubation	Negligible	High	Minor	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Bullhead	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Rheophilic coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Eurytopic / minor coarse fish	Spawning & egg incubation	N/A	N/A	N/A	Medium
	Juvenile	Negligible	Medium	Minor*	Medium
	Adults	Negligible	Medium	Minor*	Medium
Angling	n/a	Negligible	Low	Minor*	Medium

* Impact predicted to be Negligible, but categorised as Minor in the absence of a Negligible category.

Uncertainties

The fish assemblages of the water bodies are well described by historical survey data, but the majority of surveys across all water bodies are outdated, with the exception of a 2022 survey on the River Croal and a 2023 survey on the River Tonge (one site each). In addition, key species-specific habitat requirements are clearly documented in literature, against which the assessment has been based. Despite this, there are inherently some difficulties in confidently predicting how changes in in-river habitat or water quality will translate through to impacts at the population level due to the complexity of biotic and abiotic interactions that exert pressures on fish populations. As such, the assessment is considered to have a **Medium** overall confidence level.

A3.3.8 References

Environment Agency (2004) Flow and Level Criteria for Coarse Fish and Conservation Species. Science Report SC020112/SR.EA, 2006 sailing.

Fieseler, C. and Wolter, C. (2006) A fish-based typology of small temperate rivers in the northeastern lowlands of Germany. *Limnologica - Ecology and Management of Inland Waters*, 36 (1): 2-16.

A3.4 Protected Species

A3.4.1 Background

This assessment focusses on the potential effects of implementation of the Belmont drought order on protected and notable species. The geographical extent of the study area covered Belmont Reservoir plus a total of four WFD surface water bodies:

- Eagley Brook (GB112069064570)
- River Tonge (GB112069064530).
- River Croal (including Blackshaw Brook) (GB112069064550).
- Irwell (Croal to Irk) (GB112069061451).

This assessment covers: bats (Chiroptera spp.), beaver (Castor fiber), birds (inclusive of waders, riverine, wildfowl and gulls), common amphibians, great crested newts (Triturus cristatus; GCN), otters (Lutra lutra), reptiles, water voles (Arvicola amphibious), and white-clawed crayfish (Austropotamobius pallipes; WCC). Possible impacts on protected macrophyte, macroinvertebrate, fish species, and invasive non-native species (INNS) are covered separately in Sections A3.1, A3.2, A3.3, A3.5 respectively.

The proposed drought order is not predicted to have any significant impact on terrestrial ecosystems (see Designated Sites, Section A4.4 for details) and thus potential effects on most terrestrial species have not been considered.

This assessment also considers any in-combination effects that could occur if the implementation of the Belmont drought order occurs at the same time as implementation of a 12 Ml/d drought permit at the neighbouring Jumbles Reservoir.

A3.4.2 Legislation

Bats

Bats and the places they use for shelter or protection (i.e. roosts) receive legal protection under the Conservation of Habitats and Species Regulations 2017 (Habitats Regulations, 2017) and the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019 (Habitats Regulations 2019). They receive further legal protection under the Wildlife and Countryside Act (WCA) 1981, as amended.

Changes have been made to parts of the Habitats Regulations 2017 so that they operate effectively from 1st January 2021. The changes are made by the Habitats Regulations 2019, which transfer functions from the European Commission to the appropriate authorities in England and Wales. All other processes or terms in the 2017 Regulations remain unchanged and existing guidance is still relevant.

The following bat species are listed under Section 41 of the NERC Act 2006 as a Species of Principal Importance for Nature Conservation in England: barbastelle bat (*Barbastella* *barbastellus*), Bechstein's bat (*Myotis bechsteinii*), noctule (*Nyctalus noctula*), soprano pipistrelle (*Pipistrellus pygmaeus*), brown long-eared bat (*Plecotus auritus*), greater horseshoe bat (*Rhinolophus ferrumequinum*) and lesser horseshoe bat (*Rhinolophus hipposideros*).

Beavers

Beavers are protected under the Conservation of Habitats and Species Regulations 2017 (Habitats Regulations 2017) and the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019 (Habitats Regulations 2019). This legislation lists beavers as a European protected species. They receive further legal protection under the WCA, as amended.

Birds

The Conservation of Habitats and Species Regulations 2017, (Habitats Regulations 2017) and the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019 (Habitats Regulations 2019) places a duty on public bodies to take measures to preserve, maintain and re-establish habitat for wild birds.

All breeding birds are protected under the Wildlife and Countryside Act WCA 1981 (as amended). Additional protection is afforded to those species listed on Schedule 1 of the Act.

Common Amphibians

Common frog (*Rana temporaria*), common toad (*Bufo bufo*), smooth newt (*Lissotriton vulgaris*) and palmate newt (*Lissotriton helveticus*) receive partial protection in England under Schedule 5 of the WCA (as amended) with respect to sale only.

Common toads are listed under Section 41 of the NERC Act 2006 as a Species of Principal Importance for Nature Conservation in England.

Great Crested Newts (GCN)

GCN and the places they use for shelter or protection receive legal protection under the Conservation of Habitats and Species Regulations 2017, (Habitats Regulations 2017) and the Conservation of Habitats and Species Regulations (Amendment) (EU Exit) Regulations 2019 (Habitats Regulations 2019). The receive further protection under the WCA (as amended).

GCN are listed under Section 41 of the NERC Act 2006 as a Species of Principal Importance for Nature Conservation in England.

Otters

Otters are designated and protected as European protected species (EPS). EPS are protected under the Conservation of Habitats and Species Regulations 2017. They receive further legal protection under the WCA (as amended).

Otters are listed as rare and most threatened species under Section 41 of the Natural Environment and Rural Communities Act (2006).

Reptiles

Six native reptile species live and breed within England. The two rarest reptiles, including sand lizard (*Lacerta agilis*) and smooth snake (*Coronella austriaca*), are designated and protected as an EPS and are protected under the Conservation of Habitats and Species Regulations 2017. As an EPS in England, the legislation provides full protection to sand lizard and smooth snake breeding sites and resting places.

Four of the native species, including common lizard (*Zootoca vivipara*), slow-worm (*Anguis fragilis*), adder (*Vipera berus*) and grass snake (*Natrix helvetica*) receive partial protection under Schedule 5 of the WCA (as amended), in respect to killing, injuring, and sale. The WCA (as amended) affords full protection to both the sand lizard and smooth snake.

Reptiles are protected under the WCA (as amended), and although widespread throughout the UK, their populations are considered to be declining. As a result, all species of reptile (six in the UK) are listed as a biodiversity priority species under the NERC Act (2006).

Water Voles

Water voles receive full protection in England under Schedule 5 of the WCA (as amended).

Water voles are listed under Section 41 of the NERC Act 2006 as a Species of Principal Importance for Nature Conservation in England.

White-clawed crayfish (WCC)

The Conservation of Habitats and Species Regulations 2017 places a duty on public bodies to take measures to preserve, maintain, and re-establish habitat for WCC. The regulation has regard to the EU Habitats Directive 92/43/EEC, where WCC receive protection through European designated sites including Special Area of Conservation (SAC) for their protection.

WCC receive partial protection in England under Schedule 5 of the WCA (as amended), in respect to killing, injuring, and sale.

WCC are listed under Section 41 of the NERC Act 2006 as a Species of Principal Importance for Nature Conservation in England.

A3.4.3 Potential pathways of impact

The main potential effects of the proposed drought order would occur as a result of potential changes to the availability of suitable habitats for breeding or refuge and potential changes to the availability (access to and quantity of) food sources. At a receptor-specific level these potential routes of impact are as follows:

- Bats
  - Waterways provide a pivotal ecological corridor for foraging and commuting bats, and a reduction in bankside vegetation coverage, river flow, water quality, or change in marginal exposure and wetted width, could result in a decrease in insect prey availability (invertebrates with aquatic life stages e.g. stoneflies and mayflies) and thus food sources for all UK bat species populations. Despite the fact that bats do not typically consume aquatic invertebrates in their larval or nymph stages, any modifications resulting from the proposed drought order could have a subsequent impact on invertebrates in their terrestrial adult phases, which bats utilise.
- Beavers
  - Changes to water levels or flow could affect emergent macrophyte distribution / extent on the river margins which could have subsequent effects on the availability of appropriate food resources for beavers. Beavers have a small foraging distance of 60 m from the water's edge (20 m average).
  - Dam building is triggered by low water levels, so conversely a decrease in water levels could have some positive impact but if water levels drop too low, entrances to lodges could be exposed on existing dams.
- Birds
  - For piscivorous waterbirds and otter, predation of fish may be more effective under low water level and/ or flow conditions as both juvenile and adult fish may become more visible in shallower water and more concentrated as the wetted perimeter decreases.
  - Impacts of the proposed drought order on insectivorous waterbirds, such as dippers (*Cinclus cinclus*), and grey wagtails (*Motacilla cinerea*) would be primarily though changes in the total abundance and community composition of macroinvertebrates.
  - For herbivorous waterbirds, lowered water levels could make aquatic macrophytes more accessible initially but if the water level were to fall below the zone of macrophyte growth there may not be further plant food sources at lower levels.
  - For nesting waterbirds, falling water levels could strand floating nests or make nests held above the water accessible to terrestrial predators.
- Common Amphibians
  - The common toad generally prefers deeper water bodies in which to breed such as ponds and reservoirs. A reduction in water levels in Belmont Reservoir could impact toad breeding cycles. However, toads are unlikely to utilise

flowing bodies of water. They are considered as a precaution in this EAR because they are important protected species associated with aquatic habitats that are known to occur locally.

- GCN
    - GCN generally prefer small to medium sized fish-free ponds for breeding and do not breed in rivers. No impacts of the drought order on groundwater levels are predicted. Potential pathway routes of impact are therefore not expected within the study water bodies themselves, nor within groundwater-dependent terrestrial ecosystems such as ponds.
    - GCN generally require consistent moderate to high water quality. Although they may use ponds of different conditions, GCN can be sensitive to changes in the water quality. As long as the pond has adequate oxygen, low nitrate levels and, in the case of breeding ponds, enough macrophytes appropriate for laying eggs, they can withstand short-term low water quality (Peak District National Park Authority, 2011).
    - GCN are considered in this EAR because they are important protected species associated with aquatic habitats that are known to occur locally.
    - Cumulative effects of water quality and water levels as a result of the implemented drought order could lead to decreased resilience of any metapopulations already present in the vicinity of the study area and may increase the probability of invasive non-native species establishing
- Otters
    - The primary means by which the proposed drought order might impact otters is through a change in food supply and water quality.
    - Fish species, such as salmon (*Salmo salar*), brown trout (*Salmo trutta*), and eels (*Anguilla anguilla*), comprise a significant proportion of an otter's diet, and therefore negative impacts on fish populations may adversely impact otters.
    - Otters require high quality and unpolluted water and therefore a reduction in the water quality through the concentration of pollutants may adversely impact otter habitat suitability.
- Reptiles
    - For reptile species with a proclivity for water, such as grass snake, changes in water levels could alter abundance of prey such as amphibians and fish. In addition to this, water level changes could make reptiles more accessible to predators such as heron (*Ardea cinerea*) and birds of prey.
    - Changes in water levels could alter the availability and / or suitability of riparian reptile habitat and / or hibernacula.
- Water Voles
    - Changes to water levels or flow could affect emergent macrophyte distribution / extent on the river margins and therefore that could have subsequent effects on the water vole food resources.
    - Falling water levels could make water vole burrows more accessible to terrestrial predators, such as American Mink (*Neogale vision*).
    - Water voles primarily feed on aquatic vegetation such as reeds, sedges, and grasses. Poor water quality can reduce the abundance and condition of these

habitats, leading to a scarcity of food resources for the populations. Nutrient pollution (e.g., excess nitrogen or phosphorus), can lead to oxygen depletion in water bodies and prevent habitat growth.

- WCC
    - The main mechanisms via which the proposed drought order might impact WCC are through a reduction in river flow or habitat cover, which could make them more vulnerable to predation.
    - Crayfish are more vulnerable to predators when there is a lack of cover from rocks and crevices. Through decreases in wetted width and water depth, a shift in water level may affect the amount of cover available, especially on the margins (Holditch, 2003). Other predators, such as larger fish or invasive species like the American signal crayfish (*Pacifastacus leniusculus*), might have easier access to crayfish in these reduced habitats.
    - WCC require high levels of dissolved oxygen and excessive nutrient enrichment is therefore a threat to crayfish (Holditch, 2003) due to increased algae and associated increases in biochemical oxygen demand (BOD). At low flows the dilution potential is significantly reduced comparative to normal conditions, which increases the risk of harming vulnerable species such as WCC. Although sub-lethal pollution may not cause mortality it can still result in lower recruitment or a high incidence of disease (Peay, 2003). Increases in the concentration of suspended solids could clog the respiratory structures of crayfish (Peay, 2003). Increased water temperature could lower oxygen levels, which are critical for crayfish survival. Insufficient oxygen can stress the crayfish, make them more susceptible to disease, and potentially cause mortality.

A3.4.4 Sources of information and methods

The distribution and abundance of protected species in the study area was assessed using information from various sources including:

- Greater Manchester Local Records Centre (GMLRC);
- Lancashire Environment Record Network (LERN);
- The Fifth Otter Survey of England (Crawford, 2010);
- England Otter Survey Database (JNCC, 2023);
- The Breeding and Wintering Bird Atlas of Lancashire (White et al., 2013);
- British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS);
- The Fifth Otter Survey of England (Crawford, 2010);
- England Otter Survey Database (JNCC, 2023);
- The Breeding and Wintering Bird Atlas of Lancashire (White et al., 2013);
- British Trust for Ornithology (BTO) Wetland Bird Survey (WeBS);

- Citations for relevant SSSIs.

These data were screened systematically to identify any additional protected species that had been recorded in the study area within the last 10 years, and which could potentially be affected by the proposed drought order. The assessment therefore focused on the following:

- bats;
- beaver;
- birds (inclusive of waders, wildfowl, riverine and gulls);
- common amphibians;
- GCN;
- otters;
- reptiles;
- water voles; and
- WCC.

Referring to the predicted magnitude and duration of changes in water levels, habitat availability, water quality and prey species described in Appendices A2.1, A2.2 and A2.3, potential impacts on these protected and notable species were assessed qualitatively using professional judgement.

The impact assessment was conducted in line with Guidelines for Ecological Evaluation and Assessment (CIEEM, 2018, updated 2024), outlined in Section 3.1.

A3.4.5 Baseline

Bats

Several hundred bat records were identified by the biological record centres (GMLRC & LERN). Species included common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle, noctule bat, Natterer's bat (*Myotis nattereri*), whiskered/Brandt's bat (*Myotis mystacinus/brandtii*), Daubenton's bat (*Myotis daubentonii*) and brown long-eared bat.

In total 66 records were identified within the vicinity of Belmont Reservoir, although precise locations of records within this area were not provided. The bat records included roosting, foraging, and commuting records. No roosts were identified within any structures associated with the study area water bodies (i.e. culverts or road bridges), within the last 10 years.

Considering the local biological records in the survey area, for the purpose of this assessment, it is assumed that bats currently utilise all water bodies within the study area.

Beaver

No records of beaver were identified within the search area by the biological records centres (GMLRC & LERN). The known distribution of this species does not overlap with the locations associated with the drought order, and as a result, this species is not considered further in this assessment.

Birds

The most recent breeding and wintering bird atlas of Lancashire (White *et al.,* 2013) identifies that the upland catchment that feeds the Belmont Reservoir and downstream rivers supports a breeding wader assemblage which includes golden plover (*Pluvialis apricaria)*, lapwing (*Vanellus vanellus)*, curlew (*Numenius arquata)*, dunlin (*Calidris alpina)*, redshank (*Tringa tetanus)* and snipe (*Gallinago gallinago)* with oystercatcher (*Haematopus ostralegus)* and common sandpiper (*Actitis hypoleucos)* more closely associated with the watercourses. The breeding wader assemblage is an interest feature of the West Pennine Moors SSSI making the populations of national importance. White *et al.* (2013) identifies breeding lapwing, little ringed plover (*Charadrius dubius)* and common sandpiper at Belmont Reservoir. These breeding wader populations are of local importance.

The wintering waterbird assemblage and populations in the wider area can be identified through the long running counts of the Wetland Bird Survey (WeBS). These counts cover Belmont Reservoir and nearby Delph Reservoir and identify a typical waterbird assemblage with major components. This assemblage includes mallard (*Anas platyrhynchos)*, Canada goose (*Branta canadensis)*, teal (*Anas crecca)*, goosander (*Mergus merganser)* and cormorant (*Phalacrocorax carbo)*. Table A3-17 presents the 5 year mean peak waterbird counts for 2018/19 to 2022/23 from the WeBS summary report for all species recorded at the sites. Notably, the average count for black-headed gull (*Chroicocephalus ridibundus*) is high, while there are also relatively large numbers of some wildfowl and wader species.

Table A3-17 presents data relating to Delph and Belmont Reservoirs, which are grouped together in the published summary information as a single site. Summary data is not available for Belmont Reservoir separately. The relevant rivers and smaller flowing watercourses are not covered by the WeBS surveys.

The most recent breeding and wintering bird atlas of Lancashire (White *et al*., 2013) identifies breeding kingfisher (*Alcedo atthis)*, sand martin (*Riparia riparia)*, dipper (*Cinclus cinclus)*, grey wagtail (*Motacilla cinerea)* and pied wagtail (*M. alba)* in the area, all of which can be associated with watercourses. White *et al*. (2013) does not disclose any particular nesting sites or watercourses relevant to this assessment. During the winter, all of these species except sand martin may still be present but are more mobile and tend to move downstream as they avoid potentially freezing conditions.

WeBS data is available for Belmont Reservoir (as part of the combined Delph and Belmont Reservoirs site), and River Croal – Rock Hall to Irwell Confluence) and is displayed in Tables Table A3-17 and Table A3-18.

Table A3-17 Waterbird Species recorded during WeBS counts for Delph and Belmont Reservoirs, 5 year mean and peak counts for 2019/20 to 2023/24

Species	Peak Count	Average Count	Species	Peak Count	Average Count
Canada Goose	83	72	Cormorant	19	14
Greylag Goose	129	82	Moorhen	20	13
Greylag Goose (British/Irish)	98	73	Oystercatcher	18	17
Pink-footed Goose	9	3	Lapwing	295	178
Shelduck	1	1	Curlew	142	112
Shoveler	2	0	Woodcock	5	2
Gadwall	2	0	Jack Snipe	12	3
Wigeon	1	0	Snipe	60	29
Mallard	314	213	Common Sandpiper	1	0
Pintail	1	0	Redshank	1	1
Teal	366	142	Black-headed Gull	24,100	15,371
Pochard	1	0	Mediterranean Gull	59	42
Tufted Duck	4	1	Common Gull	50	21
Goldeneye	2	1	Great Black-backed Gull	41	19
Smew	1	0	Herring Gull	395	151
Goosander	110	97	Yellow-legged Gull	2	1
Great Crested Grebe	2	1	Lesser Black-backed Gull	535	352
Grey Heron	7	4	Kingfisher	1	1

Table A3-18 Waterbird Species recorded during WeBS counts for River Croal - Rock Hall to Irwell confluence, 5 year mean and peak counts for 2018/19 to 2022/23

Species	Peak Count	Average Count	Species	Peak Count	Average Count
Canada Goose	2	1	Moorhen	4	1
Mallard	11	8	Black-headed Gull	23	8
Grey Heron	1	1	Kingfisher	1	0
Cormorant	1	1			

Common Amphibians

Approximately 39 records of common toad were identified by the biological records centres (GMLRC & LERN), from within the last ten years, within the study area. Historical records of other amphibian species were returned in the desk study.

The majority of common toad records were not located within Belmont Reservoir but were identified in smaller water bodies and brooks over 5 km downstream. One record was sufficiently close to be considered as associated with the Belmont Reservoir, although precise locations of records within this area were not provided.

Whilst limited records of common toad were associated with the water bodies of interest, common toads have been included in this assessment as a precautionary approach.

GCN

GCN have been recorded in the downstream extent of the Belmont study area where three records within the last ten years were identified during the data search (GMLRC and LERN). Multiple historical records were also returned.

The GCN records returned were from ponds associated with Bank Top Site of Biological Importance (SBI) located approximately 6.5 km downstream of Belmont Reservoir. All records were from ponds within proximity to Eagley Brook and not associated with the watercourse directly (a suboptimal habitat for this species).

Whilst no records of GCN were returned within the water bodies of interest, GCN have been included in this assessment as a precautionary approach.

Otters

One record of otter was identified within the study area, within the last ten years, by the biological records centres (GMLRC & LERN). Three historic records of otter were returned; however, these were recorded before 2000 and therefore do not represent current population trends.

The record was from the Bradshaw Brook located approximately 7 km south-east of Belmont Reservoir. Bradshaw Brook is not directly hydrologically connected to Belmont Reservoir.

Despite the limited amount of local biological records in the survey area, it is known that otters have increased their range across UK river catchments in recent years and so otters have been included in the assessment as a precautionary approach.

Reptiles

Two records from the last ten years of common reptile species were returned by the biological records centres (GMLRC & LERN), these records were limited to common lizard. No records of the scarcer reptile species (smooth snake and sand lizard) were identified by either of the biological records centres (GMLRC & LERN).

Both records of common lizard were sufficiently close to be considered as associated with Belmont Reservoir, although precise locations of records within this area were not provided.

Whilst limited reptile records were returned in the data search, all common reptile species have been included in the assessment as a precautionary approach.

The known distribution of smooth snake is limited to the English counties of Dorset, Devon, Hampshire, Surrey and West Sussex. The known distribution of sand lizard is limited to small, isolated areas of Dorset, Hampshire, Surrey and Merseyside. Sand lizard have been reintroduced into other areas in the south-east, south-west, Lancashire, and Wales, although these also do not overlap with the drought order location. As a result, neither sand lizard nor smooth snake are considered further in this assessment.

Water voles

One record of water vole in the study area was returned by the biological records centres (GMLRC & LERN) in the last 10 years. Additional historic records of water vole were returned, however, the majority of these were recorded before 2000 and therefore do not represent current population trends.

The record was from Limestone Brook located approximately 2.5 km north-west of Belmont Reservoir, dated 2018. Limestone Brook is hydrologically connected to the River Yarrow and Yarrow Reservoir but is not considered to be hydrologically connected to Belmont Reservoir or any of the study area water bodies downstream.

American mink, considered an INNS, has largely contributed to the rapid decline of native water voles in the UK since the mid-1900s. Three records of American mink were identified within the study area.

Whilst limited water vole records were returned in the data search, they have been included in this assessment as a precautionary approach.

WCC

No records of WCC were identified within the search area by the biological records centres (GMLRC & LERN). Similarly, none of the designated sites named in Appendix A4.4 listed WCC as a reason for designation or mention any current populations within them.

One record of the invasive signal crayfish (*Pacifastacus leniusculus*), dated 2024, was identified within the study area.

Although no sightings have been recorded within the study area, and no designations include WCC as a designation feature, it is possible that WCC may be present. White-clawed crayfish have therefore been included in this assessment as a precautionary approach.

A3.4.6 Impact assessment

Impact assessment – Scenario 1 - Proposed Belmont drought order alone (4.5 Ml/d)

Bats

A change in river flow is not anticipated to have an effect on bat populations should they be using the corridor for commuting and foraging purposes. Similarly, changes in marginal exposure, and wetted area, are not anticipated to have any impact on bat populations. This is because insect prey availability is not anticipated to decrease beyond the tolerance of any bat species, given that the macroinvertebrate community in the study area is of low sensitivity to the environmental change (Section A3.2). As with hydrological changes, a reduction in wetted area, and a change in marginal exposure can cause adverse effects to macroinvertebrate populations however this is not anticipated. A lower water level can decrease the number of insects that bats feed on, leading to food scarcity and possible increased competition for resource; however, a significantly lower water level is not anticipated and thus no impact to bat food resource is expected.

If water quality declines (e.g., due to pollution, chemical increase i.e. nitrates, or low oxygen levels), the population of aquatic insects may decrease, leading to fewer food sources for bats. This would encourage bats to locate areas of greater food supply in other areas in the surrounding environment and could result in a decreased population size in the study areas. This is not anticipated in this case given that the impact magnitude on water quality at Belmont is considered to be Low for most parameters (Medium for ammonia and phosphate in Eagley Brook), and only a minor significance of impact on the macroinvertebrate communities of all water bodies is predicted under all drought order scenarios (Appendix A3.2).

Bats are considered to be of **Medium** sensitivity, and the significance of impact on them will be **Negligible** (categorised as **Minor** in the absence of a Negligible category).

Birds

Wading birds

The breeding waders noted in the baseline are largely associated with moorland habitats and are not greatly impacted by altered flow for their survival or breeding productivity. They will nest and feed on wetlands associated with the river, rather than the river banks themselves, and can therefore be considered to be of low sensitivity. The exception is common sandpiper, oystercatcher and little ringed plover that feed on aquatic invertebrates within watercourses and around the reservoir and may breed where there are suitable areas of gravel. Some nesting and feeding areas may be in hydrological connectivity with the rivers in the study area.

The sensitivity of breeding waders to low flow is considered to be Low and any potential impacts would be of Negligible significance for the reasons outlined above, and the short-term nature of the drought order. Outside of the main breeding season the sensitivity of wading birds is also considered to be Low from any changes in water levels and any potential impacts can also be excluded as being of Negligible significance as these birds migrate typically to coastal habitats, to coastal farmland or, in the case of the majority of common sandpiper, to Africa. The impacts on wetlands in the floodplain, even if there is hydrological connectivity with the river, are likely to be Negligible. Even if such wetlands were in hydrological connectivity with the rivers in the study area, the Belmont drought order is predicted to have a low to medium impact on river water levels (section A2.2) and with naturally higher flows during winter, there is expected to be a negligible impact on any adjacent wetlands. The impact significance is therefore considered to be Low.

Wildfowl and gulls

Breeding wildfowl, such as mute swan (*Cygnus olor*) and mallard, can breed along riverbanks. Such birds could conceivably be affected by low flows if their nest sites become more exposed and vulnerable to predators as water levels fall. The results indicated in Section A2.2 suggest that Eagley Brook is predicted to experience the greatest flow reductions under the proposed drought order as the watercourse closest to Belmont Reservoir. There is a risk of slightly increased marginal exposure under the Belmont drought order scenario, resulting in a slight contraction in wetted area and, consequently, aquatic habitat availability.

The macrophyte and phytobenthos communities of these water bodies are expected to be resilient to changes in habitat area and water depth of the magnitude and duration predicted under the proposed drought order.

As wildfowl are considered to have a Low sensitivity to the potential changes in water level predicted for this drought order and it is not anticipated to cause any significant loss of macrophytes (Appendix 3, section A3.1) the significance of any impact on wildfowl is negligible. In the absence of a negligible category, however, the impact significance has been categorised as Minor.

Foraging habitat of any overwintering geese are likely to be on cropland and improved grassland however it is unlikely that there would be any impacts through implementation of the drought order. As the watercourses are relatively small, they are unlikely to be used by significant numbers of roosting geese, and the WeBS data for the River Croal - Rock Hall to Irwell confluence site has no records of any native geese species. Therefore, no impacts on geese are predicted.

Riverine birds

Piscivorous birds such as kingfisher may benefit from any resulting low flows and reduced wetted perimeter as this results in a concentration of fish into smaller and/ or shallower areas of the channel. If a drought is prolonged, then fish stocks may become depleted resulting in a reduction in food for piscivorous birds. The proposed Belmont drought order is predicted to have only Minor or Moderate negative impacts on most fish species in most water bodies, in comparison with the baseline scenario, both alone and in-combination with a possible Jumbles drought permit (Appendix 3, section A3.3). Therefore, it is unlikely that there will be a significant impact on food availability for piscivorous birds.

Many riverine birds (e.g. dipper, grey wagtail, sand martin) feed on invertebrates, which are likely to remain present in significant numbers. It is therefore unlikely that there would be significant impacts upon these species. As sand martin and kingfisher breed in nest holes above the water level, reduced water levels would not impact on availability of nest sites. The overall impact significance is therefore considered to be negligible but categorised as Minor in the absence of a negligible category.

Sawbills, such as the goosander, which feed on fish (particularly trout), may benefit from any resulting low flows and reduced wetted perimeter as this may result in a concentration of fish into smaller and / or shallower areas or channel. On the upper reaches of Eagley Brook, the proposed drought order is predicted to have a Moderate impact on trout spawning/egg incubation, and on the River Tonge and the River Croal, the Belmont drought order alone is predicted to have a Minor impact on all fish populations (Appendix 3, section A3.3). As sawbills are considered to have a Low sensitivity to the potential changes in water level predicted for this drought order, and can feed on a variety of fish species, then it is likely that there will a negligible impact on food availability for these birds. In the absence of a negligible category, however, the impact significance has been categorised as Minor.

Common Amphibians

Common toads prefer to breed in deeper bodies of water such as ponds and reservoirs, and tend to migrate back to the same body of water each spring to breed. Similarly, smooth and palmate newts prefer static bodies of water during their breeding season. Changes in water level or flow are not anticipated to effect common amphibian populations directly due to the unlikely habitation of rivers. Hydrogeological changes, such as groundwater level reductions are not predicted as a result of the drought order, and as a result subsequent effects are unlikely to noticeably impact suitable breeding pond habitats to the point where populations are at risk.

There is a risk of slightly increased marginal exposure under the Belmont drought order scenario. However, the effects on common amphibians are anticipated to be minor to negligible, with impacts decreasing further downstream from the reservoir.

Predicted changes in water quality are Low or Medium and any associated impacts on macroinvertebrates are unlikely to be noticeable/measurable.

Common amphibians are considered to be of **Low** sensitivity, but the magnitude of effect of the proposed drought order on them will be **Negligible**, and so the proposed drought order will have no more than a **Minor** significance impact on common amphibians.

Great crested newts

As with common amphibians, GCN prefer to breed in deeper bodies of water, and are not typically found in moving water bodies.

The water level changes predicted under the proposed drought order are unlikely to cause significant impacts on GCN. It is unlikely that the water levels and wetted width of the watercourses would reduce to a degree that would have an effect on GCN distribution.

Given that no ponds have been identified in hydraulic connectivity with rivers in the study area at low flows, the predicted changes to water quality and water levels are unlikely to significantly influence suitable breeding pond habitat to a point where populations of GCN are threatened.

Based on the biological records in the area, limited tolerance to change, and the influence of water quality and water levels on potential breeding locations, GCN are considered to be of **Medium** sensitivity, but the magnitude of effect of the proposed drought order on them will be **Negligible**, and so the proposed drought order will have no more than a **Minor** significance impact on GCN.

Otters

Otters prey predominantly on fish, with amphibians (mainly frogs) and crayfish also taken. However, there is no evidence of fish species selection with otters usually taking fish species in approximate proportion to their abundance (Chanin, 2003). Otters may take eels, very large fish, or very small fish (often in large numbers), although small fish (less than 30 mm in length) are seldom consumed (Chanin, 2003). In the short term, otters may benefit from lower flows associated with the drought order, as well as any reduction in depth and wetted width, as this may result in a concentration of fish into smaller and / or shallower areas or channel. Referring to the assessment of impacts on fish (Section A3.3), it is unlikely that there will be a significant impact on food availability for otters in any of the water bodies in the study area should they be present.

Any changes in water quality associated with the drought order are unlikely to cause direct harm to otters due to their ability to withstand environmental pressures and ability to disperse. The water quality assessment concluded that all proposed drought order scenarios were considered to be unlikely to cause major impacts on any receptors under consideration. Modelled changes in water quality were predicted to be low or medium magnitude, temporary, and within the threshold of recoverability with regard to fish, therefore unlikely to have a subsequent effect on food resource for otters.

Otters are considered to be of Medium sensitivity, but the effect of the proposed drought order on them will be of **Negligible** significance (categorised as **Minor** in the absence of a Negligible category).

Reptiles

Common reptiles have been considered in this impact assessment on a precautionary basis only, with grass snake most likely to utilise the watercourses for foraging and commuting purposes. Slow worm, common lizard, and adder are also considered in the impact assessment, however, are not anticipated to utilise the study area as frequently as grass snake. A change in river flow is not anticipated to effect reptile populations directly and the small changes predicted for habitat and water quality are considered unlikely to negatively affect reptiles.

The reduction in water levels under the proposed Belmont drought order, and its downstream water bodies, is unlikely to be of significance to reptiles if they are present due to their primary terrestrial presence and hydrological presence on an opportunistic basis only.

Reptiles are considered to be of **Low** sensitivity, but the impact of the proposed drought order on them will be of **Negligible** significance (categorised as **Minor** in the absence of a Negligible category).

Water voles

For the purpose of this assessment, a precautionary approach has been adopted, which assumes that water voles are currently present on all water bodies within the study area. The main risk to water voles is when water levels rise, flooding their burrows and displacing the animals (Strachan, 1998). Considering the magnitude of impact of the drought order on flow in conjunction with water vole sensitivity to flow rates, it is unlikely that they will be significantly affected by the drought order. Water voles tend to favour water bodies of still to moderate flow rate and would be more at risk if flow rate was increased significantly (Strachan, 1998).

There is no clear mechanism by which a reduction in wetted width, depth etc., which retains a significant portion of the linear habitat, could adversely affect water vole. Conceivably, if a drought order were in place for a prolonged period, water voles could begin to establish burrows at lower levels on the bank in response to lower water levels. If this were to occur it could leave them more vulnerable to flooding when higher water levels do return. However, the predicted changes in water level that could cause these adverse effects are anticipated to be low to negligible, with impacts decreasing further downstream.

The changes to water quality predicted to occur under the proposed drought order are unlikely to have a significant impact on water vole. The small scale of effect and short-term duration of the proposed drought order is predicted to result in a negligible magnitude of effect on macrophyte communities. As a result, food resource for water vole is not anticipated to decrease as a consequence of the drought order.

Water voles are considered to be of **High** sensitivity, but the impact of the proposed drought order on them will be of **Negligible** significance (categorised as **Minor** in the absence of a Negligible category).

White-clawed crayfish

WCC populations are considered to be rapidly declining and globally endangered (Peay, 2003), making them a highly sensitive receptor. As noted above, white-clawed crayfish have been considered in this impact assessment on a precautionary basis only. Low river flows or lack of cover make crayfish more susceptible to predation. A reduction in flow could have an impact on the availability of cover, particularly in the margins (Holditch, 2003), through reductions in wetted width and water depth.

Other macroinvertebrates form a proportion of WCC diet, being a primarily carnivorous species. A reduction in food resources as a result of changes in habitat and water quality could occur. However, a minor significance of impact on the macroinvertebrate communities of all water bodies is predicted under all drought order scenarios (Appendix A3.2). As a result, insect prey availability will likely not be reduced and food resource for WCC will not be greatly impacted.

Slower-moving water can have negative influences on water quality which would in turn have a detrimental effect on crayfish populations. Implementation of any of the proposed Belmont drought order, however, is not anticipated to result in any significant change in water quality (Appendix A2.3) beyond the tolerance of this species.

Due to the current state of UK population levels and rapid decline due to various stressors, the sensitivity of WCC is considered to be **High,** but the impact of the proposed drought order on them will be of **Negligible** significance (categorised as **Minor** in the absence of a Negligible category).

Impact assessment – Scenario 2 - Proposed Belmont drought order (4.5 Ml/d) in combination with a Jumbles drought permit (12 Ml/d)

Implementation of the proposed Belmont drought order (9 Ml/d to 4.5 Ml/d) in-combination with a Jumbles drought permit (19 Ml/d to 12 Ml/d) is considered to have no overall additional impact over and above that of the proposed Belmont drought order alone. Therefore, the impacts predicted in the Belmont-only assessment above also hold true for the in-combination assessment for all receptors within all water bodies.

A3.4.7 Summary

Considering predicted changes in river flow, habitat and water quality, as well as associated effects on other ecological receptors such as macroinvertebrates and macrophytes, the sensitivities, magnitude of impact, and significance of impact are anticipated for protected species under the proposed Belmont drought order, both alone and in combination with a Jumbles drought permit, are presented in Table A3-19.

Table A3-19 Summary of predicted impacts on protected and notable species for the proposed Belmont drought order alone and in-combination with a Jumbles drought permit

Species	Scenario	Water body and season	Sensitivity	Magnitude of impact	Significance of impact	Confidence level
Bats	All	All water bodies, all year	Medium	Negligible	Minor*	Medium
Beavers	All	All water bodies, all year	N/A	N/A	N/A	N/A
Wading birds	All	All water bodies (breeding and non-breeding seasons)	Low	Negligible	Minor*	Medium
Waterfowl and gulls	All	All water bodies (breeding and non-breeding seasons)	Low	Negligible	Minor*	Medium

Species	Scenario	Water body and season	Sensitivity	Magnitude of impact	Significance of impact	Confidence level
Riverine birds	All	All water bodies (breeding and non-breeding seasons)	Low	Negligible	Minor*	Medium
Common amphibians	All	All water bodies, all year	Low	Negligible	Minor*	Medium
Great crested newts	All	All water bodies, all year	Medium	Negligible	Minor*	Medium
Otters	All	All water bodies, all year	Medium	Negligible	Minor*	Medium
Reptiles	All	All water bodies, all year	Low	Negligible	Minor*	Medium
Water voles	All	All water bodies, all year	High	Negligible	Minor*	Medium
White-clawed Crayfish	All	All water bodies, all year	High	Negligible	Minor*	Low

* Impact predicted to be negligible but categorised as **Minor** in the absence of a negligible category.

Uncertainties

It should be acknowledged that data supplied by local biological record centres are not always accurate and exact locations are often not precise, so cannot be determined with full confidence. However, any records detailed as 10 figure national grid references (NGR) should theoretically be accurate to 1 m, 8 figure NGR accurate to 10 m, 6 figure NGR accurate to 100 m, and so forth.

The assessment has been based on the sensitivity of each species in relation to the various pathways and professional judgement. Thus, a **Medium** level of confidence is considered appropriate based on current available data for bats, common amphibians, GCN, reptiles, otters, and water voles. A **Low** level of confidence is considered appropriate based on current available data for WCC due to the high sensitivity of the species to a variety of environmental stressors and the lack of recent data on current population levels.

Further sources of information would help to improve confidence in the assessment of wading birds, wildfowl and gulls and riverine birds during the breeding season, i.e. spring through autumn. Therefore, in the absence of these data, **Medium** confidence has been assigned to the assessment of impacts on these receptors during the breeding season and **High** outside of breeding season.

A3.4.8 References

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A3.5 Invasive Non-Native Species

A3.5.1 Background

Invasive Non-Native Species (INNS) are organisms introduced by human activities to a new environment where they are not native, causing environmental, social and economic harm. They are one of the leading threats to biodiversity and the sustainability of functional ecosystems. The impacts of INNS are well documented and include predation pressures, resource competition, transmission of disease, habitat engineering, hybridisation with native species, and impacts to human health and safety. These negative impacts, both independently or in combination, can endanger populations of native species, reduce biological diversity, and wider ecosystem function. INNS impacts are fundamentally of most concern at the ecological level; however, they also negatively affect the value that can be obtained from ecosystem services, either by reducing yield or increasing the cost and difficulty of linked operations. A recently study estimated that INNS cost the UK economy over £4 billion per year (Eschen *et al*., 2023).

Although INNS are often introduced to broadly suitable environments, they do not always establish into a viable population and / or go on to become invasive (i.e. to negatively impact the environment, economy or human health and welfare). Unsuccessful establishment can be due to several factors, including the environment being naturally resilient to change, the presence of a native predator, or other stochastic factors which influence invasion success. Even though these barriers to establishment exist, INNS are, by definition, highly adaptable, generalist species that can occupy different trophic levels or are more resilient to selective pressures. Invasion success is, however, considered to be a function of the frequency of introduction events and the number of viable life stages introduced with each event – the greater these numbers are, the greater the 'propagule pressure' that is placed on a habitat and thus the more likelihood that successful establishment will occur.

The routes, mechanisms, and vectors by which INNS are introduced are generalised under the term pathways. There are many potential pathways; however, examples include recreational activities such as watersports, facilitating the accidental transfer of INNS on equipment or clothing, movement of organisms for aquaculture or horticulture, or water operations such as raw water transfers (RWTs).

Scope of chapter

The latest drought planning guidance (EA, 2025) recommends that environmental assessment explicitly addresses the potential impacts of drought orders/permits on the risk of spreading INNS.

This chapter provides a comprehensive desk-based assessment to examine how INNS receptors could respond to the pathway impacts of the proposed drought order, through the exploration of two elements of INNS risk:

- How any changes to the pathways of impact may influence the abundance, population health and/or capacity for spread (cumulatively referred to as fitness, hereafter) of INNS present within the study area.
- The potential impacts that changes to INNS fitness resulting from the implementation of the drought order may place on other sensitive receptors within the study area – primarily based on the WFD UK Technical Advisory Group (UK TAG) summary impact scores.

Included within this chapter is the assessment of how INNS receptors could respond to the pathway impacts of the proposed Belmont (4.5Ml/d) drought order, and in-combination with the proposed Jumbles drought permit (12Ml/d).

A3.5.2 Pathways to impact

Modifications or disruptions to a habitat or environment following the implementation of a drought order can increase its vulnerability to invasion and impact from INNS. These changes, and the biological responses they elicit, may be either detrimental or beneficial to INNS. For example, an increase in wetted bankside areas can support the range expansion of riparian INNS, while a reduction in wetted area may increase the relative density of established aquatic populations.

Changes in water quality parameters, such as temperature, nutrient levels, or oxygen content, may also create conditions that favour INNS over native species. For instance, warmer water temperatures may give INNS a competitive advantage over native species that are less tolerant of such conditions.

INNS impact assessments are primarily informed by professional judgement, supported by relevant literature and data where available. In the absence of species-specific data, assessments are cross-referenced with related taxa where possible, and associated uncertainties are adjusted accordingly.

A3.5.3 Sources of information and methods

Species focused assessment

The primary objective of this chapter is a species-focused assessment undertaken to determine the potential effects of the proposed Belmont drought order on the INNS that are currently recorded within the Belmont Reservoir Study Area, and in the Eagley Brook, River Tonge, River Croal, and River Irwell water bodies downstream.

As other (horizon) INNS may be introduced to the relevant water bodies at any point in the future (temporally and geographically), the species currently recorded as present can be considered as indicative of how other, taxonomically similar, INNS may also respond.

Sensitivity of INNS to pathways of impact

INNS (as receptors) are categorised as **Not Sensitive** where they are not expected to respond to a particular impact. Where a response is anticipated, INNS are categorised as **Low**, **Medium** or **High** Sensitivity, depending on the scale of sensitivity.

Importantly, sensitivity categorisation for INNS does not inherently consider the direction of change to INNS fitness, i.e., whether the biological response is beneficial or detrimental. For example, an INNS assessed as having High Sensitivity to changes in flow rates may respond positively or negatively, but the direction of that response is not considered when determining sensitivity. The direction of change to INNS fitness is considered at the next step.

Significance of impact on INNS fitness

INNS sensitivities are cross referenced with the predicted magnitude of each pathway impact to determine the significance of impact on the species (as described in Section 3.1)[14]. However, significance of impact is typically used to represent a categorical scale for negative effects on protected species or ecologically important receptors, with benefits often considered as a single, less differentiated category. For INNS, we adopt a modified approach to ensure that both the negative and beneficial impacts on INNS fitness are assessed with equal resolution. This approach allows for a more comprehensive assessment of how implementation of a drought order/permit may affect INNS in either direction:

1) Significance of impact on INNS fitness is **[Major/Moderate/Minor] Negative.**
    a. INNS fitness is expected to decrease from the current baseline.
    b. Recognised as a <u>positive outcome for the wider environment and associated socio-economics</u>.
2) Significance of impact on INNS fitness is **[Major/Moderate/Minor] Beneficial.**
    a. INNS fitness is expected to increase above current baseline.
    b. Recognised as a <u>negative outcome for the wider environment and associated socio-economics.</u>
3) Significance of impact on INNS fitness is **Minor Neutral.**
    a. INNS fitness is not expected to change from the current baseline.
    b. Recognised as a <u>neutral outcome for the wider environment and associated socio-economics.</u>
4) Significance of impact on INNS fitness is **[Major/Moderate/Minor] variable.**
    a. INNS fitness may increase or decrease from the current baseline.
    b. This is only used for INNS Groups (see Section A3.5.4) where multiple INNS may respond in different ways to a pathway of impact.
    c. Recognised as <u>either a positive or negative outcome from the wider environment and associated socio-economics.</u>

14 Note that these are impacts to INNS as receptors. The inherent impacts to the environment caused by each species are summarised by the UK TAG impact classifications (see Table A3-22).

The significance of impact results for each INNS assessed are then synthesised into a single species outcome summary. This aggregates the pathway impacts assessed for each species, providing a conclusion on how the impact pathways identified for the drought order will cumulatively affect that species' fitness. Species outcome is calculated by (net) averaging the significance of impact categories for that species using the values provided in Table A3-20. Species outcome categories are then assigned according to the ranges shown in Table A3-20.

Table A3-20 Species significance of impact outcome calculation schematic[15]

Significance of Impact	Score	Species Outcome	Net average score
Major, negative	+3	Major, negative	2.01 to 3.00
Moderate, negative	+2	Moderate, negative	1.01 to 2.00
Minor, negative	+1	Minor, negative	0.01 to 1.00
Not Sensitive / Minor, neutral	0	Neutral net impact	0.00
Minor, beneficial	-1	Minor, beneficial	-0.01 to -1.00
Moderate, beneficial	-2	Moderate, beneficial	-1.01 to -2.00
Major, beneficial	-3	Major, beneficial	-2.01 to -3.00

For example, if an INNS has the following significance of impact values: Minor beneficial (-1), Moderate negative (+2), and Not Sensitive (0), the net score will be +1. This is divided by the number of significance of impact values (n=3) to give an average of 0.33. This is within the Minor negative species outcome range. This indicates that the INNS assessed will experience a net reduction to fitness, and represents a positive outcome for the wider environment and associated socio-economics.

Species outcome categories can be adjusted if deemed necessary, particularly if an individual impact score is considered to be too high/low when other extraneous factors are present. Where appropriate, adjustments to species outcomes are based on expert opinion and a justification provided.

Water body and study area summary

A final INNS (assemblage) outcome category is also provided for the water body or study area. This is intended to highlight water bodies that have an INNS species assemblage that is likely to experience, on-average, a benefit to fitness. This is calculated as the modal average of all species outcomes for the water body. This indicator is only intended to provide a summary reference, drawing attention to water bodies where INNS may be significantly affected by the drought order. However, it is important that decision-making should always be considered in the context of individual species outcomes, particularly those assessed as a moderate or major benefit.

15 Decimal place (e.g 1.01) is intended to indicate that range should be understood as, the range which includes greater than 1 up to 2.

Sources of INNS baseline data and methods

An INNS data assessment was completed upon the water bodies outlined in Table A3-21. This includes the buffer areas within which INNS presence was assessed – also see Figure A3-4. Buffer areas are used to account for uncertainties with records' coordinates and to capture the presence of riparian species.

Table A3-21 Water bodies assessed for INNS presence as part of this EAR

Area	Water Body Name	Water Body ID	Buffer Area (for INNS Presence)
Reservoir Source	Belmont Reservoir	N/A	1km
	Fourteen unnamed tributaries of Belmont Reservoir	N/A	250m
Downstream INNS Study Area	Eagley Brook	GB112069064570	250m
	Tonge	GB112069064530	250m
	Croal (excluding Blackshaw Brook)	GB112069064550	250m
	Irwell (to NGR: SD7543605621)	GB112069061451	250m

Belmont Reservoir Study Area and Eagley Brook

The following data sources were used to collate INNS records:

- NBN Atlas website (http://www.nbnatlas.org; [Accessed 30/05/2025]) using open access licensed data only (CC-BY, CC0, OGL[16]). Aquatic, riparian, and terrestrial INNS records were downloaded, unconfirmed and fossil records were excluded. A full list of species included in these lists is provided in Section A3.5.8. Dataset references can be found in Section A3.5.7.
- The Environment Agency's Ecology & Fish Data Explorer (https://environment.data.gov.uk/ecology/explorer/; [accessed 30/05/2025]) using freshwater fish, river invertebrates, and river macrophyte data from between 2000 and 2024.
- The Lancashire Environmental Records Network (LERN) [requested 30/05/2025]. Information provided by Lancashire Environment Record Network has been collated from many sources. LERN is grateful for the assistance given by the organizations and individual naturalists who live and work in, and visit Lancashire.
- The Greater Manchester Local Record Centre (GMLRC) [requested 30/05/2025].

16 Contains public sector information licensed under the Open Government Licence (OGL) v3.0, Public Domain Dedication (CC0) v1.0, Creative commons with attribution v4.0 (CC-BY).

River Tongue, Croal, and Irwell[17]

The following data sources were used to collate INNS records:

- NBN Atlas website (http://www.nbnatlas.org; [Accessed 15/07/2024]) using open access licensed data only (CC-BY, CC0, OGL[16]). Data were downloaded from lists attaining to Wildlife and Countryside Act (1981) Schedule 9 Species[18], Species of Union Concern[19], and WFD UKTAG Species[20], and included confirmed records only. A full list of species included in these lists is provided in Section A3.5.8. Dataset references can be found in Section A3.5.7.
- The Environment Agency's Ecology & Fish Data Explorer (https://environment.data.gov.uk/ecology/explorer/; [accessed 15/07/2024]) using freshwater fish, river invertebrates, and river macrophyte data from between 2000 and 2024.
- Note that an enquiry was made to the Greater Manchester Local Record Centre (GMLRC) for records, however at this time they did not offer an invasive species search.

Whilst APEM has endeavoured to provide accurate and reliable information, we are reliant on the accuracy of the records submitted by third parties (i.e. record centres, wildlife trusts etc.). APEM will quality assure the records where possible but cannot be held responsible for records later shown to be inaccurate.

INNS records have been analysed as provided upon download from the data provider (NBN Atlas, EA, and LRCs). There is likely to be some inherent inaccuracies in the spatial data provided which, whilst being partially accounted for in the water body buffers, may lead to the inclusion of species that are not present or the exclusion of those that are. Furthermore, the inclusion of a specific species within this assessment is reflective of records or observations at a particular point in time, i.e. the time of assessment. INNS assemblage may change over time, either in response to management and control efforts, or natural change to extant populations. Further, absence of records should not be seen as definitive proof of the absence of INNS within a specific area.

Water bodies were used as defined by the EA's catchment data explorer[21] (whilst excluding non-impacted tributaries) and clipped to the appropriate extents. Where water bodies were not present on catchment data explorer, these were mapped to an appropriate extent using

17 Note that the data collection dates differ because data for these water bodies was collected when undertaking the Delph and Jumbles EAR shelf updates.
18 Wildlife and Countryside Act 1981 – Schedule 9 (GB). (2018). See: Wildlife and Countryside Act 1981 - Schedule 9 (GB) | NBN Atlas
19 Invasive Alien Species of Union Concern (2019). See: Invasive Alien Species of Union Concern | NBN Atlas
20 WFD UKTAG aquatic alien species impact (2018). See: WFD UKTAG aquatic alien species impact | NBN Atlas
21 Environment Agency Catchment Data Explorer. Available from: England | Catchment Data Explorer

Open Street Map[22]. INNS records from NBN, LRC's and the EA were mapped and merged together using QGIS, and clipped to the appropriate buffer extent. Results were downloaded and interrogated using Microsoft Excel.

22 Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.

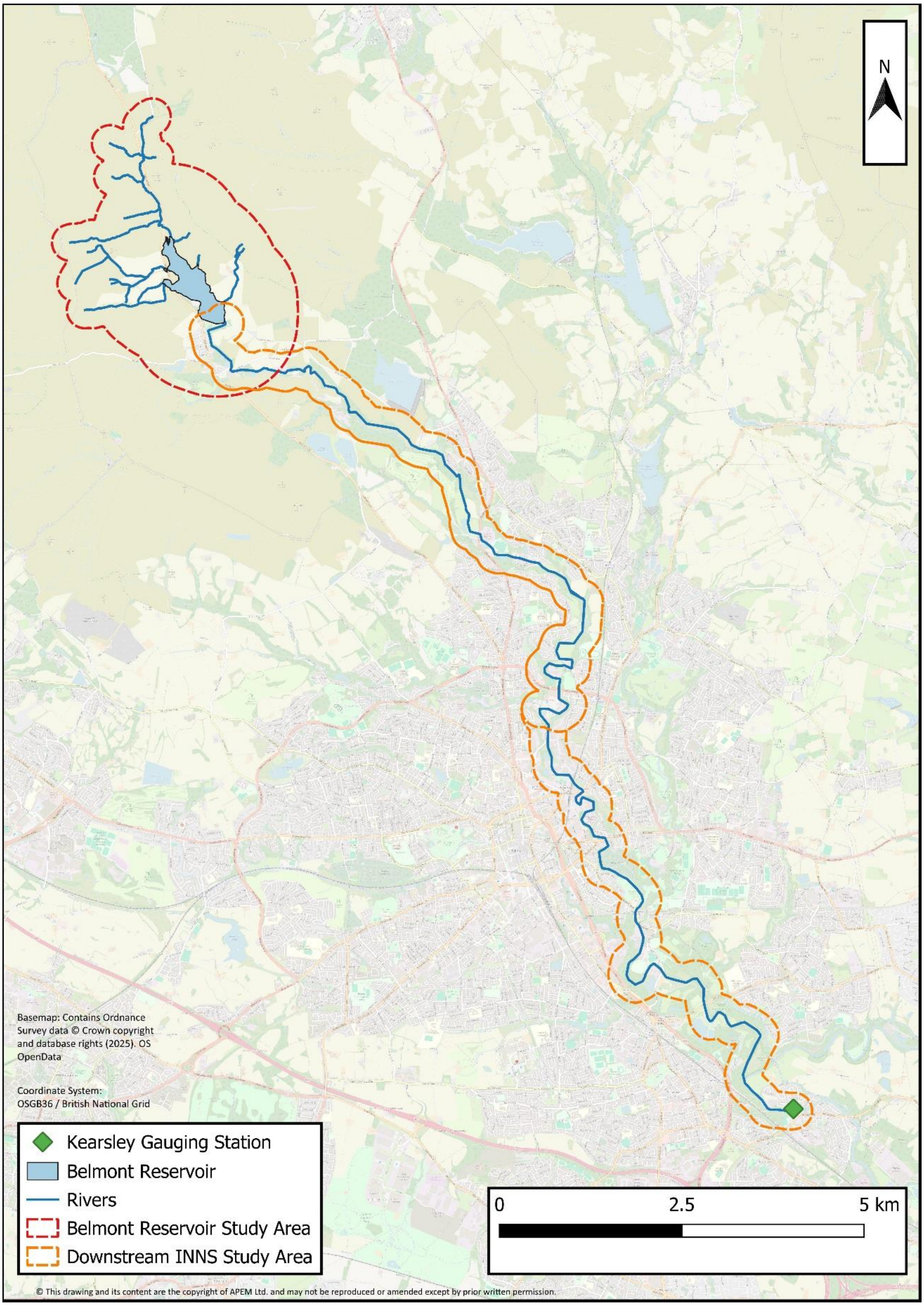

Figure A3-4 INNS assessment area. Basemap contains Ordnance Survey data © Crown copyright and database rights (2025). OS OpenData.

A3.5.4 Baseline

Improved INNS fitness, as a result of the pathways of impact, may have direct negative effects on other environmental receptors, such as increased competitive pressures towards native species. Where pathway impacts are assessed to be of benefit to INNS fitness, it is important to consider any cascading effects to other receptors. The WFD UK Technical Advisory Group (UKTAG) classifications provide a general overview of INNS impacts which are used as the basis for determining impact to other vulnerable receptors. UKTAG INNS impacts are defined as:

- **High Impact**: known to be invasive, having caused documented harm in habitats where they have become established. Example species: American signal crayfish (*Pacifastacus leniusculus).*
- **Low Impact**: known, based on stringent criteria, to have a low probability of becoming invasive, and where field observations have shown no adverse impacts over many years of establishment. Example species: Water hyacinth (*Eichhornia crassipes*).
- **Unknown Impact**: probability of becoming invasive is unknown, and for which a full species risk assessment is required[23].
- Species which clearly fall between the low and the high impact categories are assigned to the **Moderate Impact** category. Example species: Canadian pondweed (*Elodea canadensis*).

The WFD UK TAG impact categories are used to prioritise INNS for species specific assessment, and to summarise the invasive characteristics and environmental implications for each INNS present in a water body / study area.

The INNS recorded within the study area are summarised in Table A3-22. This table presents the species, its presence within the relevant water bodies, and its relevant designation (including WCA Schedule 9 listed, WFD UKTAG category, Union Concern listed). Table A3-22 also includes a species category as follows:

- Priority INNS – species within the study area that is categorised as WFD UKTAG High or Moderate Impact[24];
- Aquatic Plant – species is an aquatic plant **not** classified as WFD UKTAG High or Moderate Impact;
- Aquatic Animal – species is an aquatic animal **not** classified as WFD UKTAG High or Moderate Impact;
- Riparian Plant – species is a riparian plant **not** classified as WFD UKTAG High or Moderate Impact;
- Terrestrial Plant – species is a terrestrial plant **not** classified as WFD UKTAG High or Moderate Impact.

[23] Outside of the scope of this EAR – future UKTAG species risk assessments are being produced at a National level.
[24] WFD UK TAG, 2021. Classification of aquatic alien species according to their level of impact – working paper version 8.

- Terrestrial Animal: species is a terrestrial animal (including waterfowl) **not** classified as WFD UKTAG High or Moderate Impact – note that for this drought order terrestrial animal INNS are assumed to not be sensitive to the identified pathways of impact for all water bodies. Fitness is expected to remain unchanged from the current baseline and, therefore, terrestrial animal INNS have been scoped out of further assessment.

Terrestrial / riparian plant categories are as determined by Booy, Wade and Roy (2015)[25] or if not listed, by NBN Atlas designation. If present at a water body, Priority Species are assessed as individual receptors. Non-Priority Species are aggregated by classification (as outlined above) and assessed as a group.

[25] Booy, O., Wade, M. and Roy, H., 2015. *Field guide to invasive plants and animals in Britain*. Bloomsbury Publishing.

Table A3-22 INNS recorded within the study area. Presence within water body indicated by year of most recent record. Includes Environment Agency, LERN, and NBN Atlas Open Source Data. Note that seven terrestrial animal species were recorded in the study area but these are not assessed further so are not presented in this table.

Species	Category	Water body					Species Designation
		Reservoir source	Downstream INNS Study Area				
		Belmont Reservoir & Tribs	Eagley Brook	Tonge	Croal	Irwelll	
American skunk-cabbage (*Lysichiton americanus*)	Priority INNS	X (2018)	X (2018)				WFD UKTAG High Impact; Invasive Alien Species of Union Concern.
Balm-of-Gilead (*Populus balsamifera x deltoides = P. x jackii*)	Riparian Plant	X (2018)					None
Bluebell (*Hyacinthoides non-scripta x hispanica = H. x massartiana*)	Terrestrial Plant	X (2019)	X (2019)				None
Box-leaved honeysuckle (*Lonicera pileata*)	Terrestrial Plant	X (2015)	X (2015)				None
Bramble (*Rubus armeniacus*)	Terrestrial Plant	X (2020)	X (2019)				None
Broad-leaved bamboo (*Sasa palmata*)	Terrestrial Plant	X (2015)	X (2015)				None
Bullate cotoneaster (*Cotoneaster rehderi*)	Terrestrial Plant	X (2004)					None
Butterfly-bush (*Buddleja davidii*)	Terrestrial Plant	X (2020)	X (2015)				None
Canadian goldenrod (*Solidago canadensis*)	Riparian Plant	X (1994)	X (1994)				None
Cherry laurel (*Prunus laurocerasus*)	Terrestrial Plant		X (2016)				None
Chinese bramble (*Rubus tricolor*)	Terrestrial Plant	X (2015)	X (2015)				None
Common carp (*Cyprinus carpio*)	Priority INNS		X (1999)		X (2000)		WFD UKTAG **High Impact**.
Confused bridewort (*Spiraea salicifolia x douglasii = S. x pseudosalicifolia*)	Riparian Plant	X (2004)	X (1999)				None

Species	Category	Water body					Species Designation
		Reservoir source	Downstream INNS Study Area				
		Belmont Reservoir & Tribs	Eagley Brook	Tonge	Croal	Irwelll	
Confused Michaelmas-daisy (*Aster novi-belgii*)	Terrestrial Plant	X (2006)	X (2006)				None
Corsican pine (*Pinus nigra*)	Terrestrial Plant	X (2020)	X (2015)				None
Curly waterweed (*Lagarosiphon major*)	Priority INNS		X (2012)				WFD UKTAG **High Impact**; Invasive Alien Species of Union Concern; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Daffodil (*Narcissus agg.*)	Terrestrial Plant	X (2021)					None
Early goldenrod (*Solidago gigantea*)	Riparian Plant	X (2004)	X (2004)				None
Fox-and-cubs (*Pilosella aurantiaca*)	Terrestrial Plant	X (2015)					None
Freshwater amphipod (*Crangonyx pseudogracilis / floridanus*)	Aquatic Animal	X (2019)	X (2024)	X (2023)	X (2014)		WFD UKTAG **Low Impact.**
Freshwater mollusc (*Physa / Physella Acuta*)	Aquatic Animal	X (2012)	X (2023)	X (2019)			WFD UKTAG **Unknown Impact.**
Garden Lady's-mantle (*Alchemilla mollis*)	Riparian Plant	X (2020)	X (2019)				None
Giant hogweed (*Heracleum mantegazzianum*)	Priority INNS	X (2015)	X (2024)	X (2021)	X (2022)	X (2022)	WFD UKTAG **High Impact**; Invasive Alien Species of Union Concern; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Grey alder (*Alnus incana*)	Riparian Plant	X (2011)	X (2005)				None
Ground elder (*Aegopodium podagraria*)	Terrestrial Plant	X (2018)	X (2019)				None

Species	Category	Water body					Species Designation
		Reservoir source	Downstream INNS Study Area				
		Belmont Reservoir & Tribs	Eagley Brook	Tonge	Croal	Irwelll	
Gunnera sp.	Priority INNS		X (2015)				WFD UKTAG **High Impact**, G. tinctoria is listed under Wildlife and Countryside Act (1981) Schedule 9 and Invasive Alien Species of Union Concern.
Himalayan balsam (*Impatiens glandulifera*)	Priority INNS	X (2019)	X (2024)	X (2022)	X (2019)	X (2017)	WFD UKTAG **High Impact**; Invasive Alien Species of Union Concern; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Himalayan cotoneaster (*Cotoneaster simonsii*)	Terrestrial Plant	X (2005)	X (2005)				Wildlife and Countryside Act (1981) Schedule 9 Listed.
Hjelmqvist's cotoneaster (*Cotoneaster hjelmqvistii*)	Terrestrial Plant	X (2004)					None
Honesty (*Lunaria annua*)	Terrestrial Plant		X (2021)				None
Horse-chestnut (*Aesculus hippocastanum*)	Terrestrial Plant	X (2015)	X (2007)				None
Japanese knotweed (*Fallopia japonica*)	Priority INNS	X (2015)	X (2024)	X (2022)	X (2022)	X (2017)	WFD UKTAG **High Impact**; Invasive Alien Species of Union Concern; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Japanese rose (*Rosa rugosa*)	Terrestrial Plant	X (2015)	X (2015)				Wildlife and Countryside Act (1981) Schedule 9 Listed.
Jenkins' spire snail (*Potamopyrgus antipodarum*)	Priority INNS	X (2019)	X (2024)	X (2024)	X (2014)		WFD UKTAG **Moderate Impact.**
Large bindweed (*Calystegia silvatica*)	Terrestrial Plant		X (2011)				None

Species	Category	Water body					Species Designation
		Reservoir source	Downstream INNS Study Area				
		Belmont Reservoir & Tribs	Eagley Brook	Tonge	Croal	Irwelll	
Lawson's cypress (*Chamaecyparis lawsoniana*)	Terrestrial Plant	X (2015)	X (2012)				None
Lodgepole pine (*Pinus contorta*)	Terrestrial Plant	X (2020)	X (2015)				None
Monkeyflower (*Mimulus guttatus*)	Priority INNS		X (1994)				WFD UKTAG **Moderate Impact.**
Musk (*Mimulus moschatus*)	Riparian Plant		X (1983)				None
Montbretia (*Crocosmia pottsii x aurea = C. x crocosmiiflora*)	Riparian Plant	X (2020)	X (2019)				WFD UKTAG **Low Impact**; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Pink purslane (*Claytonia sibirica*)	Riparian Plant	X (2007)	X (2021)				WFD UKTAG **Low Impact.**
Rhododendron (*Rhododendron ponticum*)	Priority INNS	X (2025)	X (2020)	X (2016)	X (2014)		WFD UKTAG **High Impact**; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Russian comfrey (*Symphytum officinale x asperum = S. x uplandicum*)	Riparian Plant	X (2015)	X (2015)				None
Salmonberry (*Rubus spectabilis*)	Terrestrial Plant	X (2004)					None
Signal crayfish (*Pacifastacus leniusculus*)	Priority INNS		X (2024)*	X (2018)	X (2018)		WFD UKTAG **High Impact**; Invasive Alien Species of Union Concern; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Sitka spruce (*Picea sitchensis*)	Terrestrial Plant	X (2020)	X (2015)				None
Snowberry (*Symphoricarpos albus*)	Terrestrial Plant	X (2019)	X (2019)				None
Spanish bluebell (*Hyacinthoides hispanica*)	Terrestrial Plant	X (2018)	X (1995)				None
Spotted-laurel (*Aucuba japonica*)	Terrestrial Plant	X (2015)	X (2015)				None
Sweet cicely (*Myrrhis odorata*)	Riparian Plant	X (2019)	X (2004)				None

Species	Category	Water body					Species Designation
		Reservoir source	Downstream INNS Study Area				
		Belmont Reservoir & Tribs	Eagley Brook	Tonge	Croal	Irwelll	
Sycamore (*Acer pseudoplatanus*)	Terrestrial Plant	X (2019)	X (2019)				None
Thunberg's barberry (*Berberis thunbergii*)	Terrestrial Plant	X (2019)	X (2019)				None
Trailing bellflower (*Campanula poscharskyana*)	Terrestrial Plant	X (2015)	X (2015)				None
Turkey oak (*Quercus cerris*)	Terrestrial Plant	X (1996)					None
Turnip (*Brassica rapa*)	Terrestrial Plant	X (2020)					None
Water fern (*Azolla filiculoides*)	Priority INNS				X (2022)		WFD UKTAG **High Impact**; Wildlife and Countryside Act (1981) Schedule 9 Listed.
Wall cotoneaster (*Cotoneaster horizontalis agg.*)	Terrestrial Plant	X (2015)	X (2015)				Wildlife and Countryside Act (1981) Schedule 9 Listed.
White dogwood (*Cornus alba*)	Terrestrial Plant	X (2020)					None
White-stemmed bramble (*Rubus cockburnianus*)	Terrestrial Plant	X (2020)					None
Yellow archangel (*Lamiastrum galeobdolon subsp. argentatum*)	Terrestrial Plant	X (2019)	X (2019)				Wildlife and Countryside Act (1981) Schedule 9 Listed.

** Information provided by Environment Agency contact.*

A3.5.5 Impact assessment

This section provides summary conclusions for all INNS assessed within the water bodies / study area. Full species assessments for all INNS recorded and the water bodies are provided in Section A3.5.10. INNS responses have been assessed by comparing the INNS baseline with the impacts of drought order implementation. Unless explicitly stated, INNS fitness outcomes consider the effects of actions implemented under the drought order, not the impacts of a natural drought without intervention.

Belmont Reservoir

Pathway impacts

Pathway impacts at the reservoir have been predicted as negligible. With this considered, aggregated INNS fitness (all taxa) within the reservoir is expected to remain unchanged from the current baseline and is therefore categorised as having **net neutral** species outcome. Confidence in this conclusion is **Medium**.

Risk of spread from reservoir

Although general INNS fitness within the reservoir is expected to remain unchanged from the current baseline, the reduction to the compensation flow associated with the drought order, is expected to reduce the capacity for INNS to spread from the reservoir and its catchment into the downstream water bodies.

A total of 50 INNS were assessed within the Belmont Reservoir Study Area, six of which are categorised as Priority INNS. The significance of the impacts associated with each INNS within the reservoir showed considerable uniformity, with all species expected to experience a reduction in ability to spread downstream from the reservoir (Table A3-21).

The INNS assemblage within Belmont Reservoir is expected to experience an overall fitness outcome in response to implementation of the drought order that has been summarised as **Moderate negative,** representing a positive outcome for the wider environment. Confidence is variable but has been summarised as **Low**.

Table A3-23 Species outcomes for INNS recorded within Belmont Reservoir study area

Species Outcome	INNS
Major negative	-
Moderate negative	American skunk-cabbage (*Lysichiton americanus*) Giant hogweed (*Heracleum mantegazzianum*) Himalayan balsam (*Impatiens glandulifera*) Japanese knotweed (*Fallopia japonica*) Jenkins' spire snail (*Potamopyrgus antipodarum*) Aquatic animal Riparian plant
Minor negative	Rhododendron (*Rhododendron ponticum*) Terrestrial Plant
Neutral	-
Minor beneficial	-
Moderate beneficial	-
Major beneficial	-

Full assessments for all species recorded at this water body are provided in Section A3.5.10, Table A3-31.

Eagley Brook

A total of 49 INNS were assessed in the Eagley Brook, eleven of which are categorised as Priority INNS. The significance of the impacts associated with each INNS within the Eagley Brook water body varies significantly, from moderate beneficial to moderate negative depending on the taxa and their responses to the pathways assessed (Table A3-24).

The INNS assemblage within Eagley Brook is expected to experience an overall fitness outcome in response to the implementation of the drought order that is summarised as **minor beneficial,** representing a negative outcome for the wider environment. Note that one INNS, curly waterweed, is expected to receive a moderate beneficial impact to fitness. Overall confidence in this outcome is **Low**.

Table A3-24 Species outcomes for INNS recorded in Eagley Brook.

Species Outcome	INNS
Major negative	-
Moderate negative	Common carp (*Cyprinus carpio*) Aquatic animal
Minor negative	American skunk-cabbage (*Lysichiton americanus*) Jenkins' spire snail (*Potamopyrgus antipodarum*) Signal crayfish *(Pacifastacus leniusculus)*
Neutral	-
Minor beneficial	Giant hogweed (*Heracleum mantegazzianum*) *Gunnera* sp. Himalayan balsam (*Impatiens glandulifera*) Japanese knotweed (*Fallopia japonica*) Monkeyflower (*Mimulus guttatus*) Rhododendron (*Rhododendron ponticum*) Riparian plant Terrestrial plant
Moderate beneficial	Curly waterweed (*Lagarosiphon major*)
Major beneficial	-

See Table A3-26 for a more detailed summary of the impact to fitness upon curly waterweed (categorised as moderate beneficial). Full assessments for all species recorded at this water body is provided in Section A3.5.10, Table A3-32.

Table A3-25 Species outcome for curly waterweed within the Eagley Brook.

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Curly waterweed (*Lagarosiphon major*)	Belmont (4.5Ml/d)	Hydrology/Medium	Medium	Moderate, beneficial	Low	*L. major* (Curly waterweed) prefers still or slow-moving freshwater and thrives in sheltered areas with high light availability. Whilst a reduction in aquatic habitat is expected to reduce the available habitat for this species, *L. major* grows best under high light intensity so, as a submerged macrophyte, a minor reduction in water level may facilitate increased fitness. *L. major* can exist in a variety of nutrient conditions including eutrophic water bodies, but will suffer in poor light intensity. Additionally, increased levels of ammonia may be phytotoxic. However, increased levels of nitrate and phosphate are expected to be beneficial to fitness, so water impacts from water quality have been precautionarily summarised as an overall benefit to fitness. Curly waterweed is expected to experience a **moderate beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Low	Minor, beneficial	Low	
		Water Quality/Low	Low	Minor, beneficial	Low	

River Tonge

A total of eight INNS were assessed within the River Tonge, six of which are classified as Priority INNS. The significance of the impacts associated with each INNS across the River Tonge water body varies between taxa from minor negative to minor beneficial (Table A3-26).

Under both scenarios (i.e. Belmont drought order alone and/or in-combination with a Jumbles drought permit) the INNS assemblage within the River Tonge is expected to experience an overall fitness outcome in response to implementation of the drought order that has been summarised as **minor beneficial**. Overall confidence in this outcome is **Low**.

Table A3-26 Species outcomes for INNS recorded at the River Tonge

Species Outcome	INNS Belmont (4.5Ml/d) (Scenario 1) Belmont (4.5Ml/d) + Jumbles (12 Ml/d) (Scenario 2)
Major negative	-
Moderate negative	-
Minor negative	Signal Crayfish (*Pacifastacus leniusculus*) Jenkins' Spire Snail (*Potamopyrgus antipodarum*) Aquatic Animal
Neutral	-
Minor beneficial	Giant Hogweed (*Heracleum mantegazzianum*) Himalayan Balsam (*Impatiens glandulifera*) Japanese Knotweed (*Fallopia japonica*) Rhododendron (*Rhododendron ponticum*)
Moderate beneficial	-
Major beneficial	-

Full assessment for all species recorded in this water body is provided in Section A3.5.10, Table A3-33.

River Croal

A total of nine INNS were assessed within the River Croal, eight of which are classified as Priority INNS. The significance of the impacts associated with each INNS across the River Croal water body is variable across taxa and scenario. Impact significance and direction vary from minor beneficial to minor negative (Table A3-27).

Under the Belmont drought order alone (Scenario 1), the INNS assemblage within the River Croal is expected to experience an overall fitness outcome in response to the implementation of the drought order that is categorised as **minor negative,** however, three INNS (signal crayfish, water fern, and Jenkins' spire snail) are expected to receive beneficial impacts to fitness**.** Overall confidence in this outcome is **Low.**

In-combination with a Jumbles drought permit (Scenario 2), the INNS assemblage within the River Croal is expected to experience an overall fitness outcome in response to the implementation of the drought order that is categorised as **minor beneficial.** Overall confidence in this outcome is **Low.**

Table A3-27 Species outcomes for INNS recorded at the River Croal

Species Outcome	INNS	
	Belmont (4.5Ml/d) (Scenario 1)	Belmont (4.5Ml/d) + Jumbles (12Ml/d) (Scenario 2)
Major negative	-	-
Moderate negative	-	-
Minor negative	Common Carp (*Cyprinus carpio*) Giant Hogweed (*Heracleum mantegazzianum*) Himalayan Balsam (*Impatiens glandulifera)* Japanese Knotweed (*Fallopia japonica*)	Common Carp (*Cyprinus carpio*) Signal Crayfish (*Pacifastacus leniusculus*) Jenkins' Spire Snail (*Potamopyrgus antipodarum*) Aquatic Animal
Neutral	Rhododendron *(Rhododendron ponticum)* Aquatic Animal	
Minor beneficial	Signal Crayfish (*Pacifastacus leniusculus*) Water Fern (*Azolla filiculoides*) Jenkins' Spire Snail (*Potamopyrgus antipodarum*)	Giant Hogweed *(Heracleum mantegazzianum)* Himalayan Balsam (*Impatiens glandulifera*) Japanese Knotweed (*Fallopia japonica*) Rhododendron *(Rhododendron ponticum*) Water Fern (*Azolla filiculoides*)
Moderate beneficial	-	-
Major beneficial	-	-

Full assessment for all species recorded in this water body is provided in Section A3.5.10, Table A3-34.

River Irwell

A total of three INNS were identified within the River Irwell, all of which were identified as Priority INNS. The significance of impact associated with each INNS within the water body showed uniformity (Table A3-28).

Under both scenarios, the INNS assemblage within the River Irwell is expected to experience an overall fitness outcome in response to the implementation of the drought order that is categorised as **net neutral.** Overall confidence in this outcome is **medium.**

Table A3-28 Species outcomes for INNS recorded at the River Irwell

Species Outcome	INNS Belmont (4.5Ml/d) (Scenario 1) Belmont (4.5Ml/d) + Jumbles (12 Ml/d) (Scenario 2)
Major negative	-
Moderate negative	-
Minor negative	-
Neutral	Giant Hogweed (*Heracleum mantegazzianum*) Himalayan Balsam (*Impatiens glandulifera*) Japanese Knotweed (*Fallopia japonica*)
Minor beneficial	-
Moderate beneficial	-
Major beneficial	-

Full assessment for all species recorded at this water body is provided in Section A3.5.10, Table A3-35.

A3.5.6 Summary

The pathway impacts predicted for this drought order, both alone and in combination with a Jumbles drought permit, could create conditions that are influential towards INNS fitness:

1. The reduction in compensation flow is expected to reduce the capacity for INNS to spread from Belmont Reservoir Study Area into the downstream water bodies.
2. The reduction in downstream river flow may reduce the potential for the propagules of certain species, particularly macrophytes, to be dispersed downstream but conversely may increase the potential for motile species (e.g. signal crayfish) to migrate upstream.
3. The reduction in aquatic habitat in the downstream water bodies may decrease the density of aquatic INNS, while creating additional habitat for colonisation by riparian species.
4. Changes to certain water quality parameters in some water bodies, downstream of the reservoir, may affect the fitness of INNS taxa in a variable way.

Overall, the proposed drought order, both alone and in combination with a Jumbles drought permit, is considered to result in minor and moderate impacts on INNS fitness in Belmont Reservoir and the downstream river water bodies depending on taxa and location.

The fitness of the INNS present within Belmont Reservoir is not expected to deviate from baseline, other than a moderate negative impact on their capacity to spread from the reservoir due to the reduced compensation release.

Species outcomes represent the cumulative outcome of all the pathway impacts assessed as influencing an individual INNS. Although some species are predicted to experience a beneficial change to fitness as a result of the drought order, only one species outcome, across all water bodies and scenarios, exceeds minor beneficial (Curly Waterweed in the Eagley brook).

Therefore, and with the exception of Curly Waterweed, it is considered unlikely that any changes to INNS fitness in response to the implementation of the drought order will result in observable or large scale cascading impacts on native flora and fauna during or after the implementation of the drought order. The return to baseline (normal compensation flow) post-implementation, is expected to naturally mitigate any transitory increases in fitness experienced by INNS.

Consequently, across all scenarios, INNS species outcomes within the study area are precautionarily summarised as **Minor, beneficial** with regard to INNS fitness, representing a negative outcome for the wider environment. Confidence in this determination is also variable but overall is classified as **Low**.

Uncertainties

The INNS assessment has been summarised as having an overall **Low** level of confidence. INNS sensitivities and direction of significance have been determined by professional judgement supported by relevant literature. INNS are, by definition, highly adaptable, generalist species that can occupy different niches, trophic levels or are more resilient to selective pressures. However, limited, often fragmented, research exists on how INNS are expected to respond to pathways of impact, and the detailed environmental conditions of their preferred habitats.

INNS are considered as 'priority' INNS where they are classified as WFD UKTAG High or Moderate Impact; these are assessed at a species level. Species that do not meet this classification are grouped into broader taxonomic categories. Whilst species within these groups share similar ecological characteristics, some variability is still expected between them – meaning that conclusions are aggregated at the taxonomic level, introducing a degree of uncertainty for lower impact INNS.

This assessment has been undertaken using a desk-based methodology only. The records used are reflective of observations at a particular point in time; however, INNS assemblage may change as a result of new introductions, natural changes to extant populations, or management and control efforts. Furthermore, there exists some spatial inaccuracies within the data used which, whilst being partially accounted for in the methodology, are a source of additional uncertainty. Therefore, the presence of a species within a water body should not been seen as definitive proof of current presence, nor should the absence of records be seen as definitive proof of the absence of INNS within a specific area.

A3.5.7 References

Base map and data from OpenStreetMap and OpenStreetMap Foundation (CC-BY-SA). © https://www.openstreetmap.org and contributors.

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A3.5.8 Species Lists

Table A3-29 INNS included within the NBN Atlas Data Download

Species (Latin Name)			
Acacia saligna	*Corvus splendens*	*Impatiens glandulifera*	*Parthenocissus inserta*
Acartia (Acanthacartia) tonsa	*Coscinodiscus wailesii*	*Juncus ensifolius*	*Parthenocissus quinquefolia*
Achtheres percarum	*Cotoneaster bullatus*	*Kontikia andersoni*	*Pelophylax esculentus*
Acipenser baerii	*Cotoneaster horizontalis*	*Kontikia ventrolineata*	*Pelophylax ridibundus*
Acipenser gueldenstaedtii	*Cotoneaster integrifolius*	*Lagarosiphon major*	*Penaeus japonicus*
Acipenser nudiventris	*Cotoneaster microphyllus s.str.*	*Lamiastrum galeobdolon subsp. argentatum*	*Perccottus glenii*
Acipenser ruthenus	*Cotoneaster simonsii*	*Laminaria japonica*	*Persicaria perfoliata*
Acorus calamus	*Crangonyx pseudogracilis*	*Lemna minuta*	*Persicaria wallichii*
Acridotheres tristis	*Craspedacusta sowerbii*	*Lepomis gibbosus*	*Petasites japonicus*
Agardhiella subulata	*Crassula helmsii*	*Lespedeza cuneata*	*Petricolaria pholadiformis*
Agarophyton vermiculophyllum	*Crepidula fornicata*	*Leucaspius delineatus*	*Phagocata woodworthi*
Ailanthus altissima	*Crocosmia pottsii x aurea = C. x crocosmiiflora*	*Leuciscus idus*	*Physella acuta*
Aix galericulata	*Ctenopharyngodon idella*	*Limnodrilus cervix*	*Physella gyrina*
Aix sponsa	*Cygnus atratus*	*Lithobates catesbeianus*	*Pikea californica*
Alectoris chukar	*Cynomys*	*Lophura nycthemera*	*Pileolaria berkeleyana*
Alectoris graeca	*Cyprinus carpio*	*Ludwigia grandiflora*	*Pinctada imbricata radiata*
Allium paradoxum	*Diadumene lineata*	*Ludwigia grandiflora subsp. hexapetala*	*Pistia stratiotes*
Allium triquetrum	*Didemnum vexillum*	*Lupinus nootkatensis*	*Planaria torva*
Alopochen aegyptiaca	*Dikerogammarus haemobaphes*	*Lygodium japonicum*	*Pleurosigma*
Alternanthera philoxeroides	*Dikerogammarus villosus*	*Lysichiton americanus*	*Plotosus lineatus*
Alytes obstetricans	*Disphyma crassifolium*	*Macrocystis angustifolia*	*Podarcis muralis*
Ambloplites rupestris	*Dreissena polymorpha*	*Macrocystis integrifolius*	*Potamopyrgus antipodarum*
Ammothea hilgendorfi	*Dreissena rostriformis bugensis*	*Macrocystis laevis*	*Procambarus acutus*
Amphibalanus amphitrite	*Echinogammarus ischnus*	*Macrocystis pyrifera*	*Procambarus clarkii*
Andropogon virginicus	*Echinogammarus trichiatus*	*Macropus rufogriseus*	*Procambarus fallax*
Anser caerulescens	*Egeria densa*	*Magallana gigas*	*Procambarus fallax f. virginalis*
Anser canagicus	*Ehrharta calycina*	*Marenzelleria viridis*	*Procyon lotor*
Anser indicus	*Eichhornia crassipes*	*Marstoniopsis insubrica*	*Prosopis juliflora*
Antithamnionella spirographidis	*Elodea callitrichoides*	*Melanothamnus harveyi*	*Pseudorasbora parva*
Antithamnionella ternifolia	*Elodea canadensis*	*Menetus (Dilatata) dilatatus*	*Psittacula krameri*
Aponogeton distachyos	*Elodea nuttallii*	*Mercenaria mercenaria*	*Pueraria montana var. lobata*
Arthurdendyus triangulatus	*Emys orbicularis*	*Micropterus salmoides*	*Rangia cuneata*
Asclepias syriaca	*Ensis leei*	*Microstegium vimineum*	*Rattus rattus*
Asparagopsis armata	*Ergasilus briani*	*Mimulus cupreus*	*Rhithropanopeus harrisii*
Astacus astacus	*Ergasilus sieboldi*	*Mimulus cupreus x luteus x variegatus*	*Rhodeus amarus*

Species (Latin Name)			
Astacus leptodactylus	*Eriocheir sinensis*	*Mimulus cupreus x smithii (M. x hybridus)*	*Rhodeus sericeus*
Aulacomya ater	*Ethmodiscus punctiger*	*Mimulus guttatus*	*Rhododendron luteum*
Australoplana sanguinea	*Eusarsiella zostericola*	*Mimulus guttatus x cupreus = M. x burnetii*	*Rhododendron ponticum*
Austrominius modestus	*Fallopia japonica*	*Mimulus guttatus x luteus = M. x robertsii*	*Rhododendron ponticum x Rhododendron maximum*
Azolla filiculoides	*Fallopia japonica x sachalinensis = F. x bohemica*	*Mimulus guttatus x luteus x cupreus*	*Rosa rugosa*
Baccharis halimifolia	*Fallopia sachalinensis*	*Mimulus guttatus x luteus x variegatus*	*Ruditapes philippinarum*
Biddulphia sinensis	*Ferrissia (Petancylus) californica*	*Mimulus luteus x cupreus = M. x maculosus*	*Sagittaria latifolia*
Bombina variegata	*Ficopomatus enigmaticus*	*Monocorophium sextonae*	*Salvelinus fontinalis*
Bonnemaisonia hamifera	*Girardia tigrina*	*Muntiacus reevesi*	*Salvinia molesta*
Botryocladia wrightii	*Glis glis*	*Mya arenaria*	*Sander lucioperca*
Branchiura sowerbyi	*Goniadella gracilis*	*Myiopsitta monachus*	*Sargassum muticum*
Branta canadensis	*Gonionemus vertens*	*Myocastor coypus*	*Sciurus carolinensis*
Branta leucopsis	*Grateloupia doryphora*	*Myriophyllum aquaticum*	*Sciurus niger*
Bubo bubo	*Grateloupia subpectinata*	*Myriophyllum heterophyllum*	*Silurus glanis*
Cabomba caroliniana	*Gunnera manicata*	*Myriophyllum quitense*	*Smyrnium perfoliatum*
Caecidotea communis	*Gunnera tinctoria*	*Myriophyllum robustum*	*Solieria chordalis*
Callosciurus erythraeus	*Gymnocoronis spilanthoides*	*Myriophyllum simulans*	*Spartina anglica*
Caprella mutica	*Hemigrapsus sanguineus*	*Mytilopsis leucophaeata*	*Sphaerium transversum*
Carassius auratus	*Hemigrapsus takanoi*	*Nasua nasua*	*Styela clava*
Cardiospermum grandiflorum	*Hemimysis anomala*	*Neodexiospira brasiliensis*	*Syrmaticus reevesii*
Carpobrotus edulis	*Heracleum mantegazzianum*	*Neoergasilus japonicus*	*Tadorna ferruginea*
Cenchrus setaceus	*Heracleum persicum*	*Neovison vison*	*Tamias sibiricus*
Cervus nippon	*Heracleum sosnowskyi*	*Netta rufina*	*Thalassiosira tealata*
Chelicorophium curvispinum	*Herpestes javanicus*	*Nyctereutes procyonoides*	*Threskiornis aethiopicus*
Chrysolophus amherstiae	*Homarus americanus*	*Nycticorax nycticorax*	*Tracheliastes polycolpus*
Chrysolophus pictus	*Humulus scandens*	*Oncorhynchus mykiss*	*Trachemys scripta*
Claytonia sibirica	*Hydrocotyle ranunculoides*	*Ondatra zibethicus*	*Triadica sebifera*
Clymenella torquata	*Hydroides dianthus*	*Orconectes limosus*	*Triturus carnifex*
Codium fragile	*Hydroides ezoensis*	*Orconectes virilis*	*Undaria pinnatifida*
Codium fragile subsp. atlanticum	*Hydropotes inermis*	*Ostrea chilensis*	*Urosalpinx cinerea*
Codium fragile subsp. fragile	*Hyla arborea*	*Oxyura jamaicensis*	*Vallisneria spiralis*
Colpomenia peregrina	*Hypania invalida*	*Pachycordyle navis*	*Vespa velutina*
Corbicula fluminea	*Ichthyosaura alpestris*	*Pacifastacus leniusculus*	*Xenopus laevis*
Cordylophora caspia	*Impatiens capensis*	*Parthenium hysterophorus*	*Zamenis longissimus*
Cortaderia jubata			

A3.5.9 GMLRC INNS Search

These INNS were selected as they are classified as WFD UKTAG High Impact species.

Table A3-30 INNS included in the GMLRC data request

INNS
Signal crayfish (*Pacifastacus leniusculus*)
Killer shrimp (*Dikerogammarus villosus*)
Demon shrimp (*Dikerogammarus haemobaphes*)
Zebra mussel (*Dreissena polymorpha*)
Japanese knotweed (*Fallopia japonica*)
Himalayan balsam (*Impatiens glandulifera*)
New Zealand pigmyweed (*Crassula helmsii*)
Rhododendron (*Rhododendron ponticum*)
Nuttall's waterweed (*Elodea nuttallii*)
Water fern (*Azolla filiculoides*)
Floating pennywort (*Hydrocotyle ranunculoides*)
Curley water-thyme (*Lagarosiphon major*)
Water primrose (*Ludwigia grandiflora*)
Parrot's feather (*Myriophyllum aquaticum*)
Giant hogweed (*Heracleum mantegazzianum*)

A3.5.10 INNS assessments

Table A3-31 Summary of capacity for INNS spread from Belmont Reservoir study area (reduction in compensation flow)

Species/INNS category	Sensitivity to reduced compensation flow (d/s capacity for spread)	Significance of impact	Confidence level	Outcome
American skunk-cabbage (*Lysichiton americanus*)	Medium	Moderate, negative	Medium	INNS are expected to receive a mixture of minor and moderate impacts upon fitness as a result of reduced compensation flow. However, all changes are expected to be **negative** for INNS, with the capacity for spread from the reservoir decreasing relative to the current baseline. Confidence in this conclusion is mixed, but has been summarised as **Low**.
Giant hogweed (*Heracleum mantegazzianum*)	Medium	Moderate, negative	Medium	
Himalayan balsam (*Impatiens glandulifera*)	Medium	Moderate, negative	Medium	
Japanese knotweed (*Fallopia japonica*)	Medium	Moderate, negative	Medium	
Jenkins' spire snail (*Potamopyrgus antipodarum*)	Medium	Moderate, negative	Medium	
Rhododendron (*Rhododendron ponticum*)	Low	Minor, negative	Low	
Aquatic animal (n = 2)	Medium	Moderate, negative	Low	
Riparian plant (n = 10)	Medium	Moderate, negative	Low	
Terrestrial plant (n = 32)	Low	Minor, negative	Low	
Aquatic plant (n = 0)	No INNS that fall within the 'aquatic plant' category were identified within the Belmont Reservoir study area.			

Table A3-32 Impact assessment of INNS receptors present within the Eagley Brook water body in response to drought order implementation

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
American skunk-cabbage (*Lysichiton americanus*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Low	Propagules of this species can be spread downstream by flowing water. Lower river flow or reduction in aquatic connectivity may reduce the success of this route for spread. This species thrives in very wet/boggy soil. Although relatively tolerant to seasonal fluctuations in water levels a substantial or extended reduction to aquatic habitat may reduce plant vigour and success. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. Reduced dissolved oxygen conditions for prolonged periods could impair root respiration and function, potentially leading to reduced vigour or increased susceptibility to root pathogens. However, *L. americanus* is generally robust in organically enriched habitats and can tolerate short-term hypoxia. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. American skunk-cabbage is expected to experience a **minor negative** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Medium	Moderate, negative	Low	
		Water Quality/Low	Low	Minor, beneficial	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Common carp (*Cyprinus carpio*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Low	This species has a high degree of ecological plasticity and is fairly adaptable to changing water levels and reductions to flow rates. It is tolerant of shallow and temperature fluctuating water bodies and can tolerate intermittent hypoxia. Increased sedimentation can support feeding and spawning. Prolonged lower water volumes may increase fish density, potentially enhancing reproductive success, but may raise the risk of disease and intraspecific competition at extreme levels. *C. carpio* is generally tolerant to increased phosphate, ammonia, and lower dissolved oxygen; however, chronic exposure to ammonia and reduced DO may still impair overall fitness. While the impacts to *C. carpio* are likely to be transitory, the nature of some of these impacts (such as water level reductions) may delay or act as a barrier to the full realisation of impact to fitness, particularly post-drought order implementation where conditions will return to baseline. Common carp are expected to experience a **moderate negative** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Medium	Moderate, negative	Medium	
		Water Quality/Low	Low	Minor, negative	Low	
Curly waterweed (*Lagarosiphon major*)	Belmont (4.5Ml/d)	Hydrology/Medium	Medium	Moderate, beneficial	Low	*L. major* (Curly waterweed) prefers still or slow-moving freshwater and thrives in sheltered areas with high light availability. Whilst a reduction in aquatic habitat is expected to reduce the available habitat for this species, *L. major* grows best under high light intensity so, as a submerged macrophyte, a minor reduction in water level may facilitate increased fitness.

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Habitat & Geomorphology/Medium	Low	Minor, beneficial	Low	*L. major* can exist in a variety of nutrient conditions including eutrophic water bodies, but will suffer in poor light intensity. Additionally, increased levels of ammonia may be phytotoxic. However, increased levels of nitrate and phosphate are expected to be beneficial to fitness, so water impacts from water quality have been precautionarily summarised as an overall benefit to fitness. Curly waterweed is expected to experience a **moderate beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Water Quality/Low	Low	Minor, beneficial	Low	
Giant hogweed (*Heracleum mantegazzianum*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Medium	A reduction in flow may limit spread potential. A reduction in water levels and river flows may lead to drier riparian soils, reducing habitat suitability and slowing vegetative spread/seedling establishment. Conversely increasing bank size may provide increased available riparian habitat. Reduced water levels and flow may limit the plant's ability to establish in some floodplain areas. However, in areas where groundwater or residual moisture persists, it may still be able to thrive. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. The species is unlikely to be directly affected by BOD changes in nearby water bodies however, reduced dissolved oxygen conditions for prolonged periods could impair root respiration and function, potentially leading to reduced vigour. Increased phosphate
		Habitat & Geomorphology/Medium	Medium	Moderate, beneficial	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Water Quality/Low	Low	Minor, beneficial	Low	could increase the plant's fitness and capacity for spread, especially where other environmental conditions are favourable. Giant hogweed is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
Gunnera sp.	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Medium	*Gunnera tinctoria* distributes propagules by water, so a reduction in flow may limit the spread of this species. While *Gunnera* sp. prefer moist soils, they are capable of surviving in dryer conditions. However, a reduction in water levels and river flows may lead to drier riparian soils, which do reduce habitat suitability and slowing vegetative spread. Conversely increasing bank size may provide increased available riparian habitat. The impact of habitat & geomorphology has been precautionarily summarised a beneficial. Little is known about the response of *Gunnera* sp. to changes in water quality. Thriving in wet conditions, increases in ammonia or reduced dissolved oxygen may have negative impacts to fitness, however increases in nitrate may increase growth. For this study, water quality has been precautionarily assumed to have a beneficial impact to fitness. *Gunnera* sp. is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Low	Minor, beneficial	Low	
		Water Quality/Low	Low	Minor, beneficial	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Himalayan balsam (*Impatiens glandulifera*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Medium	*I. glandulifera* distributes propagules through water-mediated seed dispersal. A reduction in flow may limit spread potential. A reduction in water levels and river flows may lead to drier riparian soils, reducing habitat suitability and slowing vegetative spread. Conversely increasing bank size may provide increased available riparian habitat. This species can persist in a range of moisture conditions, especially if shading and competition are low. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. The species is unlikely to be directly affected by BOD changes in nearby water bodies however, reduced dissolved oxygen conditions for prolonged periods could impair root respiration and function, potentially leading to reduced vigour or increased susceptibility to root pathogens. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. Himalayan balsam is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Medium	Moderate, beneficial	Low	
		Water Quality/Low	Low	Minor, beneficial	Low	
Japanese knotweed (*Fallopia japonica*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Low	*F. japonica* distributes propagules through water-mediated dispersal. A reduction in flow may limit spread potential. A reduction in water levels and increasing bank size may provide increased available riparian habitat. This species can persist in a range of moisture conditions, and spreads aggressively.

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Habitat & Geomorphology/Medium	Medium	Moderate, beneficial	Low	Largely tolerant or isolated from changing water quality. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. Japanese knotweed is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Water Quality/Low	Low	Minor, beneficial	Low	
Jenkins' spire snail (*Potamopyrgus antipodarum*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, beneficial	Medium	*P. antipodarum* is highly adaptable and thrives in a wide range of freshwater environments, including lakes, rivers, reservoirs, and even disturbed or degraded systems. Reduced flow rates may facilitate increased upstream spread. Although tolerant of reductions to river levels on balance this is considered a negative impact to baseline fitness. *P. antipodarum* is tolerant to transitory or moderate changes to water quality; however, chronic high ammonia levels or low dissolved oxygen will have a negative impact to the species. Increased phosphate may increase *P. antipodarum* food availability which could increase fitness. Jenkins' spire snail is expected to experience a **minor negative** change to fitness in response to the drought order. Confidence in this species outcome result is **Medium**.
		Habitat & Geomorphology/Medium	Medium	Moderate, negative	Medium	
		Water Quality/Low	Low	Minor, negative	Medium	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Monkeyflower (*Mimulus guttatus*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Medium	Propagules of this species can be spread downstream by flowing water, so a reduction in flow may limit spread. A reduction in water levels and increasing bank size may provide increased available riparian habitat. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. The species is unlikely to be directly affected by BOD changes in nearby waterbodies however, reduced dissolved oxygen conditions for prolonged periods could impair root function, potentially impairing growth. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable; however, benefits may be moderated by shading from faster-growing competitors. Monkeyflower is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Medium	Moderate, beneficial	Low	
		Water Quality/Low	Low	Minor, beneficial	Low	
Rhododendron (*Rhododendron ponticum*)	Belmont (4.5Ml/d)	Hydrology/Medium	Not Sensitive	Minor, neutral	Low	*R. ponticum* is a terrestrial invasive shrub, typically found in woodlands, heathlands, and moist upland areas, rather than aquatic environments. As such, it is deemed not sensitive to direct impacts from changes in flow and water quality in aquatic systems. The reduction to aquatic habitat may open increased terrestrial habitat for spread. Rhododendron is expected to experience a **minor beneficial** change to fitness in response to the drought order.
		Habitat & Geomorphology/Medium	Low	Minor, beneficial	Medium	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Water Quality/Low	Not Sensitive	Minor, neutral	Low	Confidence in this species outcome result is **Low**.
Signal crayfish (*Pacifastacus leniusculus*)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, beneficial	Low	*P. leniusculus* are adaptable to a range of flow regimes and water depths, including low-flow or isolated conditions. They burrow into banks to maintain moisture and shelter, which can buffer them against temporary reductions to aquatic habitat although long term reductions may reduce fitness. Lower flows may concentrate individuals and prey, potentially benefiting feeding opportunities, but can also increase competition and predation risk. Lower flows may also promote upstream migration. Generally tolerant to water quality changes, although chronic exposure may have longer term implications for fitness. Signal crayfish are expected to experience a **minor negative** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Low	Minor, negative	Low	
		Water Quality/Low	Low	Minor, negative	Medium	
Aquatic animal (n = 2)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, variable	Low	The fitness of aquatic animals is expected to be influenced variably depending on the niche habitat requirements of the specific species identified within this water body. As aquatic species, a reduction in aquatic habitat is generalised as having a negative effect upon fitness. As aquatic species, a reduction to water quality is generalised as having a negative effect upon fitness.
		Habitat & Geomorphology/Medium	Medium	Moderate, negative	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Water Quality/Low	Low	Minor, negative	Low	Aquatic animals are expected to experience a **moderate negative** change to fitness in response to the drought order, however some pathways will have variable impacts. Confidence in this species outcome result is **Low**.
Riparian plant (n = 10)	Belmont (4.5Ml/d)	Hydrology/Medium	Low	Minor, negative	Low	Many riparian plant species reproduce by seed spread by water. A reduction in flow may reduce the success of this reproduction mechanism. A reduction in aquatic habitat may increase the amount of available bankside habitat for spread. Whilst the impact of changing water quality parameters upon riparian plants is variable between specific species, it can be precautionarily assumed that increasing levels of phosphate could increase a plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. Riparian plants are expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome result is **Low**.
		Habitat & Geomorphology/Medium	Medium	Moderate, beneficial	Low	
		Water Quality/Low	Low	Minor, beneficial	Low	
Terrestrial plant (n = 26)	Belmont (4.5Ml/d)	Hydrology/Medium	Not Sensitive	Minor, neutral	Low	As terrestrial species, these plants are not expected to be sensitive to changes in hydrology or water quality in aquatic systems. A reduction in aquatic habitat may increase the amount of available terrestrial habitat for spread. Terrestrial plants are expected to experience a **minor beneficial** change to fitness in response to the drought order.
		Habitat & Geomorphology/Medium	Low	Minor, beneficial	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Water Quality/Low	Not Sensitive	Minor, neutral	Low	Confidence in this species outcome result is **Low**.
Aquatic plant (n = 0)	Belmont (4.5Ml/d)	No INNS that fall within the 'aquatic plant' category were identified within the Eagley Brook study area.				

Table A3-33 Impact assessment of INNS receptors present within the River Tonge water body in response to drought order implementation

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Giant Hogweed (*Heracleum mantegazzianum*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, negative	Medium	A reduction in flow may limit spread potential. A reduction in water levels and river flows may lead to drier riparian soils, reducing habitat suitability and slowing vegetative spread/seedling establishment. Conversely increasing bank size may provide increased available riparian habitat. Reduced water levels and flow may limit the plant's ability to establish in some floodplain areas. However, in areas where groundwater or residual moisture persists, it may still be able to thrive. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. The species is unlikely to be directly affected by BOD changes in nearby water bodies however, reduced dissolved oxygen conditions for prolonged periods could impair root respiration and function, potentially leading to reduced vigour. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions are favourable.
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	
		Water quality/Low	Low	Minor, beneficial	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, negative	Medium	
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Water quality/Low	Low	Minor, beneficial	Low	Under **both scenarios**, within this water body Giant hogweed is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome is **low**.
Himalayan Balsam (*Impatiens glandulifera*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, negative	Medium	*I. glandulifera* distributes propagules through hydrochorous (water-mediated) seed dispersal. A reduction in flow may limit spread potential. A reduction in water levels and river flows may lead to drier riparian soils, reducing habitat suitability and slowing vegetative spread. Conversely increasing bank size may provide increased available riparian habitat. This species can persist in a range of moisture conditions, especially if shading and competition are low. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. The species is unlikely to be directly affected by BOD changes in nearby water bodies however, reduced dissolved oxygen conditions for prolonged periods could impair root respiration and function, potentially leading to reduced vigour or increased susceptibility to root pathogens. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. Under **both scenarios**, within this water body Himalayan balsam is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome is **low**.
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	
		Water quality/Low	Low	Minor, beneficial	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, negative	Medium	
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	
		Water quality/Low	Low	Minor, beneficial	Low	
Japanese Knotweed (*Fallopia japonica*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, negative	Low	*F. japonica* distributes propagules through water-mediated dispersal. A reduction in flow may limit spread potential. A reduction in water

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	levels and increasing bank size may provide increased available riparian habitat. This species can persist in a range of moisture conditions, and spreads aggressively. Largely tolerant or isolated from changing water quality. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. Under **both scenarios**, within this water body Japanese knotweed is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome is **low**.
		Water quality/Low	Low	Minor, beneficial	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, negative	Low	
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	
		Water quality/Low	Low	Minor, beneficial	Low	
Rhododendron (*Rhododendron ponticum*)	Belmont (4.5Ml/d)	Hydrology/Low	Not Sensitive	Minor, neutral	Low	*R. ponticum* is a terrestrial invasive shrub, typically found in woodlands, heathlands, and moist upland areas, rather than aquatic environments. As such, it is deemed not sensitive to direct impacts from flow reduction in aquatic systems. The reduction to aquatic habitat may open increased terrestrial habitat for spread. Under **both scenarios**, within this water body, Rhododendron is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome is **low**.
		Habitat and geomorphology/Low	Low	Minor, beneficial	Medium	
		Water quality/Low	Not Sensitive	Minor, neutral	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Not Sensitive	Minor, neutral	Low	
		Habitat and geomorphology/Low	Low	Minor, beneficial	Medium	
		Water quality/Low	Not Sensitive	Minor, neutral	Low	
Signal Crayfish (*Pacifastacus leniusculus*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, beneficial	Low	*P. leniusculus* are adaptable to a range of flow regimes and water depths, including low-flow or isolated conditions. They burrow into banks to maintain moisture and shelter, which can buffer them against

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Habitat and geomorphology/Low	Low	Minor, negative	Low	temporary reductions to aquatic habitat although long term reductions may reduce fitness. Lower flows may concentrate individuals and prey, potentially benefiting feeding opportunities, but can also increase competition and predation risk. Lower flows may also promote upstream migration. Generally tolerant to water quality changes, although chronic exposure may have longer term implications for fitness. Under **both scenarios**, within this water body signal crayfish are expected to experience a **minor negative** change to fitness in response to the drought order. Confidence in species outcome result is **low.**
		Water quality/Low	Low	Minor, negative	Medium	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, beneficial	Low	
		Habitat and geomorphology/Low	Low	Minor, negative	Low	
		Water quality/Low	Low	Minor, negative	Medium	
Jenkins' Spire Snail (*Potamopyrgus antipodarum*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, beneficial	Medium	*P. antipodarum* is highly adaptable and thrives in a wide range of freshwater environments, including lakes, rivers, reservoirs, and even disturbed or degraded systems. Reduced flow rates will facilitate increased upstream spread. Although tolerant of reductions to river levels on balance this is considered a negative impact to baseline fitness. *P. antipodarum* is tolerant to transitory or moderate changes to water quality; however, chronic high ammonia levels or low dissolved oxygen will have a negative impact to the species. Increased phosphate may increase *P. antipodarum* food availability which could increase fitness. Under **both scenarios**, within this water body Jenkins' spire snail are expected to experience a **minor negative** change to fitness in response to the drought order.
		Habitat and geomorphology/Low	Medium	Minor, negative	Medium	
		Water quality/Low	Low	Minor, negative	Medium	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, beneficial	Medium	
		Habitat and geomorphology/Low	Medium	Minor, negative	Medium	
		Water quality/Low	Low	Minor, negative	Medium	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
						Confidence in species outcome result is **medium.**
Aquatic Animal (n = 2)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, variable	Low	The fitness of aquatic animals is expected to be influenced variably depending on the niche habitat requirements of the specific species identified within this water body. As aquatic species, a reduction in aquatic habitat is generalised as having a negative effect upon fitness. As aquatic species, a reduction to water quality is generalised as having a negative effect upon fitness. Under **both scenarios**, within this water body aquatic animals are expected to experience a **minor negative** change to fitness in response to the drought order, however some pathways will have variable impacts. Confidence in species outcome result is **low.**
		Habitat and geomorphology/Low	Medium	Minor, negative	Low	
		Water quality/Low	Low	Minor, negative	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, variable	Low	
		Habitat and geomorphology/Low	Medium	Minor, negative	Low	
		Water quality/Low	Low	Minor, negative	Low	
Aquatic Plant (n = 0)	All	No INNS that fall within the 'aquatic plant' category were identified within the River Tonge study area.				
Riparian Plant (n = 0)	All	No INNS that fall within the 'riparian plant' category were identified within the River Tonge study area.				
Terrestrial Plant (n = 0)	All	No INNS that fall within the 'terrestrial plant' category were identified within the River Tonge study area.				

Table A3-34 Impacts assessment of INNS receptors present within the River Croal water body in response to drought order implementation

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Common Carp (*Cyprinus carpio*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, negative	Low	This species has a high degree of ecological plasticity and is fairly adaptable to changing water levels and reductions to flow rates. It is tolerant of shallow and temperature fluctuating water bodies and can tolerate intermittent hypoxia. Increased sedimentation can support feeding and spawning. Prolonged lower water volumes may increase fish density, potentially enhancing reproductive success, but may raise the risk of disease and intraspecific competition at extreme levels. *C. carpio* is generally tolerant to increased phosphate, ammonia, and lower dissolved oxygen; however, chronic exposure to ammonia and reduced DO may still impair overall fitness. While the impacts to *C. carpio* are likely to be transitory, the nature of some of these impacts (such as water level reductions) may delay or act as a barrier to the full realisation of impact to fitness, particularly post-drought permit implementation where conditions may return to baseline. Under **both scenarios**, within this water body, Common carp are expected to experience a **minor negative** change to fitness in response to the drought order. Confidence in species outcome result is **low.**
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Medium	
		Water quality/Negligible	Low	Minor, neutral	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, negative	Low	
		Habitat and geomorphology/Low	Medium	Minor, negative	Medium	
		Water quality/Low	Low	Minor, negative	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Giant Hogweed (*Heracleum mantegazzianum*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, negative	Medium	A reduction in flow may limit spread potential. A reduction in water levels and river flows may lead to drier riparian soils, reducing habitat suitability and slowing vegetative spread/seedling establishment. Conversely increasing bank size may provide increased available riparian habitat. Reduced water levels and flow may limit the plant's ability to establish in some floodplain areas. However, in areas where groundwater or residual moisture persists, it may still be able to thrive. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. The species is unlikely to be directly affected by BOD changes in nearby water bodies however, reduced dissolved oxygen conditions for prolonged periods could impair root respiration and function, potentially leading to reduced vigour. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions are favourable. Under the **Belmont drought order alone**, within this water body Giant hogweed is expected to experience a **minor negative** change to fitness in response to the drought order. Under the **Belmont + Jumbles scenario**, within this water body Giant hogweed is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome is **low**.
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	
		Water quality/Negligible	Low	Minor, neutral	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, negative	Medium	
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	
		Water quality/Low	Low	Minor, beneficial	Low	
Himalayan Balsam (*Impatiens glandulifera*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, negative	Medium	*I. glandulifera* distributes propagules through hydrochorous (water-mediated) seed dispersal. A reduction in flow may limit spread potential. A reduction in water levels and river flows may lead to drier riparian soils, reducing habitat suitability and slowing vegetative

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	spread. Conversely increasing bank size may provide increased available riparian habitat. This species can persist in a range of moisture conditions, especially if shading and competition are low. Although largely tolerant to changing water quality, increases to ammonia may be phytotoxic impairing nutrient uptake or root development. The species is unlikely to be directly affected by BOD changes in nearby water bodies however, reduced dissolved oxygen conditions for prolonged periods could impair root respiration and function, potentially leading to reduced vigour or increased susceptibility to root pathogens. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. Under the **Belmont drought order alone**, within this water body Himalayan balsam is expected to experience a **minor negative** change to fitness in response to the drought order. Under the **Belmont + Jumbles scenario**, within this water body Himalayan balsam is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome is **low**.
		Water quality/Negligible	Low	Minor, neutral	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, negative	Medium	
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	
		Water quality/Low	Low	Minor, beneficial	Low	
Japanese Knotweed (*Fallopia japonica*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, negative	Low	*F. japonica* distributes propagules through water-mediated dispersal. A reduction in flow may limit spread potential. A reduction in water levels and increasing bank size may provide increased available riparian habitat. This species can persist in a range of moisture conditions, and spreads aggressively.
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Water quality/Negligible	Low	Minor, neutral	Low	Largely tolerant or isolated from changing water quality. Increased phosphate could increase the plant's fitness and capacity for spread, especially where other environmental conditions remain favourable. Under the **Belmont drought order alone**, within this water body Japanese knotweed is expected to experience a **minor negative** change to fitness in response to the drought order. Under the **Belmont + Jumbles scenario**, within this water body Japanese knotweed is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in this species outcome is **low**.
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, negative	Low	
		Habitat and geomorphology/Low	Medium	Minor, beneficial	Low	
		Water quality/Low	Low	Minor, beneficial	Low	
Rhododendron (Rhododendron ponticum)	Belmont (4.5Ml/d)	Hydrology/Low	Not Sensitive	Minor, neutral	Low	*R. ponticum* is a terrestrial invasive shrub, typically found in woodlands, heathlands, and moist upland areas, rather than aquatic environments. As such, it is deemed not sensitive to direct impacts from flow reduction in aquatic systems. The reduction to aquatic habitat may open increased terrestrial habitat for spread. Under the **Belmont drought order alone**, within this water body Rhododendron is expected to experience a **neutral net impact** to fitness in response to the drought order. Under the **Belmont + Jumbles scenario**, within this water body Rhododendron is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in species outcome result is **low.**
		Habitat and geomorphology/Negligible	Low	Minor, neutral	Medium	
		Water quality/Negligible	Not Sensitive	Minor, neutral	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Not Sensitive	Minor, neutral	Low	
		Habitat and geomorphology/Low	Low	Minor, beneficial	Medium	
		Water quality/Low	Not Sensitive	Minor, neutral	Low	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Signal Crayfish (*Pacifastacus leniusculus*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, beneficial	Low	*P. leniusculus* are adaptable to a range of flow regimes and water depths, including low-flow or isolated conditions. They burrow into banks to maintain moisture and shelter, which can buffer them against temporary reductions to aquatic habitat although long term reductions may reduce fitness. Lower flows may concentrate individuals and prey, potentially benefiting feeding opportunities, but can also increase competition and predation risk. Lower flows may also promote upstream migration. Generally tolerant to water quality changes, although chronic exposure may have longer term implications for fitness. Under the **Belmont drought order alone**, within this water body Signal crayfish are expected to experience a **minor beneficial** change to fitness in response to the drought order. Under the **Belmont + Jumbles scenario**, within this water body Signal crayfish are expected to experience a **minor negative** change to fitness in response to the drought order. Confidence in species outcome result is **low.**
		Habitat and geomorphology/Negligible	Low	Minor, neutral	Low	
		Water quality/Negligible	Low	Minor, neutral	Medium	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, beneficial	Low	
		Habitat and geomorphology/Low	Low	Minor, negative	Low	
		Water quality/Low	Low	Minor, negative	Medium	
Water Fern (*Azolla filiculoides*)	Belmont (4.5Ml/d)	Hydrology/Low	High	Moderate, beneficial	Medium	This species prefers still or slow flowing waters, and can be flushed away in fast flowing water. As an aquatic macrophyte, a reduction in aquatic habitat is expected to have a negative effect upon fitness. *A. filiculoides* has a large range of environmental tolerances including pollution and nutrients, and is usually present in eutrophic conditions. As a result, increasing levels of nitrate and phosphate are expected to be beneficial to fitness.
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	
		Water quality/Negligible	Low	Minor, neutral	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	High	Major, beneficial	Medium	

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Habitat and geomorphology/Low	Medium	Minor, negative	Low	Under **both scenarios**, within this water body, Water fern is expected to experience a **minor beneficial** change to fitness in response to the drought order. Confidence in species outcome result is **low.**
		Water quality/Low	Low	Minor, beneficial	Low	
Jenkins' Spire Snail (*Potamopyrgus antipodarum*)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, beneficial	Medium	*P. antipodarum* is highly adaptable and thrives in a wide range of freshwater environments, including lakes, rivers, reservoirs, and even disturbed or degraded systems. Reduced flow rates will facilitate increased upstream spread. Although tolerant of reductions to river levels on balance this is considered a negative impact to baseline fitness. *P. antipodarum* is tolerant to transitory or moderate changes to water quality; however, chronic high ammonia levels or low dissolved oxygen will have a negative impact to the species. Increased phosphate may increase *P. antipodarum* food availability which could increase fitness. Under the **Belmont drought order alone**, within this water body Jenkins' spire snail are expected to experience a **minor beneficial** change to fitness in response to the drought order. Under the **Belmont + Jumbles scenario**, within this water body Jenkins' spire snail are expected to experience a **minor negative** change to fitness in response to the drought order. Confidence in species outcome result is **medium.**
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Medium	
		Water quality/Negligible	Low	Minor, neutral	Medium	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, beneficial	Medium	
		Habitat and geomorphology/Low	Medium	Minor, negative	Medium	
		Water quality/Low	Low	Minor, negative	Medium	
Aquatic Animal (n = 1)	Belmont (4.5Ml/d)	Hydrology/Low	Low	Minor, variable	Low	The fitness of aquatic animals is expected to be influenced variably depending on the niche habitat requirements of the specific species

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	identified within this water body. As aquatic species, a reduction in aquatic habitat is generalised as having a negative effect upon fitness. As aquatic species, a reduction to water quality is generalised as having a negative effect upon fitness. Under the **Belmont drought order alone**, within this water body aquatic animals are expected to experience a **neutral net impact** to fitness in response to the drought order. Under the **Belmont + Jumbles scenario**, within this water body aquatic animals are expected to experience a **minor negative** change to fitness in response to the drought order. Note that some pathways will have variable impacts. Confidence in species outcome result is **low.**
		Water quality/Negligible	Low	Minor, neutral	Low	
	Belmont (4.5Ml/d) + Jumbles	Hydrology/Medium	Low	Minor, variable	Low	
		Habitat and geomorphology/Low	Medium	Minor, negative	Low	
		Water quality/Low	Low	Minor, negative	Low	
Aquatic Plant (n = 0)	All	No INNS that fall within the 'aquatic plants' category were identified within the River Croal study area.				
Riparian Plant (n = 0)	All	No INNS that fall within the 'riparian plants' category were identified within the River Croal study area.				
Terrestrial Plant (n = 0)	All	No INNS that fall within the 'terrestrial plants' category were identified within the River Croal study area.				

Table A3-35 Impact assessment of INNS receptors present within the River Irwell in response to drought order implementation

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Giant Hogweed (*Heracleum mantegazzianum*)	Belmont (4.5Ml/d) Belmont (4.5Ml/d) + Jumbles	Hydrology/Negligible	Low	Minor, neutral	Medium	Due to the negligible nature of all impact pathways, under **both scenarios** within this water body, Giant hogweed is expected to experience a **neutral net impact**, and therefore absence of**,** change to fitness in response to the drought order. Confidence in species outcome result is **Medium**.
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	
		Water quality/Negligible	Low	Minor, neutral	Low	
Himalayan Balsam (*Impatiens glandulifera*)	Belmont (4.5Ml/d) Belmont (4.5Ml/d) + Jumbles	Hydrology/Negligible	Low	Minor, neutral	Medium	Due to the negligible nature of all impact pathways, under **both scenarios** within this water body, Himalayan balsam is expected to experience a **neutral net impact**, and therefore absence of**,** change to fitness in response to the drought order. Confidence in species outcome result is **Medium**.
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	
		Water quality/Negligible	Low	Minor, neutral	Low	
Japanese Knotweed (*Fallopia japonica*)	Belmont (4.5Ml/d) Belmont (4.5Ml/d) + Jumbles	Hydrology/Negligible	Low	Minor, neutral	Low	Due to the negligible nature of all impact pathways, under **both scenarios** within this water body, Japanese knotweed is expected to experience a **neutral net impact**, and therefore absence of**,** change to fitness in response to the drought order. Confidence in species outcome result is **Medium**.
		Habitat and geomorphology/Negligible	Medium	Minor, neutral	Low	
		Water quality/Negligible	Low	Minor, neutral	Low	
Aquatic Plant (n = 0)	All	No INNS that fall within the 'aquatic plant' category were identified within the River Irwell study area.				
Aquatic Animal (n = 0)	All	No INNS that fall within the 'aquatic animal' category were identified within the River Irwell study area.				
Riparian Plant (n = 0)	All	No INNS that fall within the 'riparian plant' category were identified within the River Irwell study area.				

Species	Scenario(s)	Pathway/Impact (at Water Body)	Sensitivity (of INNS)	Significance of Impact	Confidence Level	Species Outcome
Terrestrial Plant (n = 0)	All	No INNS that fall within the ‘terrestrial plant’ category were identified within the River Irwell study area.				

A4. Assessment of impact on other receptors

A4.1 Socio-economics, Tourism and Recreation

A4.1.1 Background

This section describes the socio-economic impact and impacts to tourism and recreation of reducing the compensation flow from Belmont Reservoir to Eagley Brook under the proposed drought order upon the communities of the Belmont study area during a time of drought. It does not assess the impact of a drought itself which would occur anyway in the absence of a drought order.

A4.1.2 Potential pathways of impact

Previous experience of drought measures show that socio-economic and community impacts are usually only likely to occur with drought measures to regulate demand, rather than those to protect the environment.

A4.1.3 Sources of information and methods

Super Output Area data (sourced from gov.uk) have been used to identify the demographic of the surrounding communities. General searches have also been undertaken to identify what local services and amenities are present within the study area. The previous scoping report for Belmont Reservoir was consulted (Amec, 2013), as well as EAR shelf copies for the nearby Delph and Jumbles reservoirs (APEM, 2025 a,b).

A4.1.4 Baseline

Socio-economics

Super Output Area data shows that the communities of the Belmont study area are largely urban. There are no hospitals directly in the study area, although there are some located nearby in Bolton. There are also a number of care homes located in Bolton near to the study area. Recreational activities (water sports, walking etc), particularly around Belmont Reservoir, contribute to the local economy. There is a third-party abstractor on the Eagley Brook. No third-party abstractors have been identified in the reaches of the Tonge, Croal and Irwell that are within the study area.

Tourism and recreation

Belmont Reservoir is popular with walkers and birdwatchers, and it is the base of the Bolton sailing club, who do not permit fishing from the reservoir, though there are fishing lakes in the nearby village of Belmont. Water based recreation in the Belmont study area is restricted to the reservoirs rather than the main rivers. This is due to the physical nature of the watercourses, with many artificial channels, culverts and impassable structures such as weirs. However, kayaking and canoeing has become more popular on the River Irwell in recent years due in part to an improvement in water quality. Angling takes place along the Eagley Brook and the Tonge.

A4.1.5 Impact assessment

Socio-economics

Although Belmont Reservoir is not used for abstraction purposes, its role as a compensation reservoir is crucial, and the implementation of the proposed drought order would retain water in Belmont Reservoir and prolong the ability to make future compensation releases. The proposed drought order is aimed at protecting the environment, which will be of benefit to the regional population. There are advantages, through early reaction to drought, to prevent the need for more extensive drought responses.

Due to the reservoir's status as a CoR it is not expected that the implementation of the proposed drought order will lead to any interruptions to public water supply. Therefore, there will not be any adverse impacts on vulnerable customers, schools, the Health Service and other essential users.

The proposed drought order is not expected to have a significant impact on tourism and recreation in the area and therefore it will not adversely impact this section of the local economy, including when in combination with a Jumbles 12 Ml/d drought permit.

On balance, the benefits of prolonging provision of some compensation flow to downstream water bodies and the lack of significant negative socio-economic impacts on the communities, the effect of the drought order is considered to be of **Beneficial** impact significance alone or in combination with a Jumbles drought permit.

Tourism and recreation

Given the negligible impact predicted on the aesthetic value of the river channels, it is expected that there will be no significant effect on people using the footpaths in close proximity to the channels. Potential impacts on river-based recreation attributable to the proposed drought order relate to modified river flows affecting wetted perimeter, water depth and velocity. However, the rivers in question, with the exception of the Irwell, are not known to be used for boating or canoeing. The hydrological impacts predicted for the River Irwell are negligible, and therefore it is expected that the proposed drought order would have no effect in this context. The potential impacts of the proposed drought order on angling are considered to be negligible on the Eagley Brook.

The implementation of the proposed drought order would result in a reduction in reservoir drawdown rate, which would result in more water being retained in Belmont Reservoir. Maintaining high water levels in reservoirs is important in order to facilitate sailing so this could be expected to have a minor beneficial impact on tourism and recreation. Therefore, the impact significance on Belmont Reservoir is considered to be **Beneficial**.

Given the magnitude of the impacts on pathways predicted under the proposed drought order, it is anticipated that the implementation of the proposed drought order will have a negligible impact on tourism and recreation in the Belmont study area.

Overall, given that the magnitude of the impacts predicted is likely to be Negligible and the receptor sensitivity is Low, it is anticipated that the implementation of the proposed drought order will have a **Negligible** (categorised as **Minor** in the absence of a negligible category) impact significance on tourism and recreation in the Belmont study area, including when in combination with a Jumbles drought permit.

A4.1.6 Summary

A summary of the impacts is shown in Table A4- below.

Table A4-1 Summary of predicted impacts of the proposed drought order on socio-economics, tourism and recreation for all water bodies

Receptor	Water body	Sensitivity	Significance of impact	Confidence level
Socio-economics	All water bodies (both scenarios)	Low	Beneficial	High
Tourism and recreation	Belmont Reservoir (Scenario 1)	Low	Beneficial	High
Tourism and recreation	All downstream river water bodies (both scenarios)	Low	Minor*	High

* Impact predicted to be negligible, but categorised as Minor in the absence of a negligible category.

Uncertainties

A **High** confidence level has been assigned to the assessment of all receptors in this section, as the available data is considered appropriate for the scale of this study.

A4.1.7 References

Amec (2013) Belmont Reservoir Drought Order Scoping and Data Gap Analysis Report. Report to Environment Agency. 33670 D13147i2. July 2013. 95pp.

APEM (2025a) Delph Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

APEM (2025b) Jumbles Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

A4.2 Aesthetics and Landscape

A4.2.1 Background

Visual impacts relate to the effect on, and the consequent appearance of the local landscape and the effect on local landscape character, together with the perception of these changes to the baseline environmental conditions on the people (visual receptors) who may experience them. This section gives consideration to the likely landscape and visual amenity impacts of the proposed drought order. Also considered are the effects of the proposed drought order on local planning policies and landscape character.

A4.2.2 Potential pathways of impact

The key considerations in assessing the impact of the proposed drought order on the landscape and visual amenity value of the Belmont Reservoir, Eagley Brook, River Tonge, River Croal and River Irwell are as follows:

- The impact to river flow type and therefore the character of the watercourses in the Belmont study area.
- The seasonal timing and frequency of any changes, in particular the impact over spring and summer, when members of the public are most likely to be utilising the landscape around the Belmont study area for recreation.

A4.2.3 Sources of information and methods

The assessment is based on a review of existing data and results from other sections of this environmental assessment as well as the Amec (2013) scoping report.

A4.2.4 Baseline

All the rivers within this study area are visible at many points through a combination of roads, bridges, public footpaths and cycle ways, country parks, golf courses, playing fields, privately owned residential and industrial premises. There are many channel modifications along its course, which take the shape of bridges and weirs. These structures affect the characteristics of flow in the parts of the channel they occupy.

A4.2.5 Impact assessment

The potential impacts on landscape and visual amenity attributable to the proposed drought order relate to an increase in the number of days that these watercourses will experience a reduction in wetted perimeter during low-flow conditions.

The net result of the implementation of the proposed drought order would be a reduction in drawdown rate of Belmont Reservoir, leading to more water being retained. This will minimise the reduction of the wetted perimeter of the reservoir in such periods, will prolong the ability to make future compensation releases, and will facilitate a more rapid recovery of water levels following a drought period. The increased retention of water within the reservoir could be anticipated to have a minor-positive aesthetic impact magnitude.

The outputs from the hydrology and habitat and geomorphology assessments (see Appendices 2 and 3 (Section A2 and A3) indicate that changes resulting from the implementation of the proposed drought order would be of Medium magnitude on Eagley Brook, that is to say that changes would be noticeable (albeit short-term); Low on the rivers Tonge and Croal, i.e. just noticeable, and Negligible on the River Irwell, i.e. unlikely to be noticeable. As such, it is considered that implementation of the proposed drought order under all scenarios would be unlikely to significantly detract from the aesthetic value of the watercourses, and the proposed drought order will only be implemented during natural drought conditions, meaning that river flows will be unaffected for the majority of the time. It is unlikely that the proposed drought order will impact significantly on planning activities in the area. Planning and development in the area is evidently a considered and logical process, and the proposed drought order is unlikely to alter the council's approach. The character of the landscape may be slightly impacted by a reduction in wetted perimeter, but this impact has been deemed to be insignificant (i.e. Not Sensitive).

Therefore, given that the magnitude of changes as regards hydrology and habitat and geomorphology are at worst expected to be of Medium magnitude (Eagley Brook) and otherwise Low / Negligible magnitude, and given that the sensitivity of the aesthetics and landscape receptors is considered to be Low, it is anticipated that the proposed drought order will have a **Negligible** (categorised as **Minor** in the absence of a negligible category) impact on the study area. This is applicable to a Belmont drought order alone or in combination with a Jumbles drought permit.

A4.2.6 Summary

A summary of impacts on aesthetics and landscape is presented in Table A4-2 below.

Table A4-2 Summary of predicted impacts on aesthetics and landscape for the proposed drought order for all water bodies

Receptor	Water body	Sensitivity	Significance of impact	Confidence level
Aesthetics and landscape	Belmont Reservoir (Scenario 1)	Low	Beneficial	High
	All downstream water bodies (both scenarios)	Low	Minor*	Medium

* Impact predicted to be negligible, but categorised as Minor in the absence of a negligible category.

Uncertainties

Confidence in the Belmont Reservoir assessment is **High**. There is some uncertainty as regards the assessment of water bodies downstream of Belmont Reservoir, given that the assessment is based on the impacts resulting from changes in hydrology and habitat and geomorphology (Appendix 2). Confidence in this assessment is therefore **Medium**.

A4.2.7 References

Amec (2013) Belmont Reservoir Drought Order Scoping and Data Gap Analysis Report. Report to Environment Agency. 33670 D13147i2. July 2013. 95pp.

A4.3 Archaeology and Cultural Heritage

A4.3.1 Background

This section assesses potential impacts on archaeological deposits associated with and / or adjacent to the rivers and reservoirs potentially affected by the proposed drought order.

A4.3.2 Potential pathways of impact

No definitive pathways of impact resulting from the proposed drought order on features of archaeological and / or cultural heritage importance have been identified.

A4.3.3 Sources of information and methods

A search for statutory and non-statutory historical features was conducted using MAGIC (http://www.magic.gov.uk/), an interactive mapping website providing authoritative geographic information about the natural environment from across government.

The following layers were interrogated:

- Scheduled monuments (historic statutory land-based designations).
- World heritage sites (historic statutory land-based designations).
- Listed buildings (historic statutory land-based designations).
- Registered battlefields (historic non-statutory land-based designations).
- Registered parks and gardens (historic non-statutory land-based designations).

National Trust properties were assessed using National Trust Open Data available from the National Trust website (www.nationaltrust.org.uk).

The shelf copy EAR for Delph and Jumbles reservoirs were also consulted (APEM, 2025, a,b)

A4.3.4 Baseline

The study area was searched starting from Belmont Reservoir downstream to Kearsley gauging station on the River Irwell (i.e. the downstream limit of the assessment). No scheduled ancient monuments, world heritage sites or registered battlefields were identified across the entire study area. Registered parks were present in the River Tonge and River Irwell study reaches, and one on the River Croal. However, none are located on, or immediately adjacent to, the main watercourses. A viaduct is present on the River Tonge and is registered as a listed building. There are 7 bridges, viaducts or aqueducts constituting listed buildings on the River Irwell.

A4.3.5 Impact assessment

The heritage features identified as occurring within or immediately adjacent to the rivers within the area of study are unlikely to be directly impacted by any reduction in flow rate, velocity or wetted perimeter. Features such as bridges have experienced a wide range of flows over time and are robust to these variations. As no pathway for impact has been identified, the sensitivity of this receptor is considered Not Sensitive and has not been assessed further for the Belmont drought order whether alone or in combination with a Jumbles drought permit.

A4.3.6 Summary

A summary of impacts on archaeology and cultural heritage is presented in Table A4-3 below.

Table A4-3 Summary of predicted impacts on archaeology and cultural heritage for the proposed drought order for all water bodies considered

Water body	Sensitivity	Significance of impact	Confidence level
All water bodies	Not Sensitive	N/A	High

Uncertainties

Given that no definitive pathways of impact resulting from the proposed drought order scenario on features of archaeological and / or cultural heritage importance have been identified, the assigned confidence level is High.

11.3.7 References

APEM (2025a) Delph Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

APEM (2025b) Jumbles Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

MAGIC Website: http://www.magic.gov.uk/

National Trust Website: http://www.nationaltrust.org.uk/visit/places/find-a-place-to-visit/

A4.4 Designated Sites

A4.4.1 Background

This assessment focusses on the impact of the proposed drought order on designated sites within the Belmont study area.

A4.4.2 Potential pathways of impact

Sites designated under UK, European and international legislation are considered where they may be designated for their wildlife or geological interest. Designated sites may be impacted via a change in river level leading to exposure of sediments. This has the potential to impact the integrity of the substrate itself and the utilisation of the shoreline by flora and fauna protected under the designation. Sites designated for riverine and/ or riparian features are likely to be more sensitive to changes in water levels.

A4.4.3 Sources of information and methods

A search for statutory and non-statutory designated sites within the Belmont study area was conducted using MAGIC (http://www.magic.gov.uk/). The search was restricted to features located on the banks of the watercourses in the Jumbles study area.

The following layers were interrogated:

- Areas of Outstanding Natural Beauty (AONB);
- Local nature reserves;
- National nature reserves;
- National parks;
- Ramsar sites;
- Sites of Special Scientific Interest (SSSI);
- Special Areas of Conservation (SAC); and
- Special Protection Areas (SPA).

These statutory designations are considered to be of National (domestic UK legislation) or International (European and international legislation) Importance (Table A4-4).

Local wildlife sites are non statutory designations, they were assessed using data held by and requested from the relevant local record centres (Table A4-5).

The shelf copy reports for Delph and Jumbles reservoirs were consulted (APEM, 2025, a,b). The scoping report by Amec (2013) was also consulted, however designated site boundaries have changed significantly since its publication and the information contained therein was no longer valid.

A4.4.4 Baseline

Two local wildlife sites were identified surrounding Belmont Reservoir, which also constitutes a local wildlife site.

Immediately downstream of Belmont Reservoir is the Eagley Brook. Gale Clough and Shooterslee Wood SSSI is located to the west of the Eagley Brook and is the best example of a clough woodland on acid soils in Greater Manchester. It runs most of the length of the Gale Brook which flows from Dingle reservoir and joins the Eagley Brook just upstream of its confluence with the Delph Brook. This site is also designated as a local wildlife site.

The Eagley Valley LNR is designated as an urban LNR, it is a small area comprising the riparian zone of the Eagley Brook.

The Tonge River Section SSSI, is located on the west bank of Eagley Brook, it is a geological SSSI, designated due to its Carboniferous rock formation.

An additional 8 local wildlife sites were also identified as being associated with the Eagley Brook, one of which, Bank Top, is also an LNR.

A single site was identified on the River Tonge: Leverhulme Park, which is designated as both a local wildlife site and local nature reserve.

Further downstream, on the River Croal, five local wildlife sites were identified of which two are also designated as local nature reserves (Moses Gate and Nob End) and one also as a SSSI (Nob End). The Nob End SSSI is situated on the outskirts of the village of Little Lever and lies at the confluence of the rivers Croal and Irwell. The site consists of a flat-topped, steep-sided tip of alkali waste, produced as a by-product of the Leblanc process for the making of sodium carbonate. The plateau of the tip is approximately 10 m above the level of the rivers. The site supports a rich establishment of calcicolous vegetation for which it is designated; the most significant and extensive of which can be found on eroding, base-rich clay cliffs. It is principally characterised by an open-structed sward in which herbs typical of limestone grasslands predominate, although orchids are also well represented across the site.

Along the River Irwell, a further six local wildlife sites were identified, one of which, the Clifton Country Park, is also designated as a local nature reserve. Two further SSSIs were identified within the wider catchment; Ashclough SSSI and West Pennine Moors SSSI. However, both sites are located either upstream or outside of the hydrological zone of influence and were therefore not considered further.

Table A4-4 Statutory designated sites within the Belmont study area

Site Name	Designation	Grid reference	Water body
West Pennine Moors	SSSI	SD 686 183	Eagley Brook
Gale Clough and Shooterslee Wood	SSSI	SD 700 141	Eagley Brook
Eagley Valley	LNR	SD 721 130	Eagley Brook
Tonge River Section	SSSI	SD 725 095	River Tonge
Leverhulme Park	LNR	SD 735 085	River Tonge
Moses Gate	LNR	SD 742 065	River Croal
Nob End	SSSI; LNR	SD 749 063	River Croal
Clifton County Park	LNR	SD 775 040	River Irwell

Table A4-5 Local wildlife sites within the Belmont study area

Site name	Water body	LNR	Grid reference	Reason for designation	Features/ species potentially at risk
Belmont Barn Inbye	Belmont Reservoir	N	SD669166	Flowering Plants and Ferns (Ff4b); Birds (Av9)	The site comprises a series of fields that mainly support agriculturally improved grassland. Some areas of marshy grassland are also present. The site is of significant ornithological interest.
Higher Pasture House Inbye	Belmont Reservoir	N	SD675169	Birds (Av9)	The site comprises gentle undulating fields situated to the east of Belmont Reservoir. The fields are of significant ornithological interest supporting good numbers of breeding waders.
Belmont Reservoir	Belmont Reservoir	N	SD672170	Birds (Av8e, Av5, Av4, Av3, Av1)	The site is of significant ornithological importance. A number of species regularly breed at the site. The reservoir ‘draw-down’ zone supports a fairly rich flora.
Belmont Gorge	Eagley Brook	N	SD 675161	Woodland (Wd10, Wd11, Wd12); Grassland (Gr4); Swamp, fen and reedbed (Fe7); Rock habitats (Ro2); Artificial habitats (Ar3)	A large and varied site, which is remarkably inaccessible due to the steepness of the terrain. The dam slopes at the north end of the site have semi-improved mown, neutral grassland. The overflow channel itself, however, and the stepped weirs below it, support quite a wetland community.
Lower Whittaker Pastures	Eagley Brook	N	SD677162	Grassland (Gr3, Gr1)	The site comprises a mosaic of semi-natural grasslands and flushes in a large sloping pasture. The banks above the

Site name	Water body	LNR	Grid reference	Reason for designation	Features/ species potentially at risk
					streams are particularly species-rich. Patches of acidic grassland occur on the steeper, lower slopes above Belmont Brook. Small patches of scrub scatter the streambanks.
Upper Longworth Clough	Eagley Brook	N	SD688158	Woodland and Scrub (Wd1); Habitat Mosaics (Hm2); Birds (Av8j)	The site comprises a mosaic of woodland, scrub, species-rich grassland, flushes, swamp and open water habitats. Wet woodland and scrub is found at the bottom of the clough slopes and beside the brook
Hampsons Flushes & scrub	Eagley Brook	N	SD695148	Swamp and Fen (Fe1)	Across the site is a spring line from which arise a series of flushes that run down into Hampsons Wood.
Eagley Brook Field	Eagley Brook	N	SD703147	Grassland (Gr3)	Alder-ash woodland is present on damp ground at the base of the slope, along the brookside.
Longworth Clough	Eagley Brook	N	SD705146	Woodland (Wd1)	A complex matrix of habitats along the valleys of two converging brooks. Fringing Eagley Brook there are areas of woodland with associated marshy areas. The stream shows good examples of back channels and the woodland is inundated at times of high flow.
Dunscar reservoirs & Longworth Lane Pastures	Eagley Brook	N	SD709138	Woodland (Wd1); Grassland (Gr2); Ponds & Small Lodges (Fw2)	The two reservoirs are of importance for their aquatic flora and fauna, marginal vegetation and their attractiveness to birds. The reservoirs are fed by springs, which form flushes and marsh vegetation on the slopes of the grassland to the north. The poor spring-fed fen/marshy grassland zone around the reservoirs supports a variety of flora.
Gale Clough & Shooterslee Wood	Eagley Brook	N	SD705138	Woodland (Wd1); Grassland (Gr2)	Clough woodland which on the upper drier slopes of the valley are characterised by oak and birch with wet woodland on the lower slopes. The banks support a number of species-rich marsh/marshy grassland and flush habitats,
Bank Top	Eagley Brook	Y	SD725124	Woodland (Wd1) Amphibians (Am1)	Large site supporting a range of habitats and variety of biodiversity interest. Semi-natural broadleaved woodland dominates with part being recognised as Ancient Woodland. Other habitats include semi-natural grassland, tall ruderal, mill lodges and a brook. Bank Top Lodge is an important amphibian

Site name	Water body	LNR	Grid reference	Reason for designation	Features/ species potentially at risk
					site supporting breeding frogs, common toad and smooth, palmate and great crested newts.
Leverhulme Park	River Tonge	Y	SD 735 085	Plantation Woodland (Wd2); Grassland (Gr2)	The site is known to support wetland birds including species such as, kingfishers, wagtails, grey herons and dippers; thus, aquatic species are present.
Smith Road Reservoirs & Raikes Clough	River Croal	N	SD 733 072	Woodland (Wd1)	Possible riparian habitat present.
Bull Hill	River Croal	N	SD 738 071	Calcareous Grassland (Gr3); Open Water (Fw3)	No/ limited information available.
Moses Gate	River Croal	Y	SD 742 065	Pond & Small Lodges (Fw2); Birds (Br6 & Br7)	The site is known to support waterfowl, large bird populations and brown trout, i.e. aquatic species present.
Manchester Bolton and Bury Canal (West)	River Croal	N	SD 744 071 – SD 761 056	Canal (Fw3)	Submerged plants provide aquatic habitat for amphibian, invertebrate and fish species. Not hydrologically connected to the Croal so impact unlikely on this water body. Connection to the Irwell remains, but large stretches of the canal are now dry so impact likely to be minor.
Nob End	River Croal	Y	SD 749 063	Calcareous Grassland (Gr3); Scrub (Wd3)	Riparian features present at the site. Site runs adjacent to the rivers Croal and Irwell. It is also designated as a SSSI. The SSSI citation states that there is interaction with water-table in the northern region of the site (closest to the Croal), supporting areas of marshy grassland and willow carr. The SSSI comprises just one unit, which is classed as being in unfavourable - recovering condition.
Woodland near Ringley Bridge	River Irwell	N	SD 761 057	Ancient Woodland (Wd1)	Terrestrial designation; unlikely to be impacted.
Ringley Woods	River Irwell	N	SD 773 047	Ancient Woodland (Wd1)	Terrestrial designation; unlikely to be impacted.
Rhodes Farm Sewage Works	River Irwell	N	SD 785 039	Open water (Fw3); Swamp (Fw1); Birds	No/ limited information available.
Clifton County Park	River Irwell	Y	SD 775 040	Woodland (Wd1) Ponds & Lodges (Fw2) Birds (Br6 & WB1)	No/ limited information available.
Unity Brook	River Irwell	N	SD 765 042	Woodland (Wd1)	Terrestrial designation; unlikely to be impacted.

A4.4.5 Impact assessment

As previously stated, sites designated under UK, European and international legislation are considered with regards to potential impact from the proposed drought order alone and in-combination with a Jumbles drought permit.

Under both scenarios, it is expected that the changes in water level, average velocity, depth, wetted width or wetted perimeter of the downstream watercourses will not be significantly different than the predicted water level in a drought under the normal (statutory) compensation flow scenario. Water quality impacts would be of Low magnitude for most parameters (Medium for ammonia and phosphate in Eagley Brook) and also transitory. Given that the impacts resulting through the defined pathways will be transitory, it is considered that these changes will likely be within the tolerance of any flora and fauna present (**Low** receptor sensitivity) at the designated sites identified above.

The designated sites are terrestrial and are unlikely to be directly affected by drought order implementation. However, various aquatic and riparian features / species are present within some of the identified sites and, ideally, further information would inform the understanding of the value / possible sensitivity of these sites.

Given the lack of impacts of the proposed drought order on the identified designated sites, and the transitory nature of predicted hydraulic and water quality change, the potential impact of the Belmont drought order is expected to be **Minor (Negligible)**, including when in combination with a Jumbles drought permit.

A4.4.6 Summary

A summary of the predicted impacts on designated sites under the proposed drought order is presented in Table A4-6.

Table A4-6 Summary of predicted impacts on designated sites for the proposed drought order for all water bodies considered

Scenario	Site	Sensitivity	Significance of impact	Confidence level
1 – Belmont drought order alone	All	Low	Minor*	Medium
2 – Belmont drought order with a Jumbles drought permit	All	Low	Minor*	Medium

* Impact predicted to be negligible, but categorised as Minor in the absence of a negligible category.

Uncertainties

The uncertainties outlined in Appendices 2 and 3 (Section A2 and A3), are compounded by the lack of data as regards to a number of the designated sites listed in Table A4-6 above. Thus, the overall confidence level is considered to be Medium.

A4.4.7 References

Amec (2013) Belmont Reservoir Drought Order Scoping and Data Gap Analysis Report. Report to Environment Agency. 33670 D13147i2. July 2013. 95pp.

APEM (2025a) Delph Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

APEM (2025b) Jumbles Drought Permit Environmental Assessment Report. APEM Report P00014169. United Utilities, April 2025, Draft.

MAGIC Website: http://www.magic.gov.uk/

A4.5 Other abstractors

A4.5.1 Background

This section assesses potential impacts of the drought order on those who have a licence to abstract surface water in the zone of influence considered in this assessment. This zone extends from the outfall of Belmont Reservoir to upstream of the confluence of the River Tonge and River Croal. The assessment was based on a review of abstraction licence data provided by the EA and information provided by UU.

A4.5.2 Potential routes of impact

Other abstractors may be affected via:

- Reduced river flows, such that there is insufficient water in the channel to satisfy the licenced abstraction. This does not occur at any of the abstractions considered in this assessment.
- Reduced river flows below any Hands-off Flow (HoF) specified in their licence that reduce the frequency or duration of periods during which abstraction would be possible.
- Reduced river levels that affect their physical ability to abstract water from the river (e.g. due to depth of an abstraction pipe/inlet).
- Reduced river levels that affect the availability of groundwater for abstraction. This would only occur where groundwater levels depended upon direct hydraulic connectivity with the surface water. Whilst there is potential for some surface water / groundwater hydraulic connectivity within the catchment, impacts of the reduction in compensation flow from Belmont Reservoir on hydrogeology are expected to be negligible, risks to groundwater abstractions are considered negligible, and therefore this pathway of impact is not considered further.

These issues are considered in the impact assessment below for Scenario 1 (Belmont drought order alone). There are no non-UU abstractions in the Croal catchment downstream of the Bradshaw Brook confluence (i.e. none that could potentially be affected by in-combination effects of a Jumbles Reservoir drought permit). Consequently, due to the lack of any pathway of impact, Scenario 2 (Belmont Drought order in combination with a Jumbles drought permit) is not considered further.

A4.5.3 Sources of information

Abstraction licence data provided by the EA for the Eagley Brook, Astley Brook and River Tonge catchments were collated and reviewed to identify any non-UU abstractors within the zone of influence. This data included information on the maximum daily and annual abstractions for each licence, and for some licences, information on HoF conditions.

A4.5.4 Baseline

Nine non-UU abstractions are currently licenced within the zone of influence (Table A4-7). These include both surface water and groundwater abstractions, ranging from 0.003-2.046 Ml/d, with the largest four abstracting at least 0.02 Ml/d (Table A4-7). For two of these licences, the EA confirmed that no HoF conditions are imposed, but the HoF status of the remaining seven licences is unknown (Table A4-7).

Table A4-7 Non-UU abstractions in the zone of influence

Name	Licence Number	Sub-catchment	Groundwater (GW) or Surface Water (SW)	Considered in Impact Assessment	Maximum Licenced Daily Abstraction (Ml/d)	Hands-off Flow Conditions
Belmont Bleaching and Dyeing	2569003014	1	SW	Y	2.046	None
Belmont Bleaching and Dyeing	2569003018	3	SW	Y	0.02	No data
Dunscar Golf Club	2569003079	5	GW	N	0.012	No data
Agriculture	2569003080	6	GW	N	0.005	No data
Turton Golf Club	2569003075	7	SW	Y	0.026	None
Agriculture	2569003071	8	GW	N	0.01	No data
Total Fitness Health Clubs	2569003096R01	9	GW	Y	0.085	No data
Agriculture	2569003083	10	GW	N	0.003	No data
Agriculture	2569003066	10	GW	N	0.009	No data

A4.5.5 Impact Assessment

Abstractions are at greatest risk of impact where the reductions in river flow between the Baseline and drought order scenarios are larger. Larger abstractions, by contributing to flow reductions, may also be at greater risk. Surface water abstractions are also more likely to have HoF conditions.

The largest abstractors are located upstream of the confluence with Bradshaw Brook (Table A4-7).

In subcatchments 1 and 3, two licences permit Belmont Bleaching and Dyeing to abstract a combined maximum of 2.066 Ml/d of surface water from Eagley Brook. In subcatchment 7, Turton Golf Club are licenced to abstract 0.026 Ml/d of surface water, although the nearest watercourse appears to be outside the WFD Eagley Brook catchment boundary, despite the licence information indicating that this abstractor is located within the catchment. Further downstream in subcatchment 9, a single licence permits Total Fitness Health Clubs to abstract 0.085 Ml/d of groundwater in the River Tonge catchment.

Table A4-8 illustrates the increase in the Baseline and Scenario 1 flows at the outlet of the relevant subcatchment, in the event that each of the abstractions were independently ceased. This table also shows the reduction between the Baseline and Scenario 1 flows both with and without each abstraction.

Table A4-8 Increases in baseline and Scenario 1 flows without selected abstractions, and reductions between baseline and Scenario 1 flows with and without selected abstractions

Name and Licence Number	Increase in Baseline Flow without Abstraction (%)	Increase in Scenario 1 Flow without Abstraction (%)	Reduction Between Baseline and Scenario 1 Flow with Abstraction (%)	Reduction Between Baseline and Scenario 1 without Abstraction (%)
Belmont Bleaching and Dyeing (SW) (2569003014)	29.1 at the outlet of subcatchment 1	80.5 at the outlet of subcatchment 1	63.9 at the outlet of subcatchment 1	49.5 at the outlet of subcatchment 1
Belmont Bleaching and Dyeing (SW) (2569003018)	0.23 at the outlet of subcatchment 3	0.47 at the outlet of subcatchment 3	51.3 at the outlet of subcatchment 3	51.2 at the outlet of subcatchment 3
Turton Golf Club (2569003075) (SW)	0.19 at the outlet of subcatchment 7	0.28 at the outlet of subcatchment 7	32.9 at the outlet of subcatchment 7	32.84 at the outlet of subcatchment 7
Total Fitness Health Clubs (GW) (2569003096R01)	0.43 at the outlet of subcatchment 9	0.55 at the outlet of subcatchment 9	22.63 at the outlet of subcatchment 9	22.53 at the outlet of subcatchment 9

A4.5.6 Summary

The assessment is summarised for all water bodies in Table A4-9.

Table A4-9 Summary of potential impacts on other abstractors under the Belmont drought order alone (Scenario 1)

Location and Licence	Water Body Affected	Risk of Impact	Confidence Level
Belmont Bleaching and Dyeing (SW) (2569003014)	Eagley Brook	High	Uncertain
Belmont Bleaching and Dyeing (SW) (2569003018)	Eagley Brook	High	Uncertain
Turton Golf Club (SW) (2569003075)	Eagley Brook	Moderate	Uncertain
Total Fitness Health Clubs (GW) (2569003096R01)	River Tonge	Low	Uncertain

The assessment of impacts on other abstractors has been made in the absence of information on HoF conditions for every licence, and information on abstraction pipe inlet depths, for example.

The risk of impact on the surface water abstractors in the Eagley Brook catchment is considered **High** for the two Belmont Bleaching and Dyeing licences, and **Moderate** for the Turton Golf Club licence. The groundwater abstraction at Total Fitness Health Clubs in the River Tonge catchment is considered to be at **Low** risk of impact. These categorisations are Uncertain for all abstractors. Additional uncertainty is introduced into the assessment of the surface water abstraction at Turton Golf Club due to the location information reported in the licence.

Uncertainties

A more accurate determination of whether third party abstractors may be affected by the proposed drought order would be possible with confirmation of whether the other seven non-UU licences have HoF conditions imposed. Additionally, other relevant information, such as the depths of abstraction pipe inlets, would help in assessing any potential risks to the physical feasibility of abstracting water from the watercourses under the proposed drought order conditions.