YORKSHIRE WATER DROUGHT PLAN 2022

Updated Environmental Monitoring Plan

Report for: Yorkshire Water Services Ltd

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VERSION CONTROL

Version	Publication date	Author	Content/ changes
1.0	2013	Cascade Consulting, Arup	First EMP
2.0	February 2016	YWS	Updated post start of AMP6 baseline data monitoring. Integrated methodology agreed with EA in (Appendix A) January 2016
2.1	February 2016	YWS	Updated baseline methodology section to reflect Appendix A
2.2	July 2016	YWS	Final updates to Appendix A
3	June 2017	Cascade Consulting, Arup	Updated EMP following updating of the 2017 DP and associated EARs
3.1	July 2018	Ricardo, Arup	Minor modifications as part of Drought Plan 2018 finalisation
4.0	August 2020	Ricardo	First draft of updated EMP for Draft DP 2021 and associated EARs
4.1	February 2021	Ricardo	Updated following EA comments and completion of EAR updates
4.2	September 2021	Ricardo	Minor updates following Draft Drought Plan 2022 consultation
5.0	August 2022	Ricardo	Final for application
6.0	May 2025	Ricardo	Updated DP2022 EMP to support permit applications and revised monitoring and mitigation recommendations in consultation with the EA.
7.0	June 2025	Ricardo	Minor updates following review by Environment Agency.

EXECUTIVE SUMMARY

This Environmental Monitoring Plan (EMP) accompanies Yorkshire Water's Drought Plan 2022 and provides a framework for monitoring and mitigation that would be followed during preparation for a drought permit / order. It outlines the methods through which Yorkshire Water will ensure it understands and manages the effects of its drought management actions on the environment. The report has been prepared in accordance with the Environment Agency Water Company Drought Plan Guideline (2025).

The EMP is comprised of the following components:

- An assessment of additional survey requirements to support/inform decisions on environmental sensitivity and likely impact, including the establishment of baseline conditions.
- Identification of in-drought monitoring requirements to assess impacts arising from drought management actions and to assess the effectiveness of mitigation options put in place to manage any impacts.
- Identification of post-drought monitoring requirements to assess the recovery of a site, along with mitigation options to aid the recovery from drought management actions.

The EMP draws on the conclusions and recommendations identified in the accompanying Environmental Assessment Reports (EARs) and preliminary environmental assessment and screening reports for drought options in a third consecutive year of drought. The development of mitigation and monitoring requirements have been based upon the assessment of sensitive receptors identified as having a significant risk of impact as a result of implementing any proposed drought management actions. Following the Environment Agency guidance, significant risk has been considered to be where the significance of impacts is identified as being moderate or major.

As environmental conditions will naturally change and evolve over time, and thus the potential for significant impacts upon sensitive receptors may change, baseline monitoring has been identified to address this, with all sensitive receptors considered for monitoring.

Monitoring proposals for the baseline, on-set of drought, in-drought and post-drought conditions address a range of factors, including: the identification of sensitive receptors to be monitored; recommendations for specific methods to be utilised for monitoring; timing and frequency of monitoring; and identification of parties who would be responsible for undertaking the monitoring. Although exact locations of monitoring sites have not been established, a plan of action for their identification has been established.

Throughout the development of the EMP and the supporting environmental assessment process, Yorkshire Water have proactively engaged key stakeholders, Environment Agency and Natural England.

The EMP will be periodically reviewed to ensure the conclusions and recommendations remain valid and lessons learnt from the implementation of drought management actions are incorporated. Key stakeholders will be further consulted as part of the overall drought permit/order application process during any drought event.

Contents

GLOSSARY

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.

Biological Quality Elements (BQE)

The Water Framework Directive specifies the quality elements that are used to assess the ecological status of a water body. These are referred to as Biological Quality Elements (BQE) and form a component of this ecological status include fish, invertebrates, macrophytes etc.

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.

Drought Order

An authorisation granted by the Secretary of State under Section 73 of the Water Resources Act (199) when there are drought conditions, which impose restrictions upon the use of water, and/or allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis. A drought order can be applied for by the Environment Agency for environmental reasons and by a Water Undertaker for Public Supply reasons. A drought order lasts for 6 months but can be extended for a total of one year.

Drought Permit

An authorisation granted by the Environment Agency under drought conditions which allows for abstraction/impoundment outside the schedule of existing licences on a temporary basis (generally for 6 months, but can be extended up to a total of one year) under Schedule 8 of the Water Resources Act (1991).

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.

European Protected Species

European Protected Species and their habitats receive full protection through inclusion within Schedule II of the Conservation of Habitats and Species Regulations 2010 (as amended), which transposes Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora into national statute.

FCS2

The Fisheries Classification Scheme (2) method enables the assessment of fish in rivers according to the requirements of the Water Framework Directive (WFD). It encompasses fish abundance, taxonomic composition and age structure. There are two parts, or sub-models, to the FCS2 species models. The first, the calibration submodel, predicts the expected numbers of a species to be found at a given site (based on physical, chemical and geographical attributes) if it were at reference conditions. The second, the application sub-model, compares the actual number of fish observed on a survey with the expectation predicted by the calibration mode. The result is an individual species EQR which is interpreted as the probability of observing the number of individuals which were actually observed, or less, if the site were at reference conditions.

Level of service

Water resource availability is dependent on factors such as precipitation, that vary through time. During periods of scarcity, restrictions, such as hosepipe bans, can be introduced that help maintain depleted water resources so that Yorkshire Water can fulfil their responsibility to customers over the frequency of restrictions, e.g. drought order implementation would be limited to a frequency of 1 year in 25.

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 of alkalinity of a liquid based on a logarithmic scale of concentration of hydrogen ions. < 7 is acidic, > 7 is alkaline.

Ramsar site

Ramsar sites support internationally important wetland habitats and species and are listed under the Convention on Wetlands of International Importance, especially as waterfowl habitat (Ramsar Convention, 1971). Nationally planning policy indicates that Ramsars should be afforded the same level of protection as Special Areas of Conservation and Special Protection Areas.

Site of Special Scientific Interest (SSSI)

Designated under the Wildlife and Countryside Act 1981 (as amended), with additional protection afforded through the Countryside and Rights of Way Act (2000) and Environmental Damage (Prevention and Remediation) Regulations (2009), to protect habitats and the habitats of species that are considered to be of national importance.

Special Area of Conservation (SAC)

Designated under the Habitats Directive and implemented through the Habitats Regulations (1994) to protect important European Habitat, especially those of threatened species, in sites of community importance.

Special Protection Area (SPA)

Designated under the Birds Directive and implemented through the Wildlife and Countryside Act (1991) to protect important European Habitat for birds.

River Invertebrate Classification Tool (RICT)

The River Invertebrate Classification Tool (RICT) is used to contextualize WHPT scores, by using a RIVPACS (River Invertebrate Prediction and Classification System model to predict site specific reference values and provide a WFD compliant probabilistic classification. The RIVPACS models are based on a database of reference samples from streams and rivers across the UK. These were collected between 1978 and 2002. The Regulatory Agencies for surface waters in the UK have recently begun to use the new web-based River Invertebrate Classification Tool (RICT) to classify the ecological quality of rivers.

PyWR

The water resources model used by Yorkshire Water. Within PyWR each of the reservoir sources or groups has defined control lines. The level of service is achieved by ensuring that the storage within the system is balanced. PyWR prioritises the use of water in the system depending on each reservoir's storage in relation to the control lines.

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

BOD	–	Biochemical Oxygen Demand
BQE	–	Biological Quality Element
CEH	–	Centre for Ecology and Hydrology
CIEEM	–	Chartered Institute of Ecology and Environmental Management
CPUE	–	Catch Per Unit Effort
CSO		Combined Sewer Overflow
DPG	–	Environment Agency (2025) Drought Plan Guideline
EA	–	Environment Agency
EAR		Environmental Assessment Report
EcIA	–	Ecological Impact Assessment
EMP	–	Environmental Monitoring Plan
EQI	–	Ecological Quality Index
EQR	–	Ecological Quality Ratio
FCS2	–	Fisheries Classification System 2
HoF		Hands off Flow
JNCC	–	Joint Nature Conservation Committee
LIFE	–	Lotic-invertebrate Index for Flow Evaluation
LNR	–	Local Nature Reserve
LWS		Local Wildlife Site
MCZ		Marine Conservation Zone
Ml	–	Megalitres (1Ml is equivalent to 1000 cubic metres or 1,000,000 litres)
NE	–	Natural England
NERC	–	Natural Environment and Rural Communities (refers to Section 41 of the Act)
NNR	–	National Nature Reserve
PSI		Proportion of Sediment-sensitive Invertebrates
PyWR		Python Water Resources: an open-source water resources simulation model
RBMP		River Basin Management Plan
RHS	–	River Habitat Survey
RICT		River Invertebrate Classification Tool
SAC	–	Special Area of Conservation
SPA	–	Special Protection Area
SRP		Soluble Reactive Phosphorous
SSSI	–	Site of Special Scientific Interest
STW	–	Sewage Treatment Works
TUB		Temporary Use Ban
UKAS	–	United Kingdom Accreditation Service

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

1. INTRODUCTION

1.1 PURPOSE OF THE ENVIRONMENTAL MONITORING PLAN

This Environmental Monitoring Plan (EMP) accompanies Yorkshire Water's Drought Plan 2022 and provides a framework for monitoring and mitigation that would be followed during preparation for a drought permit or order. As the water company, Yorkshire Water is responsible under the "Water Company Drought Plan Guideline" (Environment Agency (EA), 2025) for understanding the effects of its drought management actions on the environment. Where possible the EMP presents a monitoring framework to differentiate the impacts of implementing the drought measure from those caused by environmental drought conditions. The EMP builds on the information presented in the previous EMP, prepared for the previous Yorkshire Water drought plans (Yorkshire Water, 2011, 2019, 2022).

The EMP is a working document and Section 6 of the EA Drought Plan Guideline (DPG)[1] suggests that the EMP is subject to a regular review to ensure that it remains fit for purpose, especially where new data/ evidence becomes available.

Figure 1.1 indicates the Yorkshire Water Operational Area and the potential drought options discussed within the EMP, including those alternative options for a longer-term drought (marked in red or shown in the inset map). Detailed maps of each drought option and the impacted reaches are available within each of the individual Environmental Assessment Reports (EARs):

- North Area Reservoirs (5 drought options)
- North West Area Reservoirs (12 drought options)
- South Area Reservoirs (8 drought options)
- South West Area Reservoirs, separated into:
    - Upper Calder (10 drought options)
    - Middle Calder (10 drought options)
- Elslack Drought Order (EA Drought Order)
- Holme Styes Reservoir (EA Drought Order)
- Gorpley Reservoir Drought Order (EA Drought Order)
- River Ouse at Moor Monkton intake
- River Ure at Kilgram Bridge intake
- River Wharfe at Lobwood intake
- River Derwent Annual Abstraction Increase
- River Hull at Hempholme intake.

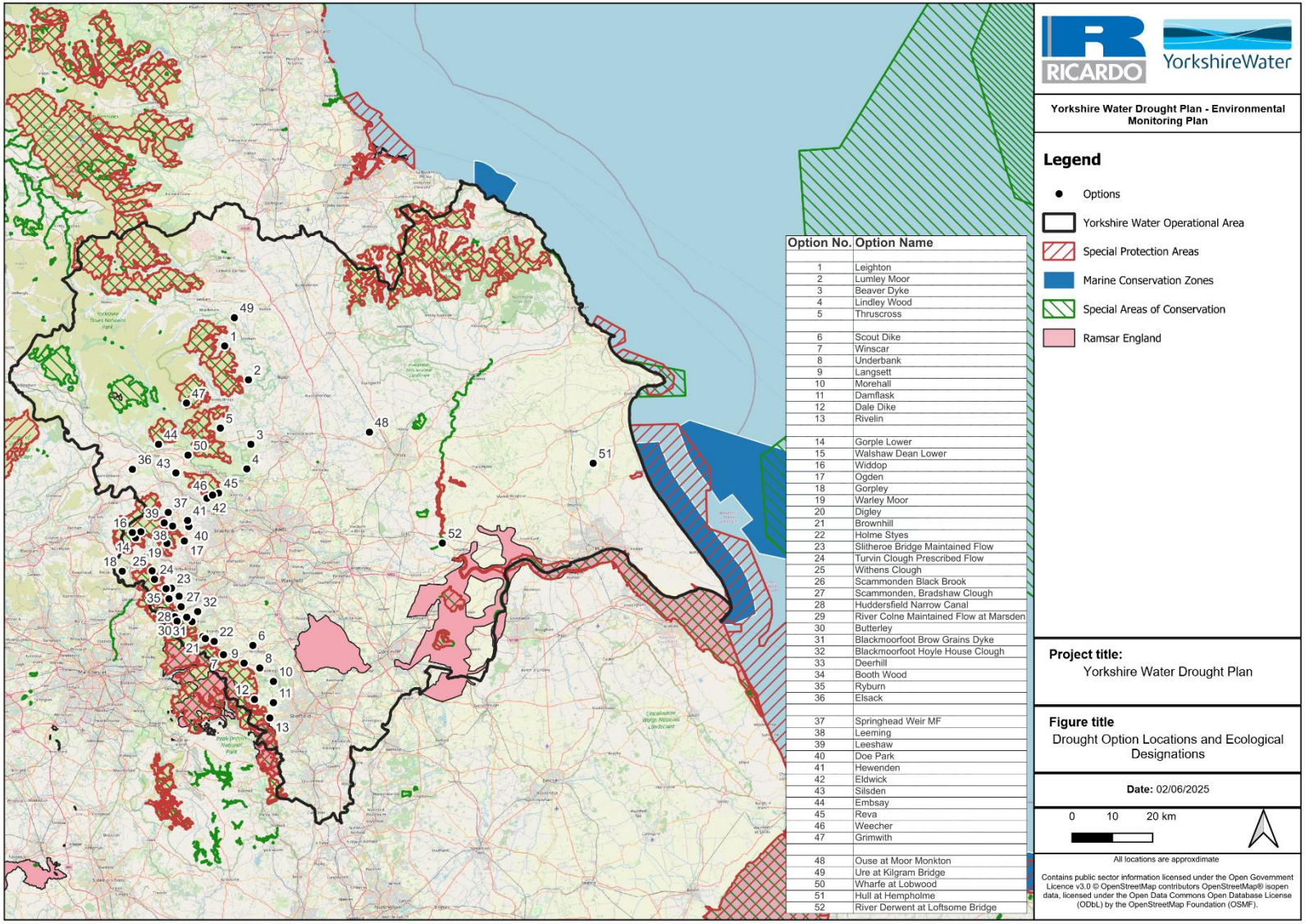
This document encompasses all 53 of these potential drought options within the Yorkshire Water supply system.

In addition, a range of schemes have been reviewed as those suitable for consideration in a more severe drought (lasting two or more years). These 'extreme' supply actions have been subject to sensitivity screening during preparation of Drought Plan 2022:

During a drought, those 'extreme' drought options which are to be considered for progression would be subject to further work. This includes additional monitoring to better inform the preliminary assessments that have been carried out to date, reducing the uncertainties as to potential impact. Further work would include re-screening of the schemes in collaboration with the Environment Agency and Natural England and the setting out of a robust baseline monitoring programme, including for any construction impacts. After collection of this baseline data, full EARs would be prepared. These EAR documents would set out in detail any mitigation requirements and associated monitoring. This includes consideration of SSSIs potentially influenced by the long-term drought options,

[1] Environment Agency (2025) Water Company Drought Plan Guideline, March 2025.

Figure 1.1 Yorkshire Water Drought Plan Option Location Map



Option No.	Option Name
1	Leighton
2	Lumley Moor
3	Beaver Dyke
4	Lindley Wood
5	Thruscross
6	Scout Dike
7	Winscar
8	Underbank
9	Langsett
10	Morehall
11	Damflask
12	Dale Dike
13	Rivelin
14	Gorple Lower
15	Walshaw Dean Lower
16	Widdop
17	Ogden
18	Gorpley
19	Warley Moor
20	Digley
21	Brownhill
22	Holme Styes
23	Slitheroe Bridge Maintained Flow
24	Turvin Clough Prescribed Flow
25	Withens Clough
26	Scammonden Black Brook
27	Scammonden, Bradshaw Clough
28	Huddersfield Narrow Canal
29	River Colne Maintained Flow at Marsden
30	Butterley
31	Blackmoorfoot Brow Grains Dyke
32	Blackmoorfoot Hoyle House Clough
33	Deerhill
34	Booth Wood
35	Ryburn
36	Elsack
37	Springhead Weir MF
38	Leeming
39	Leeshaw
40	Doe Park
41	Hewenden
42	Eldwick
43	Silsden
44	Embsay
45	Reva
46	Weecher
47	Grimwith
48	Ouse at Moor Monkton
49	Ure at Kilgram Bridge
50	Wharfe at Lobwood
51	Hull at Hempholme
52	River Derwent at Loftsome Bridge

1.2 BACKGROUND AND BASIS OF THE ENVIRONMENTAL MONITORING PLAN

The EMP has been prepared in support of Yorkshire Water's Drought Plan and in compliance with the requirements of Section 6 (Environmental Assessment, Monitoring and Mitigation) of the DPG.

This detailed EMP and the encompassing Yorkshire Water Drought Plan 2022 should be viewed in conjunction with the relevant Environment Agency Drought Plans, which aim to reconcile the interests of public water supplies, other abstractors and the environment during a drought, at both national and regional/ local levels. Like water company Drought Plans, the Environment Agency's Drought Plan is also reviewed on an annual basis. The Environment Agency's Drought Plan will not, however, specify additional ecological monitoring to track the onset or severity of drought such as that covered by this EMP.

Guidance states that in a Drought Plan, a water company must describe the measures they may need to take to restrain the demand for water within their water supply system, obtain extra water from other sources, and how the effects of an environmental drought and those resulting from the application of a drought permit/order are to be monitored.

1.2.1 Environmental Monitoring Plan Guidance

Guidance on the objectives and content of the EMP is given in Section 4 and 5 of the Environment Agency "Environmental assessment for water company drought planning" supplementary guidance to the DPG. The issues specified are addressed in subsequent sections of this report. The guidance states that an EMP should include details of the monitoring required and states this should include:

Baseline monitoring – collection and maintenance of baseline monitoring datasets help understand the nature of the environment under 'normal' circumstances, along with establishing the sensitivity of the environment to changes in flow and any especially sensitive receptors of interest. Baseline monitoring is also essential in enabling understanding of the actual environment impact of supply side drought management actions. It allows comparison between the environment under 'normal' conditions against observed environmental datasets during and after a drought.

In-drought monitoring - to help assess the immediate environmental impacts of drought action during a drought along with informing choices and implementation of mitigation measures. This can be split between pre-permit/order application (**On-set**) and post-permit/order implementation (**In-drought**) stages.

Post-drought (recovery) monitoring - to help assess any longer term environmental impacts of, or recovery from, the implementation of drought actions.

The guidance states the EMP should include for each stage:

- the elements/receptors of the environment you will monitor
- the location, in-year and between year frequency of monitoring, sampling/survey methods, relevant standards
- any changes in approach between stages (for example, increasing the frequency of sampling during the in-drought stage)
- who is responsible for carrying out this monitoring
- the existing environmental datasets you have and how the additional monitoring you plan to carry out will complement these and improve your environmental assessments
- how you plan to analyse the resulting monitoring datasets and the data analysis tools you will use.

It may be possible to avoid, reduce or mitigate adverse effects on the environment. The guidance states a drought plan should, therefore, identify:

- pre-drought mitigation actions: actions you will implement before or whilst the drought is developing to reduce the likely environmental impact of your proposed actions
- in-drought mitigation actions: actions you will implement during a drought to minimise the environmental impact of your proposed actions
- post drought mitigation actions: actions you will implement following a drought to reduce any environmental impacts that may occur as a result of the actions you implement and aid recovery from them.

The DPG also indicates that a drought plan should provide evidence that the mitigation measures that are proposed will be effective for the receptors that could be at risk from a drought action. The EMP should show how this will be monitored. The drought plan should also include details of any additional permits or approvals needed to carry out the mitigation measures.

In some cases, mitigation actions may be necessary to prevent derogation of other abstractions (for example, by providing alternative supplies or releasing compensation water into watercourses to limit the impact of reduced flows).

1.2.2 Consultation

A wide-ranging consultation process has been undertaken in the preparation of Drought Plan 2022, building on engagement carried out during previous drought planning cycles. The Environment Agency has played a central role in this process, and the monitoring methodologies and locations presented in this Environmental Monitoring Plan (EMP) reflect discussions and shared understanding with the Agency. Earlier consultation included engagement between the Environment Agency and Yorkshire Water in August and December 2011, as well as further discussions from January to March 2013 following the Addendum to the Draft Drought Plan, to review proposed mitigation and monitoring measures. Additional consultation was undertaken in March 2020 to inform updates to the Drought Plan 2022 and associated environmental assessments. It was agreed that, where possible, monitoring stations should align with existing Environment Agency and Yorkshire Water sites and apply standard methodologies to ensure data compatibility. Yorkshire Water's Final Drought Plan 2022 was published in April 2022. Further consultation was undertaken in May 2025 to review and refine the mitigation measures within the EMP, ensuring they are appropriate and effective for the identified receptors under drought conditions. The Draft Drought Plan 2027 is currently under revision and the EMP will be updated to support this, with formal consultation expected in October 2025.

1.3 MITIGATION AND MONITORING KEY

For ease of reference and identification, the mitigation and monitoring options identified at each stage of the process (baseline, on-set of drought, in-drought and post-drought) have been assigned a prefix code to distinguish between them. The following abbreviations have been used:

- Baseline Monitoring – BMON
- On-set of Drought Monitoring – ODMON
- In-drought Monitoring – IDMON
- In-drought Mitigation – IDMIT
- Post-drought Monitoring – PDMON
- Post-drought Mitigation – PDMIT.

1.4 BIOSECURITY

Biosecurity is a major issue across the UK to prevent disease and pathogen transfer and the spread of invasive species. It is therefore important that prior to commencing any monitoring or mitigation measures, a biosecurity plan is completed to highlight risks associated with monitoring or mitigation activity and ensure good working practice is followed. It is recommended that biosecurity is included in site risk assessment procedures alongside other environmental and health and safety risks.

During a drought, biosecurity risks may be elevated. If drought permits or orders are implemented, Yorkshire Water will work with the Environment Agency, Natural England, land owners (e.g. CLA) and the agriculture sector (e.g. NFU) to promote the importance of biosecurity measures at times of low flows. This could include joint press releases and website messages, as well as articles in appropriate magazines and journals. A joint message is likely to have the greatest impact, rather than one organisation working in isolation.

1.5 REPORT STRUCTURE

This EMP comprises the following sections:

- Monitoring – including baseline monitoring outside of drought conditions and mitigation-led monitoring (on-set, in and post drought)

- Mitigation – in-drought and post-drought mitigation measures
- Monitoring specific to each impacted reach

Four appendices have been included. **Appendix A** sets out the detailed monitoring and mitigation for each reach. **Appendix B.1** comprises a spreadsheet embedded into this report which sets out information on existing baseline monitoring sites; **Appendix B.2** provides details for ecology survey methodologies. **Appendix C** provides a detailed specification for surveillance walkover monitoring. **Appendix D** provides additional guidance for ecological actions .

2. MONITORING

2.1 INTRODUCTION

Section 4 of the DPG supplementary guidance states monitoring data are required to inform an environmental assessment in advance of a drought, and any in-drought and post-drought data requirements. This section of this EMP details the monitoring measures that will be undertaken during each progressive stage of a drought: on-set of drought (pre-permit/order application), in-drought (post-permit/order implementation) and post-drought (recovery). Following consultation with the EA as detailed in **Section 1.2.2**, monitoring leading to selection and implementation of appropriate mitigation measures will be undertaken. Section 5 of the DPG supplementary guidance states that it may be possible to avoid, reduce, mitigate or compensate for adverse effects that drought actions have on the environment and the drought plan must identify in-drought and post drought mitigation measures (see **Section 1.2.1** above).

Walkover surveys will monitor water quality, flow, levels and habitat available, providing immediate qualitative information on the effects of the drought measures, and allow decisions to be taken quickly regarding further monitoring and/or mitigation requirements. Further targeted surveys are recommended where walkover surveys identify potential serious significant impacts. These targeted surveys may result in implementation of mitigation measures where required.

Quantitative and qualitative monitoring surveys are recommended for different stages of the drought process where a reliable data set is required in order to determine impacts to sensitive receptors and reduce uncertainty in environmental assessment. This monitoring will provide data necessary to satisfy the requirement of Section 4.3 of the DPG for water companies to review the environmental impacts of the drought by analysing baseline, in-drought and post-drought data (where post-drought monitoring has been required). Location, timing and frequency information for recommended mitigation-led monitoring surveys is summarised in **Section 3.10**.

For those ‘extreme’ drought options, further work would be triggered during the development of a drought and in accordance with the triggers set out in the Final Drought Plan 2022. Scenario modelling reported in the Drought Plan indicates that in the spring of a second year of drought, discussions would take place with EA and NE on the instigation of environmental monitoring requirements associated with the relevant long-term options. These discussions would start prior to taking the decision to implement long term drought options to endeavour to provide a summer drought environmental baseline before a third summer of drought. A first step would be to carry out re-screening of the relevant schemes in collaboration with EA and NE, leading to mitigation requirements and associated monitoring being confirmed and included in a full EAR.

2.1.1 Monitoring

Where possible the baseline monitoring program for hydrometric data, water quality, fisheries and macroinvertebrates will continue during the on-set, in drought and post drought option implementation periods in order to provide robust data on environmental conditions during and after the implementation of drought options. Monitoring in any post drought option implementation period will need to prioritise survey of sites related to implemented drought options.

Data collected in the baseline, on-set and in drought this period can be compared to data collected in post-drought conditions to determine the rates of recovery and any further appropriate mitigation required. However, it should be noted that sensitive receptors are most likely to be experiencing stress during the on-set and in drought period and the use of invasive techniques will be avoided where possible. Biological surveys would only proceed if agreed with the EA following review of risk to stress on aquatic communities.

2.2 ROUTINE BASELINE MONITORING

Baseline monitoring is required to identify impacts of the drought options over and above the effects of environmental drought. A comprehensive review of existing baseline information relating to Yorkshire Water supply-side drought options has been carried out in preparation of the Yorkshire Water Drought Plan and accompanying documents. The adequacy of these data have been reviewed and consideration has been made as to whether there is a need for further baseline monitoring to reduce uncertainty regarding the presence or distribution of important receptors, which will be updated through the review of the assessment. The following

sections provide details of the agreed approach for baseline monitoring. The monitoring codes used in the reach specific specifications are identified as appropriate throughout the section.

The use of existing monitoring sites and standard methodologies applied in data collection are recommended, where possible and where relevant additional requirements are described. It should be noted, however, that not all existing monitoring sites are necessarily proposed. This baseline monitoring programme is customised to the individual sites associated with a particular drought option and the sensitive receptors known to be present within proximity to the site. Where initial assessment of sensitive receptors (following the EA DPG) identified a lack of data to inform full assessment and subsequent sensitivity was classed as 'uncertain', further surveys may be recommended to inform detailed assessment. It should be noted, however, that in some cases professional expert judgement is accepted in the absence of detailed data and further surveys are only recommended where uncertainty remains.

The long-term water resource drought options have not been subject to the same rigorous review of baseline monitoring data, but a screening exercise has been carried out to identify the key data required and available. It is considered that there would adequate time to review existing baseline data at the onset of a water resources drought given the lead time associated with these options.

2.2.1 Control Site Selection

The use of control sites during impact monitoring is essential to assess additional impacts of implementing drought options over and above that of environmental drought conditions alone. These un-impacted sites form a comparison with impacted sites following a drought. The precise location of these control sites should be determined in discussion with the regulators. It will be possible however, to identify potential sites during the walkover survey. Ideally control sites will be located on un-impacted reaches within the same catchment, but this may not be possible in all cases, and comparable sites in other catchments can constitute valid control sites in these circumstances. The total number of sampling sites should ideally be split equally between control and impact locations to provide a balanced statistical design to give the most robust assessment. However, in reality the number of sites required to provide this will be difficult to achieve in the context of the EMP. Water quality monitoring control sites will be selected from the EA routine monitoring network, undertaken by the EA with no increase in monitoring frequency.

2.2.2 Physical Environment

2.2.2.1 Environment Agency Surveys

The EA routinely monitor a number of sites within impacted reaches as part of Water Framework Directive (WFD) monitoring programmes. These monitoring surveys can also be utilised for in-drought and post-drought assessments. Monitoring includes the following key elements:

- River flow monitoring at a series of gauging stations
- Physico-chemical water quality monitoring at sites on all the main rivers for parameters outlined in the 2010 Defra Directions (carried out for WFD and other purposes).

2.2.2.2 Hydrology (River Flows and Water levels)

River flow data assist the baseline understanding of the river catchment, establish the zone of influence of the drought options and assist in the differentiation of drought-related impacts and drought options on hydrology and hydro-ecology.

To ascertain the hydrological impacts of the various drought options, a variety of different hydrological/hydrometric datasets were obtained. These generally came from either the EA or Yorkshire Water. The existence of each data type, around each of the drought options, was dependent on the site specific details of each of the drought options. The following data types were obtained:

- Continuous river stage/level gauging
- Continuous flow data
- River spot flow data
- Reservoir outflow measurements (including compensation flows)

- Reservoir level data, providing an indication of the frequency of the spill of excess water from Yorkshire Water's reservoirs
- River abstraction data for Yorkshire Water's intakes
- PyWR water resource modelling data
- Precipitation.

Flow data were obtained for a number of watercourses. Data were generally obtained from the EA and Yorkshire Water although some data were obtained from the Centre of Ecology and Hydrology's (CEH) national river flow archive website. Flow data provide an indication of the amount of water (specifically discharge or volume rate of flow) that flows past the gauge at that moment in time.

When a gauge is measuring and recording flow data for a number of years, and is located in the same place, long terms flow records can be obtained. Long-term flow records show the typical variation of flow within a watercourse over time. Statistics on flow can be obtained for long term datasets. Typical statistics include median flow and infrequent high and low flows. Of relevance for drought studies are the low flow statistics, such as Q_{95} which represents flow equalled or exceeded for 95% of days in the measured record (equivalent to an average of all but 18 days per year). Obtained flow data included compensation flow data for the drought options reservoirs.

River stage/level measured data (obtained from the EA) are generally long-term measurements of the depth of a watercourse at a fixed location. Stage refers to elevation above ordnance datum whilst level is relative to a nearby local datum (such as bed level). Stage/level measurements are a coarser approximation of the variability of a river over time in that higher levels are generally associated with higher discharges. In the absence of local flow data, stage/levels have been used in the assessment generally to show if the variability in stage/level experienced nearer to a potentially impacted reach is similar to that of flow gauge further upstream/downstream. If the local stage/level is similar to the more distant flow gauge, then the measured flow gauge data may be used to derive approximate flows (through catchment apportioning) in the vicinity of where the drought option, and any impact of it, is focussed.

Reservoir spill and level data were obtained from Yorkshire Water. Reservoir level data are measured at regular intervals (typically daily or weekly) and provides an indication of how full the reservoir is. When a reservoir is full, excess water flowing into the reservoir will overflow (or spill) into the downstream watercourse. Generally daily spill measurements can be obtained or derived from measurements taken as part of the compensation flow recording immediately downstream of the reservoir.

Water resource modelling, using PyWR, has also been obtained from Yorkshire Water and used as part of the hydrological assessment. Within PyWR, Yorkshire Water's supply options are included and how the supply options behave under drought conditions can be simulated. Simulations would include aspects such as compensation releases. The PyWR outputs characterised two dry periods (one in the late 1920s and the other between 1995/97). The simulations provide an indication of the time of year when drought options would likely occur (the timing), how long the drought option may be in place and how long the impacts of the drought option would occur (the duration).

Within PyWR each of the reservoir sources or groups has defined control lines. The level of service is achieved by ensuring that the storage within the system is balanced. PyWR prioritises the use of water in the system depending on each reservoir's storage in relation to the control lines.

There is an adequate coverage of hydrometric data in the study area. In order for this to remain the case, the existing monitoring regime, undertaken by Yorkshire Water and the EA, should continue as at present.

- **BMON_H** - Environment Agency/Yorkshire Water to continue monitor river flows and levels/reservoir levels and spill at key monitoring sites.

2.2.2.3 River Habitats / Geomorphology

In order to understand the impacts of changes in flow on habitats and geomorphology, existing river habitat and geomorphological data were sought. The characterisation of the river habitats of the reaches is informed by bespoke walkover surveys undertaken by Yorkshire Water and the EA, River Habitat Surveys (RHS) undertaken by the EA and supplementary mapped/aerial imagery information.

The bespoke walkover surveys were undertaken by Yorkshire Water and the EA during late summer 2018 in specified 500m walkover reaches (lengths of each impacted reach deemed particularly sensitive or representative sections of the entire reach). Additional walkovers were undertaken in summer 2020 to complete the dataset for all reaches. These walkovers were undertaken using the River Conditions Observation Form - Low Flows developed by the EA (see **Appendix C** for further details). An appreciation of the adequacy of the data used throughout the assessment is provided in the river habitat section of the Physical Environment descriptions within the EARs. Generally, geomorphology data are affected by spatial distribution and variability, temporal issues and visibility of the river.

RHS data were obtained from the EA for the areas investigated. These data are collected along a 500m section of river using 10 spot sites and a "sweep-up" of the receptors within and around the river not included in the 10 spot sites. The survey contains a range of ecological, hydrological, geomorphological data for the channel bed and banks, flow and surrounding land. The survey also collects information on the anthropogenic modifications present within and around the channel and the land-use around the channel. These data are generally semi-quantitative with some quantitative data describing channel width and depth. The spatial distribution of the RHS data obtained for the geomorphological assessment was limited, particularly in the smaller reaches where it was common for there to be no RHS data. In addition, the limited spatial distribution of sites has meant that no more than a general overview of geomorphology could be obtained for most reaches. This was reinforced where riparian tree cover obscured the channel and no geomorphological information on the channel could be obtained.

Aerial imagery data of the impacted reaches were viewed using Google Earth. The aerial images were used to assess the impacted reaches by deriving counts of geomorphological features in the channel (e.g. sediment bars, riffles, pools, bank erosion etc.), the presence of anthropogenic structures in and around the channel, particularly weirs, bridges and reinforced or resectioned banks and the surrounding land use. In addition, the images were used to acquire measurements of channel length and width and the width of weirs. Aerial imagery may be limited in some cases due to the presence of riparian vegetation obscuring the channel, which means features and channel dimensions could not be directly assessed. This limitation was particularly important where there was no walkover or RHS data, hence no geomorphological interpretation could be undertaken at such sites. This can be more common in smaller rivers at altitudes between the steepest upland channels and the widest lowland channels.

In general the river habitat data and aerial imagery is limited by the dates of survey/imagery. Due to the dynamic nature of rivers it is expected that the data contained in the walkovers, RHS and aerial imagery is unlikely to be the most current data. This may lead to an assessment of the river habitats and geomorphology of the impacted river reach which is less representative than the current day.

Given the potential changes in habitat in the period leading up to a future drought it was agreed with the EA during consultation in March 2020 that no further baseline walkovers should be specified. Walkovers are specified for the drought onset period (see Section 3 below).

2.2.2.4 Water Quality

2.2.2.4.1 Routine River Water Quality Surveys

The EA routinely monitor a number of river sites within impacted reaches as part of WFD monitoring programmes. These monthly monitoring surveys can also be utilised for in-drought and post-drought assessments.

Monitoring includes the following key water quality elements:

- General water quality parameters: water temperature and pH
- Sanitary water quality parameters: Dissolved oxygen concentration, dissolved oxygen saturation, total ammonia, un-ionised ammonia
- Nutrient quality: soluble reactive phosphate.

These datasets have been reviewed and their suitability discussed between Yorkshire Water and the EA. An appreciation of the adequacy of the data used throughout the assessment is provided in the Water Quality section of the Physical Environment description of each scheme (within the EARs). Generally, there is adequate coverage of water quality data in the study areas. In order for this to remain the case, the existing monitoring regime, undertaken by the EA, should continue as at present:

- **BMON_WQ** - Environment Agency routine water quality monitoring at existing network of sites on current monthly programme, which includes those on un-impacted reaches suitable as control sites.

Yorkshire Water will continue to review the EA monitoring programme to ensure it provides an adequate data set.

2.2.2.4.2 Yorkshire Water WwTW Final Effluent Quality

In order to ascertain the water quality risks presented by Yorkshire Water wastewater treatment works (WwTW) in the study areas of each drought option, discharge consent conditions were obtained. For selected WwTW where mitigation of final effluent quality is under consideration, Yorkshire Water have reviewed WwTW performance against consent conditions (informed by final effluent monitoring data where available) to express the potential for such mitigation. This action is included under the in drought mitigation measure 'IDMIT_3' (see Section 3.4 below). The May 2025 Yorkshire Water 'Wastewater Treatment Works Optimisation and Maintenance for Drought Plan' sets out the mitigation actions for these works[2].

During any future on-set of drought periods Yorkshire will consult with the EA regarding any WwTWs not identified as significant water quality pressures at the time of the writing of the application ready EARs, but which may be a cause for concern. Additional sites will be added to the priority list of sites for optimisation as required.

A 'Combined Sewer Overflows Optimisation and Maintenance for Drought Plan'[3] has also been developed by YORKSHIRE WATER, which identifies all significant intermittent water quality pressures identified in this EAR. During any future drought onset period YORKSHIRE WATER will also consult with the Environment Agency and additional sites could be identified as required.

WwTW final effluent monitoring data have not been used directly in the assessment of impacts to sensitive receptors.

2.2.3 Ecology

2.2.3.1 Macroinvertebrate and Fish Monitoring Surveys

The EA routinely monitor a number of sites within impacted reaches as part of WFD monitoring programmes. These monitoring surveys can also be utilised for in-drought and post-drought assessments. To ensure a sufficient dataset to inform the environmental baseline for environmental assessment Yorkshire Water also carry out further macroinvertebrate and fish monitoring. These datasets are used in the preparation of the EARs. The full list of monitoring sites for the macroinvertebrate and fish monitoring programme are included as Appendix B.1.

For all available macroinvertebrate data where environmental variables were available, EQRs were calculated using RICT for $WHPTN_{TAXA}$ and $WHPT_{ASPT}$ indices which are directly relate the macroinvertebrate community to WFD status over the monitoring period. Baseline conditions for sites within the zone of influence of the drought option was also established through existing data. These included graphing the hydrology, water quality, habitat and macroinvertebrate (LIFE scores and WHPT EQRs) variation temporally over the monitored period. This information was used to inform the assessment of any potential impacts on the macroinvertebrate community

As part of the WFD assessment of the fish element the EA undertakes a FCS2 assessment for most WFD waterbodies. The assessment within each EAR considered the scale and longevity of any fish status impacts and determined the severity and duration of impacts to the physical environment as a result of the drought permit/order and the specific requirements of the fish population present. These assessments were informed by the last FCS2 data available for sites within impacted reaches associated with each drought option.

Datasets have been reviewed and their suitability discussed between Yorkshire Water and the EA. Data for those sensitive receptors identified to be at risk of impacts at a moderate or major significance as a result of the drought options should be reviewed and updated, where appropriate, prior to future drought permit/order applications.

[2] YWSL (2025) Wastewater Treatment Works Optimisation and Maintenance for Drought Plan.
[3] YWSL (2025) Combined Sewer Overflows Optimisation and Maintenance for Drought Plan.

Monitoring includes the following key elements which should continue:

- **BMON_E1** - Macroinvertebrate monitoring at a number of locations, including rivers potentially affected by drought measures; to continue in low flow/drought years pending agreement with the Environment Agency regarding aquatic species welfare.
- **BMON_E2** - Fish (including Lamprey) monitoring at a number of locations, including rivers potentially affected by drought measures; to continue in low flow/drought years pending agreement with the Environment Agency regarding aquatic species welfare.

2.2.3.2 Habitat walkovers

Yorkshire Water will undertake targeted mapping of hydrological habitat types within drought permit/order reaches to enhance the baseline dataset. Understanding the quantity, distribution, and composition of habitats such as riffles, runs, and glides, as well as features relevant to key ecological receptors like lamprey and salmonids, provides an important contextual layer to point-based biological data.

Habitat mapping will be carried out using an adapted methodology based on the Hendry–Cragg–Hine methodology[4] during normal or low-flow conditions. Surveys will be recorded on paper maps and later digitised into GIS files suitable for spatial analysis. These will allow for the quantification of key habitat types and features and support assessment of their availability in relation to sensitive species.

Surveyed areas will be covered following a 1 in 4 sampling methodology, whereby a survey reach is selected randomly along the river reach conforming to this constraint. An example would be for a 2km survey reach having one 500m walkover mapping reach within it. This has been shown to be statistically representative and would capture 90% of the variation within a river[5] and is the sampling methodology adopted for River Habitat Surveys. In order to provide a robust baseline of habitats under “normal” flows.

Monitoring includes the following key elements which should continue:

- **BMON_E3** - Walkover surveys of to map habitat distribution and quality, identifying drought sensitive habitats such as areas of riffle, pools and artificial features as well as features relevant to key ecological receptors like lamprey and salmonids. Results to be captured by annotated walkover maps.

2.2.3.3 Species-specific monitoring

A comprehensive biodiversity data review was undertaken to support the environmental assessment process. This included a records search from West Yorkshire Ecology and a review of data previously compiled during preparation of the Drought Plan (Cascade Consulting, 2009). The review focused on the distribution of NERC Act Section 41 Priority Species, including fine-lined pea mussel (*Pisidium tenuilineatum),* otter (*Lutra lutra*), water vole (*Arvicola amphibius*) and white-clawed crayfish (*Austropotamobius pallipes*). Additional anecdotal records, particularly for white-clawed crayfish, water vole, and otter, were also provided by the Environment Agency in 2016.

During consultation with the Environment Agency, it was acknowledged that targeted surveys for fine-lined pea mussel and white-clawed crayfish have not been included, owing to their low probability of presence and limited detectability downstream of reservoirs. Instead, information on these species will be supplemented by data collected through baseline monitoring (BMON_E1, BMON_E2, BMON_E3) and drought-specific monitoring (ODMON_WS, IDMON_WSE), where available. The Environment Agency further confirmed that while potential impacts on NERC Act Section 41 Priority Species must be considered, supplementary surveys are not required where broader monitoring programmes or previous assessments confirm species presence or absence, or where absence has been agreed through consultation with the Environment Agency.

[4] Hendry, K., Cragg-Hine, D. (1997). *Restoration of River Habitat for Salmon and Trout: A Review of Current Practice and Future Options.* Atlantic Salmon Trust, Pitlochry, UK

[5] Wilkinson, J., Martin, J., Boon, P.J. and Holmes, N.T.H. (1998). Convergence of field survey protocols for SERCON (System for Evaluating Rivers for Conservation) and RHS (River Habitat Survey). In Boon, P.J. and Raven, P.J. (Eds), The Application of Classification and Assessment Methods to River Management in the UK. Special issue of Aquatic Conservation: Marine and Freshwater Ecosystems, 8, 579-596

The available datasets from the Environment Agency, Yorkshire Water, and West Yorkshire Ecology provide a substantial baseline for understanding species presence and informing environmental assessments across the Yorkshire Water supply system.

For riparian mammals such as otter and water vole, it is assumed that these species could be present within all impact reaches unless absence has been confirmed through consultation with the Environment Agency. Accordingly, no dedicated surveys have been proposed for these species. It is expected that mitigation measures designed to protect aquatic species (such as brown trout), which require the maintenance of appropriate flows and water levels, will also sustain suitable conditions for riparian species.

Furthermore, post-drought monitoring for otter is not considered necessary. Given their extensive home ranges (up to 70 km), otters may not immediately return to previously occupied reaches following a drought, and a temporary absence could be misinterpreted as a significant ecological impact. Additionally, intrusive post-drought breeding surveys could disturb cub-rearing and may result in greater harm than benefit.

2.3 CONSTRUCTION RELATED SURVEYS

In addition to the drought related monitoring surveys, infrastructure construction activities related to the long-term water resource drought options will require prior ecological survey and assessment to ensure compliance with environmental legislation and statutory duties. The ecological receptors likely to require consideration have been identified in **Tables 4.6** and **4.7** below, however this is not an exhaustive list. Prior assessment, through an Extended Phase 1 Habitat survey, will enable identification of the ecological receptors likely to be impacted upon by the construction phase. Completion of a baseline survey will be required to inform the construction process and should be completed a year prior to construction of the scheme. Therefore, surveys necessary to enable construction should be considered when the potential requirement for each scheme is identified after the onset of a water resources drought. As an up-to-date baseline is not required in the same timescales as for sensitive receptors to the drought-related impacts, monitoring for the baseline has not been identified. Monitoring and mitigation has not been identified for terrestrial receptors relating to a construction impact at the on-set of drought, in-drought and post-drought timings as they are not sensitive to this.

As impacts associated with the construction of the necessary infrastructure are limited to the time in which the scheme is constructed, and lengthy monitoring requirements are likely to be avoided through appropriate route selection, it is necessary to keep these separate from impacts associated with implementation of the drought options. Furthermore, once the schemes have been constructed, the terrestrial impacts can be removed from future revisions of the EMP.

2.4 ON-SET ENVIRONMENTAL DROUGHT MITIGATION-LED MONITORING

The current Yorkshire Water drought plan is based on a modelled 1 in 80 years drought. Baseline monitoring is required to identify impacts of drought operations over and above the effects of environmental drought. The likely severity of drought conditions experienced during a 1 in 80 years scenario provides difficulties when attempting to establish baseline conditions. Current hydrological conditions will differ significantly from those conditions expected prior to the implementation of drought options, therefore data collected for monitoring purposes cannot sufficiently represent pre-implementation ‘baseline’ conditions. It is noted that the collection of data in the immediate period prior to a 1 in 80 years drought will provide data of some relevance (**Section 2**), however collection of data in this season will not provide directly comparable seasonal data (i.e. species ecology and sensitivity will vary seasonally as population dynamics change). Given these difficulties, the collection of pre-drought data for comparison with in-drought and post-drought will not be recommended in this EMP. Therefore, the following information should be collected during the on-set of drought to provide directly comparable information with the in-drought and post-drought.

2.4.1 On-set of environmental drought walkovers

The identification of the extent and location of flow sensitive habitats is recommended using a walkover survey during the on-set of environmental drought prior to the implementation of drought options. During previous consultation the Environment Agency stated a preference for walkover surveys and non-invasive techniques to establish the impacts of the drought option and target mitigation, and for Yorkshire Water to carry out the required walkovers, with Environment Agency support if required. Walkover surveys during the onset of

environmental drought will monitor the current hydrological, water quality and habitat conditions under low flow conditions and inform at an early stage any requirement for further survey and mitigation:

- **ODMON_WS** - Walkover surveys of habitat quality and identification of drought sensitive habitats such as areas of riffle, pools and artificial features such as weirs and sluices that may be isolated or impassable during low flows. Results to be captured by annotated walkover maps and completion of a 'River Conditions Observation Form - Low Flows' form.

Detailed discussion of the surveillance walkover survey methodology to be used for on-set and in-drought walkovers is given in **Appendix C**. The reach specific specifications for the walkovers (i.e. recommended river reach for initial survey) are found in Appendix A.

These surveys are intended to provide a reliable, efficient and low impact method of assessing the current environmental situation within potentially impacted reaches and are not intended to be detailed quantitative surveys. The need for further quantitative monitoring surveys, with detailed parameter analysis, will be assessed following walkover surveys. Walkover surveys will be conducted by experienced field surveyors, with knowledge and understanding of walkover surveys, river habitats and ecological receptors associated with this environment. These initial walkover surveys will identify the 'monitoring/surveillance' reaches, based on selection of most significantly impacted reaches, which will remain consistent throughout the subsequent walkover surveys, although where impacts increase in magnitude or extent at later stages of the drought, the survey area may be widened to encompass this.

2.5 IN DROUGHT (DURING DROUGHT OPTION IMPLEMENTATION) MITIGATION-LED MONITORING

In-drought surveys will be undertaken to monitor changes to sensitive receptors during the implementation of the drought option(s) and to identify the need for mitigation measures. General mitigation measures are suggested based on the likely impacts to sensitive receptors and this current list should be updated where additional 'new' impacts are identified from walkover surveys. The mitigation specific to each impacted reach is detailed in **Appendix A**. It is recommended that in-drought monitoring programmes are initiated immediately once the drought options are implemented. Some mitigation measures may be applied more appropriately during post-drought conditions, when drought option measures are removed. In such cases these are described in **Section 3.2**.

2.5.1 In drought walkover surveys

Surveillance walkover surveys will be conducted at sites identified during the on-set period as well as sites with water quality pressures which may be exacerbated during periods of low flow during the drought permit/order implementation (details for the specification for each reach are provided in **Appendix A**). Surveys will be undertaken throughout the drought option implementation period, including on the day of the flow change, the day after and then weekly thereafter until no further changes are noted.

- **IDMON_WSE**- Surveillance walkover surveys of habitat quality and ecological stress, recording signs of environmental problems (reaches to match those in ODMON_WS)

- **IDMON_WSWQ1** - Targeted surveillance walkover surveys of water quality and ecological stress local to 'significant' water quality pressures', to include water quality spot sampling in priority areas such as pools and weirs where aquatic species may become isolated during low flows.

The surveys will comprise a visual assessment of the river and associated features and water quality spot sampling including a mapped record of channel parameters, and fixed-point photographic records. The surveys will identify the need for mitigation measures (see Section 3.4), and include an assessment of the effectiveness of any mitigation measures implemented in the impacted reaches prior to each survey. The full specification for the walkovers, including triggers for mitigation, are included as Appendix C.

Sites that have been identified as particularly sensitive, or where the severity of the impact appears to be increasing or expanding in range, will be surveyed more frequently during the in-drought period to monitor the zone of influence from drought options.

Consideration for mitigation and monitoring of water quality pressures outside of the identified reaches yet influencing impacted reaches will be given during the walkover surveys.

2.5.2 CSO spill event monitoring

CSOs are designed to only spill untreated wastewater when the local sewerage network is over-capacity, as can occur during storm events. It is unlikely that CSOs will spill during drought conditions. However, YW have a comprehensive CSO optimisation and maintenance plan to ensure CSO's are operating as optimally as possible.**IDMON_WSWQ2** - Discharge validation at key outfalls and downstream, where triggered by review of monitoring data. On site walkovers will validate whether key CSOs are spilling, or have been recently spilt, observe for signs of fish stress and take spot water quality sampling at additional locations including at locations of potential fish stress.

In addition, Yorkshire Water consider that the most likely reason for a CSO spill in a drought would be owing to abnormal operation of the CSO, typically resulting from a blockage. Both Yorkshire Water and the EA are aware that mitigating the impacts of CSOs is very difficult and that Yorkshire Water own a very large number of CSOs in the study areas. In order to prevent impacts most of these CSOs are telemetered and flow trends are monitored by Yorkshire Water and their Repair and Maintenance Partners on a daily basis. Where flow trends are found to be abnormal (i.e. indicating a blockage), Yorkshire Water has a clear operational response procedure for resolving this by e.g. jetting the CSO. This procedure aims to prevent impacts before they occur.

2.6 POST DROUGHT MONITORING

In order to assess whether the implementation of the drought options has any long-term effects on any environmental receptors, monitoring after implementation of drought options will be necessary for certain receptors, as described below. This is in addition to the general baseline hydrometric, water quality, fisheries and macroinvertebrate monitoring specified above in **Section 2** which is assumed to continue and will provide a quantitative dataset to assess whether the implementation of drought options has had any long-term effects on any sensitive environmental receptors with the extent of hydrological influence associated with each of the drought options and to demonstrate recovery where appropriate.

Monitoring post-drought will continue at those locations that are included in the baseline monitoring programme and at a frequency and duration as agreed with the Environment Agency.

Additional monitoring at further locations may also be required if identified during in-drought walkovers. This could also include monitoring of sensitive receptors such as fine-lined pea mussel, white-clawed crayfish and/or juvenile lamprey. Such monitoring will continue until such time that the data shows that the relevant receptors/aquatic communities are fully recovered and in agreement with the Environment Agency.

The recovery of sensitive receptors is considered likely to be rapid, based on recovery of waterbodies following previous drought years, such as 1995, where invertebrate communities (key indicator species) illustrated a rapid recovery after being subjected to serious hydrological stress. On reflection of this, the post drought monitoring programme is anticipated to comprise lower survey effort than during the on-set and in-drought periods. However, survey will allow sufficient data for comparison with on-set and in-drought data in order to determine recovery.

Surveys associated with each drought option are detailed in **Appendix A** and could include any combination of the following suite of monitoring:

- **PDMON_E1** - Macroinvertebrate monitoring at a number of locations, to monitor recovery of their distribution and abundance.
- **PDMON_E2** – Fish (including Lamprey) monitoring at a number of locations, to monitor recovery of their distribution and abundance.

2.7 MONITORING LOCATION, TIMING AND RESPONSIBILITY

Yorkshire Water is responsible for ensuring that the necessary data are collected to allow environmental assessment to inform the Drought Plan. Location, timing and frequency information for recommended further baseline monitoring surveys is summarised in **Table 2-1**. All surveys listed are the responsibility of Yorkshire Water.

Table 2-1 Summary of location, timing, frequency and responsibility for baseline monitoring surveys

Code	Monitoring Surveys	Location	Timing	Frequency	Responsibility
Baseline Monitoring					
BMON_H	EA/ Yorkshire Water to continue monitor river flows and levels/reservoir levels and spill at key monitoring sites	Existing EA/ Yorkshire Water river flow and level gauge monitoring network	Continuous	Continuous (current programme)	EA / Yorkshire Water
BMON_WQ	EA to continue routine water quality monitoring at existing network of sites on current monthly programme, which includes those on un-impacted reaches suitable as control sites.	Existing EA and Yorkshire Water Sites	Year round	Monthly (current programme)	EA
BMON_E1	Macroinvertebrate monitoring at a number of locations, including rivers potentially affected by drought measures; to continue in low flow/drought years pending agreement with the EA regarding aquatic species welfare.	At least one monitoring point within each reach	Spring, summer and autumn	Three surveys (spring, summer[6] and autumn) for three years followed by spring and autumn sampling one year in every three. Most recent survey identified in Appendix B.1	EA / Yorkshire Water
BMON_E2	Fish (including Lamprey) monitoring at a number of locations, including rivers potentially affected by drought measures; to continue in low flow/drought years pending agreement with the EA regarding aquatic species welfare.	At least one monitoring point within each reach	July to September	Annual surveys for three consecutive years and then once every three years. Most recent survey identified in Appendix B.1	EA / Yorkshire Water
BMON_E3	Walkover surveys to map habitat distribution and quality, identifying drought sensitive habitats such as areas of riffle, pools and artificial features as, well as features relevant to key ecological receptors like lamprey and salmonids. Results to be captured by annotated walkover maps.	At least one monitoring point within each reach	July to September	One survey within a 6 year baseline period	Yorkshire Water
On-set of Environmental drought					
ODMON_WS	Walkover surveys of habitat quality and identification of drought sensitive habitats such as areas of riffle, pools and artificial features such as weirs and sluices that may be isolated or impassable during low flows. Results to be captured by annotated walkover maps and completion of a 'River Conditions Observation Form - Low Flows' form	At least one monitoring point within each reach	Duration of environmental drought	On the day of the flow change, the day after and then weekly thereafter until no further changes are noted.	Yorkshire Water

[6] A representative selection sites to be included for summer surveys will be agreed with the EA.

Code	Monitoring Surveys	Location	Timing	Frequency	Responsibility
In-Drought (during drought option implementation)					
IDMON_WSE	Surveillance walkover surveys of habitat quality and ecological stress, recording signs of environmental problems (reaches to match those in ODMON_WS)	Impacted reaches	Duration of drought permit/order	On the day of the flow change, the day after and then weekly thereafter until no further changes are noted.	Yorkshire Water
IDMON_WSWQ1	Targeted surveillance walkover surveys of water quality and ecological stress local to 'significant' water quality pressures', to include water quality spot sampling in priority areas such as pools and weirs where aquatic species may become isolated during low flows.	Impacted reaches with identified 'significant' water quality pressure(s)	Duration of drought permit/order	On the day of the flow change, the day after and then weekly thereafter until no further changes are noted.	Yorkshire Water
Post-Drought (Drought Options Removed)					
PDMON_E1	Macroinvertebrate monitoring at a number of locations, to monitor recovery of their distribution and abundance.	Sites to be defined by baseline surveys and walkover surveys (susceptible sites)	Following drought permit/order cessation	Bi-monthly until return to baseline.	Yorkshire Water
PDMON_E2	Fish (including Lamprey) monitoring at a number of locations, to monitor recovery of their distribution and abundance.	Sites to be defined by baseline surveys and walkover surveys (susceptible sites)	Following drought permit/order cessation	Bi-monthly until return to baseline.	Yorkshire Water

3. MITIGATION

3.1 IN DROUGHT MITIGATION OPTIONS

The IDMON_WSE and IDMON_WSWQ1 surveillance walkovers incorporate visual and water quality monitoring. Detailed specification for the walkovers is provided in Appendix C. This includes a number of suggested signs of environmental distress which may be observed during the visual observations and the water quality sampling. If the monitoring identifies signs of environmental distress Yorkshire Water would notify the EA by telephone on 0800 80 70 60 and undertake a remedial course of action to address the signs of environmental distress. The recommended mitigation options associated with each specific reach are detailed in **Appendix A** but these actions could include any of the following suite of mitigation options:

The following measures are recommended to mitigate against flow impacts from third party abstractions on sensitive receptors, where appropriate:

- **IDMIT_H1** – Negotiation with the licence holder of a temporary reduction of third party abstractions presenting 'significant' impacts to sensitive receptors, including financial compensation by Yorkshire Water.
- **IDMIT_H2** – At identified SSSIs, mitigation would comprise the temporary cessation of impacting drought options by Yorkshire Water.

The following measures are recommended to mitigate against water quality impacts on sensitive receptors where appropriate:

- **IDMIT_WQ1** – Improving the effluent quality from Yorkshire Water WwTWs presenting 'significant' impacts to sensitive receptors, thereby reducing the water quality pressure (ammonia and oxygen balance) on the impacted receptors. Detailed in YORKSHIRE WATER WwTW optimisation plan[7].
- **IDMIT_WQ2** – Short–term relaxation of drought permit flow reduction to dilute/disperse a build up of water quality pressures identified during walkover surveys IDMON_WSWQ1

Further measures are recommended to mitigate against impacts on sensitive receptors where appropriate:

- **IDMIT_E1** – Gradual or temporary adjustments to abstraction or compensation flows to prevent stranding, displacement, or stress in sensitive aquatic species (e.g. fish, macroinvertebrates, white–clawed crayfish).
- **IDMIT_E2** – Aeration of watercourse where significant mortality or change in species abundances are likely to be attributed to water quality deterioration
- **IDMIT_E3** - Creation of alternative refuges in deeper water where walkover surveys identify the loss of important deep water habitat or high densities of fauna in refuges (fish, white-clawed crayfish, water vole)
- **IDMIT_E4** - Provision of in-stream structures and flow baffles to create functional refuges to support flow sensitive species where walkover surveys identify a projected loss of habitat inundation (macroinvertebrates, fish, white-clawed crayfish, water vole, otter)
- **IDMIT_E5** - Regular inspection and clearing of screens to ensure they retain their correct working function (fish, white-clawed crayfish)
- **IDMIT_E6** - Rescue of individuals or groups, in consultation with the EA or NE as appropriate, and relocation to suitable habitat where they are seen to be in distress or where artificially high densities are likely to result in significant impacts (fish, white-clawed crayfish). Measures will be taken to ensure biosecurity at all times. It should be noted that movement of crayfish requires licensing which can take up to 8 weeks. Movement of crayfish would only take place after consultation agreeing that this was the best course of action.

[7] YWSL (2025) Wastewater Treatment Works Optimisation and Maintenance for Drought Plan.

3.2 POST DROUGHT MITIGATION OPTIONS

Some mitigation options are considered to be most effective when applied following removal of drought option measures (i.e. post drought).

The recommended post-drought mitigation options associated with each specific reach are detailed in **Appendix A** but could include any of the following suite of mitigation options:

- **PDMIT_E1** – Enhancement of habitat beyond the impacted reach (macroinvertebrates, fish, fine-lined pea mussel, water vole, white-clawed crayfish).
- **PDMIT_E2** – Provision of artificial freshets to ensure fish are capable of migrating where survey identifies insufficient water depth or volume across structures to facilitate migration (fish).
- **PDMIT_E3** – Modification to barriers and/or flows to improve passage where walkover survey identifies insufficient water depth or volume at obstacles (fish).
- **PDMIT_E4** – Restocking of coarse fish from the catchment where monitoring indicates loss of fish abundance or recruitment (fish).

3.3 MITIGATION LOCATION, TIMING AND RESPONSIBILITY

Yorkshire Water is responsible for ensuring that the necessary data are collected to allow environmental assessment to inform the Drought Plan. Location, timing and frequency information for recommended further baseline monitoring surveys is summarised in **Table 3-1**. All surveys listed are the responsibility of Yorkshire Water.

Table 3-1 Summary of potential impacts and triggers to inform mitigation measures

DP27 Code	Description	Potential Impact identified in EAR	Trigger to inform mitigation action	Receptor(s)
In-Drought (During Drought Option Implementation)				
IDMIT_H1	Negotiation with the licence holder of a temporary reduction of third party abstractions presenting 'significant' impacts to sensitive receptors, including financial compensation by Yorkshire Water.	Reduced flow means there is insufficient water available for other licenced abstractors.	Third party abstractors will be notified as part of stakeholder communications during formal submission of permit/order. YW will liaise at time of formal submission and prior to implementation.	Third party abstractions presenting 'significant' impacts present
IDMIT_H2	At identified SSSIs, mitigation would comprise the temporary cessation of impacting drought options by Yorkshire Water.	For a summer permit, a lack of suitable flow and water quality deterioration may affect water–dependent designated receptors regardless of drought permit implementation, but a drought permit will increase this risk.	Informed by walkover surveys and local knowledge / reports	Designated Sites presenting 'significant' impacts present
IDMIT_WQ1	Improving the effluent quality from Yorkshire Water WwTWs presenting 'significant' impacts to sensitive receptors, thereby reducing the water quality pressure (ammonia and oxygen balance) on the impacted receptors.	Aquatic species, especially those sensitive to changes in water chemistry (like white–clawed crayfish and certain fish species), may experience stress or mortality from altered ammonia and oxygen levels.	If water quality monitoring indicates clear and persistent deterioration in WFD classification for individual element	Yorkshire Water WwTWs presenting 'significant' impacts present
IDMIT_WQ2	Short–term relaxation of drought permit flow reduction to dilute/disperse a build up of water quality pressures identified during walkover surveys IDMON_WSWQ1	Reduced flows during drought conditions can cause pollutants to accumulate, leading to decreased water quality. Relaxing flow reductions allows for dilution and dispersion of contaminants.	If water quality monitoring indicates clear and persistent deterioration in WFD classification for individual element	N/A
IDMIT_E1	Gradual or temporary adjustments to abstraction or compensation flows to prevent stranding, displacement, or stress in sensitive aquatic species (e.g. fish, macroinvertebrates, white–clawed crayfish).	Sudden changes in flow can leave fish, macroinvertebrates, and crayfish stranded in isolated pools or dry areas, especially in low flow conditions. Gradual adjustments help maintain connectivity.	River flow, level or water quality guide thresholds and/or fish stress reporting	fish, macroinvertebrates, white–clawed crayfish
IDMIT_E2	Aeration of watercourse where significant mortality or change in species abundances are likely to be attributed to water quality deterioration	Reduced river levels cause less mixing and hence lower dissolved oxygen levels.	If river dissolved oxygen falls below 60% / 6.0 mg/l for more than 24 hours and is likely to remain below. (Aerators are however considered a last resort, as they only have local effects and can disrupt fluvial sediment).	fish, macroinvertebrates, white–clawed crayfish

DP27 Code	Description	Potential Impact identified in EAR	Trigger to inform mitigation action	Receptor(s)
IDMIT_E3	Creation of alternative refuges in deeper water where walkover surveys identify the loss of important deep water habitat or high densities of fauna in refuges (fish, white-clawed crayfish, water vole)	There is potential for the loss of deep-water habitat under low flow conditions, leading to high densities of fish, white-clawed crayfish, and water vole within remaining refuges, which may increase stress, competition, and the risk of mortality.	Informed by walkover surveys and local knowledge/reports	fish, white–clawed crayfish, water vole
IDMIT_E4	Provision of in-stream structures and flow baffles to create functional refuges to support flow sensitive species where walkover surveys identify a projected loss of habitat inundation (macro-invertebrates, fish, white-clawed crayfish, water vole, otter)	There is potential for reduced habitat inundation and loss of in-stream flow diversity during low flows, which may impact macroinvertebrates, fish, white-clawed crayfish, water vole, and otter by reducing the availability of functional refuges and increasing vulnerability to predation and desiccation	Informed by walkover surveys and local knowledge/reports	macroinvertebrates, fish, white-clawed crayfish, water vole, otter
IDMIT_E5	Regular inspection and clearing of screens to ensure they retain their correct working function (fish, white–clawed crayfish)	During low flows, screens and barriers can become clogged with debris, impeding the passage of fish and potentially leading to stranding or stress.	Informed by walkover surveys and local knowledge/reports	fish, white–clawed crayfish
IDMIT_E6	Rescue of individuals or groups, in consultation with the EA or NE as appropriate, and relocation to suitable habitat where they are seen to be in distress or where artificially high densities are likely to result in significant impacts (fish, white–clawed crayfish). Measures will be taken to ensure biosecurity at all times. It should be noted that movement of crayfish requires licensing which can take up to 8 weeks. Movement of crayfish would only take place after consultation agreeing that this was the best course of action.	There is potential for fish to become stranded in disconnected sections of the watercourse under lower flows or experience increased stress or mortality due to reduced water quality.	River flow, level or water quality guide thresholds and/or fish stress reporting	fish, white–clawed crayfish
Post-Drought (Drought Options Removed)				
PDMIT_E1	Enhancement of habitat beyond the impacted reach (macroinvertebrates, fish, fine–lined pea mussel, white–clawed crayfish, water vole)	During drought, reduced water levels can degrade habitats by exposing sediment, reducing wetted area, and altering flow dynamics.	Informed by walkover surveys and local knowledge / reports	macroinvertebrates, fish, fine–lined pea mussel, white–clawed crayfish, water vole
PDMIT_E2	Provision of artificial freshets to ensure fish are capable of migrating where survey identifies insufficient water depth or volume across structures to facilitate migration (fish)	Drought and low flows can lead to fragmented habitats, impeding fish migration and dispersal.	Informed by walkover surveys and local knowledge / reports	fish

DP27 Code	Description	Potential Impact identified in EAR	Trigger to inform mitigation action	Receptor(s)
PDMIT_E3	Modification to barriers and/or flows to improve passage where walkover survey identifies insufficient water depth or volume at obstacles (fish)	Physical barriers may become more significant during low flows, preventing fish passage and movement between suitable habitats.	River flow, level or water quality guide thresholds and/or fish stress reporting	fish
PDMIT_E4	Restocking of coarse fish from the catchment where monitoring indicates loss of fish abundance or recruitment (fish)	Low flow events can result in population decline due to increased mortality, reduced breeding success, and loss of juveniles.	Informed by walkover surveys and local knowledge / reports	fish

3.4 DATA ANALYSIS

In order to assess whether the implementation of the drought options has any long-term effects, monitoring after implementation of drought options will be necessary for certain receptors. Comparison of the post-drought monitoring results to monitoring data from (a) baseline monitoring locations, (b) monitoring of control sites and (c) in-drought monitoring locations (where available), will provide a quantitative dataset to determine whether the implementation of drought options has had any long-term effects on any sensitive environmental receptors within the extent of hydrological influence associated with each of the drought options, demonstrate recovery where appropriate, and identify the need for further monitoring and mitigation.

Identifying any long-term effects on ecological receptors and an assessment of the efficacy of any in-drought and post drought mitigation measures should be initially informed by a direct comparison of the relevant biological metrics/indices.

For macroinvertebrate communities, this includes a direct comparison of the EQRs calculated using RICT for $WHPT_{NTAXA}$ and $WHPT_{ASPT}$ indices and a direct comparison of the total WHPT score, LIFE scores and PSI scores as obtained for a specific monitoring site (i.e. where monitoring has been completed pre-drought and post drought from the monitoring site). A drought option is considered to have resulted in an impact on the macroinvertebrate community where EQRs have reduced by one biological band[8] when comparing the results of a minimum of five-year baseline monitoring data. Comparison against a long-term data set is required to allow for natural variation in community structure as detailed below.

For fish communities, the assessment should consider a direct comparison of the species assemblage, density and biomass for a specific monitoring site (i.e. where monitoring has been completed pre-drought and post-drought from the monitoring site). Biomass estimates should be calculated using standard length–weight relationships[9] derived from species-specific constants, enabling robust comparison across sites where direct weighing is not feasible. The data analyses should also include a comparison of length-frequency distribution plots to identify any impacts on recruitment. The assessment should be underpinned by a minimum of five years of baseline monitoring data to account for natural variability in fish communities. While the Environment Agency's Fisheries Classification Scheme 2 (FCS2) tool may be used to explore potential indications of pressure, it should not be used in isolation to determine drought-related impacts. Due to limitations associated with historical and input data, FCS2 outputs should be interpreted cautiously and supplemented by expert judgement and contextual analysis of site-specific metrics. A weight-of-evidence approach should be adopted that integrates quantitative trends with ecological interpretation of the observed changes. This ensures that any conclusions regarding the potential impact of a drought option on fish communities are both scientifically sound and proportionate to the quality and resolution of the available data.

It is noted that monitoring results could vary naturally as a result of changes in habitat availability following a severe natural event (e.g. drought or flood). As such, the assessment of any impacts on the ecological receptors, and the subsequent need for further post drought mitigation, should also consider the result of the baseline, in-drought and post drought monitoring results at control sites. For example, the overall estimated biomass of the fish community with a river reach associated with a drought option may have reduced by 10%, however, a similar observation could be made at a control site. As such, the 10% reduction could be considered to be as a result of natural variations/drought impacts and not necessarily as a result of the implementation of a drought option. This assessment should be undertaken alongside an evaluation of length–frequency distributions, which can help identify changes in population structure (e.g. recruitment failure or age-class loss) that may not be apparent from biomass estimates alone.

Biological indices and metrics are mostly informative and basic representations of a biological community's condition and represents a summary of complex ecological data. To reduce any uncertainty in the assessments it is, therefore, recommended that the assessment is further supported by a statistical analysis of the macroinvertebrate and fish community data using an appropriate software package (e.g. Primer or R) to complete a similarity analysis. The statistical analyses should be used to identify which species typified survey sites pre- and post-drought option implementation and whether there has been a statistically significant

[8] See Part 4, Section 1 of the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015)

[9] Environment Agency (1999). *Fisheries Assessment Software within the Environment Agency* (R&D Technical Report W176). Bristol: Environment Agency. ISBN: 1 85705043 6.

difference in either the diversity and/or abundance of the ecological communities. The statistical analyses should include comparisons between impacted sites and control sites, and should consider all baseline monitoring data collected within a minimum five-year pre-drought period (where available), recognising that the data do not need to span five consecutive years. This approach supports a more robust assessment of natural variation.

3.5 PERMITS AND APPROVALS

Many of the mitigation measures will require permits or approvals prior to implementation as summarised in **Table 3-2**. Irrespective of the need for a permit or permission, all planned mitigation measures would be discussed with the Environment Agency in advance of implementation, as well as with Natural England, other authorities, stakeholders and landowners as appropriate.

Table 3-2 Mitigation measures: permits and approvals

Mitigation Measure	Permit or Permission Required?
In-Drought (During Drought Option Implementation) – Mitigation	
IDMIT_H1- Negotiation with the license holder of a temporary reduction of third party abstractions presenting 'significant' impacts to sensitive receptors, including financial compensation by Yorkshire Water.	None, but agreement between the license holder and Yorkshire Water would be required
IDMIT_H2 - At identified SSSIs, mitigation would comprise the temporary cessation of impacting drought options by Yorkshire Water.	None – within Yorkshire Water's control
IDMIT_WQ1 - Improving the effluent quality from Yorkshire Water WwTWs presenting 'significant' impacts to sensitive receptors, thereby reducing the water quality pressure (ammonia and oxygen balance) on the impacted features.	None. No additional infrastructure or environmental permissions required.
IDMIT_WQ2 – Short–term relaxation of drought permit flow reduction to dilute/disperse a build up of water quality pressures identified during walkover surveys IDMON_WSWQ1.	None – within Yorkshire Water's control
IDMIT_E1 – Gradual or temporary adjustments to abstraction or compensation flows to prevent stranding, displacement, or stress in sensitive aquatic species (e.g. fish, macroinvertebrates, white–clawed crayfish).	None – within Yorkshire Water's control
IDMIT_E2 – Aeration of watercourse where significant mortality or change in species abundances are likely to be attributed to water quality deterioration	Discussion with the EA on aeration methods to determine whether any permits or formal permissions are required.
IDMIT_E3 – Creation of alternative refuges in deeper water where walkover surveys identify the loss of important deep water habitat or high densities of fauna in refuges (fish, white-clawed crayfish, water vole)	May require environmental permit from EA or Local authority depending on nature of the work and NE consent if works are in a SSSI or European site
IDMIT_E4 – Provision of in-stream structures and flow baffles to create functional refuges to support flow sensitive species where walkover surveys identify a projected loss of habitat inundation (macro-invertebrates, fish, white-clawed crayfish, water vole, otter)	Environmental permit from EA or Local Authority (and NE assent if works are in a SSSI or European site)
IDMIT_E5 – Regular inspection and clearing of screens to ensure they retain their correct working function (fish, white-clawed crayfish)	None – within Yorkshire Water's control

Mitigation Measure	Permit or Permission Required?
IDMIT_E6 – Rescue of individuals or groups, in consultation with the EA or NE as appropriate, and retention for later release where they are seen to be in distress or where artificially high densities are likely to result in significant impacts (fish, white-clawed crayfish).	EA consent required for fish movement and crayfish licence required (with consultation with NE).
Post-Drought (Drought Options Removed) – Mitigation	
PDMIT_E1 – Enhancement of habitat beyond the impacted reach (macroinvertebrates, fish, fine-lined pea mussel, water vole, white-clawed crayfish).	May require environmental permit from EA or Local Authority depending on nature of the work and NE consent if works are in a SSSI or European site
PDMIT_E2 – Provision of artificial freshets to ensure fish are capable of migrating where survey identifies insufficient water depth or volume across structures to facilitate migration (fish).	Depending on how the freshet is achieved, environmental permit and/or discharge permit *may* be required if it involves reservoir compensation flow releases higher than the statutory requirement. If it is achieved by reduction or cessation of abstraction, then no consent is needed.
PDMIT_E3 – Modification to barriers and/or flows to improve passage where walkover survey identifies insufficient water depth or volume at obstacles (fish).	Likely to require environmental permit from EA and the permission of the owner of the barrier or river reach.
PDMIT_E4 – Restocking of coarse fish from the catchment where monitoring indicates loss of fish abundance or recruitment (fish).	EA consent required (with consultation with NE for designated conservation sites or species).

4. ENVIRONMENTAL MONITORING PLAN (EMP) FOR EACH IMPACTED REACH

The monitoring and mitigation measures set out in this EMP have been based on previous experience and evidence from droughts in Yorkshire or other parts of the UK and/or from water management experiences more broadly from water companies and the Environment Agency (for example, aeration of waterbodies by United Utilities on the Manchester Ship Canal or by the Environment Agency and Thames Water on the lower River Thames). The monitoring techniques required are well-known and have been applied both in drought conditions and normal conditions by Yorkshire Water and its contractors. The monitoring and mitigation measures have been discussed with the Environment Agency in developing this EMP to ensure they are appropriate and will afford environmental protection. Some of the mitigation measures do carry a level of risk (for example the capture and relocation measures), and for this reason full consultation with the Environment Agency and Natural England will take place to agree whether a particular mitigation action is the best option in the prevailing drought situation and that it will have the greatest chance of success. Whilst no mitigation measure can claim to provide a 100% success rate, there is good evidence from across the UK that the measures set out in this EMP will likely have a positive, beneficial effect for the environment.

A synchronised approach is proposed in this EMP to monitor baseline, in-drought and post-drought changes. Monitoring reaches have been selected to allow co-ordination of hydrology, water quality and aquatic ecology sampling under similar hydrological conditions. Monitoring recommendations have been made for sensitive features that have been identified as having a serious risk from the drought options i.e. a moderate or major risk (or minor in the case of designated sites). These risks are based on cumulative impacts where reaches are subject to influence from two or more drought options and thus are a worst-case scenario.

The monitoring specification is set out for each impacted reach in **Appendix A** in a series of 'reach sheets' which are presented according to the EAR to which they relate:

- Appendix A.1 – North Area Reaches
- Appendix A.2 – North West Area Reaches
- Appendix A.3 – South West Area Reaches
- Appendix A.4 – South Area Reaches
- Appendix A.5 – River Option Reaches
- Appendix A.6 – EA Drought Order Reaches

The information for each reach includes the following:

- Relevant WFD waterbodies
- Relevant drought options
- Summary of sensitive features and impact assessment
- Significant water quality pressures
- Water quality thresholds appropriate to WFD river type
- Monitoring specification, including grid references for walkover reach(es) (Baseline, On-set of environmental drought, In-drought and Post-drought)
- Mitigation measures (In-drought and Post-drought)

As set out above, further work is required on the 'extreme' supply drought actions. A detailed assessment of 'extreme' actions would be completed in advance of use of these actions and this would include specification of monitoring required to fill data gaps.

The mitigation recommendations have been made in a hierarchy of approach which follows the general principle of 1) reducing the pressure at source; 2) pressure management in the river; and 3) ecological action. The implementation of mitigations during the in-drought and post-drought periods should follow this principle, with movement to mitigation measures in the next hierarchy dependent upon the success or failure of mitigation in the lower hierarchy.

The flow and water quality pressures identified relate to existing discharges and abstractions in the reaches that could present a 'serious' impact to sensitive receptors within the reach and therefore require consideration

of mitigation. A range of other flow and water quality pressures have been reviewed in the EARs and have been assessed as presenting minor or negligible risks to sensitive receptors.

The sensitive receptors list identifies all of the receptors that have been considered for assessment in the EARs and not just those that require consideration of monitoring or mitigating. The mitigation and monitoring at the on-set of drought, in-drought and post-drought stages relate only to those sensitive receptors identified as being at risk of moderate and major impacts from the drought options, or where the risk is uncertain.

Detailed descriptions for ecological survey methodologies can be found in **Appendix B.2**.

The mitigation included within **Appendix A** identifies the suite of mitigation options that are available for management or reduction of impacts upon the sensitive receptors. As each mitigation option can be employed for a range of sensitive receptors, it is not feasible to identify the range of options for each sensitive feature. Consequently, it is the responsibility of Yorkshire Water to identify the appropriate options to deploy based upon the sensitive receptors present. The hierarchal approach, as identified above, is represented by the order in which the measures are presented. The movement from the first suite of mitigation to the second, and so on, is dependent upon the applicability and/or the success of the options available in the first approach.

APPENDICES

APPENDIX A - MONITORING PLAN FOR IMPACTED REACHES

APPENDIX A CONTENTS

[see separate documents]

APPENDIX B.1 - Baseline Monitoring Sites

EXISTING BASELINE SURVEY SITES

A comprehensive review has been undertaken in collaboration with the EA with respect to existing baseline survey monitoring sites. The review accounts for sites covered in the EARs for the North Area Reservoirs, the South Area Reservoir, the North-West Reservoir, South West Area and River Abstractions.

For the purposes of this EMP, information has been collated in a spreadsheet on the following attributes:

- Scheme
- Reach
- River Name
- Feature
- Site Name
- Grid Reference
- Site Ref
- Responsibility
- Last Survey Date used in EAR
- Method
- Comments

The spreadsheet is a live document which is updated to reflect ongoing monitoring by Yorkshire Water and the EA and consolidates past monitoring details and plans for future seasons. The spreadsheet has been shared with the EA and Yorkshire Water will continue to liaise with the EA and provide future versions.

Data Exchange

In order to ensure that both Yorkshire Water and the Environment Agency has up-to-date baseline information available in the event of a drought, a data exchange agreement is in place between both organisations for those monitoring sites set out in this spreadsheet. Data for those sites on the spreadsheet will normally be exchanged on a 6-monthly basis, increasing to a monthly basis during a drought (and more frequently if agreed necessary during drought). The 6-monthly updates will also include the notification of the cessation of any monitoring parameters or points and the creation of any new monitoring parameters or points.

As part of the annual review of the Drought Plan (and this EMP), discussion should take place with the Environment Agency as to any changes in WFD classification for impacted reaches and whether this requires a change to the baseline monitoring programme. The baseline monitoring programme should be reviewed and refreshed as part of the annual review.

APPENDIX B.2 - Ecology Survey Methodologies

Fish (Including Lamprey)

Electro-fishing is the term applied to a process that establishes an electric field in the water to capture fish. When exposed to the field, fish become oriented toward the anode and as the density of the electric field increases, they swim toward it. Once near the anode, fish are immobilised allowing them to be captured by surveyors. All surveys will be conducted following the standard method and technique guidelines developed by the Environment Agency[10,11,12,13], which conforms to British Standard BS EN 14011:2003[14] .

The survey methodology proposed is to carry out fully quantitative (three run) catch depletion electro-fishing surveys for each site, where a section of watercourse (between 50m and 100m long) will be isolated using stop nets positioned at the upstream and downstream extent of each surveyed section. Narrow watercourses (≤5m wide) will be fished using a single anode, with either an E-Fish Backpack or bankside control box system. Wider watercourses (>5m wide) will be surveyed using two anodes with an bankside electric fishing control box system. For rivers between 5 and 10m in width a single anode may still be effective if the waters being fished are shallow and there is plenty of instream cover to provide fish refuges. The conditions at the site at the time of fishing should be carefully considered. The fishing team will work in an upstream direction, with surveyors moving anodes side to side to “draw” fish towards the current where they will be immobilised and removed from the electrical field with the use of dipnets.

Should it not be possible to isolate the survey area with stop nets (e.g.: the river is too wide to effectively set stop nets) a semi-quantitative catch per unit effort (CPUE) methodology will be utilised instead whereby a section of watercourse measuring approximately 100m in length will be fished, with the time during which an electric field is established is recorded using a stopwatch. Any sites not suitable in nature for wading (>5m wide and >1m deep) will be surveyed using an electric fishing control box system from within a boat fitted with an outboard engine. One surveyor will manoeuvre the boat and manage the electric fishing control box whilst the second surveyor will operate the anode, and a third surveyor will remove immobilised fish from the electrical field with the use of a dipnet.

Fish sampled during each electric fishing survey will be immediately transferred to an aerated container from which they will be identified to species level, measured from the tip of their snout to the end of the middle caudal fin rays (Fork Length [FL]), before being returned safely to the watercourse.

Once each electric fishing has ceased, a physical habitat survey will be carried out that includes assessments of water depth, channel width, flow types, substrate composition, sediment deposition, channel modifications, surrounding land use, vegetation cover and fish cover.

Finally, the physico-chemical properties of each surveyed water will be measured using a calibrated handheld multiparameter water quality sonde.

Specific survey methodologies may differ from these general protocols; however, any deviations will be clearly documented within the survey data files and applied consistently in successive years to minimise residual error in the baseline dataset.

Electric fishing for lamprey

Where suitable juvenile lamprey (ammocoetes) habitat, as described by Maitland (2003)[15], is identified within or in proximity to fish monitoring sites, a species-specific electrofishing method using a single anode to establish lamprey presence within the survey reach. Using electrofishing apparatus whereby the anode will be energised for 20 seconds, followed by a five-second rest, this will be repeated for two minutes as detailed in:

[10]Beaumont, W. R. C., Taylor, A. A. L., Lee, M. J. and Welton, J. S. (2002). Guidelines for Electric Fishing Best Practice. Environment Agency R & D Technical Report W2-054/TR. Bristol, Environment Agency.

[11] Environment Agency (2001). Electric fishing Code of Practice. EAS/6100/4/02. Environment Agency, Bristol.

[12] Environment Agency (2007). Technical reference material: WFD electric fishing in rivers. Operational instruction. Environment Agency, Bristol.

[13] Britton J.R. (2003) Fisheries Monitoring Programme Work Instruction 3.3: Sampling fish scales for age and growth determination. Environment Agency Management System.

[14] British Standards Institution (2003). BS EN 14011:2003: Water Quality. Sampling of Fish with Electricity. London, BSI.

[15] Maitland P. S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

'Common Standards Monitoring Guidance for Freshwater Fauna (2015)[16]' and in accordance with Harvey and Cowx (2003)[17]. Lamprey specific surveys will be undertaken after a fish survey. Lamprey captured will be removed from the electrical field, speciated where possible and individuals will be measured to Total Length (TL) and life-stage recorded, noting that ammocoetes will be identified as either sea lamprey (*Petromyzon marinus*) or *Lampetra* sp., as *Lampetra* ammocoetes cannot be distinguished between brook lamprey (*Lampetra planeri*) and river lamprey (*Lampetra fluviatilis*) in the field due to no significant differences in pigmentation patterns and morphology[18,19,20] .

Lamprey Surveys and the presence or absence of lamprey ammocoetes captured at each site will be recorded separately to any standard fish monitoring surveys. These data will provide additional supporting evidence on species distribution and within the impacted reaches. Lamprey will be considered to be present in all areas of suitable habitat in a reach where their presence has been confirmed through YW or EA surveys.

Location and Timing

The number of fish monitoring sites per reach will be scaled according to reach length: one site for reaches under 5 km, two sites for reaches between 5–10 km, three sites for reaches between 10–20 km, and four sites for reaches over 20 km. Within each reach identified for monitoring, sites will be selected to provide representative data that reflect the ecological characteristics and variability of the reach. This approach ensures that monitoring effort is proportionate to spatial extent, supporting the effective detection of localised impacts and changes in fish communities.

Following a review of existing Lamprey data and findings from Habitat walkover surveys. Additional Lamprey electrofishing will be carried out in areas of suitable habitat within reaches where lamprey presence has not been previously established.

In order to differentiate the effects of an environmental drought and those resulting from the application of a drought permit/order, the monitoring will include control sites outside of the extent of influence, i.e. unregulated reaches, both before and after the drought.

It is anticipated that the electro-fishing surveys will be undertaken annually for a period of three years. However, after two years it will be reviewed as to whether the third years are required as the data collected may be statistically robust. The survey would then be repeated one year in every three, in accordance with 'Common Standards Monitoring Guidance for Rivers (JNCC, 2015[21]).

Timing and approval to undertake electric fishing surveys is subject to authorisation by the EA under Section 27a of the Salmon and Freshwater Fisheries Act 1975 by submission of an FR2 application form for authorisation to use fishing instruments other than rod and line in England. This can take up to one month to process. However, sites located within a conservation zone such as a Site of Significant Scientific Interest (SSSI) may require further authorisation by Natural England therefore may take longer to process.

Macroinvertebrates

A semi-quantitative methodology will be employed for the collection of benthic macro-invertebrates from shallow in-stream habitats. These data will provide continuity with previously gathered data and enable the use of a routine biological assessment tool for rivers based on invertebrates, River Invertebrate Classification Tool (RICT).

Where watercourses are safe to wade in, a 3-minute kick sample method, including a one-minute hand search will be used. Where watercourses are too deep to wade, or the substrate of the river is not safe to enter then 3-minute sweep sample methodology was applied. At deep sites where sweep sampling is not suitable,

[16] JNCC (2015) Common Standards Monitoring Guidance for Freshwater Fauna, Version October 2015, JNCC, Freshwater, ISSN 1743-8160.

[17] Harvey J & Cowx I (2003). Monitoring the River, Brook and Sea Lamprey, Lampetra fluviatilis, L. planeri and Petromyzon marinus. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough.

[18] Potter, I.C. and Osborne, T.S. (1975). The systematics of British larval lampreys. Journal of Zoology 176, 311–329.

[19] Hardisty, M.W. (1986a). Lampetra fluviatilis (Linnaeus, 1758). In: Holcík J (ed). The Freshwater Fishes of Europe. Vol. 1, Part I. Petromyzontiformes. Aula-Verlag,Wiesbaden, 249–278.

[20] Hardisty, M.W. (1986b). Lampetra planeri (Bloch, 1784). In: Holcík J (ed). The Freshwater Fishes of Europe. Vol. 1, Part I.Petromyzontiformes. Aula-Verlag,Wiesbaden, 279–304.

[21] JNCC (2015) Common Standards Monitoring Guidance for Freshwater Fauna, Version October 2015, JNCC, Freshwater, ISSN 1743-8160.

airlifting was conducted via a boat to a cross-section of the wider watercourses. This sampling aligns with the Environment Agency sampling methodology 018_081[22]which involves sampling all in-stream habitats, in accordance to their relative abundance. All samples will be collected using a standard sampling net (1mm mesh), which conforms to BS EN ISO 10870[23]. A range of environmental variables will be recorded including, but not limited to, water quality, depth, width, slope and substrate composition, this is required to determine the expected diversity and abundancies of the biological elements.

Samples will be placed in one-litre sample pots, preserved in Industrial Mentholated Spirit (IMS) on site and transported to the laboratory for sorting and identification to Taxonomic Level 5 (TL5) by trained macroinvertebrate taxonomists, in adherence with Environment Agency Operational Instruction 024_08[24]

Location and Timing

To encompass natural seasonal variations in populations of benthic macroinvertebrates, sampling will be required in Spring (March to May) and Autumn (September to November) in accordance with the sampling procedure agreed with Yorkshire Area Environment Agency. Additional surveys to be carried out at representative sites during Summer.

The number of macroinvertebrate monitoring sites per reach will be scaled according to reach length: one site for reaches under 5 km, two sites for reaches between 5–10 km, three sites for reaches between 10–20 km, and four sites for reaches over 20 km. Within each reach identified for monitoring, sites will be selected to provide representative data that reflect the ecological characteristics and variability of the reach. This approach ensures that monitoring effort is proportionate to spatial extent, supporting the effective detection of localised impacts and changes in macroinvertebrate communities.

It is anticipated that baseline data will be collected annually for three years. However, after two years, it will be reviewed as to whether the third year is required, as the data collected may be statistically robust. It will then be repeated one year within every three, in accordance with 'Common Standards Monitoring Guidance for Terrestrial and Freshwater Invertebrates[25]'

General Methodological Notes

In addition to the methodologies outlined above, it should also be noted that sites will only be surveyed providing:

1. Access and permission is granted by the relevant landowner/ tenant
2. Access is safe
3. Weather and river flow conditions are suitable.

[22] Environment Agency (2009). Freshwater macro-invertebrate sampling in rivers. Operational Instruction 018_08. Issued 16/06/2009

[23] British Standards Institution (2012) BS EN ISO 10870:2012 Water Quality – Guidelines for the selection of sampling methods and Devices for Benthic Macroinvertebrates in Freshwaters. London, BSI.

[24] Environment Agency (2014). Freshwater macroinvertebrate analysis of riverine samples: Operational Instruction 024_08. Issued 28/01/14. Environment Agency, Bristol.

[25] Joint Nature Conservation Committee (2008) Common Standards Monitoring Guidance for Terrestrial and Freshwater Invertebrates. Available at http://data.jncc.gov.uk/data/80873e1e-63eb-44a0-925c-b5edec5fa3fd/CSM-TerrestrialFreshwaterInvertebrates-2008.pdf.

APPENDIX C - ON-SET / IN DROUGHT WALKOVER SURVEY SPECIFICATION AND MITIGATION TRIGGERS

Surveillance Walkover Assessment Specification – ODMON_WS, IDMON_WSE and IDMON_WSWQ1
Visual monitoring "walkover surveys" of the riverine environment and spot sample measurements of water quality will be undertaken to identify environmental problems on impacted reaches that may be affected or caused by Yorkshire Water lowering compensation flows. Surveillance surveys will be undertaken in each impacted reach during the on-set and in drought periods (OMON_1, IDMON_WSE), and at additional locations where 'significant' water quality pressures are identified (IDMON_WSWQ1).

Duration and Frequency

Initial walkover assessments will be undertaken during the onset of drought period (ODMON_WS). The in drought surveillance walkovers (IDMON_WSE and IDMON_WSWQ1) will take place from the day prior to the drought option flow change until the drought permit / order expires or is revoked, unless otherwise agreed by the EA. For all surveillance walkover surveys the frequency will be as follows:

- The day prior to the flow change
- The day of the flow change (to the Tier 1 condition as specified in the Drought Plan and reported in the relevant EAR).
- One week after the flow change (and not within three calendar days of the previous survey). Where significant changes are recorded from the previous walkover survey, weekly thereafter until no further change identified, unless otherwise agreed by the EA.
- The day of any consequent flow change (to the Tier 2 condition as specified in the Drought Plan and reported in the relevant EAR).
- One week after the flow change (and not within three calendar days of the previous survey). Where significant changes are recorded from the previous walkover survey, weekly thereafter until no further change identified, unless otherwise agreed by the EA.

Method

The visual monitoring of the potentially affected reaches to detect any potential change in habitat will be recorded onto the 'Low Flows River Conditions Observation Form', a copy of which is included at the end of this appendix. Photographs should be taken at recorded locations to be repeated during subsequent surveys.

Changes in fish habitat can be discreet and subtle as discharge reduces. Baseline maps (and images) should be available in each survey reach such that changes can be detected and reported by the field team.

Location

Subject to any clarification provided by initial walkover assessments undertaken during the onset of drought period (OMON_1), surveillance walkover surveys of habitat quality and ecological stress should be undertaken at the locations specified for each impacted reach in **Appendix A** (IDMON_WSE). Surveillance walkover surveys of water quality and ecological stress should also be undertaken at those sites identified in **Appendix A** for reaches in which 'significant' water quality pressures have been identified (IDMON_WSWQ1), and will extend 10m upstream and at least 100m downstream of the discharge.

Environmental Problems

Environmental problems observed may include:

- Fish in distress, for example gasping at the surface or leaping out of the water
- Dead or dying fish
- Concentration of fish in restricted areas/pools which could increase susceptibility to predation
- Exposure of key functional habitat, particularly where there are reduced flows over or siltation of brown trout redds
- Stranding of fish in marginal areas
- Signs of pollution

From general water quality spot surveys; low levels of dissolved oxygen below the boundary of WFD moderate and poor status or high values of ammonium (surrogate for total ammonia) in excess of boundary of WFD

moderate and poor status; or high values of unionised ammonia in excess of 40µg/l. For onset of drought walkovers the good-moderate boundary will be used to provide an early warning of potential areas at risk.

The included indicators of environmental stress for dissolved oxygen saturation and total ammonia for standard environmental problems are the boundary of WFD moderate and poor status, appropriate by WFD river type. These values, as proposed by the Environment Agency are:

Dissolved oxygen

- Upland and Low Alkalinity WFD River Typology: less than 64%
- Lowland and High Alkalinity WFD River Typology: less than 54%
- Salmonid rivers: less than 64%

Ammonia

- Upland and Low Alkalinity WFD River Typology: 0.75mg/l total ammonia
- Lowland and High Alkalinity WFD River Typology: 1.1mg/l total ammonia.

If the monitoring identifies signs of environmental distress Yorkshire Water would notify the EA by telephone on 0800 80 70 60 and undertake a remedial course of action to address the signs of environmental distress – see 'Mitigation Measures' below.

Data Recording

Yorkshire Water shall measure and record the following information for all environmental problems identified:

- The location of the site of environmental problems observed
- Time
- Water quality parameters
- Any hydromorphological distress such as bank slippage or changes in erosional zones against the baseline condition
- Photographs should be taken of any signs of environmental distress
- Weather conditions at the time of the observations
- Any discolouration or odours
- Time series of event as conditions prevail
- Where relevant to the environmental problem observed the following would be recorded:
    - Approximate number of dead fish
    - Any signs of physical damage or fish distress
    - Approximate number of fish in distress, gasping at the surface or leaping out of the water
    - Whether the fish are being stranded in shallow pools
    - Description of stretches of any watercourses that have no flow or significantly reduced flow
    - Approximate size of the fish affected
    - The species of fish affected
    - Signs of pollution
    - Any new erosion or bank slippage.

Photographic imagery will be captured before, during and after each flow reduction event. The imagery will provide a clear visual representation of the changing flow conditions during the compensation reduction process and demonstrate how this is impacting the high priority areas with NGR's and direction recorded at each photography station.

Water Quality Monitoring

In-stream water quality monitoring should be undertaken in the form of spot sample measurements using hand held meters to identify environmental problems on the affected waterbodies that may be caused by the reduction in flow. These spot sample measurements should be targeted in priority areas, such as holding pools as these areas offer key refuge for adult fish as the water recedes, but also below any significant water quality pressures (identified for each reach sheet in **Appendix A**).

Water quality monitoring should be undertaken during each walkover survey from the day prior to the compensation flow being reduced, until the drought permit/order expires or is revoked.

In situ probe readings and spot water quality samples should be taken in the centre of the channel at mid-depth where appropriate. The following parameters will be recorded:

- Dissolved oxygen concentration (mg/l) and saturation (%)
- Conductivity
- Water temperature
- pH
- Turbidity
- Ammonium concentration
- Unionised ammonia
- Suspended solids
- Other determinands as specified in **Appendix A** for specific reaches (e.g. iron)

If low levels of dissolved oxygen (less than 54 or 64% saturation depending on river typology) are recorded during monitoring Yorkshire Water will initiate appropriate mitigation measures.

Reporting

Yorkshire Water will provide the EA a report within one week of surveys being undertaken, detailing:

- Inventory of walkover surveys undertaken: dates, locations and findings
- Summary of water quality measurements, where taken
- Completed *River Conditions Observation Form - Low Flows* from surveillance walkover surveys of habitat quality and ecological stress

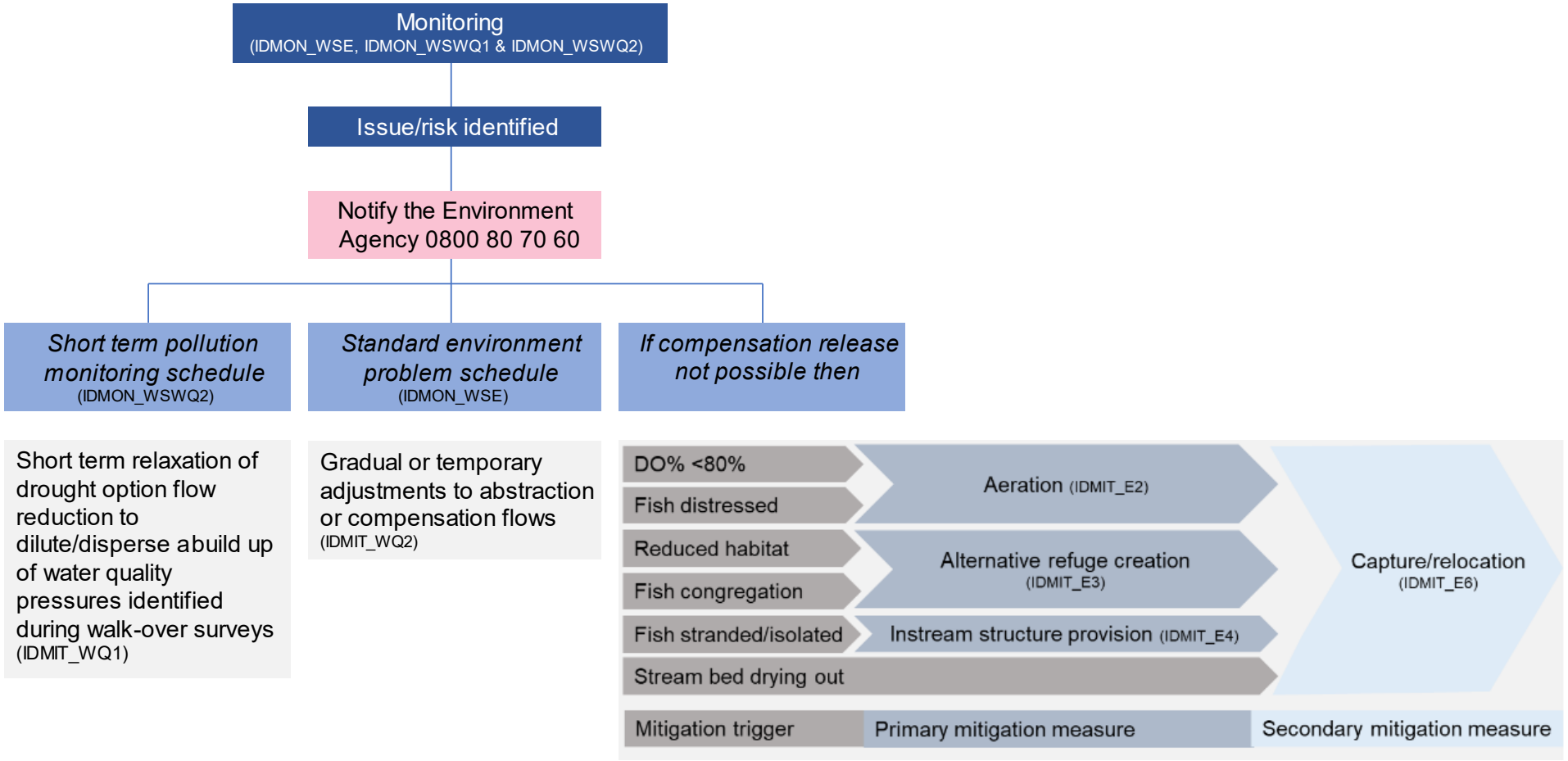
The report shall be sent to:

Drought.Yorkshire@environment-agency.gov.uk

Mitigation Measures

If during the visual and water quality monitoring there are significant environmental problems observed (e.g. fish in distress/ low dissolved oxygen / reduced habitat availability etc.), then a mitigation response may be required. Mitigation recommendations for each impacted reach are included in **Appendix A**. The mitigation recommendations have been made in a hierarchy of approach which follows the general principle of 1) reducing the pressure at source; 2) pressure management in the river; and 3) ecological action. The implementation of mitigations during the in-drought and post-drought periods should follow this principle, with movement to mitigation measures in the next hierarchy dependent upon the success or failure of mitigation in the lower hierarchy. **Figure C.1** illustrates the mitigation response decision making process.

Figure C.1 Mitigation Response



Low Flows River Conditions Observation Form

[*See separate file*]

APPENDIX D - MITIGATION MEASURES – GUIDANCE FOR ECOLOGICAL ACTIONS

IDMIT_E2 Aeration of watercourse

Aeration of watercourse where significant mortality or change in species abundances are likely to be attributed to water quality deterioration

If dissolved oxygen saturation falls to unsatisfactory levels (below the boundary of WFD moderate and poor status, appropriate by WFD river type), then oxygen infusion should proceed at these locations, where fish are likely to congregate in impounded refuge areas. Aeration units will be on site prior to the drought option being initiated, ready to be deployed by the monitoring teams if required and would be powered by a series of leisure batteries which are capable of powering diffusers (suitable to uplift dissolved oxygen in small rivers).

However, if after deployment of the aeration units, dissolved oxygen saturation is recorded at or below the trigger level for a period of 2hrs, the monitoring team will report immediately to Yorkshire Water, so that an increased continuous release of compensation water from the reservoir can be initiated.

Aeration should only be considered a temporary measure and would be focussed at locations where fish are likely to congregate (deeper pooled water or glides). It should also be considered in reaches that experience chronic pollution issues or where a risk of potential contamination has been identified from the preliminary walkover survey. Should the oxygen diffusion and increased compensation flow not be sufficient to raise dissolved oxygen levels within 24hrs, a fish relocation procedure should be initiated. Should fish show signs of distress or mortality during this time they would be relocated to the defined ‘safety’ point.

IDMIT_E3 Placing stones or logs in a main river to enhance habitats

Creation of alternative refuges in deeper water where walkover surveys identify the loss of important deep water habitat or high densities of fauna in refuges (fish, white-clawed crayfish, water vole)

Placing stones or logs in a main river to enhance habitats is permitted under flood risk activity (FRA) exemption FRA18[26] where installation of habitat structure made of natural materials (but not including weirs and berms) is permitted on a main river. Placing these items may assist in creating alternate refuges in the event that identified refuges are insufficient or not retained during compensation reduction procedures. These structures should be permitted assuming:

- stones must be less than 400mm in any dimension and of a type that occurs naturally in the main river
- logs must be of less than 2m in length, less than 400mm in diameter and oriented to within 45° of the flow of water
- logs must be from a tree species that occurs naturally in the vicinity of the main river; and it must be securely pinned to the bed or bank of the main river to prevent wash out and congregation downstream
- the stones or logs are placed in the channel over no more than 20m of the length, and 20% of the width, of the main river
- no stones or logs are placed within 100m of a non-agricultural building in the floodplain, a natural channel habitat structure, an existing emplacement of stones or logs placed in the main river for habitat enhancement or a man-made structure on or in the main river
- all material should be removed within 1 month of the expiry of the drought permit/order.

IDMIT_E4 Provision of in-stream structures

Provision of in-stream structures and flow baffles to create functional refuges to support flow sensitive species where walkover surveys identify a projected loss of habitat inundation (macroinvertebrates, fish, white-clawed crayfish, water vole, otter)

[26] https://www.gov.uk/government/publications/environmental-permitting-regulations-exempt-flood-risk-activities/exempt-flood-risk-activities-environmental-permits

It may be necessary to introduce in-stream structures at sites to create functional refuges to support displaced fish stocks. Installing habitat structures made of natural materials (excluding weirs and berms) is permitted under exemption FRA15[27] which allows installation of structures made of natural materials (but not including weirs and berms).

These structures should be ready to be installed at suitable sites and would be permitted as long as:

- the structure occupies no more than half the width of the cross-sectional area of the channel in the main river and no more than 20m of the length of the main river
- no part of the structure is higher than 0.3m above the level of the river bed or 25% of the height of the bank (excluding any wall or embankment), whichever is greater
- the structure is made from naturally occurring woody material and is securely fastened to the bed of the main river, the bank or both
- no works take place within 100m of a non-agricultural building in the floodplain, another natural channel habitat structure, stones or logs placed in the main river for habitat enhancement or a man-made structure on or in the main river
- all structures should be removed within 1 month of the expiry of the drought permit/order.

IDMIT_E6 Fish capture and relocation

Rescue of individuals or groups, in consultation with the EA or NE as appropriate, and relocation to suitable habitat where they are seen to be in distress or where artificially high densities are likely to result in significant impacts (fish, white-clawed crayfish). Measures will be taken to ensure biosecurity at all times. It should be noted that movement of crayfish requires licensing which can take up to 8 weeks. Movement of crayfish would only take place after consultation agreeing that this was the best course of action.

A combined approach should be used to capture any fish, either isolated from the main flow of the river or showing signs of distress from the DP implementation process. Standard methods should be used including electric fishing to capture fish from cover features and also manual searches (under cobbles etc.) using hand nets to manually capture fish. Any fish captured should be relocated to a suitable area of habitat less affected by the reduction in flow. All electric fishing should be undertaken by fully trained fisheries scientists following standard electric fishing practice for operators and equipment, as developed by the European Standards Committee and detailed in the Environment Agency Code of Practice and Electric Fishing Equipment Annex A and B, Issue II regulations

If fish continue to show signs of distress or distressed fish are occupying areas not suitable for aeration, they should be captured and held for a short period, allowing recovery of both the fish and the levels of instream dissolved oxygen. In the case that these levels fail to recover, the fish should be moved to a suitable release site downstream where appropriate conditions exist on the day. It may also be necessary to relocate fish across barriers where the reduced compensation flow restricts movement between two areas as a result of an instream barrier.

Any eel captured should be kept in a separate tank to all other fish species as they secrete mucus which can infest the gills of other fish. Dissolved oxygen concentration should be monitored and optimum concentrations maintained by continuous infusion, using an oxygenation unit.

A description of juvenile lamprey habitat recorded during the initial baseline walkover should be summarised. In the event that juvenile lamprey habitat is encountered and considered to be at risk during the compensation reduction, these areas should be carefully monitored. As long as the compensation flow is lowered gradually, any juvenile lamprey will migrate towards the wetted fraction of the watercourse. This commonly occurs via subterranean substrate. However, where a risk of lamprey larval bed isolation is identified, the standard approach to capturing the larval life stage of lamprey would be applied with multiple electric fishing runs applied in optimal habitat until a depletion suggests that the population has been adequately removed (it may not be possible to capture all lamprey during this process). Any juvenile lamprey captured should be relocated to optimal habitat downstream where flows are sufficient enough to cover these areas.

The location of a suitable relocation site for fish should be described including the NGR, suitable parking and safe access to the site. The exact site of relocation should mimic conditions present at the site where the fish

[27] https://www.gov.uk/government/publications/environmental-permitting-regulations-exempt-flood-risk-activities/exempt-flood-risk-activities-environmental-permits

were captured, established by flow types and substrate present. This must be the case for fish species with specific functional habitat preferences such as juvenile lamprey.

The likelihood of the presence of white clawed crayfish in the impacted reaches is identified on each reach sheet. For these reaches it is recommended that the drought option implementation process is undertaken gradually in order to allow for individuals to seek refuge in the wetted areas of the watercourse. Should this not be the case, individuals identified as stranded by quickly receding stream width should be moved to appropriate, wetted habitat as close as possible and within the same reach.

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