



# Drought Plan: Environmental Assessment Report – River Wharfe at Lobwood Annual Abstraction Increase

Final

Report for Yorkshire Water Services Ltd

**Customer:**

Yorkshire Water Services Ltd

**Customer reference:**

4800132285

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**Date:**

19/10/2022

**Ref:** ED 14166

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## Glossary

### **Abstraction Licence**

The authorisation granted by the Environment Agency (England) or Natural Resources Wales (for sites in Wales) to allow the removal of water from a source.

### **Biochemical Oxygen Demand (referred to as BOD)**

The amount of oxygen that would be consumed if all the organic material in one litre of water were oxidised by bacteria and protozoa.

### **Compensation Releases**

Water company licences that authorise abstractions from a reservoir may have conditions imposed, whereby specified amount of water has to be released into the watercourse, downstream of the reservoir in order to compensate the river for the abstraction.

### **Discharge Consent**

A written consent issued by the Environment Agency permitting the discharge of specific pollutants into the aquatic environment. Discharge consents have conditions attached to them that limit the amount and concentration that can be discharged to ensure that there is no threat to the environment.

### **Drought Order**

An authorisation granted by the Secretary of State (England) or Welsh Ministers (Wales) under drought conditions which imposes restrictions upon the use of water and/or allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis.

### **Drought Permit**

An authorisation granted by the Environment Agency (England) or Natural Resources Wales (for sites in Wales) under drought conditions which allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis.

### **Environmental Drought**

Environmental droughts arise from reduced water flows in rivers and streams. In the summer raised temperatures may further exacerbate drought conditions. Such conditions cause physiological stress to living organisms, the degree of stress increasing with drought severity and time.

### **Environmental Quality Ratio (EQR)**

EQRs express the current condition of a biological quality element such as macroinvertebrates or fish. This is achieved by comparing the observed value of the appropriate metric (for example WHPTASPT) calculated from samples with the value of the same metric expected at WFD reference state.

### **Local Wildlife Sites (LWS)**

Local Wildlife Sites are non-statutory designations. They are areas which are locally important for the conservation of wildlife. They are identified and selected for the significant habitats and species that they contain.

### **Lotic-Invertebrate Index Flow Evaluation (referred to as LIFE)**

Is a method that allows the aquatic invertebrate community recorded at a site to be scored according to its dependence on current velocity. The LIFE value obtained can be compared to that predicted for the site under normal flow conditions and may show if the invertebrate community is experiencing flow related stress. Comparing observed and predicted scores for each gives an Environmental Quality Index (EQI) that is used as a measure of stress experienced at a site from low flow. A value of 1.0 indicates that the invertebrate community has the flow sensitivity predicted for the site. A value of less than 0.975 indicates the possibility of significant stress due to low flow.

## **Macroinvertebrate**

Macroinvertebrates are small, but visible with the naked eye, animals without backbones (insects, worms, larvae etc.). Waterbodies have communities of aquatic macroinvertebrates. The species composition, species diversity and abundance in a given waterbody can provide valuable information on the relative health and water quality of a waterway.

## **Natural Environment and Rural Communities (NERC) Act Section 41**

The Natural Environment and Rural Communities (NERC) Act came into force on 1 October 2006. Section 41 of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in England. The NERC Act Section 41 list contains many of England's rarest and most threatened species. The lists are known as the Section 41 habitats of principal importance (also known as 'priority habitats') and the Section 41 species of principal importance (also known as 'priority species').

## **pH**

A measure of the acidity or alkalinity of a liquid based on a logarithmic scale of concentration of hydrogen ions. < 7 is acidic, > 7 is alkaline.

## **Ramsar site**

Internationally important wetland site.

## **Special Area of Conservation (SAC)**

Special Area of Conservation – Designated under the European Habitats Directive (1991)

## **Special Protection Area (SPA)**

Special Protection Area – Classified under the European Birds Directive (1979)

## **Site of Special Scientific Interest (SSSI)**

A site given a statutory designation by either Natural England or Natural Resources Wales because it is particularly important, on account of its nature conservation value.

## **Supply Drought**

A supply drought occurs when water sources are at low levels due to a lack of rainfall. Water companies manage resources to ensure public supplies do not run out.

## **Walley Hawkes Paisley Trigg (referred to as WHPT)**

Is a method that allows the aquatic invertebrate communities recorded at a site to be scored according to their tolerance to environmental pressures such as organic pollution. WHPT can be expressed as a score (the sum of values for each taxon in a sample), as an average score per taxon (ASPT) and as the number of scoring taxa (N-taxa). WFD status is based on ASPT and N-taxa. WHPT was introduced as the basis for the UK's river invertebrate status classification under the Water Framework Directive in the second River Basin Management Plans, published in 2015.



## Abbreviations

AOD	–	Above Ordnance Datum
BOD	–	Biochemical Oxygen Demand
CIEEM	–	Chartered Institute of Ecology and Environmental Management
DPG	–	Environment Agency (2020) Drought Plan Guideline
EcIA	–	Ecological Impact Assessment
EMP	–	Environmental Monitoring Plan
EQR	–	Ecological Quality Ratio
JNCC	–	Joint Nature Conservation Committee
LIFE	–	Lotic-invertebrate Index for Flow Evaluation
LNR	–	Local Nature Reserve
LWS		Local Wildlife Site
MI	–	Megalitres (1MI is equivalent to 1000 cubic metres or 1,000,000 litres)
NERC	–	Natural Environment and Rural Communities (refers to Section 41 of the Act)
NNR	–	National Nature Reserve
RHS	–	River Habitat Survey
SAC	–	Special Area of Conservation
SPA	–	Special Protection Area
SSSI	–	Site of Special Scientific Interest
WFD-		Water Framework Directive: Council of the European Communities 2000 Directive 2000/60/EC (OJ No L 327 22.12.2000) (establishing a framework for Community action in the field of water policy). As transposed into UK law by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003. Statutory Instrument 2003 No. 3242
WHPT	–	Walley Hawkes Paisley Trigg (see Glossary)
WwTW	–	Wastewater Treatment Works

## Executive summary

This Environmental Assessment Report (EAR) provides an independent and robust assessment of the potential environmental effects of the implementation of Yorkshire Water Services Ltd's (YWSL) River Wharfe at Lobwood Annual Abstraction Increase drought option. The report has been prepared in support of a drought permit/order application by YWSL in autumn 2022.

The environmental assessment has been conducted in accordance with Government regulations and using the Environment Agency's 2020 Drought Plan Guideline (DPG)<sup>1</sup> and the Environment Agency's July 2020 'Environmental Assessment for Water Company Drought Plans- supplementary guidance'.

In accordance with the DPG, the environmental assessment comprises the following components:

- an assessment of the likely changes in hydrology (flow/level regime) due to implementing the proposed drought options;
- identification of the key environmental features that are sensitive to these changes and an assessment of the likely impacts on these features;
- identification of mitigation that may be required to prevent or reduce impacts on sensitive features; and
- recommendations for baseline, in-drought and post-drought permit monitoring requirements.

The environmental assessment focuses on the potential changes to water availability (levels and flows) and any consequent implications for geomorphology, water quality, ecology and other relevant environmental receptors, for example, landscape, navigation, recreation and heritage.

This EAR considers the impacts of the River Wharfe Annual Abstraction Increase drought option in Appendix A, with a summary presented in Sections 5 and 6. Cumulative impacts with other drought options listed in YWSL's Drought Plan 2022 are considered. The assessments undertaken confirm the features requiring consideration of monitoring and mitigation; which are summarised in Section 6 and provided in full in the Drought Plan 2022 Environmental Monitoring Plan (EMP).

Throughout the environmental assessment process, YWSL have proactively engaged key stakeholders, including the Environment Agency and Natural England.

Key stakeholders will be further consulted throughout the drought permit application process.

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<sup>1</sup> Environment Agency (2020) Water Company Drought Plan Guideline, April 2020.

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# 1 Introduction

## 1.1 Purpose of document

The Yorkshire Water Services Ltd (YWSL) Drought Plan 2022<sup>2</sup> was developed in line with the Environment Agency's Drought Plan Guideline (DPG). The DPG requires that water companies must demonstrate in their drought plan that they have met their responsibility to monitor, assess and where possible mitigate for the environmental impact of all their supply side drought options, including drought permits and drought orders.

Drought permits/orders are 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. Ultimately, the environmental assessments should inform choices on when and how to use the different supply side drought options considered in a drought plan.

The objective of this Environmental Assessment Report (EAR) is to provide an independent and robust assessment of the potential environmental effects of the implementation of the River Wharfe Annual Abstraction Increase drought permit.

This EAR has been prepared in support of a drought permit application in late summer 2022 to the Environment Agency, in accordance with the Water Resources Act 1991, as amended by the Environment Act 1995, the Water Act 2003 and subsequently the Water Act 2014.

The environmental assessment has been conducted in accordance with Government regulations and using the Environment Agency's 2020 DPG and the July 2020 'Environmental Assessment for Water Company Drought Plans - supplementary guidance'.

In accordance with the DPG, the environmental assessment comprises the following components:

1. an assessment of the likely changes in hydrology (flow/level regime) due to implementing the proposed drought options.
2. identification of the key environmental features that are sensitive to these changes and an assessment of the likely impacts on these features.
3. identification of mitigation that may be required to prevent or reduce impacts on sensitive features.
4. recommendations for baseline, in-drought and post-drought permit monitoring requirements.

The methodology for this environmental assessment was developed during preparation of the 'shelf copy' environmental assessment<sup>3</sup> in consultation with the Environment Agency, and is documented separately in 'YWSL's Drought Plan 2022 Environmental Assessment Methodology'<sup>4</sup>. A summary of the assessment approach is provided in Section 3.

The assessments undertaken in this EAR confirm the features requiring consideration of mitigation and appropriate monitoring triggering mitigation. Appropriate mitigation actions identified are both available and practicable and reflect previous agreement with the Environment Agency (see Section 1.3). The methodologies and details for monitoring and mitigation requirements are documented in the standalone document 'YWSL's Drought Plan 2022 Environmental Monitoring Plan (EMP)' which accompanies the drought permit/order application. A summary of the monitoring and mitigation requirements are also included in Section 6 of this EAR.

This EAR should be read alongside the Methodology and EMP documents.

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<sup>2</sup> Yorkshire Water (2022) Yorkshire water Final Drought Plan 2022. April 2022, Available at: <https://www.yorkshirewater.com/about-us/resources/drought-plan/>

<sup>3</sup> Ricardo Energy & Environment (2021). Drought Plan: Environmental Assessment Report – River Ouse. Report for Yorkshire Water Services Ltd. February 2021.

<sup>4</sup> Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

## 1.2 Background to study

Water companies in England and Wales are required to prepare and maintain Statutory Drought Plans under Sections 39B and 39C of the Water Industry Act 1991, as amended by the Water Act 2003 (and subsequently the Water Act 2014), which set out the short operational steps a company will take before, during and after a drought. The Water Industry Act 1991 defines a Drought Plan as ‘a plan for how the water undertaker will continue, during a period of drought, to discharge its duties to supply adequate quantities of wholesome water, with as little recourse as reasonably possible to drought orders or drought permits’.

The Drought Plan (England) Direction 2016 states that Drought Plans should be submitted within 4 years and 3 months after the date on which its Drought Plan, or its last revised Drought Plan, is published. Yorkshire Water Services Limited (YWSL) published their current statutory Drought Plan in April 2022.

The Drought Plan provides a comprehensive statement of the actions YWSL will consider implementing during drought conditions to safeguard essential water supplies to customers and minimise environmental impact.

Drought Plans encompass a number of drought options that will only be implemented if and when required. Each drought is different in terms of its severity, season, location and duration and each combination of these factors may require a bespoke reaction in terms of measures. In the context of drought planning, individual drought options are taken to constitute alternatives. YWSL’s Final Drought Plan 2022 comprises a total of 63 drought options (49 ordinary supply-side options, 9 long term supply-side options and 5 demand options).

**This EAR has been prepared in support of a drought permit application in autumn 2022. It provides an update to the ‘shelf copy’ report which was produced in support of YWSL’s Drought Plan 2022.**

Following agreement with the Environment Agency<sup>5</sup>, the physical environment and environmental features assessments presented in the ‘shelf copy’ report have been retained for this application EAR. The assessments are considered suitable to support the current application as no significant dry weather events have been experienced in the Yorkshire region subsequent to the completion of the ‘shelf copy’ assessments in 2021. However, in order to provide sufficient evidence that no changes have occurred to the sensitivity of protected/notable species or the macroinvertebrate or fish communities within the impacted reaches, a full review and analysis of additional baseline monitoring data has been undertaken. This review had included incorporation of the available 2020-21 data from the YWSL and Environment Agency baseline monitoring programmes. The results of this analysis are presented as accompanying spreadsheets in support of the drought permit application. In addition, a review of water quality pressures has been undertaken following progression of the YWSL Storm Overflow Assessment Framework (SOAF) programme since the ‘shelf copy’ assessments were undertaken. Where applicable, changes have been made to the outcomes of the physical environment assessment to reflect this review.

## 1.3 Consultation

Throughout the preparation and submission of the Final Drought Plan 2019 YWSL proactively engaged with key stakeholders and regulators regarding the scope and outcomes of the environmental assessment, including with the Environment Agency and Natural England. Discussions were also held between YWSL and the Environment Agency on the scope of monitoring/mitigation in Autumn 2018 following a period of prolonged dry weather. These discussions identified certain issues around the appropriateness and practicality of YWSL’s monitoring-led mitigation plan as set out in its Draft Drought Plan 2019 EMP. The outcome of these discussions and resulting agreements have informed the basis

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<sup>5</sup> Email exchange between Yasmina Gallaher (Yorkshire Water), and Ineke Jackson (Environment Agency) on 20 July 2022.

of the approach for the update of the environmental assessments and EMP for the Draft Drought Plan 2021.

YWSL then held a number of meetings during the early stages of the preparation of the Draft Drought Plan 2021, including several meetings focused on the proposed approach to the environmental assessments which are documented in the Drought Plan 2022 Environmental Assessment Methodology<sup>6</sup>. Proactive consultation continued to be conducted for the Drought Plan 2022 submission, including on the outcomes of the environmental assessment process.

Further consultation with key stakeholders will be undertaken throughout the drought permit application process.

## 1.4 Content of report

The structure of this EAR is provided below with reference to other relevant documents.

**Section 1: Introduction**

**Section 2: Drought management proposals** - including an overview of YWSL's water supply system, drought planning, the need for the applications, alternative options and proposed drought permit details (to be completed at the time of a drought permit application)

**Section 3: Approach to environmental assessment** - description of the approach to assessing environmental impacts and identification of mitigation and monitoring requirements, with reference to the details which are provided in YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>7</sup>.

**Section 4: Drought options overview: River Wharfe Annual** - overview of drought permit conditions.

**Section 5: Physical environment effects: River Wharfe Annual** - baseline assessment of physical environment and assessment of potential changes in the physical environment as a result of the drought option, and from cumulative operation with options described in other EARs. Detailed information is provided in **Appendix A** and summarised in Section 5.

**Section 6: Features susceptibility and sensitivity assessment: monitoring and mitigation: River Wharfe Annual**

### Appendices

**Appendix A** Physical Environment

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6 Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

7 Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.



## 2 Drought management proposals

*See YWSL drought permit application supporting documentation.*

## 3 Approach to environmental assessment

### 3.1 Overview

The environmental assessment of the drought options in this report has been prepared in accordance with Environment Agency's 2020 DPG; specifically the Environment Agency's July 2020 'Environmental Assessment for Water Company Drought Plans - supplementary guidance'. The approach to environmental assessment and the bespoke assessment methodologies used have been developed in consultation with the Environment Agency and are documented separately in YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>8</sup> ('the Methodology').

Depending on the particular ongoing water resources drought, different management options may be available and the full range of drought permits may not be used by YWSL at the same time. This EAR considers the impacts of implementation of the River Wharfe Annual Abstraction Increase drought permit.

The Environment Agency's 2020 DPG requires the completion of environmental assessment and production of an environmental monitoring plan for each of supply side actions included in a drought plan. The environmental assessments should also include any mitigation measures that could be implemented. The Methodology provides detailed approaches to the specific requirements of the DPG which are:

1. Setting out the likely changes to the hydrology (or hydrogeology) due to a proposed action (see Section 3.4 and Section 3.5 of the Methodology).
2. Identifying the key features of the environment which are likely to be affected by these changes and assess their sensitivity (see Section 3.6 of the Methodology).
3. Assess the likely impact on these features, allocate a level of confidence in your assessment and set out the actions you will take to reduce uncertainty (see Section 3.7 of the Methodology).
4. Mitigating against the potential impacts and where datasets are considered insufficient to undertake an environmental assessment it is the responsibility of the water company to implement environmental monitoring to generate the information required (see Section 3.8 of the Methodology).

The overall approach taken in completing the environmental assessment to demonstrate an understanding of the impact on the environment of implementing the proposed drought options is illustrated in **Figure 3.1**.

Results of the assessment have also informed the Habitats Regulations Assessment (HRA)<sup>9</sup> and Strategic Environmental Assessment (SEA)<sup>10</sup> which support YWSL's Drought Plan 2022, and are documented separately.

The Environment Agency's 2020 DPG also requires water companies to 'consider the combined environmental effects of your supply side drought options, and where relevant, the combination effects of your actions with those of neighbouring water companies and other abstractors'. The SEA and HRA for a drought plan as a whole has informed these combined assessments.

### 3.2 Limitations of assessment

Details on the quality of the data collected and used in the assessment, limitations and any assumptions made, are included in the relevant technical appendices (**Appendix A**).

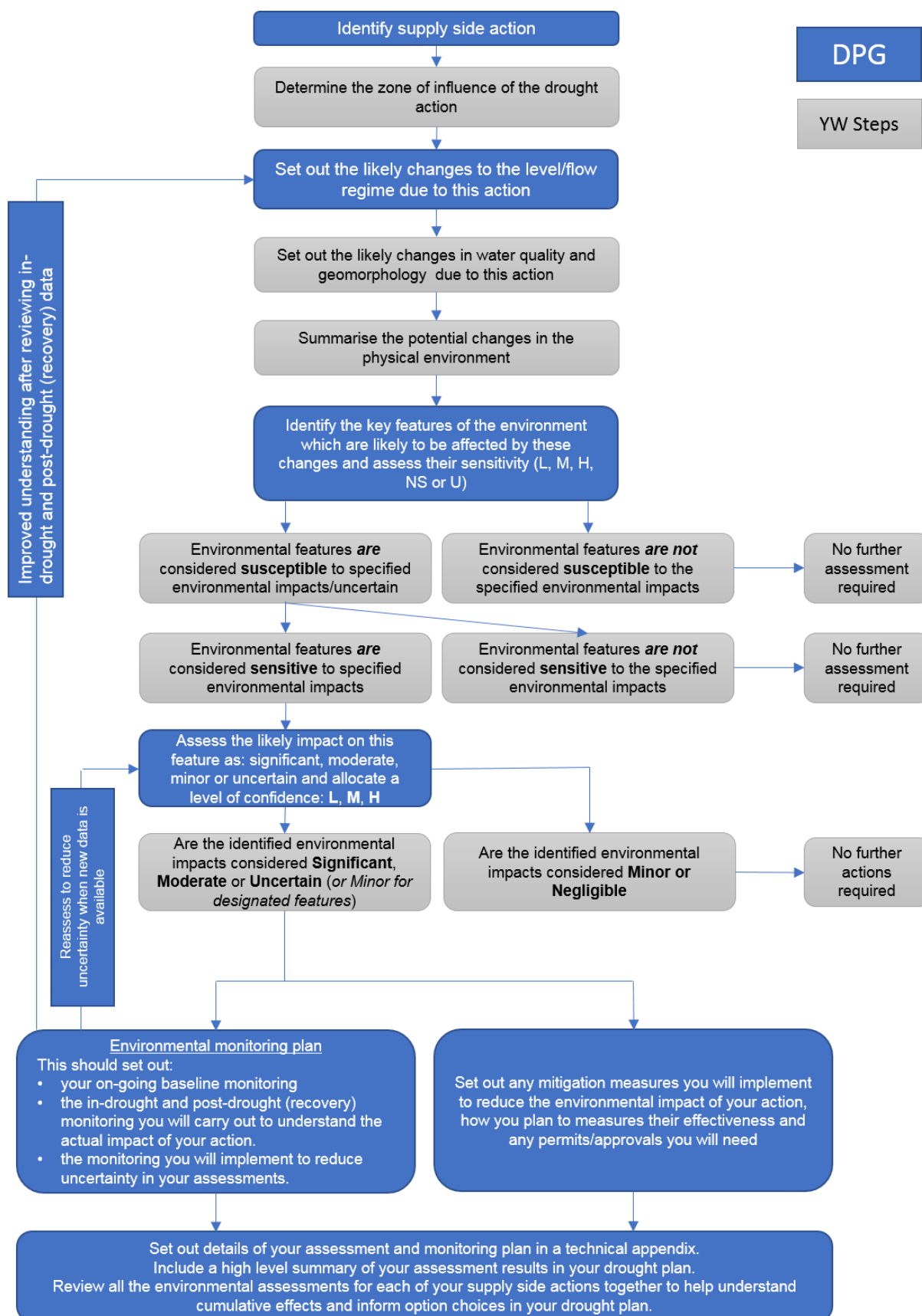
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<sup>8</sup> Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

<sup>9</sup> Yorkshire Water (2022) Yorkshire Water Drought Plan 2022 Habitats Regulation Screening Report, April 2022. Available at <https://www.yorkshirewater.com/media/vzenyqzb/yorkshire-water-drought-plan-2022-hra.pdf>.

<sup>10</sup> Yorkshire Water (2022) Yorkshire Water Drought Plan 2022 SEA Environmental Report, April 2022. Available at <https://www.yorkshirewater.com/media/c2qgvnsf/yorkshire-water-drought-plan-2022-sea-environmental-report.pdf>.

**Figure 3.1 Approach to undertaking environmental assessments as identified in the 2020 DPG.**  
 Steps in blue are 2020 DPG tasks. Tasks indicated in grey are YWSL tasks



## 4 Drought option overview

### 4.1 Drought permit description

This EAR assesses the potential impacts on the environmental features of the River Wharfe catchment during the period of implementation of associated drought options.

The River Wharfe catchment includes the River Wharfe Annual Abstraction Increase drought permit as summarised in **Table 4.1**. Further details on the existing arrangements at the site and the proposed drought option are found in **Appendix A**, Section A2. The study area is illustrated in **Figure 4.1**.

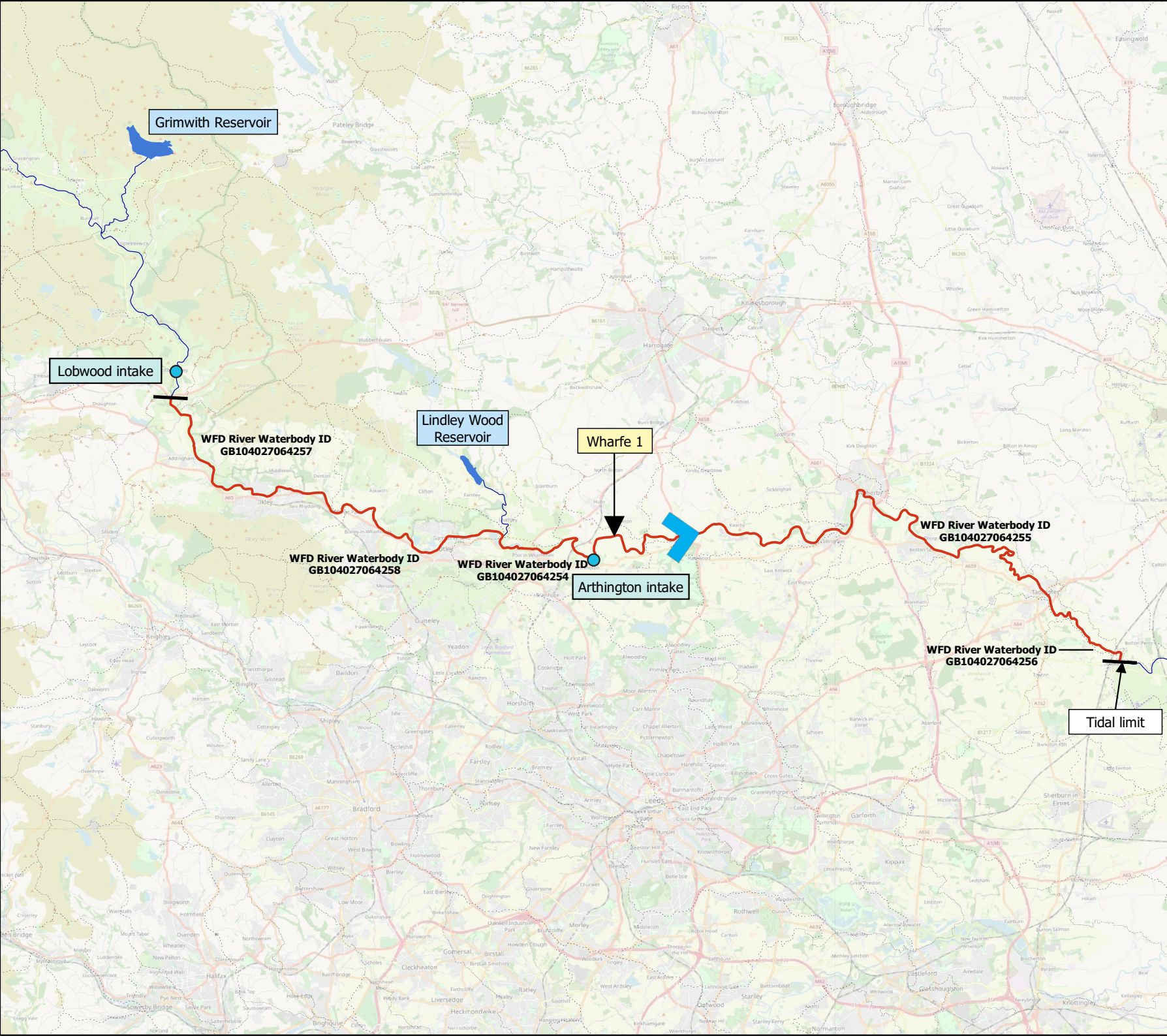
**Table 4.1 River Wharfe Annual drought permit description**

Abstraction Water Source	NGR	Normal Abstraction MI/d <sup>11</sup>	Proposed Drought Permit Abstraction MI/d	Benefit MI/d
Wharfe	SE075519	93.2MI/d may be abstracted from the River Wharfe at Lobwood subject to the following condition: a) When flow in the Wharfe (measured at Addingham downstream) is above 488MI/d YWSL may abstract up to 93.2MI/d	93.2MI/d may be abstracted from the River Wharfe at Lobwood subject to the following condition: a) When flow in the Wharfe (measured at Addingham downstream) is above 488MI/d YWSL may abstract up to 93.2MI/d (NO CHANGE)	~36.3MI/d (application specific) daily average increase (within conditions above)
		88.6MI/d may be abstracted from the River Wharfe at Lobwood subject to the following conditions: b) When flow in the Wharfe (measured at Addingham downstream) is between 389MI/d and 488MI/d YWSL may abstract up to 88.6MI/d	88.6MI/d may be abstracted from the River Wharfe at Lobwood subject to the following conditions: b) When flow in the Wharfe (measured at Addingham downstream) is between 389MI/d and 488MI/d YWSL may abstract up to 88.6MI/d (NO CHANGE)	
		c) When flow in the Wharfe (measured at Addingham downstream) is between 252MI/d and 389MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood less 6.8MI/d	c) When flow in the Wharfe (measured at Addingham downstream) is between 252MI/d and 389MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood less 6.8MI/d (NO CHANGE)	
		d) When flow in the Wharfe (measured at Addingham downstream) is less than 252MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood (and at Arthington <sup>12</sup> ) plus an additional 22.7MI/d	d) When flow in the Wharfe (measured at Addingham downstream) is less than 252MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood (and at Arthington) plus an additional 22.7MI/d (NO CHANGE, although there may be a reduction in regulating release if the River Wharfe at Lobwood drought option is implemented.)	
		Annual total abstraction (1 April to 31 March) 23,742MI	Annual total abstraction (1 April to 31 March) ~29,217MI (application specific)	







<sup>11</sup> 1MI/d is 1 million litres per day

<sup>12</sup> When flow at Addingham gauge is lower than 252MI/d, YWSL must also release from Grimwith Reservoir at least what they intend to abstract from Arthington. They may abstract up to 25MI/d from Arthington when flow at Addingham is less than 488MI/d.





## Legend

-  Reach Divides
-  River Reaches
-  Reservoir
-  Points of Interest
-  WFD Management Catchment
-  Flow Direction



**Project title:**  
Yorkshire Water Drought Plan  
Environmental Assessment

**Figure title:**  
River Wharfe Annual  
Overview Map

Figure 4.1 **Date:** August 2020

**NGR:** SE 27604 47362 **Scale:** 1:235000

Note: All locations are approximate

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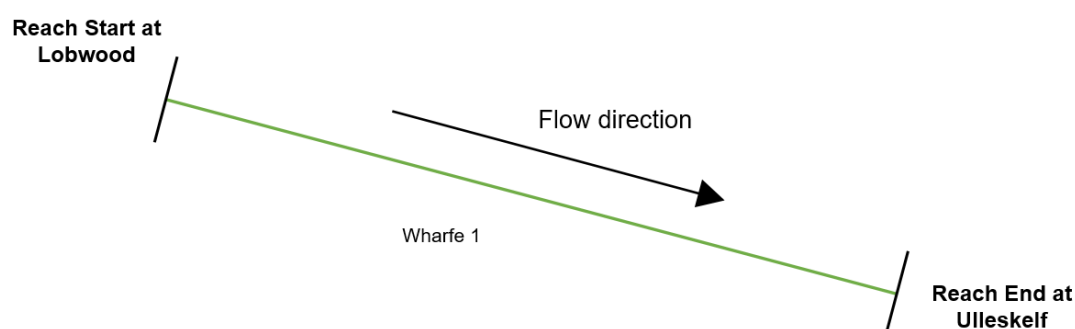
## 4.2 Potentially impacted reaches

The zone of influence associated for a drought option is defined through hydrological effects. Within the overall zone of influence, reaches are then defined on a hydrological basis. Section 3.4 of YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>13</sup> sets out this approach in detail. The reach for the River Wharfe Annual Abstraction Increase drought permit has been defined previously during the environmental assessment of YWSL past drought plans. **Table 4.2** provides details of this reaches, which is illustrated in **Figure 4.1**, and in a schematic below in **Figure 4.2**.

**Table 4.2 River Wharfe Annual drought permit reach details**

Reach name	Watercourse name	Reach start	Reach end	Down-stream reach	Drought option Wharfe Annual
Wharfe 1	River Wharfe	Lobwood	Ulleskelf	N/A	✓

**Figure 4.2 River Wharfe Annual drought permit reach schematic**



## 4.3 WFD waterbodies in study area

The study area and focus of the environmental assessment covers the WFD waterbodies listed in **Table 4.3**. The WFD waterbodies are also illustrated on **Figure 4.1**.

**Table 4.3 WFD waterbodies considered in the assessment**

Drought Option	Reach	WFD Waterbody
River Wharfe Annual	Wharfe 1	GB104027064257 River Wharfe from Barben Beck/ River Dibb to Hundwith Beck GB104027064258 River Wharfe from Hundwith Beck to River Washburn GB104027064254 River Wharfe from River Washburn to Collingham Beck GB104027064255 River Wharfe from Collingham Beck to Tadcaster Weir GB104027064256 River Wharfe from Tadcaster Weir to River Ouse

<sup>13</sup> Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.



## 5 Physical environment effects: River Wharfe Annual

Potential impacts on the physical environment due to the River Wharfe Annual Abstraction Increase drought permit are summarised below in **Table 5.1**. Full details are provided in **Appendix A**.

**Table 5.1 Summary of potential changes in the physical environment as a result of the River Wharfe Annual drought option**

Reach	River flow impact	Flow depleted reaches and risks	Risk to river habitats	Risk to water quality
Wharfe 1	<ul style="list-style-type: none"> <li>• Reductions of up to 6% in river flows throughout the reach only from January to March inclusive</li> <li>• No hydrological impact anticipated during the period from October to December inclusive.</li> </ul>	None	None	None

## 6 Environmental features screening: River Wharfe Annual

### 6.1 Summary of impacts

Details regarding the approaches/methodologies used for assessing susceptibility and sensitivity to drought management actions and the assessment of the impacts associated with drought management actions are presented in Sections 3.6 and 3.7 of YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>14</sup>.

The environmental preferences within which a species can successfully exist and the relationship between populations in stressed river conditions remains subject to debate. The prediction of impacts of hydrological and water quality changes on aquatic ecology remains subject to significant uncertainty and this may be exacerbated where data are limited. This assessment has, therefore, adopted a precautionary approach, with potential impacts highlighted where doubt exists.

The assessment of environmental features is informed by the assessment of the physical environment (which includes hydrology and hydrodynamics; geomorphology; and water quality), this is summarised in Section 5 presented in full in **Appendix A**.

Potentially sensitive receptors due to the River Wharfe Annual Abstraction Increase drought permit are summarised below in **Table 6.1**.

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14 Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

**Table 6.1 Summary of potential impacts to environmental features as a result of the River Wharfe drought option**

Site/Feature and designation	Hydrological Impact at Location (Major, Moderate, Minor)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Negligible)	Further Consideration Required (Yes/No)
<u>Humber Estuary</u> (SAC/SPA/SSSI and Ramsar site)	n/a (downstream of tidal limit)	Alteration in freshwater flows could potentially affect qualifying interests for which Humber Estuary is designated, specifically river and sea lamprey (entrainment, attractant flows, dissolved oxygen etc). However, the site is situated downstream of the zone of impact in which impacts are assessed as negligible, and therefore no impact on designated features is anticipated. Additionally, extensive work undertaken by YWSL has shown that cumulative impacts of all drought options would have no adverse effect on SAC/SPA integrity <sup>15</sup> .	Not sensitive	No
<u>NERC Act Species – Fish</u> - Brown Trout ( <i>Salmo trutta</i> ) - Salmon ( <i>Salmo salar</i> )	Negligible	Potentially susceptible as January to March permit coincides with upstream migration and spawning life stages (salmon). However, the implementation of the drought permit has been assessed as having a negligible impact on flows. The reduction in moderate river flow conditions is no greater than a 6% effect and at high flows this is considerably less and there would be no impact on low flows. Therefore, no significant impacts on fish are anticipated.	Not sensitive	No
<u>Notable Species – Fish</u> - Grayling ( <i>Thymallus thymallus</i> ) - Barbel ( <i>Barbus barbus</i> ) - Bullhead ( <i>Cottus gobio</i> )	Negligible	Potentially susceptible although impacts generally restricted to late spring and summer whereas the drought permit period would be January to March and therefore susceptibility of this species during this time is much lower. However, the implementation of the drought permit has been assessed as having a negligible impact on flows. The reduction in moderate river flow conditions is no greater than a 6% effect, and at high flows this is considerably less and there would be no impact on low flows. Therefore no significant impacts on fish are anticipated.	Not sensitive	No
<u>NERC Act Species – Birds</u> There are a number of species present across the region.	Negligible	The following bird species to varying extents rely on water dependent habitats. However, they are not expected to be impacted significantly from implementation of the drought permit because the flow and level changes are anticipated to be negligible. - Eurasian Curlew ( <i>Numenius arquata</i> ) - Willow tit ( <i>Parus montanus</i> ) - Reed Bunting ( <i>Emberiza schoeniclus</i> )	Not sensitive	No

<sup>15</sup> Scott Wilson (2011). Yorkshire Water Drought Plan: Assessment of Possible Impact on Humber Estuary SPA/SAC. Final Report Revision 2 February 2011. Report for Yorkshire Water.

Site/Feature and designation	Hydrological Impact at Location (Major, Moderate, Minor)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Negligible)	Further Consideration Required (Yes/No)
<u>Notable Species – Birds</u> There are a number of species present across the region.	Negligible	The following bird species to varying extents rely on water dependent habitats. However they are not expected to be impacted significantly from implementation of the drought permit because the flow and level changes are anticipated to be negligible.: Grey Wagtail ( <i>Motacilla cinerea</i> ) - House Martin ( <i>Delichon urbica</i> ) (not present during November to March) - Swallow ( <i>Hirund rustica</i> ) (not present during November to March) - Little Ringed Plover ( <i>Charadrius dubius</i> ) (not present during November to February) Redshank ( <i>Tringa tetanus</i> ) - Snipe ( <i>Gallinago gallinago</i> ) - Mute Swan ( <i>Cygnus olor</i> )	Not sensitive	No
<u>NERC Act Species</u> Fine lined pea mussel ( <i>Pisidium tenuilineatum</i> )	Negligible	Localised population <sup>16</sup> mainly below weirs that may be vulnerable to drying. However, the implementation of the drought predicted to have a negligible influence of moderate and high flows only, with no impacts on low flows.	Not sensitive	No
<u>NERC Act Species Mammals</u> Otter ( <i>Lutra Lutra</i> ) Water Vole_( <i>Arvicola amphibius</i> )	Negligible	Populations may be vulnerable to flow level change and impacts on wetted width and habitat. However, they are not expected to be impacted significantly from implementation of the drought permit because the flow and level changes are anticipated to be negligible.	Not sensitive	No
NERC Act Species – Crustacea Freshwater White – clawed Crayfish ( <i>Austropotamobius pallipes</i> )	Negligible	Yes – UK NERC Act states that the White Clawed Crayfish is sensitive to habitat modification from the management of waterbodies. Therefore, they are considered to be sensitive to hydrological impacts, particularly low flows. However, they are not expected to be impacted significantly from implementation of the drought permit because the flow and level changes are anticipated to be negligible.	Not sensitive	No

<sup>16</sup> Kileen, I.J and Williams, S. (1998) The status and distribution of *Pisidium Tenuileatum* Stelfox, 1918 (Mollusca Sphaeriidae) In the River Wharf. Quarterly Journal of Natural History for the North of England: Proceedings of the Yorkshire Naturalists' Union Spring Conference on the Magnesian Limestone, 1998 Published by the Yorkshire Naturalists' Union

Site/Feature and designation	Hydrological Impact at Location (Major, Moderate, Minor)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Negligible)	Further Consideration Required (Yes/No)
East Keswick Fitts SSSI	Negligible	<p>Area of willow carr on shingle banks beside the Wharfe. Noted for exposed riverine sediments and invertebrate interest, and flooded at high flows. Reduced flows due to option could increase exposure of cobbles and gravels at low flows. High flows are required to drive the geomorphological processes key to maintaining the presence of exposed riverine sediments and associated invertebrate assemblages (which are the main reasons for notification at East Keswick Fitts SSSI). Impact to high flows considered the primary concern.</p> <p>The analysis presented in Section 4.2.1 has shown that high flows required to drive the geomorphological processes key to maintaining the presence of exposed riverine sediments and associated invertebrate assemblages would be negligibly impacted by implementation of the drought permit. It can therefore be concluded with a high degree of certainty that the proposed drought permit will not significantly impact the high flow driven geomorphological processes required to support the habitats present within East Keswick Fitts SSSI.</p>	Not sensitive	No
Ben Rhydding Gravel Pits – Local Nature Reserve	Negligible	The LNR has a variety of habitats including marshy grassland and a lagoon with yellow water-lilies. The river contains a number of species including otter, waterfowl, waders and kingfisher.	Not sensitive	No
Kirkby Wharfe – SSSI	Negligible	An area of floodland in the valley of Dorts Dike, a Tributary of the River Wharfe. Due to the distance between the site and the impacted hydrological reach, the SSSI will not be affected by the drought option.	Not sensitive	No
Linton Common - SSSI	Negligible	The site is designated for limestone grasslands. Due to the distance between the site and the impacted hydrological reach, the SSSI will not be affected by the drought option.	Not sensitive	No
Invasive non- native species - Macroinvertebrates Caspian Mud Shrimp <i>Chelicorophium curvispinum</i> New Zealand Mud Snail <i>Potamopyrgus antipodarum</i>	Negligible	The implementation of this drought permit is not anticipated to increase the spread of Invasive non-native species.	Not sensitive	No

Site/Feature and designation	Hydrological Impact at Location (Major, Moderate, Minor)	Susceptibility to flow and level impacts	Sensitivity (Uncertain, High, Medium, Low, Negligible)	Further Consideration Required (Yes/No)
Signal Crayfish <i>Pacifiastacus leniusculus</i> Northern River Cranonyctid <i>Crangonyx pseudoargilis</i>				
Invasive non-native species – Fish Rainbow trout <i>Oncorhynchus mykiss</i>	Negligible	The implementation of this drought permit is not anticipated to increase the spread of Invasive non-native species.	Not sensitive	No
Invasive non-native species – Terrestrial plants Himalayan balsam <i>Impatiens glandulifera</i> Giant Hogweed <i>Heracleum mantegazzianum</i> Japanese Knotweed <i>Fallopian japonica</i>	Negligible	The implementation of this drought permit is not anticipated to increase the spread of Invasive non-native species.	Not sensitive	No
Invasive non-native species – Aquatic plants Canadian pondweed <i>Elodea canadensis</i>	Negligible	The implementation of this drought permit is not anticipated to increase the spread of Invasive non-native species.	Not sensitive	No



## 6.2 Screening conclusions

In line with the DPG and YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>17</sup>, only features identified as either: 1) uncertain; 2) high or medium sensitivity; or 3) low sensitivity in a designated site form the scope of monitoring, environmental assessment and consideration of mitigation actions. On this basis no further environmental assessment is required (see also **Figure 3.1**).

## 6.3 Monitoring and mitigation

As outlined in **Section 6.2**, no features have been screened in for further assessment as it has been concluded that there would be negligible impacts resulting from implementation of the drought option. On this basis, no monitoring or mitigation is proposed to support implementation of the option.

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<sup>17</sup> Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

# Appendices

## **Appendix A**    Physical Environment

## Appendix A – Physical Environment

## A1 Introduction

This appendix assesses the potential impacts on the physical environment of the catchment surrounding the River Wharfe during the period of implementation of the drought option.

Details regarding the approaches/methodologies used for assessing susceptibility and sensitivity to drought options and the assessment of the impacts associated with drought options are presented in YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>1</sup>.

**This EAR has been prepared in support of a drought permit application in autumn 2022. It provides an update to the 'shelf copy' report which was produced in support of YWSL's Drought Plan 2022. Following agreement with the Environment Agency, the physical environment and environmental features assessments presented in the 'shelf copy' report have been retained for this application EAR (see main EAR Section 1.2).**

This appendix is set out in the following sections:

Section A.2 Drought option

Section A.3 Study area

Section A.4 Physical environment effects – this includes:

1. Introduction
2. Setting
3. River flow regime
4. River habitat
5. River water quality
6. Summary of potential changes in the physical environment as a result of the drought option.

**Annex 1** provides a list of all regulated abstractions in the reach.

**Annex 2** provides a list of all wastewater treatment works (WwTW) and combined sewer overflows (CSOs) considered in the assessment.

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<sup>1</sup> Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

## A2 Drought options

### A2.1 River Wharfe Annual drought permit

Water is abstracted from the River Wharfe upstream of Addingham. Licence details and proposed drought option details are provided in **Table A2.1** below.

The drought permit application would be to increase the annual abstraction limit at Lobwood. The daily limits and regulation release conditions described in **Table A2.1** would remain unaffected. The exact details of the River Wharfe annual licence increase have been determined based on the abstraction patterns which have occurred from 1 April up to around the time of application (as the annual licensed volume applies from 1 April to 31 March inclusive). For the purposes of this assessment, it is assumed that the River Wharfe annual licence increase would be applied for in October 2022 and would then be in place from 1 November 2022 to 31 March 2023. The increase applied for would be up to an annual volume which would allow the maximum daily abstraction of up to 93.2 MI/d (depending on gauged flow) during the period 1 November to 31 March inclusive. The flow reduction is assessed relative to a baseline annual average abstraction over that period of 64.9 MI/d (i.e. constrained by the existing annual licence). In other words, it is assumed that without the drought permit Yorkshire Water will need to manage their abstractions to achieve an average of 64.9 MI/d over the full year to 31 March, whereas under the drought permit they will be licensed to abstract up to the daily maximum of 93.2 MI/d (or 88.6 MI/d whenever flow at Addingham is below 488 MI/d). The required regulation releases to support the increased abstraction (when flow at Addingham is below 389 MI/d) is assumed to continue.

The indicative increase in abstraction under this option, therefore, is 28.3 MI/d [93.2 – 64.9] when flow at Addingham is 488 MI/d or above, or 23.7 MI/d [88.6 – 64.9] when flow at Addingham is below 488 MI/d. These would be the resulting flow reductions downstream of the Lobwood intake at flows of 389 MI/d or above. Below flows of 389 MI/d, abstractions must be supported by a corresponding increase in the regulation release made from Grimwith Reservoir and therefore at these lower flow levels there would be no net effect downstream of the Lobwood intake, and in fact there could potentially be a net increase in flows in the River Dibb, and the River Wharfe from the River Dibb confluence to the Lobwood intake, due to the additional release being made. It is assumed that the flow reductions and/or flow increases would only occur during the months from November to March inclusive when the increased annual abstraction volume would be in place.

**Table A2.1 Wharfe Annual drought option licence data**

Abstraction Water Source	NGR	Normal Abstraction MI/d <sup>2</sup>	Proposed Drought Permit Abstraction MI/d	Benefit MI/d
Wharfe	SE075519	93.2MI/d may be abstracted from the River Wharfe at Lobwood subject to the following condition:  a. When flow in the Wharfe (measured at Addingham downstream) is above 488MI/d YWSL may abstract up to 93.2MI/d	93.2MI/d may be abstracted from the River Wharfe at Lobwood subject to the following condition:  a. When flow in the Wharfe (measured at Addingham downstream) is above 488MI/d YWSL may abstract up to 93.2MI/d (NO CHANGE)	
		88.6MI/d may be abstracted from the River Wharfe at Lobwood subject to the following conditions:  b. When flow in the Wharfe (measured at Addingham downstream) is between 389MI/d and 488MI/d YWSL may abstract up to 88.6MI/d	88.6MI/d may be abstracted from the River Wharfe at Lobwood subject to the following conditions:  b. When flow in the Wharfe (measured at Addingham downstream) is between 389MI/d and 488MI/d YWSL may abstract up to 88.6MI/d (NO CHANGE)	
		c. When flow in the Wharfe (measured at Addingham downstream) is between 252MI/d and 389MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood less 6.8MI/d	c. When flow in the Wharfe (measured at Addingham downstream) is between 252MI/d and 389MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood less 6.8MI/d (NO CHANGE)	
		d. When flow in the Wharfe (measured at Addingham downstream) is less than 252MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood (and at Arthington <sup>3</sup> ) plus an additional 22.7MI/d	d. When flow in the Wharfe (measured at Addingham downstream) is less than 252MI/d YWSL must release from Grimwith Reservoir the amount abstracted from the Wharfe at Lobwood (and at Arthington) plus an additional 22.7MI/d (NO CHANGE, although there may be a reduction in regulating release in the River Wharfe at Lobwood drought option if implemented.)	
		Annual total abstraction (1 April to 31 March) 23,742MI	Annual total abstraction (1 April to 31 March) ~29,217MI (application specific)	~36.3MI/d (application specific) daily average increase (within conditions above)

2 1MI/d is 1 million litres per day

3 When flow at Addingham gauge is lower than 252MI/d, YWSL must also release from Grimwith Reservoir at least what they intend to abstract from Arthington. They may abstract up to 25MI/d from Arthington when flow at Addingham is less than 488MI/d.



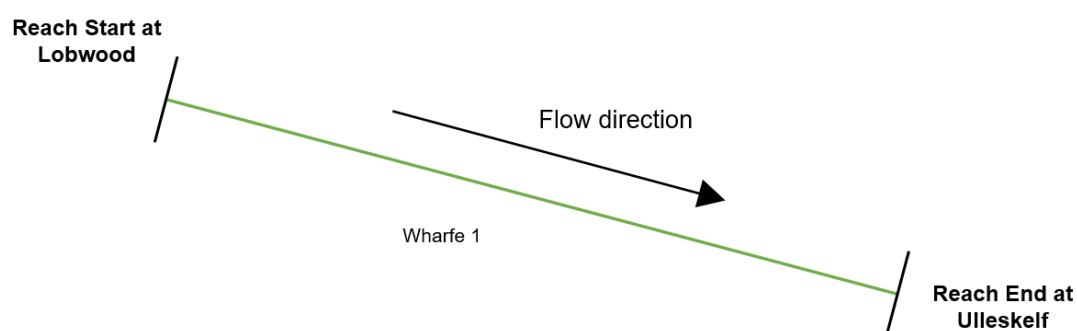
## A3 Study area

The zone of influence associated with the drought option is defined through hydrological effects. Within the overall zone of influence, the reach is defined on a hydrological basis. YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>4</sup> sets out this approach in detail in Section 3.4. The zone of influence for assessment of impacts is set out in **Section A3.1** below. Information on the likely timing of the drought option is set out in **Section A3.2** below.

### A3.1 Zone of influence of the drought options

The reaches for the Wharfe drought option has been defined previously during the environmental assessment of YWSL past drought plans. **Table A3.1** provides details of this reach, and the reach is illustrated in main EAR **Figure 4.1** and in a schematic below in **Figure A3.1**.

**Figure A3.1** River Wharfe Annual drought option schematic



4 Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

**Table A3.1 Wharfe Annual drought option reach details**

Reach name	Watercourse name	Reach start	Reach end	Down-stream reach	Drought option
					Wharfe Annual
Wharfe 1	River Wharfe	Lobwood	Ulleskelf	N/A	✓

The start of the study area has been defined as downstream of YWSL's Lobwood Intake. Though the Wharfe Annual drought option could lead to changes in the flow in the River Dibb and the River Wharfe upstream of the Lobwood intake, these flows may increase and will not decrease, therefore these reaches have not been screened into the hydrological impact section of this report.

The end of each study area has been defined previously from review of hydrological information – either flow gauge data that corroborates that drought option hydrological impacts have reduced to negligible, or by simple review of contributing catchment area where there is an order of magnitude step change in this from confluence with a significantly larger river or joining tributary.

## A3.2 Timing of drought measure effects

The drought permit application is anticipated to be submitted by YWSL in October 2022 and the implementation period would therefore be likely to cover 1 November 2022 to 31 March 2023. The annual abstraction limit re-sets on 1 April each year and the drought permit conditions would expire on 1 April.

## A3.3 Cumulative reaches with other EARs

The extent of hydrological impacts in the River Wharfe catchment would not be significantly increased beyond those identified in individual drought options (specifically the Wharfe at Lobwood, Grimwith and Lindley Wood) as a result of simultaneous deployment of all drought options in the catchment. As the hydrological impact of the Wharfe Annual drought permit is considered negligible (see Section A4.2.3), it can be concluded that its inclusion as a drought option would not increase the hydrological impacts beyond those already identified in other option assessments.

## A4 Physical environment effects

### A4.1 Introduction

This section provides a characterisation of the physical environment within the zone of influence (as defined above in **Section A3**) and includes the following information for each reach:

1. Reach setting
2. River flow regime (reference conditions and sensitivity)
3. River habitat (reference conditions and likely sensitivity)
4. River water quality, including water quality pressure (reference conditions and sensitivity).

An assessment of likely changes from drought option implementation for the zone of influence is then provided.

YWSL's Drought Plan 2022 Environmental Assessment Methodology<sup>5</sup> provides details of the approach in Section 3.5. The approach has been developed to ensure compliance with the Environment Agency's 2020 Drought Plan Guideline (DPG)<sup>6</sup> and Section 3 of the Environment Agency's July 2020 "Environmental Assessment for Water Company Drought Plans- supplementary guidance".

### A4.2 Wharfe 1

#### A4.2.1 Reach introduction

A summary of physical environment information for Wharfe 1 is provided in **Figure A4.1**. The reach includes part of the following river waterbodies:

- River Wharfe from Barben Beck/ River Dibb to Hundwith Beck (GB104027064257)
- River Wharfe from Hundwith Beck to River Washburn (GB104027064258)
- River Wharfe from River Washburn to Collingham Beck (GB104027064254)
- River Wharfe from Collingham Beck to Tadcaster Weir (GB104027064255)
- River Wharfe from Tadcaster Weir to River Ouse (GB104027064256)

#### A4.2.2 Reach setting

Wharfe 1, located on main EAR **Figure 4.1**, comprises a 68.4km stretch of the River Wharfe from Lobwood to the tidal limit at Ulleskelf (**Table A2.1**). The reach has an additional catchment area of 497km<sup>2</sup> along its length.

#### A4.2.3 River flow regime

Flows on the Wharfe 1 reach are measured at Addingham gauging station, a short distance downstream of Yorkshire Water's abstraction intake.

The increased River Wharfe abstraction licence drought permit is assumed not to be implemented until the winter months, and therefore there is no change to the gauged summer Q95 and Q99 flow statistics. The hydrological impact in the summer months (April to September inclusive) is therefore assessed as none.

The year round Q95 and Q50 flow statistics, as measured at the Addingham gauge, are 166.7 MI/d and 571.4 MI/d respectively for the period 1990-2019. During the period from January to March, at the winter Q95 flow level the additional abstraction of up to 23.7 MI/d under the River Wharfe annual licence increase drought permit would be fully supported by an equal increase in the regulation release rate

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5 Ricardo Energy & Environment (2020). Yorkshire Water Drought Plan 2022. Environmental Assessment Methodology. Report for Yorkshire Water Services Ltd. June 2020.

6 Environment Agency (2020) Water Company Drought Plan Guideline, April 2020.

from Grimwith Reservoir, so that the additional abstraction would not lead to any net flow reduction downstream of the intake.

At the year round Q50 flow statistic of 571.4 MI/d, no regulation releases are required and therefore during the period from January to March inclusive there would be a flow reduction of up to 36.3 MI/d due to increased abstraction with the drought option. This equates to a 6% reduction in the year round Q50 flow statistic.

A reduction of 6% in the year round Q50 flow statistic, combined with no change to the year round Q95 flow statistic, would be assessed as a **negligible** hydrological impact but only from January to March inclusive. There is no hydrological impact anticipated during the period from October to December inclusive.

There are two significant flow pressures influencing flow in Wharfe 1, one non-consumptive abstraction for energy production, with a peak daily licensed abstraction rate of 864MI/d without a hands-off-flow condition ('River Wharfe – Burley in Wharfedale') with potential flow impacts, however it is understood that the hydroelectric plant is not able to operate during low flow periods. There is one further abstraction for paper and printing, 'River Wharfe – Pool in Wharfedale' with a maximum daily rate of 14.4 MI/d. See Annex 1 and 2 for a full list of flow pressures considered in the assessment.

#### A4.2.4 River habitats

The physical environment has not been reviewed for the purposes of this assessment as based on the DPG requirements set out in **Figure 3.1** of the main EAR no further assessment is required.

#### A4.2.5 River water quality

The physical environment has not been reviewed for the purposes of this assessment (see Section A4.2.4) however for completeness a water quality baseline has been presented in **Figure A4.1**.

The fifth water quality monitoring location in the reach has been used due to its data quality: Wharfe at Denton Bridge, Ben Rhydding (NE-49700247). The average pH between 2010-2020 was 8.2 with a maximum temperature of 20.2°C for the same period. Ammonia concentrations were consistent with 'Good' WFD status (0.6 mg/l) throughout the monitoring period, dissolved oxygen saturation (%) values were consistent with 'Good' WFD status (75%) throughout the monitoring period and orthophosphate concentrations were consistent with 'Good' WFD status (0.061 mg/l) throughout the monitoring period with 18% of results below this value.

#### A4.2.6 Summary of potential changes in the physical environment as a result of drought option

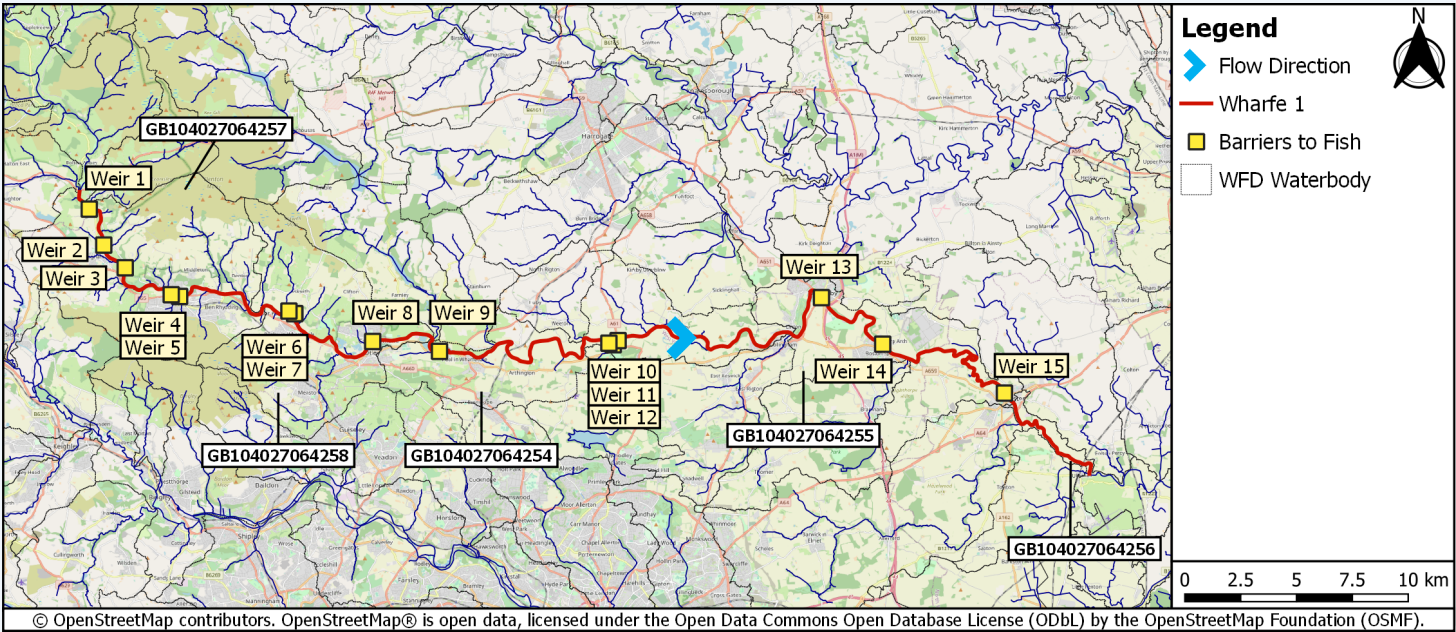
An overall summary of potential changes in the physical environment of Wharfe 1 as a result of drought option is presented in **Table A4.2**.

**Table A4.4 Summary of potential changes in the physical environment of Wharfe 1 as a result of drought option**

Physical environment aspect reviewed	Assessment of risk from implementation of drought options
<b>River flows</b> <i>Negligible impacts</i>	<ul style="list-style-type: none"> <li>• Reductions of up to 6% in annual Q50 river flows with no change in low flows.</li> </ul>
<b>Flow depleted reaches</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>River habitats</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>
<b>Water quality</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>



Reach Setting

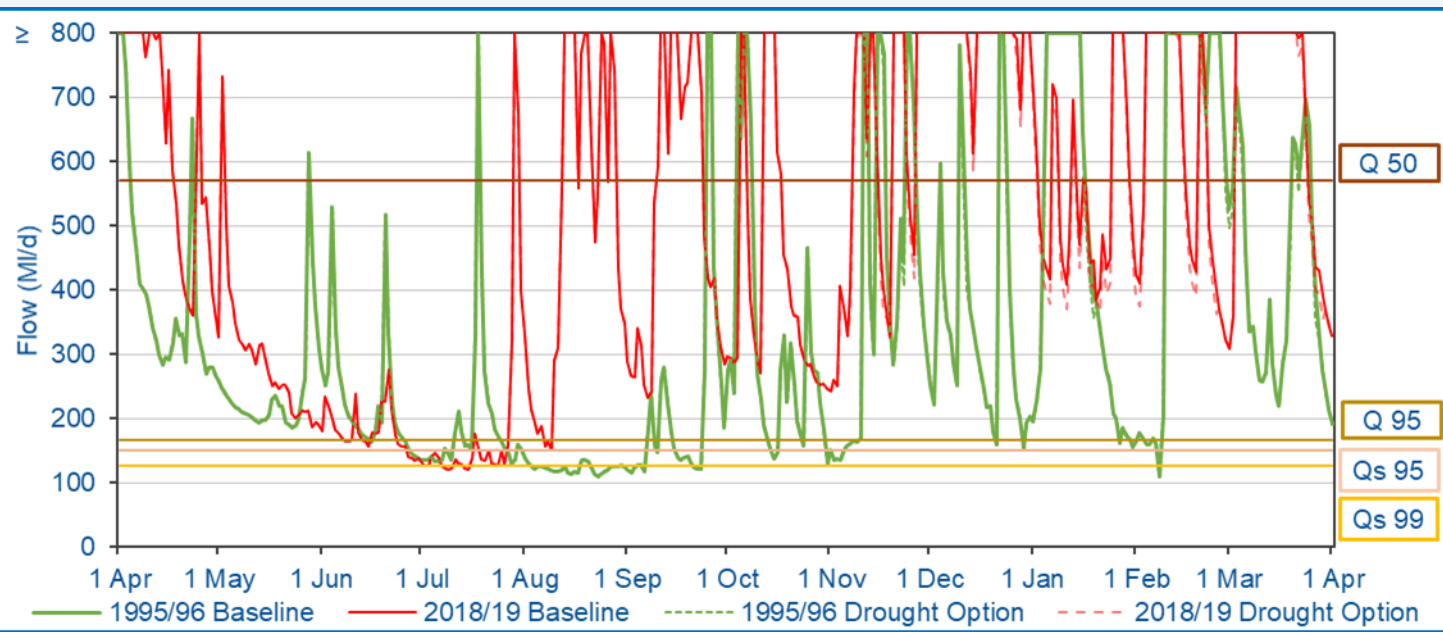


Reach Setting Information:

The bedrock geology is dominated by the Millstone Grit in the upper part of the reach, becoming more dominant downstream, where lithologies of the Zechstein Group (limestone) and undifferentiated Permian (mudstone, siltstone, sandstone) and Triassic (sandstone and conglomerate) lithologies dominate. The superficial geology is diverse due to the length of the reach. The reach is underlain by alluvium and surrounded, predominantly, by glacial tills. There are scattered river terrace deposits and glaciofluvial deposits along the reach. Soil types beneath the reach are composed predominantly of freely draining lime-rich soils and freely draining floodplain soils with a small section of loamy and clayey floodplain soils at the end of the reach between Tadcaster and the tidal limit.

	Supplementary Information
Catchment Area at Assessment Point	413.3km <sup>2</sup>
Mean Slope Gradient	0.07°
Length of Reach	68.4km
Additional Catchment Area	497.0km <sup>2</sup>
Upstream Reach	N/A
Downstream Reach	N/A

River Flow Regime



	Reference Conditions (Ml/d)	Drought Plan Conditions (Ml/d)	% Reduction	Impact
-				
Q <sub>s</sub> 95	151.2	151.2	0	Summer None
Q <sub>s</sub> 99	125.8	125.8	0	
Q95	166.8	166.8	0	Winter Negligible
Q50	571.4	543.1	6	

Significant Flow Additions/Reductions	Flow Rate (Ml/d)	Abstraction / Discharge
Wharfedale Hydro Power Ltd/ 2/27/19/206/R01	864.0	Abstraction
Whiteley Ltd/ 2/27/20/151	14.4	Abstraction

River Habitats

No walkover survey was carried out during the onset of drought in 2018. The drought permit is assessed as negligible and as such no monitoring is specified.

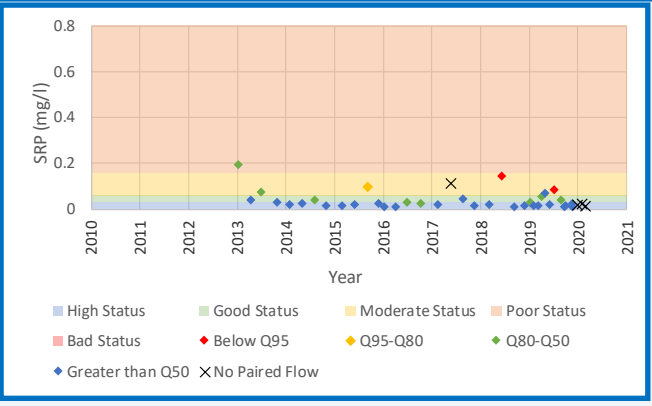
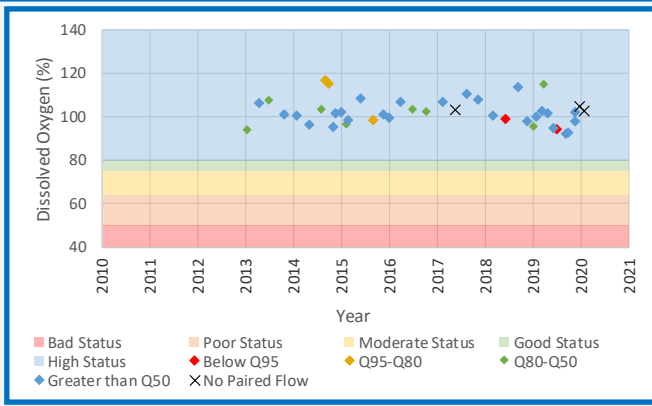
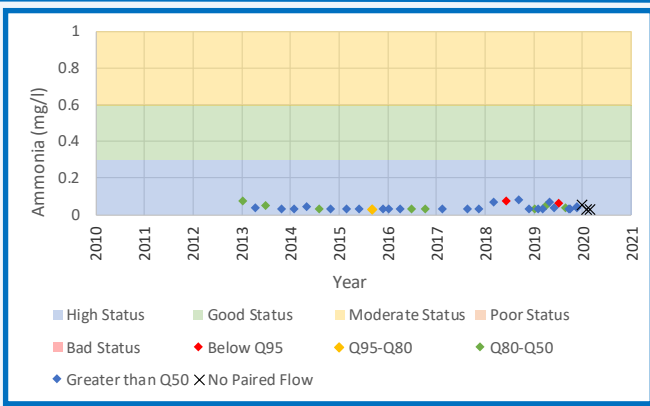
River Water Quality

There are no significant water quality pressures associated with this reach as the impacts on river flow are assessed as negligible

In the River Wharfe at Denton Bridge, Ben Rhydding (NE-49700247) the average pH between 2010-2020 was 8.2 with a maximum temperature of 20.2°C



Figure A4.1  
Wharfe 1  
Physical Environment Information



## Annex 1 – Regulated abstractions in Wharfe 1

DP reach	Licence No.	Use Description	NGR 1	Max Annual Quantity	Max Daily Quantity
Wharfe 1	2/27/19/045	Golf courses	SE185453 SE181451	-	25
Wharfe 1	2/27/19/206/R01	Electricity Production	SE1655047390	315000000	864000
Wharfe 1	2/27/20/038	General Agriculture	SE45194562	27277	681.82
Wharfe 1	2/27/20/038	General Agriculture	SE45994562	27277	681.82
Wharfe 1	2/27/20/096	General Agriculture	SE365461	30000	286.41
Wharfe 1	2/27/20/151	Paper and Printing	SE236455	4318790	14398
Wharfe 1	2/27/20/183	General Agriculture	SE427470	4546	227.3
Wharfe 1	2/27/20/191	General Agriculture	SE315462	20480	512
Wharfe 1	2/27/20/195	General Agriculture	SE42304662	19000	227
Wharfe 1	2/27/20/195	General Agriculture	SE43224576	19000	227
Wharfe 1	2/27/20/313/R01	General Agriculture	SE36004582	8000	918
Wharfe 1	2/27/20/313/R01	General Agriculture	SE37174622	8000	918
Wharfe 1	2/27/20/314/R01	General Agriculture	SE3200046300	6100	206
Wharfe 1	NE/027/0020/025	General Agriculture	SE3930046240	12000	411
Wharfe 1	NE/027/0020/002/R01	Electricity Production	SE2333245552	-	-
Wharfe 1	NE/027/0020/026	Other Environmental Improvements	SE4216747295	-	-



## Annex 2 – Water quality pressures considered in the assessment

Name	Permit Reference	Outfall NGR	Significant Water Quality Pressure	Intermittent/Continuous
Hardisty's Farm	2108	SE1450048100	No	Continuous
Pool Paper Mill	1	SE2373045540	No	Continuous
Wheatley Lane	27/19/0042	SE1370048120	No	Continuous
Ben Rhydding (Ilkley) WPC Works, St	27/19/0044	SE1447047480	No	Continuous
Ilkley STW	27/19/0045	SE1254048390	No	Continuous
Otley STW	27/20/0046	SE2227346324	No	Continuous
Wetherby STW	27/20/0054	SE4180747052	No	Continuous
Samuel Smith Old Brewery	27/20/0055	SE4875043300	No	Continuous
High Mills	27/20/0061	SE2402045490	No	Continuous
Thorp Arch STW	27/20/0068	SE4511045760	No	Continuous
Pool WPC Works	27/20/0069	SE2621045540	No	Continuous
Tadcaster WPC Works	27/20/0073	SE4957042710	No	Continuous
Langwith Valley SPS	27/20/0083	SE3732045940	No	Continuous
Britannia CSO	27/20/0114	SE4884043370	No	Continuous
Private	27/20/0127	SE3615046070	No	Continuous
Kearby STW	27/20/0128	SE3287046740	No	Continuous
Weeton STW	27/20/0129	SE2966046120	No	Continuous
Sso 250 Metres Downstream	3166(SS)	SE1170048000	No	Continuous
High Mill (Addingham)	C4186	SE0820050100	No	Continuous
Stac Polly	C4239	SE3820046400	No	Continuous
Burley/Menston (Sheffield) STW	E164	SE1860045900	No	Continuous
Otley Sailing Club	EPRCP3828XV	SE1863945756	No	Continuous
Hadfield Farm Barns & Farm House	QC.27/19/0027	SE1050048400	No	Continuous
A Residential Development	QC.27/20/0012	SE3120046100	No	Continuous
Esscroft	QR.27/19/0032	SE1530047250	No	Continuous
Esscroft Cottage	QR.27/19/0033	SE1530147250	No	Continuous
The Woodhall Hotel	QR.27/20/0022	SE3711046600	No	Continuous
Otley Angling Club Silver Mill	WA6080	SE1880045400	No	Continuous
Newton Kyme Hall	WA6243	SE4660045100	No	Continuous
Tadcaster Weir SSO	WADC615	SE4855043650	No	Continuous
Ilkley Road	WADC640	SE1963945309	No	Continuous
Bridge Street SSO	WADC757	SE2017545770	No	Continuous
Wetherby High Street CSO	1553	SE4043048052	No	Intermittent
Wyvil Crescent CSO	27/19/0019	SE1354748017	No	Intermittent
Low Mill Lane 179 CSO	27/19/0092	SE0871049560	No	Intermittent
Kirkby Wharfe/CSO	27/20/0065	SE50734099	No	Intermittent
Warren Lane Otley/CSO	27/20/0079	SE26214498	No	Intermittent
West Busk Lane No 2 CSO	27/20/0101	SE1883645012	No	Intermittent

Name	Permit Reference	Outfall NGR	Significant Quality Pressure	Water Intermittent/ Continuous
Arthington Lane CSO	27/20/0130	SE2480045330	No	Intermittent
Wattle Syke CSO	27/20/0161	SE3944046420	No	Intermittent
Boston Spa High St/CSO	C4576	SE4324645665	No	Intermittent
Wheatley Lane CSO, Ben Rhydding II	QC.27/19/0018	SE1360048120	No	Intermittent
Leeds Road Ilkley No2 CSO	QC.27/19/0024	SE1286848142	No	Intermittent
Scott Lane CSO	WADC1313	SE4030248075	No	Intermittent
Wetherby Bypass CSO	WADC1477	SE4064947691	No	Intermittent
Crook Farm CSO	WADC861	SE2522445342	No	Intermittent
Burley Lodge CSO	WRA6863	SE1713846121	No	Intermittent
Ebor Way/CSO	WA 5855	SE4407045290	No	Intermittent
Tadcaster West CSO	27/20/0112	SE4884843374	No	Intermittent
Tadcaster East (Britannia Inn) CSO	27/20/0113	SE4877043450	No	Intermittent
Wyvill Road CSO	QC.27/19/0025	SE1340248106	No	Intermittent
Billams Hill/CSO	WADC717	SE2009945880	No	Intermittent
Rivadale View CSO	3166(SS)	SE1192448068	No	Intermittent



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