Drought Plan 2019
Annex 5: Environmental Monitoring Plan

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Version 1

from Southern Water

Contents

Glossary

Abstraction Licence
The authorisation granted by the Environment Agency (England) to allow the removal of water from a source.

Biodiversity Action Plan
Principles laid down in the "Biodiversity: The UK Steering Group Action Plan" document (1995) which aims to protect and enhance diversity between and within ecosystems and habitats, diversity of species and genetic variation within individual species.

Biochemical Oxygen Demand (referred to as BOD)
The amount of oxygen that would be consumed if all the organic material in one litre of water were oxidised by bacteria and protozoa.

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

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

Drought Order
An authorisation granted by the Secretary of State under legally defined drought conditions which (amongst other powers) gives a water company the power to temporarily abstract and/or impound and/or discharge water outside of the normal abstraction licence regulatory process, or to temporarily modify the conditions of any existing abstraction licence/legal authorisation.

Drought Permit
An authorisation granted by the Environment Agency under legally defined drought conditions which gives a water company the power to temporarily abstract and/or impound water outside of its normal abstraction licence permissions.

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.

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.

Lotic-Invertebrate Index Flow Evaluation (referred to as LIFE)
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 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
In England, many rare and most threatened species are listed under Section 41 (S41) of the 2006 Natural Environment and Rural Communities (NERC) Act. Outcome 3 of the Government's Biodiversity 2020 strategy contains an ambition to ensure that *'By 2020, we will see an overall improvement in the status of our wildlife and will have prevented further human-induced extinctions of known threatened species.'* Protecting and enhancing England's Section 41 species is key to delivering this outcome.

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.

Protection of Habitats and Species
Certain habitats and species receive protection in the UK as a result of inclusion within legislative or policy frameworks. The hierarchy of protection is:

- European Protected: Natura 2000 sites (Ramsar, Special Area of Conservation and Special Protection Area) and European Protected Species.
- National Protection: Sites of Special Scientific Interest and species included under national legislation (including, but not limited to, the Wildlife and Countryside Act 1981 (as amended))
- Biodiversity Action Plan: Habitats and Species of national and regional importance due to rarity at the national or regional scale. Biodiversity Action Plan Habitats and Species do not receive any specific legislative protection through inclusion (unless included within European or National protection level).

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 Ramsar sites should be afforded the same level of protection as Special Areas of Conservation and Special Protection Areas.

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

Walley Hawkes Paisley Trigg (referred to as WHPT)
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.

Water Framework Directive (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

Abbreviations

BAP	-	Biodiversity Action Plan
BOD	-	Biochemical Oxygen Demand
CEH	-	Centre for Ecology and Hydrology
CPUE	-	Catch Per Unit Effort
EA	-	Environment Agency
EMP	-	Environmental Monitoring Plan
EQI	-	Ecological Quality Index
JNCC	-	Joint Nature Conservation Committee
LIFE	-	Lotic invertebrate Index for Flow Evaluation
LNR	-	Local Nature Reserve
MRF	-	Minimum Residual Flow
NE	-	Natural England
NNR	-	National Nature Reserve
RHS	-	River Habitat Survey
RIVPACS	-	River Invertebrate Prediction and Classification System
SAC	-	Special Area of Conservation
SPA	-	Special Protection Area
SSSI	-	Site of Special Scientific Interest
WSW	-	Water Supply Works
WTW	-	Wastewater Treatment Works
UKAS	-	United Kingdom Accreditation Service
WFD	-	Water Framework Directive

1 Introduction

1.1 Purpose of the Environmental Monitoring Plan

This Environmental Monitoring Plan (EMP) accompanies Southern Water's Drought Plan 2019 and provides a framework for monitoring and mitigation activities linked to relevant drought management measures included in the Drought Plan, in particular Drought Permits or Drought Orders to allow temporary increases in abstraction.

In accordance with the Environment Agency's Drought Plan Guidance[1], Southern Water is responsible for understanding the effects of its drought management actions on the environment and establishing the monitoring and mitigation measures for relevant identified effects. The EMP presents a monitoring framework to differentiate the impacts of implementing the drought plan measure from those caused by environmental drought conditions. It also sets out the framework and principles for baseline monitoring to improve understanding of the baseline environment. Additionally, the EMP sets out the mitigation measures to be considered during implementation of a drought plan measure.

The Southern Water Drought Plan 2019 sets out the various measures that will be considered for implementation during drought conditions. This EMP considers those measures that may have adverse effects on the environment, setting out the baseline, within drought and post-drought environmental monitoring requirements and potential mitigation measures. It also includes details of the survey methodologies to be used and the exchange of data between Southern Water, the Environment Agency and Natural England.

The EMP should be considered as a 'live' working document and subject to an annual review to ensure that it remains fit for purpose, especially where new data/ evidence becomes available and as baseline monitoring activities are carried out.

1.2 Background and basis of the EMP

The EMP has been prepared in support of Southern Water's Drought Plan and in compliance with the requirements for environmental monitoring and mitigation set out in the Environment Agency's drought plan guidance.

This detailed EMP and the encompassing Southern Water Drought Plan 2019 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.

1.2.1 Environmental Monitoring Plan Guidance

Relevant Environment Agency (EA) guidance on the objectives and content of the EMP includes:

- Water companies are responsible for understanding the effects of a drought and its drought management actions on the environment. Companies must assess the impacts of its drought management actions during and after a drought and completing environment assessments.

[1] Defra/Environment Agency (2015). Drought plans: environmental assessment and monitoring. In: *How to write and publish a drought plan*.

- Companies should ensure that adequate arrangements for environmental monitoring are detailed in an EMP within its drought plan.

- Surveys may be needed to support/inform the decisions on environmental sensitivity and likely impact or to ascertain baseline conditions.

- Monitoring during Drought Permit / Order implementation is required to assess the impact on the environment and the management of mitigation actions.

- Post-drought Permit / Order monitoring is required to assess recovery of impacted features.

- The level of monitoring needed should be risk-based. Not all sites will require in-drought and post-drought monitoring.

- Sites with moderate to major environmental risk should focus monitoring on those feature(s) sensitive to the likely impacts from implementing drought management actions. For Habitats Directive sites, data collected will be sufficient to demonstrate there is no adverse effect on the interest features. For SSSIs, data collected will need to be sensitive enough to pick up the likelihood of damage at the site.

- Control sites are important to provide a comparison between the 'natural' impacts of the drought and the impacts of the drought management action.

- The EMP should include details of any surveys to support the environmental assessment, in-drought and post-drought data needs, including:

    - the feature/s to be monitored and the methods used
    - the location of survey sites
    - the timing and frequency of monitoring
    - who will undertake the monitoring

- Separating the 'natural' impacts of a drought from those resulting from the implementation of drought management actions can be complex and made more difficult where data problems and/or a lack of hydro-ecological understanding exists. Water companies must ensure that their EMP is adequate to assess the most significant environmental impacts of its proposed drought actions and associated mitigation measures.

- The EMP needs to be agreed with the EA. Consultation with Natural England and the EA (in relation to any proposals that may affect any SACs, SPAs, NNRs, SSSIs or Ramsar sites) should be undertaken to ensure that the monitoring proposed within the EMP to assess the potential impacts at these sites is adequate.

- A water company must provide details in the Drought Plan of likely mitigation needed against serious impacts on the environment or other water users of any proposed drought action. The EMP should assist in identifying sites that may require mitigation. In some cases, mitigation actions may be necessary to prevent derogation of other abstractions (for example, by providing alternative supplies or releasing compensation water flow into watercourses to limit the impact of reduced flows).

1.2.2 Consultation

Consultation with the Environment Agency and Natural England was undertaken during the preparation of the draft Drought Plan (see Appendix 8) and comments received have been considered in developing this EMP. Further discussion with the Environment Agency and Natural England (where applicable) have been ongoing during the preparation of the revised draft and final Drought Plan to agree the precise location of monitoring sites and confirm the acceptability of monitoring methods and mitigation measures. Discussions have also included which organisations are best placed to carry out the identified surveys and mitigation measures (Southern Water retains responsibility for ensuring monitoring and mitigation takes place but others may be better placed to physically deliver), as well as taking account of likely future changes to the Environment Agency's monitoring programmes (to be discussed on a regular basis each year with the Environment Agency). The timetable for this ongoing refinement of the monitoring and mitigation measures is set out in Sections 2 and 4 of this annex.

1.3 Report Structure

This EMP has been divided into the following sections:

PART A	**Key Considerations**
Section 2	Baseline data and monitoring requirements
Section 3	Monitoring and data requirements in drought conditions
Section 4	Mitigation measures
Section 5	Permits and approvals
Section 6	Data exchange protocol
PART B	**Specific monitoring and mitigation measures**
Section 7	Monitoring and mitigation measures for each Drought Permit/Order
Section 8	Monitoring and mitigation measures for temporary emergency desalination options

Detailed Appendices

PART A. KEY CONSIDERATIONS

2 Baseline Data and Monitoring

2.1 Baseline Data and Monitoring: Introduction

Baseline data and monitoring are required to provide the context for assessing the potential environmental impacts of the relevant drought plan measures over and above the effects of environmental drought. A comprehensive review of existing baseline data and information relating to Southern Water's drought plan measures has been carried out in preparation of the Southern Water Drought Plan, Environmental Assessment Reports, HRA and WFD assessments. The adequacy of the data and information have been reviewed and consideration has been given as to whether there is a need for further baseline data acquisition and/or monitoring to reduce uncertainty regarding the presence, distribution, composition and/or quality of the physical environment and relevant environmental features (including heritage, recreation, navigation and landscape), which will can inform future updates to the environmental assessments once acquired.

The use of existing monitoring sites and standard methodologies applied in data collection are recommended wherever possible to give a long-term perspective over different weather and physical environment conditions as well as to provide continuity of datasets. It should be noted, however, that not all existing monitoring sites are necessarily proposed for the acquisition of baseline data where evidence gaps exist as the baseline monitoring programme is customised to the individual sites associated with a particular drought management measure and the sensitive features requiring assessment. Where initial assessment of sensitive features has identified a lack of data to inform full assessment, further surveys may be recommended to inform detailed assessment where this is proportionate to the risk of adverse effects.

2.2 Existing Baseline Data and Monitoring

Environment Agency Drought Plan guidance states that the EMP should detail the surveys required to inform the environmental assessments as well as for in-drought, during Drought Permit / Order implementation and post-drought monitoring and assessment. Section 3 of this EMP details the monitoring measures that will be undertaken during each progressive stage of a drought: on-set of drought; during Drought Permit / Order implementation; post-drought. This section focuses on the existing baseline data and environmental evidence.

In developing the Drought Plan 2019, and in particular to inform the Environmental Assessment Reports, HRA and WFD assessments, a wide range of hydrological, hydrogeological and environmental data have been collated from various sources, including the Environment Agency and Natural England, as well as historic Southern Water studies and nationally available environmental datasets. This information has largely provided up-to-date and relevant evidence to inform the environmental assessments.

In support of the WFD and the management of international designated sites and SSSIs, monitoring is variously undertaken by the Environment Agency, Natural England and site owners – data from these monitoring programmes have largely been collated up to the end of 2015 and it is currently assumed that such monitoring programmes will continue and data will be available in the future (noting that none of the monitoring bodies can provide a guarantee due to the reliance on funding streams which are not confirmed into the future). In a similar manner, hydrological and

hydrogeological data are collated on a regular basis from monitoring stations relevant to the Drought Permit / Order and it is assumed these will also to continue to function with the same funding caveats. For these routine monitoring programmes, a data exchange protocol has been discussed with the Environment Agency to ensure appropriate frequency of providing updated data to inform future drought plans or in the event of an actual drought arising. Section 5 of this EMP provides more details and sets out the relevant datasets.

It is understood that River Habitat Surveys (RHS) or similar surveys are unlikely to be routinely repeated by the Environment Agency in the future and this will necessitate some primary walkover surveys to be carried out periodically for impacted river reaches or sites in the future to take account of potential changes over time. These actions have therefore been included in the baseline EMP for relevant drought plan measures.

Following completion of the environmental assessments for each drought plan measure, a number of data gaps have been identified that can be addressed through discussions with local stakeholders or site owners, or through further targeted data requests (e.g. for bird species using the Wetland Bird Survey (WeBS) system; data on specific vulnerable species from local record centres run by the Wildlife Trusts). These data or information acquisition actions have been included in the baseline EMP for each drought plan measure as applicable.

In other cases, evidence gaps have been identified where no reliable and/or recent data exists. These gaps are discussed in Section 2.3 below.

2.3 Further Baseline Data and Monitoring

Following completion of the environmental assessments for each drought plan measure, a number of data or evidence gaps have been identified that require additional data acquisition or primary surveys, studies and/or discussions with site owners or stakeholders.

Table 2.1 summarises the data and evidence gap analysis carried out for each of the potential Drought Permit / Order options included in the Drought Plan based on the position in May 2018. The table indicates where robust baseline data or evidence exist, where more existing baseline data/information needs to be acquired and where there are no or insufficient baseline data available, as follows:

Y – Robust existing baseline data or evidence
Y – More existing baseline data to be acquired
N – No or insufficient baseline data available (for one reach/site or multiple reaches/sites)
N/A – Not applicable - feature is either not present or does not require monitoring

This table provides an overview of the scale and geographical extent of additional baseline data acquisition and surveys to be carried out. Specific details as to the required baseline monitoring activities are provided in **Tables 2.2 to 2.3**. Discussions have been held with the Environment Agency, Natural England and other stakeholders (as appropriate) to agree the precise locations and nature of the monitoring activities and subsequent analytical methods (or the necessary datasets to be acquired). This has included discussion about suitable control sites that will not be impacted by the Drought Permits / Orders so as to provide a baseline for comparison with impacted sites both during and following a drought.

These baseline activities will be implemented during the life of the Drought Plan subject to specific constraints, for example the occurrence of sufficiently low flow conditions to collect baseline information under representative low flow conditions. All activities are the responsibility of Southern Water but the company may work with other parties to actually deliver the activities taking account

of which organisations are best placed to carry out the requirements. Where relevant, appropriate licences and approvals will be needed to carry out the monitoring and Southern Water has responsibility to ensure that all surveyors have the appropriate licences, approvals and experience to carry out the monitoring to the required standards.

Baseline hydrological and groundwater monitoring should be carried out alongside the baseline environmental monitoring to provide the required river flow and water level data to help provide context to the observed environmental conditions. Except where identified in the tables below, it is assumed that the existing hydrological and groundwater monitoring sites will continue to be available at the current frequency (noting that this activity is shared across Southern Water and the Environment Agency and is dependent on both parties being adequately funded in the future to maintain the operation of the monitoring sites).

Discussions will continue with the Environment Agency (and Natural England where appropriate) to finalise the detailed site specific baseline monitoring schedules for each drought permit/order, including the timing and frequency of sampling. For river water quality baseline monitoring, spot sampling has been proposed for some river reaches, whilst automated continuous monitoring is proposed for other reaches: however, discussions are still ongoing with the Environment Agency to agree the final details for each relevant river reach during summer 2019.

In addition to the water quality monitoring parameters focused on environmental effects set out in Table 2.2 and Part B of this Annex, Southern Water will also carry out enhanced drinking water quality monitoring of groundwater sources where additional abstraction would be authorised by a Drought Order/Permit. Abstraction beyond daily and/or annual licence limits does potentially increase the risk of drawing lower quality groundwater to the borehole sources from beyond the normal groundwater protection zone/safeguard zones. Depending on the actual duration and magnitude of the actual abstraction under the Permit/Order, there is a consequent increased risk to raw water quality and treatment requirements for parameters such as pesticides and nitrates. Additional water quality sampling at the boreholes along with enhanced groundwater protection activities will be carried out to help minimise this risk.

Section 5 discusses the main considerations in respect of environmental protection and biosecurity when planning for the monitoring activities.

Section 6 sets out the data exchange protocol for baseline monitoring and data acquisition.

Appendix A sets out the main survey methods and analytical approaches for the main identified monitoring activities. Standard methodologies should be used for data collection, wherever possible, to ensure maximum compatibility with existing datasets and other monitoring activities elsewhere in the catchment. Appendix A also identifies any specific licences or approvals necessary to carry out the survey method.

Table 2.1 Summary of baseline data and evidence gap analysis

Drought Permit / Order	Hydrology	Geomorphology	Water Quality	Ecology								Habitat Surveys	Designated Sites	Recreation	Landscape	Invasive non-native species	Heritage features	Other
				Macro-invertebrates	Macrophytes	Fish	Estuarine Macroalgae and phytoplankton	Blue green algae	Water vole	Estuarine macro-invertebrates	Estuarine fish							
Darwell	Y	Y	Y	Y	Y	Y	Y	N	N/A	Y	Y	N	N	N	N/A	Y	N/A	N/A
Faversham	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	Y	Y	N	N	N	N/A	N/A	N	N/A
Stourmouth	Y	Y	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Powdermill	Y	Y	Y	Y	Y	Y	Y	N	N/A	Y	Y	N	N	N	N/A	Y	N/A	N/A
North Deal	Y	Y	Y	Y	Y	Y	N/A	N	N/A	N/A	N/A	N	N	N/A	N/A	N/A	N/A	N
Pulborough	Y	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	Y	N/A	N	N/A	N/A	Y	N/A	N/A
North Arundel	Y	Y	N	N	N	N	N/A	N	N	N/A	N/A	N	N	N	N/A	Y	N/A	N/A
East Worthing	Y	Y	Y	Y	N	Y	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Weir Wood	Y	Y	Y	Y	Y	Y	N/A	N/A	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lukely Brook	Y	Y	N	Y	Y	Y	N/A	N/A	N/A	N/A	N/A	N	N	N/A	N/A	N/A	N	N/A
Test Valley	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A	N	N/A	N	N/A	N/A	N/A	N/A
Caul Bourne	Y	Y	Y	Y	Y	Y	Y	N/A	N/A	Y	Y	N	N	N	N	N/A	N/A	N/A
Eastern Yar	Y	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	Y	N	N	N/A	N/A	N/A	N/A	N/A
Shalcombe	Y	Y	Y	Y	Y	Y	Y	N/A	N/A	Y	Y	N	N	N	N	N/A	N/A	N/A
River Medway Scheme	Y	Y	Y	Y	Y	Y	N/A	N	Y	Y	N/A	N	N	N	N	Y	N	N
Lower Itchen	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	N/A
Candover	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	N/A
Test Surface Water	Y	Y	Y	Y	Y	Y	N/A	N/A	N/A	N/A	N/A	Y	Y	Y	N/A	N/A	N/A	N/A

Table 2.2 Baseline data and monitoring requirements: physical environment and ecology

Physical Environment				Ecology							
Drought Order / Permit	**Hydrology**	**Geo-morphology**	**Water Quality**	**Macro invertebrates**	**Macrophytes**	**Fish**	**Estuarine Macroalgae and phyto-plankton**	**Water vole**	**Estuarine macroinvertebrates**	**Estuarine fish**	**Other**
Darwell	Collect river level data at Iden Lock and assess the volume of water pumped to the Royal Military Canal.	N/A	Targeted sampling survey for Walland Marsh ditch system. Spot samples to be undertaken during other surveys.	More baseline data for Reaches 1, 2 and 3. Seasonal surveys (spring, and autumn) in each of the reaches.	More baseline data for all years. Walkover surveys and water quality sampling. Additional surveys for known Ranunculus populations	More baseline data for reaches 2, 3 and 4., Electrofishing and collation of additional records	Annual macroalgal surveys. Spring and summer phytoplankton sampling.	N/A	Walkover surveys to further increase baseline data set for European flat oyster (*Ostrea edulis*)	Fyke and seine net surveys at two locations upstream of R.Brede and one downstream (TBC with EA)	N/A
Faversham	Further groundwater monitoring and spot flow gauging to increase baseline data set. Awaiting East Kent groundwater model (currently being updated) to define additional monitoring	N/A	Spot samples to be undertaken during other surveys.	Repeat EA Spring line Macroinvertebrate survey	Repeat EA Spring line macrophyte survey	More fish data require for reaches identified. Electrofishing and collation of additional records 1 x survey on Len (existing EA) and 1 x survey on Upper Great Stour (existing EA)	N/A	N/A	N/A	N/A	N/A
Stourmouth	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Powdermill	N/A	N/A	Need to examine current and future EA WQ sampling and ensure that either it is maintained in the Strategic monitoring review or SWS collects sufficient samples to gap fill the data. 12 samples every three years would provide a baseline for WQ. Spot samples to be undertaken during other surveys.	More baseline data for Reaches 1 and 2 Seasonal surveys in each of the reaches.	More baseline data for all years in reaches 1 and 2. Walkover surveys and water quality sampling. Additional surveys for known Ranunculus populations	More baseline data for reaches 1 and 2. Electrofishing and collation of additional records	Annual macroalgal surveys. Spring and summer phytoplankton sampling	N/A	Walkover surveys to further increase baseline data set for European flat oyster (*Ostrea edulis*)	Fyke and seine net surveys at one location on R.Brede transisional waterbody and one downstream of confluence with R.Rother (TBC with EA	N/A
North Deal	Lack of flow monitoring data in North Stream. Install flow gauging station and collate spot gauging records. For groundwater ensure list of abstractors set out in Appendix B is maintained in dialogue with the EA on an annual basis as part of the agreed data exchange protocol.	N/A	Carry out water quality sampling at 1 site in North south stream at Eastry and above Wingham STW, twice a year at times of low flow for: dissolved oxygen, pH, turbidity, suspended sediment, conductivity, temperature, ammonia and SRP Carry out 1 month's worth of continuous monitoring data at several sites which would support the point sample data	Collate local records and carry out additional seasonal surveys in all reaches identified	More baseline data for all years. Walkover surveys Additional surveys for known Ranunculus populations	More fish data require for reaches identified. Electrofishing and collation of additional records. Carry out low flow habitat walkover survey, including mapping of likely spawning and nursery habitat and barriers/obstacles to fish migration.	N/A	Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought order implementation.	Carry out seasonal (spring and autumn) invertebrate surveys.	N/A	N/A
Pulborough	N/A	N/A	Monitoring in transitional reach during low flow conditions. Spot samples during other surveys in freshwater reaches.	More baseline data for Reach 1. Seasonal surveys in each of the reaches.	Collate additional data from local wildlife centres	More baseline data for reach 1. Electrofishing and collation of additional records	N/A	N/A	N/A	N/A	N/A
North Arundel	N/A	N/A	Baseline data to be collated for WWT reserve, Park Bottom Tributary, Mill Stream and Swanbourne Lake. Water quality monitoring and sampling.	Baseline data to be collated for WWT reserve, Park Bottom Tributary, Mill Stream and Swanbourne Lake. Seasonal surveys in each of the reaches.	Baseline data to be collated for WWT reserve, Park Bottom Tributary, Mill Stream and Swanbourne Lake. Walkover surveys and water quality sampling	Baseline data to be collated for WWT reserve, Park Bottom Tributary, Mill Stream and Swanbourne Lake. Electrofishing and collation of additional records	N/A	Discuss with Sussex Wildlife Trust the available survey data for Park Bottom Tributary, Mill Stream and WWT reserve. Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought	N/A	N/A	N/A

Physical Environment				Ecology							
Drought Order / Permit	**Hydrology**	**Geo-morphology**	**Water Quality**	**Macro invertebrates**	**Macrophytes**	**Fish**	**Estuarine Macroalgae and phyto-plankton**	**Water vole**	**Estuarine macroinvertebrates**	**Estuarine fish**	**Other**
								permit implementation. Repeat survey every 3 years.			
East Worthing	It is recommended that spot flow and level gauging is carried out on Broadwater brook (Teville Stream) reach at times of low flow to create a baseline data set of 4 low flow surveys.	N/A	Carry out monitoring in perennially flowing reaches: 1 site in the Teville Stream and 1 site in Broadwater Stream every year during low flow conditions for SRP, dissolved oxygen, ammoniacal nitrogen, pH and temperature.	Further baseline data to be collated for Teville Stream and Broadwater Stream. Seasonal surveys throughout the reach	Carry out walkover and river macrophyte survey in perennially flowing reaches: 1 site in the Teville Stream and 1 site in Broadwater Stream ideally in a normal year and a dry year[2]. To be carried out June-September, incorporating existing EA monitoring locations	Baseline data to be collated for Teville Stream and Broadwater Stream, Electrofishing and collation of additional records	N/A	Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought permit implementation. Repeat survey every 3 years.	N/A	N/A	N/A
Weir Wood	Flow accretion survey required during low flows for Reach 1.	N/A	Carry out water quality sampling at 1 site in each impacted reach, twice a year at times of low flow for: dissolved oxygen, pH, turbidity, suspended sediment, conductivity, temperature, ammonia and SRP Carry out 1 month's worth of continuous monitoring data at several sites which would support the point sample data.	Carry out seasonal (spring, and autumn) macroinvertebrate surveys. 1 site per impacted reach	Carry out further monitoring surveys for macrophytes including water quality sampling to further understand SRP levels in reaches	Each reach to be surveyed for fish habitat as part of a wider low flow/low water level habitat walkover survey, including mapping of likely spawning and nursery habitat. Electrofishing and collation of additional records in all reaches to improve baseline data	N/A	Discuss with Sussex Wildlife Trust the available survey data for all freshwater reaches. Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought permit implementation. Repeat survey every 3 years.	N/A	N/A	Carry out targeted white-clawed crayfish surveys Carry out targeted depressed river mussel surveys
Lukely Brook	Seek to install additional long term groundwater monitoring (water level loggers set at a minimum of daily level readings) at key observation boreholes BH1, BH2, HA1, HA2, HA3 where feasible (loggers originally installed as part of the 2006 drought permit application).	N/A	Lack of data for Lukely Brook and Medina Estuary. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) for transitional water, pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Further baseline data to be collated for Lukely Brook. Seasonal surveys throughout the reach	Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site at Lukely Brook ideally in a normal year and a dry year (ideally complementing the existing EA monitoring, in discussion with the EA)	Electrofishing and collation of additional records in Lukely Brook to improve baseline data	N/A	N/A	N/A	N/A	N/A
Test Valley	Re-install permanent monitoring of Eveley Farm Houghton observational borehole and Test Valley gauging station on Wallop Brook if possible and review feasibility of flow gauging at Test Valley to extend historic baseline data set	N/A	Carry out water quality monitoring at 2 sites at times of low flows in the Wallop Brook (ideally at flows around Q95) to assess baseline water quality and potential impacts due to the drought order. Repeat surveys 1 x each year under low flow conditions (ideally at flows around Q95) Parameters to be analysed are soluble reactive phosphorous (SRP),	Further baseline data to be collated for Wallop Brook. Seasonal surveys throughout the reach	Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site at Wallop Brook ideally in a normal year and a dry year (ideally complementing the existing EA monitoring, in discussion with the EA)	Electrofishing and collation of additional records in Wallop Brook to improve baseline data	N/A	Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought permit implementation. Repeat survey every 3 years.	N/A	N/A	N/A

[2] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Physical Environment				Ecology							
Drought Order / Permit	**Hydrology**	**Geo-morphology**	**Water Quality**	**Macro invertebrates**	**Macrophytes**	**Fish**	**Estuarine Macroalgae and phyto-plankton**	**Water vole**	**Estuarine macroinvertebrates**	**Estuarine fish**	**Other**
			dissolved oxygen, ammoniacal nitrogen, pH, turbidity, suspended sediment and temperature.								
Caul Bourne	Increase monitoring from monthly to daily for: Apes Down, Brightstone Forest and Ashengrove observation boreholes, installing water loggers where appropriate or feasible	N/A	Lack of data for impacted reaches including Shalfleet Creek. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) (for transitional water), pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Collate available local records in the Caul Bourne to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys at 1 site, every year in spring, summer and autumn.	Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in the Caul Bourne ideally in a normal year and a dry year (ideally complementing the existing EA monitoring, in discussion with the EA)	Electric-fishing surveys to monitoring populations at 1 monitoring site on the Caul Bourne (ideally complement the existing EA monitoring, in discussion with the EA). 1 survey round every 3 years at same site.	N/A	N/A	Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys. Repeat every year in spring, summer and autumn. Identify to species level.	N/A	N/A
Eastern Yar	N/A	N/A	Lack of data for impacted reaches including Medina Estuary. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) (for transitional water), pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Collate available local records in reaches 1 and 2 in the River Medina to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys at 1 site, every year in spring, summer and autumn.	Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in the reaches 1 and 2 in the River Medina ideally in a normal year and a dry year (ideally complementing the existing EA monitoring, in discussion with the EA)	Electric-fishing surveys to monitoring populations at 1 monitoring site in reaches 1-3 in the River Medina (ideally complement the existing EA monitoring, in discussion with the EA).	N/A	N/A	N/A	N/A	N/A
Shalcombe	N/A	N/A	Lack of data for impacted reaches including Shalfleet Creek. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) (for transitional water), pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Collate available local records in the Caul Bourne and Shalcombe Stream to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys at 1 site, every year in spring, summer and autumn.	Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in the Caul Bourne and Shalcombe Stream ideally in a normal year and a dry year (ideally complementing the existing EA monitoring, in discussion with the EA)	Electric-fishing surveys to monitoring populations at 1 monitoring site on the Caul Bourne and Shalcombe Stream (ideally complement the existing EA monitoring, in discussion with the EA). 1 survey round every 3 years at same site.	N/A	N/A	Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys. Repeat every year in spring, summer and autumn. Identify to species level.	N/A	N/A
Bewl Water Reservoir / River Medway Scheme	N/A	River Habitat Survey to be completed every three years within reaches 1, 2 3a and 3b, as stated	Continuous water quality monitoring at Locations 8-10 during 2018 (in addition to sites 1-7 included in the RMS Licence) as specified	Collate available local records in the River Bewl to improve baseline datasets.	Collate any available local macrophyte data. Carry out walkover and river macrophyte survey	Electric-fishing surveys to monitoring populations at 1 monitoring site in each of the reaches (ideally complement the existing EA	N/A	. Repeat 2017 survey every 3 years,	Carry out 3 yearly Tentacled Lagoon Worm survey (*Alkmaria romijni)* to identify spatial distribution of the	1 Seine net survey d/s Allington	N/A

Physical Environment				Ecology							
Drought Order / Permit	Hydrology	Geo-morphology	Water Quality	Macro invertebrates	Macrophytes	Fish	Estuarine Macroalgae and phyto-plankton	Water vole	Estuarine macroinvertebrates	Estuarine fish	Other
		in Appendix 2 and Appendix 4 of the January 2018 Drought Permit EA Ref: DP201802114)	in Section 2 of the January 2018 Drought Permit EA Ref: DP201802114)	Carry out seasonal (spring and autumn) macroinvertebrate and invertebrate surveys within reaches 1-3	at 1 site on reaches 1-4 ideally in a normal year and a dry year (ideally complementing the existing EA monitoring, in discussion with the EA)	monitoring, in discussion with the EA). 1 survey round every 3 years at same site. Conduct eel and elver monitoring during spring 2018 at abstraction intakes.			species within the Medway estuary		

Table 2.3 Baseline data and monitoring requirements: habitats, designated sites, recreation, landscape, INNS, heritage features and other features

Drought Permit / Order	Habitats	Designated Sites	Recreation	Landscape	Heritage Features	Other
Darwell	Additional data for littoral mudflats and coastal saltmarsh required. Carry out baseline habitat survey at low tide assess inter-tidal habitat composition and quality, and confirm drought option risk assessment. Where necessary, complete transects/quadrats of saltmarsh and benthic cores of mudflats; to be agreed in consultation with Environment Agency and Natural England.	Further baseline data required for Dungeness, Romney Marsh and Rye Bay SPA/Ramsar/SSSI, impacted designated features. Obtain any bird monitoring data available (WeBS do not have sufficient cover) and where necessary complete up-to-date breeding and wintering bird surveys (to be agreed with Natural England). Carry out risk assessment of ditch network to determine likely susceptibility to drying out, and suitability to support water vole, GCN and notable invertebrates and plant species. Targeted sampling of ditch water habitats using Common Standards Methodology criteria for assessing habitat condition, where appropriate in dialogue with Natural England. Carry out water vole, great crested newt and medicinal leech sampling surveys to assess likely presence and distribution across ditch network, in dialogue with Natural England.	Discuss potential risks with Rye Harbour sailing stakeholders and carry out low tide survey at low flow conditions to determine any potential risks during drought permit implementation. Update drought permit risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with sailing stakeholders.	N/A	N/A	N/A
Faversham	Additional data for the habitats identified as being water dependent within the designated sites.	N/A	N/A	N/A	N/A	N/A
Stourmouth	N/A	N/A	N/A	N/A	N/A	N/A
Powdermill	Additional data for littoral mudflats and coastal saltmarsh required. Carry out baseline habitat survey at low tide assess inter-tidal habitat composition and quality, and confirm drought option risk assessment. Where necessary, complete transects/quadrats of saltmarsh and benthic cores of mudflats; to be agreed in consultation with Environment Agency and Natural England.	Further baseline data required for Dungeness, Romney Marsh and Rye Bay SPA/Ramsar/SSSI impacted designated features. Walkover surveys and bird counts Obtain any bird monitoring data available Carry out monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition, where appropriate in dialogue with Natural England.	Discuss potential risks with Rye Harbour sailing stakeholders and carry out low tide survey at low flow conditions to determine any potential risks during drought permit implementation. Update drought permit risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with sailing stakeholders.	N/A	N/A	N/A
North Deal	Additional data for the habitats identified as being water dependent within the designated sites.	Further baseline data required for Thanet Coast and Sandwich Bay SPA and Ramsar and Sandwich Bay to Hacklinge Marshes SSS, Impacted designated features. Walkover surveys, invertebrate surveys (spring, and autumn) and bird counts Obtain any notable invertebrate or bird monitoring data.	N/A	N/A	N/A	Wingham wastewater treatment works (WTW) Continue operational and regulatory monitoring of the quality of the final effluent to ascertain baseline conditions and any quality variability at dry weather flows. Confirm Dry Weather Flow discharge rate and its variability over different seasons. Ensure list of abstractors set out in Appendix B is maintained in dialogue with the EA on an annual basis as part of the agreed data exchange protocol (see separate Environmental Monitoring Plan)
Pulborough	Additional data for the habitats identified as being water dependent within the designated sites.	Further baseline data required for Arun Banks SSSI impacted designated features. Walkover surveys and counts of the rare hybrid club rush	N/A	N/A	N/A	N/A
North Arundel	Additional data for the habitats identified as being water dependent within the designated sites; reedbeds and Swanbourne Lake waterbody.	Further baseline data required for Arundel Park SSSI associated with Swanbourne Lake (SSSI Unit 1) and Wildlife and Wetland Trust (Unit 2); reedbed habitat, macroinvertebrates, breeding sedge and reed warblers, waterfowl assemblage.	Collate further information on the recreational and visual amenity provided by Swanbourne Lake and undertake visual and recreational impact assessment. Complete during on-set of drought. Repeat assessment every 5 years (or unless material changes to the landscape).	Collation of appropriate data for South Downs National Park and NCA as part of the baseline monitoring programme to inform a landscape impact assessment in dialogue with officers and Natural England. Complete during on-set of drought. Repeat assessment every 5 years (or unless material	N/A	N/A

Drought Permit / Order	Habitats	Designated Sites	Recreation	Landscape	Heritage Features	Other
				changes to the landscape		
East Worthing	N/A	N/A	N/A	N/A	N/A	N/A
Weir Wood	N/A	N/A	N/A	N/A	N/A	N/A
Lukely Brook	Additional data for the habitats identified as being water dependent within the designated sites. Additional data for the chalk river habitat.	Further baseline data required for the Solent Maritime SAC, Medina Estuary SSSI and Solent and Southampton Water SPA/Ramsar impacted designated features. Walkover surveys to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) and bird counts Obtain any bird monitoring data available	N/A	N/A	Discuss potential impacts on any water-dependent features of Clatterford Roman Villa heritage asset with the site owner and understand how the drought permit might impact on these features. Agree scope for any monitoring or mitigation measures.	N/A
Test Valley	Walkover survey to further assess the level of groundwater and/or hydrological connectivity with the purple moor grass and rush pastures, and lowland fen habitat. Collate any existing data. Additional data for the priority headwater habitat.	Collate existing information about use of Wallop Brook by bat species and talk to landowners, EA and NE. Bat survey at strategic locations along Wallop Brook between Broughton pumping station (upstream is ephemeral during dry periods under baseline conditions) and downstream with confluence of River Test.	Collate further information on fish population (see 'fish' monitoring above) as Wallop Brook a popular fishing reach. Collate further information on level of fishing activity and key contacts for angling associations and riparian owners in dialogue with the EA	N/A	N/A	N/A
Caul Bourne	Additional data for the habitats identified as being water dependent within the designated sites; coastal saltmarsh and mudflats. Additional data for the chalk river and priority headwater habitat.	Further baseline data required for the Solent Maritime SAC, Newtown Harbour NNR/SSSI and Solent and Southampton Water SPA/Ramsar impacted designated features. Walkover surveys to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) and bird counts Obtain any bird monitoring data available	Continue to monitor groundwater levels at nearby Chessel observation borehole and abstraction from the groundwater sources. Install water level logger in Shalcombe Manor Pond in agreement with site owner. Carry out fish surveys (see fish section above) once every 3 years and take water quality samples at the same time for dissolved oxygen, temperature, ammonia, SRP and turbidity. Discuss potential drought order effects and mitigation measures with site owner.	Collation of appropriate data for Isle of Wight AONB and NCA as part of the baseline monitoring programme to inform a landscape impact assessment in dialogue with AONB officers and Natural England. Repeat assessment every 5 years (or unless material changes to the landscape	Discuss operation of impacted mill with site owner and understand how the mill would operate in drought conditions.	N/A
Eastern Yar	Additional data for the habitats identified as being water dependent within the designated sites; coastal saltmarsh and mudflats.	Further baseline data required for the Solent Maritime SAC, Medina Estuary SSSI and Solent and Southampton Water SPA/Ramsar impacted designated features. Walkover surveys to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) and bird counts Obtain any bird monitoring data available	N/A	N/A	N/A	N/A
Shalcombe	Additional data for the habitats identified as being water dependent within the designated sites; coastal saltmarsh and mudflats. Additional data for the chalk river and priority headwater habitat.	Further baseline data required for the Solent Maritime SAC, Newtown Harbour NNR/SSSI, Prospect Quarry SSSI and Solent and Southampton Water SPA/Ramsar impacted designated features. Walkover surveys to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) and bird counts Obtain any bird monitoring data available	Continue to monitor groundwater levels at nearby Chessel observation borehole and abstraction from groundwater sources and pond. Install water level logger in pond in agreement with site owner. Carry out fish surveys (see fish section above) once every 3 years and take water quality samples at the same time for dissolved oxygen, temperature, ammonia, SRP and turbidity.	Collation of appropriate data for Isle of Wight AONB and NCA as part of the baseline monitoring programme to inform a landscape impact assessment in dialogue with AONB officers and Natural England. Repeat assessment every 5 years (or unless material changes to the landscape	Discuss operation of impacted mill with site owner and understand how the mill would operate in drought conditions.	N/A

Drought Permit / Order	Habitats	Designated Sites	Recreation	Landscape	Heritage Features	Other
River Medway Scheme	Additional data for the habitats identified as being water dependent within the designated sites.	Further baseline data required for the Medway Estuary and Marshes SPA and Ramsar, River Beult SSSI, Holborough to Burham Marshes SSSI, Medway Estuary MCZ impacted designated features. Walkover surveys to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries, ponds) and bird counts and sensitivity to low flows. Carry out a monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition where appropriate in dialogue with Natural England. Holborough to Burham Marshes SSSI baseline walkover survey to clarify the extent of the connection and reliance upon freshwater from the main channel for this SSSI to help clarify the likely impacts of the River Medway Surface water scheme. Carry out 3 yearly Tentacled Lagoon Worm survey (*Alkmaria romijni*) to identify spatial distribution of the species within the Medway estuary. Obtain any bird monitoring, invertebrate, macrophyte and water dependent species data available. Macrophyte surveys on Beult SSSI	Discuss potential risks with Chatham Maritime Marina, Port Werburgh, Gillingham Marina and Allington Marina owners and boating stakeholders and carry out low tide survey at low flow conditions to determine any potential risks during drought permits/order implementation. Discuss potential risks with EA, angling clubs and stakeholders and assess likelihood of angling at low flow drought conditions to determine any potential risks during drought permit/order implementation. Update drought permit/order risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with EA, angling clubs and stakeholders.	Collation of appropriate data for Low Weald and Greater Thames Estuary NCA as part of the baseline monitoring programme to inform a landscape impact assessment in dialogue with AONB officers and Natural England. Repeat assessment every 5 years (or unless material changes to the landscape.	Discuss hydrological controls on water levels in moats and ponds with site owners and understand how drought conditions may impact the water levels.	Dialogue with potentially affected abstractors to understand the precise location of the abstractions and the source of water and to assess the potential impact on their abstraction rights during a drought order/permit. Update risk assessment as appropriate and discuss any potential mitigation measures that could be put in place during drought permit/order implementation.

2.4 Monitoring Programme Timetable

Table 2.4 sets out the timetable for finalising and agreeing the details of the baseline monitoring programme (as well as in-drought monitoring) with the Environment Agency (and Natural England, where applicable), together with a prioritised timetable for carrying out the agreed programme of baseline monitoring. Implementation of the baseline monitoring has been prioritised with each Drought Permit/Order source allocated to one of three priority categories (highest, higher and lower priority) as shown in Table 2.5, taking account of the likelihood of the Drought Permit/Order being required and/or the potential magnitude of any environmental effects.

The Drought Permit/Orders for the Test Surface Water, Candover Augmentation Scheme and Lower Itchen sources are categorised as being of the highest importance. This reflects the agreements reached with the Environment Agency and Natural England during the 2018 Public Inquiry, and the prioritisation takes account of the environmental sensitivity of the River Test and River Itchen to Drought Permit/Orders, as well as the elevated risk of needing the Test Surface Water Drought Permit. The monitoring packages and implementation timetables have been agreed, and work commenced for some sites and parameters in summer 2018 (see Appendices B, D and F for the agreed Monitoring Plans). Similarly, the Bewl Water Reservoir/River Medway Scheme has been agreed as being of highest priority with the Environment Agency given the frequency of Drought Permit applications (most recently in winter 2017-18) and the strategic regional importance of this water source.

The timetable for baseline monitoring set out in Table 2.4 is premised on an initial 3-year monitoring programme: some monitoring will be a one-off survey and therefore not repeated (e.g. habitat walkover), other surveys will be carried out once in three years (e.g. some macrophyte surveys) and others annually (e.g. fish in sensitive water environments) or seasonally (e.g. low flow macroinvertebrate sampling). Reviews will take place at the end of each calendar year to take account of monitoring findings and any issues (e.g. survey site suitability, confounding factors, etc.). Baseline monitoring would then continue in subsequent years of the Drought Plan 2019 period based on the findings from the first three years (including picking up any sites / features not surveyed in earlier years due to weather conditions, etc.). The baseline monitoring findings will also inform development of the next Drought Plan.

Discussions have been ongoing with the Environment Agency, and Natural England where applicable, to agree specific monitoring locations and survey methods. Meetings were held with the Kent and South London (KSL), and Solent and South Downs (SSD) Environment Agency areas in July 2018 and March 2019, respectively, to agree the way forward. Ongoing discussion is being held with Natural England and the Environment Agency regarding the best approach for survey and monitoring of the designated habitats and species that are qualifying features of the Solent Maritime SAC in relation to Drought Orders on the Isle of Wight and Dungeness, Romney Marsh and Rye Bay Ramsar site in relation to the Darwell Drought Permit. We have been working closely with Natural England to identify the specific survey methods to be adopted but final agreement on the specific monitoring locations, survey methods and frequency is expected during summer 2019. We are committed to commencing the baseline monitoring as soon as we have agreed the survey approach.

Table 2.4 Drought Order / Permit Monitoring Programme Timetable (excluding Test Surface Water, Candover Augmentation Scheme and Lower Itchen sources)

Target Date	Drought Permits/Orders	Action
June 2018 to July 2019	All Permits/Orders	Agree and sign-off survey sites, control sites, delivery approach (e.g. Environment Agency, Southern Water, River Trusts), frequencies of monitoring and analytical methods/reporting for baseline and in-drought monitoring
August 2018 to July 2019	All - Higher priority Permits/Orders first followed by lower priority	Contracting and delivery plan development
Late September to November 2018	Highest priority Permits/Orders	Autumn baseline monitoring for appropriate features and/or species (where locations. methods and land access agreed in sufficient time)
Spring 2019 to Autumn 2019	Higher priority Permits/Orders	Baseline monitoring for Year 1 (where locations, methods and land access agreed in sufficient time)
Summer 2019 to December 2019	Higher priority Permits/Orders	Review Year 1 findings and confirm sites and activities for Year 2
Spring to Autumn 2020	All Permits/Orders	Baseline monitoring for Year 2 (including those features not surveyed in Year 1)
Summer 2020 to December 2020	All Permits/Orders	Review Year 1 and Year 2 monitoring findings and confirm sites and activities for Year 3
Spring to Autumn 2021	All Permits/Orders	Baseline monitoring for Year 3
Spring 2021	All Permits/Orders	Include monitoring results to date in updated drafts of EARs for Drought Plan 2021
Spring 2021	All Permits/Orders	Review Year 1 and Year 2 monitoring and agree future monitoring to develop the updated Drought Plan 2021 EMP draft for consultation (and as part of updates to the Environmental Assessment Reports)
Summer 2021 to December 2021	All Permits/Orders	Review Year 1 to Year 3 monitoring findings and confirm sites and activities for Year 4, taking account of any agreed changes made for the Drought Plan 2021 EMP
Spring 2022 to Summer 2022	All Permits/Orders	Continue with agreed monitoring for Year 4
Summer to Autumn 2022	All Permits/Orders	Review Year 1 to Year 4 monitoring and agree future monitoring for Year 5, taking account of any agreed changes made for the Drought Plan 2021 EMP
Summer 2022 to December 2022	All Permits/Orders	Review Year 1 to Year 4 monitoring findings and confirm sites and activities for Year 5
Spring 2023 to Summer 2023	All Permits/Orders	Continue with agreed monitoring for Year 5
Summer 2023 to December 2023	All Permits/Orders	Review Year 1 to Year 4 monitoring findings and confirm sites and activities for Year 5

Table 2.5 Priority Order for Baseline Monitoring Programme

Option name	Priority
Test Surface Water	Highest
Candover Augmentation Scheme	Highest
Lower Itchen Sources	Highest
Bewl Water Reservoir/River Medway Scheme	Highest
Pulborough	Higher
Test Valley	Higher
Eastern Yar	Higher
Caul Bourne	Higher
Shalcombe	Higher
Lukely Brook	Higher
Stourmouth	Lower
Faversham	Lower
North Deal	Lower
Powdermill Reservoir	Lower
Darwell Reservoir	Lower
Weir Wood Reservoir	Lower
East Worthing	Lower
North Arundel	Lower

#As explained earlier, this priority order has taken account of the likelihood of the Drought Permit or Drought Order being required and/or the potential magnitude of any environmental effects from its implementation.

3 Monitoring During Drought

3.1 Monitoring requirements

The Environment Agency Drought Plan guidance states that the EMP should detail surveys to inform environmental assessment of the prevailing conditions at the on-set of drought, during Drought Order / Permit implementation and post-drought. This section details the proposed monitoring measures to be undertaken during each of these three stages of drought. The monitoring during the on-set of drought will contribute to dialogue with the Environment Agency, Natural England and other stakeholders as appropriate as to the selection and application of potential mitigation measures should a Drought Permit / Order be implemented. The onset of drought monitoring will also help to confirm the relevant triggers for the application of mitigation measures or other relevant decisions to help protect environmental features. The Environment Agency Drought Plan guidance states that the EMP should detail the likely mitigation needed against serious impacts on the environment as a result of implementation of drought management actions. Serious impacts are interpreted as those impacts of major to moderate significance to the environment identified in the Environmental Assessment Reports.

Monitoring during implementation of a Drought Order / Permit will help assess the actual impacts on environmental features and help to determine when mitigation measures should be applied, informed where applicable by the agreed trigger conditions. The evidence collected will also help to verify the impacts predicted in the Environmental Assessment Reports and used to subsequently update the Environmental Assessment Reports.

Monitoring post-drought will help to assess any impacts that continue despite the cessation of the Drought Permit / Order and to assess the rate and nature of recovery of the environment. It will also help to establish any damage or loss linked to the Drought Permit / Order implementation and guide any applicable mitigation or post-implementation compensation measures.

A range of quantitative and qualitative monitoring surveys are recommended for each of the different stages of the drought monitoring process as discussed in sub-section 3.1.2.

3.1.1 Control Site Selection

The use of control sites during impact monitoring is essential to assess additional impacts of implementing Drought Permits / Orders over and above those due to environmental drought conditions alone. These un-impacted sites will enable a comparison with impacted sites both during and following a drought. The precise location of these control sites will be determined in discussion with the Environment Agency, Natural England or other stakeholders as appropriate, ideally consistent with the baseline control sites. 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 may 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. A list of agreed control sites are included in detailed site-specific monitoring schedules shared with the KSLES and SSD Environment Agency areas. In some cases, notably on the Isle of Wight, discussions with the Environment Agency have concluded that it has not been feasible to identify suitable control sites for all parameters, but in these circumstances other surrogate monitoring site data will need to be used where available.

3.1.2 Specific monitoring requirements

Part B of this report sets out the required specific environmental monitoring requirements at the on-set of environmental drought conditions, during Drought Permit / Order implementation and post-drought where moderate or major impacts are predicted to the environmental feature.

In many cases, habitat and features walkover surveys are recommended as part of the monitoring requirements for each of the three drought stages. These would build on the recommended walkover surveys carried out for the baseline monitoring and enable a rapid review of the prevailing environmental conditions and to identify those features likely to be at greatest risk in the specific drought conditions arising (e.g. risks in winter will be different to those in summer). In some cases (e.g. fish), the walkovers are a substitute for in-river monitoring of the feature as the monitoring would lead to additional stress on the feature under drought flow conditions.

All the monitoring activities are the responsibility of Southern Water but the company may work with other parties to actually deliver the activities taking account of which organisations are best placed to carry out the requirements. Where relevant, appropriate licences and approvals will be needed to carry out the monitoring and Southern Water has responsibility to ensure that all surveyors have the appropriate licences, approvals and experience to carry out the monitoring to the required standards.

Section 4.4 discusses the main considerations in respect of environmental protection and biosecurity when planning for the monitoring activities.

Section 5 sets out the proposed data exchange protocol for in-drought and post-drought monitoring and data acquisition.

Appendix A sets out the main survey methods and analytical approaches for the main identified monitoring activities. Standard methodologies should be used for data collection, wherever possible, to ensure maximum compatibility with existing datasets and other monitoring activities elsewhere in the catchment. Appendix A also identifies any specific licences or approvals necessary to carry out the survey method.

Monitoring at the on-set of drought conditions

The monitoring at the on-set of an environmental drought will establish the environmental conditions prevailing prior to any Drought Permit / Order implementation. This monitoring activity will be used to confirm and agree applicable mitigation measures relevant to the prevailing drought conditions (taking account of the mitigation measures proposed in this EMP, but which may need modification in light of the actual prevailing conditions). The monitoring should also help confirm appropriate triggers for implementation of the agreed mitigation measures. Mitigation measures are discussed further in Section 4 and detailed for each specific Drought Permit / Order in Section 6.

Baseline hydrological and groundwater monitoring should also continue to be carried out alongside the environmental monitoring to provide the required river flow and water level data that will be used to monitor the progression of the drought and help to explain any impacts on environmental features.

Monitoring in the River Test and River Itchen pre-Drought Order implementation

In Annex 1 of the Section 20 Agreement signed in March 2018 between Southern Water and the Environment Agency, specific reference is made to the consideration of monitoring findings to inform the final sequence of implementation of the Test Surface Water, Candover Augmentation Scheme and Lower Itchen sources Drought Orders. This reflects our general Drought Plan principles that we will take account of the prevailing environmental conditions when making decisions on implementing our Drought Plan measures in any future drought event. Under the Section 20 Agreement we will take into account the potential greater vulnerability of fish seasonally because of their migration patterns as well as reviewing and assessing the most up to date data from the monitoring installed

pursuant to the Environmental Monitoring Plan, and the latest up to date information on macrophytes and invertebrates.

Monitoring during Drought Permit / Order implementation

Surveys will be undertaken to monitor the potential impacts highlighted by the EARs during implementation of Drought Permits / Orders. This monitoring should be initiated when the Drought Permit / Order is actually implemented (rather than granted) and will be used to compare to the impacts identified during the on-set of drought. This will particularly include targeted walkover surveys, building on the same surveys carried out during the on-set of drought.

During the implementation of the Drought Permit / Orders, the agreed trigger levels will be monitored to inform the application of mitigation measures in dialogue with the Environment Agency, Natural England or other stakeholders as appropriate. Monitoring will continue until the Drought Permit / Order ceases to be implemented, and the cessation of monitoring will be agreed with the Environment Agency and Natural England.

Baseline hydrological and groundwater monitoring should also continue to be carried out alongside the environmental monitoring to provide the required river flow and water level data that will be used to monitor the progression of the drought and help to explain any impacts on environmental features.

Monitoring post-drought

Post-drought monitoring should ideally be undertaken when the hydrological and hydrogeological indicators show the start of the recovery back to 'normal' conditions for the time of year so that the rate of recovery and the extent of recovery can be tracked over a period of time. The extent of the impact of the environmental drought and Drought Permit / Order implementation should be carefully documented using the information gathered from the monitoring alongside the baseline hydrological and groundwater monitoring activities. Other meteorological data (e.g. rainfall, MORECS soil moisture deficit and air temperature) should also be captured for the drought and post-drought period from the relevant data providers to further inform the understanding of the physical drought conditions and the nature of the recovery.

Post-drought monitoring, analysis and assessment will inform the extent to which environmental features were affected by the environmental drought compared to the Drought Permit / Order. The results will determine whether any compensation measures need to be implemented to address identified loss or damage due to the Drought Permit / Order implementation. Potential compensation measures are detailed for each Drought Permit / Order in Section 6.

4 Mitigation Measures

4.1 Mitigation measures requirements

The development of mitigation requirements has been based upon the assessment of sensitive features identified in the Environmental Assessment Reports as having a significant risk of impact as a result of implementing Drought Permits / Orders. Following the Environment Agency guidance, significant risk has been considered to be where the significance of impacts is identified as being moderate or major in the Environment Assessment Reports.

Walkover surveys and other in-drought monitoring will provide information on the effects of the drought and Drought Permit / Order implementation (see Section 3) to inform decisions on the application of any mitigation measures. Further targeted surveys would then be required following implementation of mitigation measures to assess their benefit and make adjustments as may be necessary (or to suspend the mitigation measure if it is shown to have an adverse effect).

Monitoring at the onset of environmental drought will inform the risks of adverse effects of any Drought Permit / Order implementation and inform the agreement as to the precise mitigation measures to consider and the appropriate trigger for their implementation in dialogue between Southern Water, Environment Agency, Natural England and other stakeholders, as appropriate.

The mitigation measures set out in this EMP are based on the likely impacts to sensitive features and these should be further reviewed in a drought, particularly if monitoring identifies additional 'new' risks or indicates that the stated measures are not appropriate in the specific drought conditions faced. Similarly, post-drought monitoring should inform the precise nature of any required post-drought compensation measures; the compensation measures in this EMP (except for statutory compensation measures required under the Habitats Regulations which must normally be 'secured' prior to damage occurring) are therefore not precisely defined as they will necessarily need to reflect the precise nature of the loss or damage identified post-drought.

The potential mitigation measures specific to each Drought Permit / Order are detailed in Sections 6 and 7 (Part B of this EMP).

4.2 Potential mitigation measures

The mitigation recommendations adopt a hierarchy of approach which follows the general principle of: 1) reducing the pressure at source; 2) pressure management in the water body; and 3) direct ecological interventions (which require careful consideration before implementation and consequently should not be the 'first resort').

The implementation of mitigation measures 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.

Table 4.1 sets out the range of mitigation measures identified in relation to the Drought Permits / Orders and these are detailed in Section 6 of this document (as well as in the specific Environmental Assessment Reports).

Some of the mitigation measures do carry a level of risk (for example the capture and relocation of vulnerable species), and for this reason full consultation with the Environment Agency and Natural England will take place at the onset of drought triggers to agree whether a particular mitigation action is the best option in the actual 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

evidence from elsewhere in the UK that the measures set out in this EMP can have a positive, beneficial effect. Section 4.4 sets out requirements in respect of environmental protection and biosecurity in delivery of mitigation measures.

Non-ecological features
Mitigation actions may be necessary to prevent derogation of other abstractions (for example, by lowering pumps in third party boreholes and/or providing alternative water supplies). Compensation may be agreed otherwise in accordance with the provisions of Section 79 and Schedule 9 of the Water Resources Act 1991 (as amended).

4.3 Mitigation Programme

Mitigation measures have been finalised and agreed with the Environment Agency and Natural England for the highest priority Drought Permits and Drought Orders. The Lower Itchen Sources Drought Order, Candover Drought Order and Test Surface Water Drought Permit/Order details are provided in Appendices C, E and G, respectively. We have also agreed the mitigation measures for Stages 1 and 2 (highest priority) of the Bewl Water/River Medway Scheme.

Table 4.1 sets out the timetable for finalising and agreeing the details of the Drought Permit / Order mitigation measures with the Environment Agency (and Natural England, where applicable), together with a prioritised timetable for commencing implementation of any mitigation measures where it is agreed that the measures need to be implemented in advance of a Drought Permit / Order application.

During consultation with the Environment Agency and Natural England, it has been proposed that for the remaining Drought Permits and Orders (i.e. with the exception of the Lower Itchen Sources Drought Order, Candover Drought Order, Test Surface Water Drought Permit/Order and Stages 1 and 2 of Bewl Water/River Medway Scheme), that the mitigation measures be finalised following the baseline walkover surveys of the impacted reaches as these surveys are needed to more definitively agree site-specific mitigation measures beyond the more generic mitigation measures already included in the EARs. Where possible, the Environment Agency, and where applicable Natural England, will be involved with the walkover surveys such that possibilities for mitigation can be discussed on site. These walkover surveys are proposed for Summer 2019, ideally during low flow conditions.

The prioritisation follows the same prioritisation of Drought Permits / Orders as shown earlier in Table 2.5. The Drought Permit / Orders for the Test Surface Water, Candover Augmentation Scheme and Lower Itchen sources are categorised as being of the highest importance, reflecting the agreements reached with the Environment Agency and Natural England during the Hampshire Abstraction Licences Public Inquiry (see Appendices C, E and G). Stage 1 and 2 of Bewl Water/River Medway Scheme is also categorised of being of the highest importance, as agreed with the Environment Agency.

For the Calbourne, Shalcombe and Eastern Yar Drought Orders on the Isle of Wight, details of the proposed baseline survey work to inform mitigation measures were issued to Natural England in February 2019 for agreement, with some work having already been completed during winter 2018-2019 within the optimal survey window (wintering bird surveys). The outline for the mitigation package has been agreed, but discussions are ongoing to establish the specific elements, and will be informed by the baseline survey results. The revised timescales for these activities are detailed below:

- **By 30 August 2019:** Achieve Natural England sign-off to a mitigation package and timetable that would need to be delivered before any future Drought Order is granted by the Secretary of State.
- **By 30 September 2019:** Complete first year surveys (assuming optimal survey window is available following agreement with Natural England) to refine scope and detailed/location specific implementation measures. Where evidence is appropriate, scope out the detailed mitigation measures for implementation and agree delivery vehicles and funding requirements. Finalise any remaining survey work and evidence gathering to be completed to set out the remaining detailed scope of mitigation measures. Agree the further monitoring programme required to monitor the mitigation measure implementation period and also post-implementation.

The aim will be to agree and secure delivery contracts for the initial mitigation actions by 31 March 2020, so that they can commence from 1 April 2020. Annual reviews of the mitigation package and agreement on further phases would take place over the following years of the Drought Plan period.

Table 4.1 Mitigation Measures Timetable (excluding Test Surface Water, Candover Augmentation Scheme, Lower Itchen sources and Bewl Water/River Medway Scheme Stages 1 and 2)

Target Dates	Drought Permits/Orders	Action
Summer 2019 to October 2019	All Permits / Orders	Carry out walkover surveys and finalise package of mitigation measures with Environment Agency (and Natural England) where applicable) for both “up-front” and “in-drought” monitoring-led mitigation
Summer 2019 to December 2019	All Permits / Orders, with the highest / higher priority sites addressed first	Contracting and delivery plan development for any agreed “up-front mitigation measures”
Spring/Summer 2020	Highest / higher priority Permits / Orders	Carry out any detailed survey work required for any agreed “up-front” mitigation measures to develop detailed the scope/land access, etc. for the mitigation measures
Summer 2020 onwards	Highest / higher priority Permits / Orders	Commence delivery of any “up-front” mitigation measures (where feasible and not reliant on surveys/monitoring) Delivery timescales to be agreed as part of the detailed scope of work, but are likely to extend over a period of years depending on the precise nature of the measures)
Autumn 2020 onwards	Highest / higher priority Permits / Orders	Commence delivery of remaining “up-front” mitigation measures (where reliant on surveys/monitoring) Delivery timescales to be agreed as part of the detailed scope of work, but are likely to extend over a period of years depending on the precise nature of the measures)
Summer to Autumn 2020	Lower priority Permits / Orders	Carry out any detailed survey work required for any agreed “up-front” mitigation measures to inform development of the mitigation measures

Target Dates	Drought Permits/Orders	Action
		Delivery timescales to be agreed as part of the detailed scope of work, but are likely to extend over a period of years depending on the precise nature of the measures)
Spring 2021 onwards	Lower priority Permits / Orders	Commence delivery of any up-front mitigation measures for Lower Priority sites (where feasible and not reliant on surveys/monitoring) Delivery timescales to be agreed as part of the detailed scope of work, but are likely to extend over a period of years depending on the precise nature of the measures)
Autumn 2020 to Spring 2021	All Drought Permits / Orders included in Drought Plan 2021	Review all mitigation measures for updated Drought Plan 2021 (as part of Environmental Assessment Report updates)

5 Permits and Approvals

5.1 Permits and Approvals

Section 3(c) of the Drought Plan (England) Direction 2016 specifies that the Drought Plan should include details of the permits and approvals that the water undertaker expects to need in order to implement its drought management measures, including for monitoring and mitigation. Many of the mitigation (and compensation) measures will require specific permits and/or approvals to be obtained by Southern Water (or its agents acting under contract to Southern Water) prior to implementation as summarised in **Table 5.1**. 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 site or land owners as appropriate.

All works will have regard to the requirements of protected species legislation and any necessary licences will be obtained in accordance with the provisions of the Wildlife and Countryside Act 1981 (as amended).

Where assent is required for works on SSSIs under section 28I of the Wildlife and Countryside Act 1981 (as amended), this assent will be obtained as properly required under legislation.

Table 5.1 Mitigation and compensation measures: permits and approvals

Mitigation Measure	Likely permits or approvals required
Modification to pump levels in third party abstraction boreholes and/or financial compensation by Southern Water due to derogation of abstraction rights.	None, but agreement between the licence holder and Southern Water will clearly be required. Compensation payments are provided for in Section 79 and Schedule 9 of the Water Resources Act 1991 (as amended).
Modification to abstraction intakes at third party surface water abstractions and/or financial compensation by Southern Water due to derogation of abstraction rights.	May require an abstraction licence minor amendment and/or Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses) as appropriate. Agreement between the licence holder and Southern Water will clearly be required. Compensation payments are provided for in Section 79 and Schedule 9 of the Water Resources Act 1991 (as amended).
Provision of alternative water supply where derogation of abstraction rights occurs	No specific requirements for a mains water supply or provision of water bowser/tanker. May require abstraction licence if alternative source of raw water supply proposed from a controlled water.
Provision of compensation flows to the river from a borehole to maintain a minimum residual flow	Requires a discharge permit for the discharge to river; may require planning permission for laying of discharge pipe as well as approval from landowners and riparian owners.
Improving the effluent quality from a Wastewater Treatment Works	Generally none and within Southern Water's control assuming the improvement does not require major construction or construction adjacent to a watercourse when planning permission, Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses)

Mitigation Measure	Likely permits or approvals required
	may be necessary. Liaison with the EA is however recommended in respect of discharges to controlled waters.
Address point sources of effluent or nutrient loading that may be causing adverse water quality at times of very low flow	This will generally require dialogue with the site owner to assess what measures could be carried out. This might include temporary tankering of the effluent to a wastewater treatment works. No specific approvals are likely to be required.
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 (e.g. fish, white-clawed crayfish)	May require Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses) from EA depending on nature of the work and/or NE consent if works are in a SSSI or European site
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 (e.g.macroinvertebrates, fish)	Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses) from EA and/or NE consent if works are in a SSSI or European site
Artificial channel narrowing to provide functional refuges and support habitat requirement for species, enabling a quick natural recolonisation of the reach post-drought (e.g. fish, macroinvertebrates)	Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses) from EA and/or NE consent if works are in a SSSI or European site
Modification of flow structures across barriers to retain favourable conditions to facilitate the movement/migration of species (fish)	Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses) from EA and/or NE consent if works are in a SSSI or European site, plus permission from the owner of the barrier/structure will be required.
Provision of piscivorous “visual” bird scaring measures (e.g. using streamers in riparian trees) to control predation upon species using refuges (fish).	None – but consultation with EA, NE, bird specialists and RSPB would be important to ensure compliance with other nature protection legislation. Implementation would need to balance benefits to in-river species with maintenance of food sources for birds. Unlikely to be acceptable in SPA or Ramsar sites or associated functional habitat for birds.
Aeration or oxygenation 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 and/or oxygenation methods necessary to determine whether any permits or formal permissions are required.
Capture and relocate individuals across significant barriers, taking into account migratory periods (immigration and emigration) (fish).	EA consultation and consent required (with consultation with NE for designated conservation sites or species).
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 (e.g. fish, white-clawed crayfish).	EA consultation and consent required for fish movement and crayfish licence required (with consultation with NE)

Mitigation Measure	Likely permits or approvals required
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 (e.g. fish, white-clawed crayfish).	EA consultation and consent required for fish movement and crayfish licence required (with consultation with NE).
Enhancement of habitat beyond the impacted reach (e.g. macroinvertebrates, fish)	May require Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses) from EA depending on nature of the work and/or NE consent if works are in a SSSI or European site
Restocking using juvenile lamprey ammocoetes within the catchment where monitoring indicates loss of lamprey abundance or recruitment.	EA consent required (with consultation with NE for designated conservation sites and as a European and NERC species).
Restocking using offspring from broodstock from the catchment where monitoring indicates loss of fish abundance or recruitment.	EA consent required (with consultation with NE for designated conservation sites or species).
Restocking of coarse fish from the catchment where monitoring indicates loss of fish abundance or recruitment.	EA consent required (with consultation with NE for designated conservation sites or species).
Removal/treatment of Himalayan balsam (or other floral INNS identified from walkover surveys) where monitoring indicates an increase in abundance or distribution due to the drought permit/order	EA consent may be required (with consultation with NE for designated conservation sites or species) depending on the nature of the removal and/or treatment, as well as the subsequent method of disposal.
Protection to heritage features through specific mitigation works	Requires approval and agreement of site owner and may require approval and/or guidance from Historic England.
Mitigation measures to support water sports and boating/navigation facilities– various measures such as modifying boat slipways/moorings or provision of alternative sites, or local dredging; or otherwise compensation.	Requires dialogue with relevant owners/members of water sports organisations as well as riparian owners. May require Flood Risk Permit (Main River) or Land Drainage Consent (Ordinary Watercourses), dependent on nature of the works. Local dredging to be minimised and will invariably require consent and agreement of relevant regulator (dependent on location). Compensation is provided for under Section 79 and Schedule 9 of the Water Resources Act 1991 (as amended)
Mitigation measures to support angling – various measures such as provision of alternative fishing sites, or otherwise compensation for loss of angling.	Requires dialogue with relevant owners of fishing rights/members of angling associations/clubs. Compensation is provided for under Section 79 and Schedule 9 of the Water Resources Act 1991 (as amended)
Mitigation of predicted ecological risks to rivers and associated habitats and species. River restoration, re-connection to floodplains, and enhancement work to be provided pre-drought in order to build up ecological resistance to and recoverability from the effects of drought. To include reversing historic degradation	EA consent required (with consultation with NE for designated conservation sites or species).

Mitigation Measure	Likely permits or approvals required
from over-grazing, impoundments, simplification of the channel form, and removal of bankside and riparian shade in chalkstreams in order to improve drought resilience.	
Retaining of water via control structures for water dependent features within designated sites.	EA consent required (with consultation with NE for designated conservation sites or species).
If it is considered likely that a drought permit needs to be extended beyond 6 months, a river corridor survey should be undertaken of the medium and high risk reaches to note down features and their locations. This survey can then be used to help assist recovery in locations where it is not occurring naturally, by repeating the survey post drought and then at subsequent intervals (e.g. one year later).	EA consent required (with consultation with NE for designated conservation sites or species).

5.1.1 Groundwater Source Abstraction

Where it is necessary for groundwater abstractions to be 'run to waste' to a watercourse in order to comply with drinking water regulations for testing the raw water prior to putting it into the public water supply system, Southern Water will seek the appropriate consent / permit for such discharges (for example, Water Industry Act 1991, Section 165/166 consent or permanent discharge permits).

5.1.2 Land Access

Monitoring plays a critical part in informing those decisions that aim to ensure the supply and quality of water is preserved, and the wider natural environment and any vulnerable species is sufficiently protected. As part of the requirements of Section 3(c) of the Drought Plan (England) Direction 2016, water companies need to consider any risks to land access that may preclude such monitoring activities.

Securing landowner permissions for access to enable activities such as monitoring (and mitigation) to take place is recognised by Southern Water as not just essential in practical terms but as a fundamental part of our wider engagement plan. Southern Water will work with landowners, stakeholders and regulators on securing access rights where needed. Where landowners simply will not give their consent, we will look at what alternative options and locations are available, including asking or partnering with other bodies who already have secured access or who are otherwise is a better position to consider undertaking the activities on our behalf.

Following historic land access issues for monitoring, this approach is currently being adopted for the delivery of the monitoring, mitigation and compensation measures developed from the Hampshire Abstraction Licences Public Inquiry, although in that scenario the discussions with the landowners in respect of granting land rights are still active. This approach has identified a series of locations which provide sufficient data to assess the state of the environment at the time of making an application.

The Section 20 Agreement includes specific provisions to cover the risks of land access agreements not being achieved and data therefore not being acquired which is necessary to support the Drought Permit application. Paragraph 17.3 of the Section 20 Agreement states:

> *"For the avoidance of doubt, as far as the Agency is concerned, in respect of any Test Surface Water Drought Order or Permit, Candover Drought Order or Lower Itchen Drought Order:*

a. the Company will not be required to install monitoring points on land outside its ownership, or to undertake monitoring activity where landowner consent is withheld.

b. The Agency will have regard to any inability of either the Company or the Agency to obtain monitoring data resulting from the actions of third parties, when considering whether any application is 'application ready' and whether such an application should be granted. The Agency will not refuse any application for lack of evidence or decide that the Company is not 'application ready' where landowner consent is withheld without first having considered its own use of the powers under section 172 of the WRA 1991 to obtain the necessary evidence in the regular 6 monthly reviews."

In respect of the Test Surface Water Drought Permit and Order, since the Public Inquiry in March 2018 we have been continuing dialogue with relevant landowners and seeking an agreement within which drought baseline monitoring and pre-drought or during-drought mitigation works can be carried out within their area of the Lower River Test. Since the Public Inquiry, progress has been made in terms of mutual understanding of principles and expectations. Indeed, a full day of ecological monitoring and reconnaissance took place in April 2019 under compensation agreed by Southern Water. We hoped this would pave the way for a full agreement to be reached in time for further monitoring to take place in the summer of 2019 and beyond but, as at the end of June 2019, it remains uncertain whether an agreement acceptable to both parties will be reached. We will continue to work with the landowners as we wish to reach a reasonable agreement, noting that the proposed agreement does not guarantee access, but will provide a framework for gaining access permission. In the interim, the Section 20 Agreement clause referenced above will apply.

5.1.3 Marine Licences

Some of the works associated with the emergency temporary desalination options, such as abstraction intakes and hyper-saline discharge pipelines, will require obtaining a Marine Licence from the Marine Management Organisation (MMO). Early engagement will take place with the MMO should the need for the emergency desalination options arise during the developing phases of drought conditions.

5.2 Measures to ensure environmental protection and biosecurity

5.2.1 Environmental Protection

Some of the sites, species, habitats or features to be monitored and/or requiring mitigation measures are very sensitive and/or are legally protected. It is therefore imperative that appropriate planning and control measures are considered to ensure their protection during monitoring and implementation of mitigation measures. Guidance should be sought from the relevant regulatory body, site owner or relevant expert in developing an environmental protection risk assessment and plan to set out the required measures to avoid damage or loss. These plans should be shared with site owners, Environment Agency, Natural England and other relevant stakeholders in advance of carrying out the activities so that any issues or additional guidance can be discussed.

5.2.2 Biosecurity

Biosecurity is a major issue across the UK to prevent disease and pathogen transfer and the spread of invasive species; drought conditions can increase some of these risks but reduce others. It is important that prior to commencing any monitoring or implementing any mitigation measures, a biosecurity risk assessment is completed to highlight the risks relating to the proposed activities and ensure good working practice is followed. A biosecurity plan should be prepared to set out the risks

and the prevention measures (or mitigation measures should adverse effects arise). It is recommended that biosecurity is also included in site risk assessment procedures alongside other environmental and health and safety risks. The biosecurity plan and site risk assessments should be shared with site owners, Environment Agency, Natural England and other relevant stakeholders.

During a drought, Southern 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.

6 Data Exchange Protocol

6.1 Baseline data exchange

Outside of drought events, key routine baseline environmental monitoring data relevant to the Drought Plan (e.g. river flows, groundwater levels, water quality and ecological data) should be exchanged between Southern Water, Environment Agency and Natural England on a regular basis (suggested at **6-monthly to annual intervals** for agreed monitoring sites plus Southern Water's baseline monitoring programme set out in this EMP). The agreed monitoring sites should be set out in a data exchange spreadsheet and a nominated contact agreed for each party to co-ordinate the exchange, taking account of the frequency of carrying out monitoring at each site. Data should be exchanged electronically wherever possible and only after the appropriate QA checks have been carried out. Any issues with the data should be identified as part of the exchange process.

Each party is responsible for notifying the other parties of any planned changes to the monitoring programmes as early as possible such that the other parties have an opportunity to address any gaps in the dataset that this may cause.

Where required, any licensing arrangements should be put in place to enable efficient exchange of the datasets.

6.2 In-drought data exchange

During a drought, Southern Water will liaise closely with the Environment Agency and Natural England, including in respect of the in-drought monitoring programmes of each party. In the initial stages of a developing drought, there will be regular communication established and the on-set of drought environmental monitoring will be confirmed so that each party is aware of planned activities.

As far as practicable, any relevant environmental data collected by each party will be made available to the other parties (subject to appropriate licensing arrangements where necessary which are assumed to have been agreed as part of the baseline data exchange process) through electronic transfer wherever possible in a timely manner (suggested as normally **within 1 working week** of the necessary data compilation and/or analysis having been completed).

In addition to the data exchange, each party shall share as early as possible their planned in-drought monitoring programmes together with any triggers established to enhance or extend the monitoring frequency and/or spatial coverage. Any changes to the plans should be communicated in a timely manner so that other parties can react accordingly.

Southern Water will also establish communications with relevant contacts in the Environment Agency and Natural England to discuss potential mitigation measures in respect of proposed Drought Permits / Orders, and agree the specific monitoring and trigger conditions for their implementation,

building on the information within this EMP but taking account of the prevailing environmental conditions.

6.3 Post-drought data exchange

Post-drought, Southern Water will continue to liaise closely with the Environment Agency and Natural England to agree and confirm the targeted, specific post-drought monitoring programmes of each party. For Southern Water, this will be based on the proposed monitoring measures set out in this EMP and further informed by the findings of the specific in-drought monitoring activities and the prevailing environmental conditions. Given that compensation measures may be required in light of the in-drought and post-drought monitoring of impacts linked to Drought Permits / Orders, it is considered appropriate that the data exchange timeframes set out for the in-drought monitoring should apply in the initial weeks following the cessation of the Drought Permits / Orders, but reverting to the baseline frequency once drought recovery has been agreed to have occurred (noting this will vary from location to location, and from feature to feature).

The post-drought monitoring data should be pooled by all parties and meetings arranged to review and agree the key findings arising from the data on a regular basis (frequency to be agreed dependent on the prevailing conditions) until it is agreed that environmental recovery has largely occurred. It is recommended that a joint summary paper is produced to set out the key findings of fact in relation to any damage and subsequent recovery of relevant key environmental features. This should be used to direct and target any required post-drought compensation measures which should be recorded for future reference.

All data collated during the drought and post-drought (to the point of recovery of the relevant environmental features) should be reviewed by Southern Water and used to update the Environmental Assessment Reports, HRA and WFD assessment reports as necessary in advance of the next Drought Plan submission.

PART B

MONITORING AND MITIGATION DETAILS FOR EACH DROUGHT PLAN SUPPLY-SIDE OPTION

7 Monitoring and Mitigation for each Drought Permit or Order

The following tables set out the Drought Permit / Order site-specific baseline data acquisition and monitoring, in-drought monitoring and mitigation and post-drought monitoring and compensation measures in line with the Environment Agency's drought planning guidance.

Where negligible or minor adverse impacts are anticipated as set out in the Environmental Assessment Reports, no further monitoring or mitigation has been recommended in line with the Environment Agency guidance, except where otherwise agreed. The monitoring and mitigation for impacts assessed as being of moderate or major significance is set out in tables below.

IT IS IMPORTANT THAT THESE TABLES ARE READ IN CONJUNCTION WITH THE RELEVANT ENVIRONMENTAL ASSESSMENT REPORT FOR THE DROUGHT PERMIT / ORDER AS THESE REPORTS PROVIDE THE NECESSARY BACKGROUND AND CONTEXT TO THE PROPOSED MEASURES SET OUT IN THESE TABLES.

IT SHOULD ALSO BE NOTED THAT THESE TABLES COVER THE MAXIMUM EXTENT OF THE IN-DROUGHT MONITORING REQUIREMENTS WHERE DROUGHT PERMITS / ORDERS HAVE MULTIPLE STAGES OF IMPLEMENTATION AND/OR DIFFERENT SEASONS FOR IMPLEMENTATION: FOR SOME OF THE EARLIER STAGES OF IMPLEMENTATION OR SOME SEASONS, A REDUCED SCALE OF MONITORING WILL BE APPROPRIATE.

7.1 Western Area Drought Permits and Orders

7.1.1 Lukely Brook

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Solent Maritime SAC Medina Estuary SSSI Medina Estuary (Transitional Water Body)	Changes in habitat structure due to decreased freshwater input	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence.	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought.	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought permit implementation compared to the antecedent environmental drought conditions.	None applicable.	In year following drought permit implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. If existing habitats have been lost or damaged due to the drought permit, consider scope for regeneration of habitats or otherwise consider compensatory habitat options.	Southern Water in agreement with EA and NE
Solent and Southampton Water SPA and Ramsar site Medina Estuary SSSI Medina Estuary (Transitional Water Body)	Habitat degradation as a result of decreased river velocity, or level and velocity due to lower flows. Bird assemblages: Decrease in food sources as a result of changes in water quality Changes in food sources as a result of changes in water quality Population impacts as a result of adverse conditions during breeding season	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Obtain any bird monitoring data available	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought. Carry out monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought permit implementation compared to the antecedent environmental drought conditions. Carry out further monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	None applicable.	In year following drought permit implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. If existing habitats have been lost or damaged due to the drought permit, consider scope for regeneration of habitats or otherwise consider compensatory habitat options. In the year following the drought permit continue monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Southern Water in agreement with EA and NE
Fish community, including Brown Trout, European eel, river lamprey and Bullhead Lukely Brook	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows,	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitoring populations at each year. Sampling to occur at 2 confirmed sites in upstream and downstream perennially flowing reaches to provide appropriate coverage and compliment previous EA surveys (as agreed with the EA) Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is	In the year following drought permit implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA. Three years post drought permit monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
	reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.				unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	Including fish scale analysis.	
Macrophytes Lukely Brook	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of data Collate any available local macrophyte data. Carry out at an annual frequency, walkover and river macrophyte surveys at 1 site in the Lukely Brook. Ideally, surveys will take place over both a normal year and dry years and will complement existing EA monitoring, as discussed with the EA) To be carried out June-September period once per year Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP. Repeat surveys every 3 years.	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought permit implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought permit implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA
Macroinvertebrates Lukely Brook	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys each year for both spring and autumn seasons. Sampling to occur at 2 confirmed sites in upstream and downstream reaches to provide appropriate coverage and compliment previous EA surveys (as agreed with the EA) Identify specimens to species/mixed taxonomic level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Water Quality Lukely Brook Medina Estuary (Transitional Water Body)	Potential reductions in water quality due to reductions in flow.	Lack of data for these reaches. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) for transitional water, pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) for transitional water, pH, turbidity, conductivity, salinity (for transitional water only) and water temperature.	Carry out water quality monitoring at the baseline survey sites in each impacted reach during low flows / low tide conditions to assess impacts of drought permit. Monthly sampling regime during drought permit implementation. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) for transitional water, pH, turbidity, conductivity, salinity (for transitional water only) and water temperature.	Consider measures to address identified point sources of nutrient loading if SRP readings are high.	Repeat water quality sampling activity for 3 months after cessation of the drought permit or until flows in Lukely Brook recover above Q95 flows. No other action required outside of routine baseline monitoring programmes.	Southern Water in agreement with EA
Scheduled Monument Clatterford Roman Villa	Potential reduction in river flows having adverse effect on water-dependent features of this site	Discuss potential impacts on any water-dependent features of this heritage asset with the site owner and understand how the drought permit might impact on these features. Agree scope for any monitoring or mitigation measures.	Discuss prevailing drought conditions with site owner and assess current impacts of drought on water-dependent features. Implement any agreed monitoring, including any triggers for implementing any agreed mitigation measures.	Regular contact with site owner to understand how the drought permit may be affecting any water-dependent features and monitor against any agreed triggers for implementation of any mitigation measures.	Implement agreed mitigation measures.	Post-drought permit monitoring of any water-dependent features to assess recovery from any adverse effects due to drought permit implementation. Agree any post-drought permit compensation measures as appropriate with site owner and implement as may be agreed.	Southern Water in agreement with site owner and/or Historic England
Groundwater level Observation boreholes BH1, BH2, HA1, HA2, HA3	Lack of groundwater level data	Seek to install additional long term groundwater monitoring (water level loggers set at a minimum of daily level readings) at key observation boreholes where feasible (loggers originally installed as part of the 2006 drought permit application).	Continue monitoring the groundwater levels for the listed observation boreholes	Continue monitoring the groundwater levels for the listed observation boreholes	Not applicable	Continue monitoring the groundwater levels for the listed observation boreholes	Southern Water in agreement with EA

7.1.2 Test Valley

Feature	Potential Impact identified in EAR	Baseline Monitoring Key locations	On-set of environmental drought Monitoring and trigger setting	During Drought Order Implementation Period Trigger and monitoring to inform mitigation action	 Mitigation actions triggered by monitoring	Post Drought Order Monitoring and post-drought mitigation (where applicable)	Responsibility for monitoring and mitigation
Mottisfont Bats SAC and SSSI	Reduction in prey available for those species which forage over Wallop Brook and margins	Collate existing information about use of Wallop Brook by bat species and talk to landowners, EA and NE. Bat survey at strategic locations along Wallop Brook between Broughton pumping station (upstream is ephemeral during dry periods under baseline conditions) and downstream with confluence of River Test.	Repeat survey if baseline older than 2 years.	Complete monthly targeted bat surveys to establish if significant change in use of Wallop Brook during implementation of drought order.	Consider possible in-stream measures or adjustments to improve habitat conditions and confluence with River Test (where water will remain).	In the year following drought order implementation, undertake post-drought bat surveys at the baseline monitoring sites to substantiate the level of impact. Consider localised habitat improvements that could be made to restore prey availability.	Southern Water in agreement with EA and NE
Fish community, including Brown/Sea Trout, European eel and bullhead **Wallop Brook**	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitor populations at 2 monitoring sites for Wallop Brook. This will include coverage of both upstream and downstream reaches and will complement the existing EA monitoring, as discussion with the EA) 1 survey round every 1 year at same site Collate any further information from local knowledge and EA local staff, plus local biological records (including angling associations and riparian owners)	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach where safe and practical to do so. Measure dissolved oxygen, conductivity, turbidity and temperature in the field using calibrated handheld equipment, plus water quality samples for laboratory analysis (including ammonia and SRP) Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional regular walkover surveys, if situation is expected to deteriorate in river sections known to contain high fish densities. Measure dissolved oxygen, conductivity, turbidity and temperature in the field using calibrated handheld equipment during walkover surveys to provide early warning of any risks to fish. Liaison as appropriate with EA and local angling associations / riparian owners as to the current conditions in the river.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA. Three years post drought order monitoring at baseline monitoring sites to determine relative health of year classes which may have been influenced by the drought order, Including fish scale analysis.	Southern Water in agreement with EA
Macrophytes **Wallop Brook**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of data along entire reach. Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in the reach (site selected with EA consultation). Surveys will take place once per year, ideally across normal and dry years. [3]. To be carried out June-September and will complement existing EA monitoring, as discussed with the EA)	Seasonal walkover and carry out macrophyte survey at the baseline survey site (if during plant growing season) Carry out water quality sampling at same time, including samples for SRP.	Survey to be undertaken at baseline monitoring site and macrophytes identified (if drought order implemented in plant growing season) and carry out water quality sampling at same time, including samples for SRP. Walkover survey to identify any key sources of nutrient loading.	Consider measures to address identified point sources of nutrient loading. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought order implementation surveys at the baseline monitoring site for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA

[3] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring Key locations	On-set of environmental drought Monitoring and trigger setting	During Drought Order Implementation Period Trigger and monitoring to inform mitigation action	 Mitigation actions triggered by monitoring	Post Drought Order Monitoring and post-drought mitigation (where applicable)	Responsibility for monitoring and mitigation
		Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.					
Macroinvertebrates **Wallop Brook**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Collate available local records to improve baseline datasets. Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys each year for both spring and autumn seasons. Sampling to occur at 2 confirmed sites in upstream and downstream reaches to provide appropriate coverage and compliment previous EA surveys (as agreed with the EA) Identify specimens to species/mixed taxonomic level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal baseline monitoring programmes.	Southern Water in agreement with EA
Water Quality **Wallop Brook**	Potential reductions in water quality due to reductions in flow.	Limited baseline water quality data available. Carry out water quality monitoring at 2 sites at times of low flows in the Wallop Brook (ideally at flows around Q_{95}) to assess baseline water quality and potential impacts due to the drought order. Repeat surveys 1 x each year under low flow conditions (ideally at flows around Q_{95}) Parameters to be analysed are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen, pH, turbidity, suspended sediment and temperature. Hand-held probe readings for appropriate parameters plus samples for laboratory analysis.	Water quality monitoring at baseline monitoring sites. Parameters to be analysed are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen, pH, turbidity, suspended sediment and temperature. Hand-held probe readings for appropriate parameters plus samples for laboratory analysis.	Water quality monitoring at baseline monitoring sites once every month (plus targeted water quality sampling linked to walkover surveys as set out above). Parameters to be analysed are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen, pH, turbidity, suspended sediment and temperature. Hand-held probe readings for appropriate parameters plus samples for laboratory analysis.	Consider deployment of aeration equipment in key reaches with critically low oxygen levels.	No action required outside of routine baseline monitoring programme.	Southern Water in agreement with EA
Water vole **Wallop Brook**	Reduced habitat availability and/or food sources (Holborough and Burham Marshes SSSI)	Discuss with EA/Hampshire and IoW Wildlife Trust the availability of existing baseline survey information. Complete surveys if available data not adequate Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence and habitat conditions. Install gauge boards and monitor water levels	Carry out further survey to assess any risk to local population. Monitor water levels.	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Hampshire and IoW Wildlife Trust.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA & NE
Purple moor grass and rush pastures **Wallop Brook**	Decrease in habitat quality and extent as a result of decreased freshwater input	To establish a baseline, monitoring should incorporate: Walkover survey to further assess the level of groundwater and/or hydrological connectivity with this	Walkover survey to assess the level of groundwater and/or hydrological connectivity with this habitat, and whether the baseline connectivity has been lost or is at risk of being lost in the prevailing drought	Surveillance walkover to investigate if hydrological connectivity is lost during drought order implementation, if not already lost due to antecedent environmental drought conditions.	None applicable.	In year following after drought order implementation, carry out repeat walkover survey to assess any damage to the habitat that may have arisen due to the drought order and	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring Key locations	On-set of environmental drought Monitoring and trigger setting	During Drought Order Implementation Period Trigger and monitoring to inform mitigation action	 Mitigation actions triggered by monitoring	Post Drought Order Monitoring and post-drought mitigation (where applicable)	Responsibility for monitoring and mitigation
		habitat. Collate any available existing evidence of water levels and hydrological connectivity associated with this habitat.	conditions.			assess extent of recovery. If existing habitats have been lost, consider scope for replanting / re-creation of habitats, or otherwise consider compensatory habitat options.	
Priority headwater habitat: chalk river **Wallop Brook**	Increase in dry section of river downstream of Broughton	Targeted walkover survey (RHS and risk mapping) to identify habitats sensitive to drought and any refuge habitats in the lower part of the river, downstream of Horsebridge Road, which will not be impacted. Spot flow and water quality monitoring.	Repeat targeted walkover survey to assess conditions under prevailing baseline drought conditions. Spot flow and water quality monitoring.	Monthly check of habitats identified as sensitive to drought in baseline work and refuge areas, to monitor any deterioration during implementation of drought order. Spot flow and water quality monitoring at selected sites.	None applicable.	In year following after drought order implementation, carry out repeat targeted walkover survey to assess any damage to the habitat that may have arisen due to the drought order and assess extent of recovery. Due to the chemistry of the chalk streams, “concredation” of riffle habitat may occur and therefore physical works may be required to break this up.	Southern Water in agreement with EA
Hydrology and Hydrogeology Eveley Farm Houghton observational borehole and Test Valley gauging station on Wallop Brook	Data collection stopped in 2005 and 2011 respectively	Re-install permanent monitoring of borehole if possible and review feasibility of flow gauging at Test Valley to extend historic baseline data set	Continue baseline monitoring to review prevailing groundwater and river flow conditions prior to drought order implementation	Continue baseline monitoring to review prevailing groundwater and river flow conditions to assess potential effects of drought order implementation	Not applicable	Continue baseline monitoring to review groundwater and river flow conditions.	Southern Water in agreement with EA
Fishing Wallop Brook	Impacts on flow, water quality and ecology may adversely affect fishing	Collate further information on fish population (see ‘fish’ monitoring above) Collate further information on level of fishing activity and key contacts for angling associations and riparian owners in dialogue with the EA	Liaison with angling associations and riparian owners along with the EA to review prevailing conditions and monitoring findings to assess risks to fishing activity if drought order to be implemented	Liaison with angling associations and riparian owners along with the EA to review prevailing conditions and monitoring findings to assess risks to fishing activity during drought order implementation	See above for mitigation measures for fish	Liaison with angling associations and riparian owners along with the EA to review monitoring findings to assess impacts to fishing activity as a consequence of the drought order See mitigation and compensation measures for fish above	Southern Water in agreement with EA

7.1.3 Eastern Yar

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post-Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Solent Maritime SAC Medina Estuary SSSI Medina estuary (Reach 3)	Changes in habitat structure due to decreased freshwater input	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence.	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought.	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought order implementation compared to the antecedent environmental drought conditions.	None applicable.	In year following drought order implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options.	Southern Water in agreement with EA and NE
Solent and Southampton Water SPA and Ramsar site Medina Estuary SSSI Medina estuary (Reach 3)	Habitat degradation as a result of decreased freshwater flow inputs to the estuary. Bird assemblages: Changes in food sources as a result of changes in water quality and ecology Population impacts as a result of adverse conditions during breeding season	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Obtain any bird monitoring data available Carry out a baseline water quality survey for SRP and for ammoniacal nitrogen	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought. Carry out monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought order implementation compared to the antecedent environmental drought conditions. Carry out further monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	None applicable.	In year following drought order implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options. In the year following the drought order continue monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Southern Water in agreement with EA and NE
Water Quality **All reaches including estuarine**	Increases in nitrogen and phosphorous concentrations	Lack of data for impacted reaches including Medina Estuary. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) (for transitional water), pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Monitor for dissolved inorganic nitrogen and SRP in estuarine reaches and ammoniacal nitrogen and SRP in freshwater reaches	Monitor for dissolved inorganic nitrogen and SRP in estuarine reaches and ammoniacal nitrogen and SRP in freshwater reaches	No action required outside of routine baseline monitoring programme.	Monitor for dissolved inorganic nitrogen and SRP in estuarine reaches and ammoniacal nitrogen and SRP in freshwater reaches	Southern Water in agreement with EA and NE

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post-Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Macrophytes **Reaches 1 and 2**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of data Collate any available local macrophyte data. Carry out annual walkover and river macrophyte survey at 1 site (deemed most suitable after consultation with the EA). Surveys ideally to be completed in normal and a dry years[4] and will compliment previous Environment Agency Monitoring, as discussed with the EA. Surveys to be carried out June-September period. Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP. Repeat surveys every 1 year.	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA
Estuarine macroalgae and phytoplankton **Transitional water body Reach 3**	Alteration to community composition as a result of water quality deterioration Decrease in habitat availability as a result of algal blooms	Carry out summer macroalgal surveys using WFD fucoid extent tool at upstream limit and median salinity, plus WFD opportunistic macroalgae tool at 1 x baseline monitoring site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat survey every year in summer. Carry out phytoplankton surveys (chlorophyll-a 90th percentile, elevated count and seasonal succession) in spring and summer at 1 x baseline site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat surveys every year in spring and summer. Identify any key point sources of nutrient loading during surveys. Carry out water quality sampling at same time as surveys, including samples for SRP and ammoniacal nitrogen.	Carry out macroalgae/phytoplankton surveys at the baseline survey site Carry out water quality sampling at same time including samples for SRP. Identify any key sources of nutrient loading.	Survey to be undertaken of macroalgae/ phytoplankton at baseline monitoring site every month during the drought order implementation. Carry out water quality sampling at same time including samples for SRP.	Consider measures to address identified point sources of nutrient loading.	Carry out post-drought order implementation surveys at the baseline monitoring site on a monthly basis for 6 months to understand the extent of recovery from any adverse impacts. Revert to the annual baseline monitoring programme thereafter. No specific post-drought permit / order mitigation measures identified.	Southern Water in agreement with EA

[4] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post-Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Freshwater macroinvertebrates **River Medina Reach 1 and 2**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Collate available local records to improve baseline datasets. Collate available local records to improve baseline datasets. Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys. Agreed coverage with EA is 1 site in reach 2 and 2 sites in reach 1. Sampling to be undertaken every year in spring and autumn, respectively. Identify to species/mixed taxonomic level. Carry out a baseline water quality survey for SRP and for ammoniacal nitrogen	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA
Freshwater fish community (Reaches 1 and 2), including European eel, Brown trout, bullhead and brook lamprey Estuarine fish community (Reach 3)	Decreased growth, morphological change and / or alteration to feeding as a result of decreased estuarine productivity Increased mortality as a result of predation. Mortality as a result of water quality deterioration Increase in significance of barriers as a result of decreased flows Salinity gradient will alter which will affect primary productivity of the estuary and therefore their food source.	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys for monitoring populations to be conducted. Agreed coverage with EA is 1 site in reach 2 and 2 sites in reach 1. Sampling locations will also complement existing EA monitoring, as discussed with the EA) 1 survey round every 1 year at same site. Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought permit implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA. Three years post drought permit monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post-Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Mudflats **Transitional water body Reach 3**	Decrease in habitat quality and extent as a result of decreased freshwater input Changes in sediment dynamics as a result of decrease freshwater input Changes in nutrient dynamics as a result of decreased freshwater input Decrease in buffering capacity Changes in water quality, especially SRP altering community structure and food webs	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity with the mudflat habitats. Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Carry out a baseline water quality survey for SRP and for ammoniacal nitrogen	Surveillance walkover of mudflat habitats and investigate scale of any hydrological effects at low tide during environmental drought.	Surveillance walkover of mudflat habitats and investigate any changes due to reduced freshwater inflows during drought order implementation compared to the antecedent environmental drought conditions.	None applicable.	In year following drought order implementation, carry out appropriate monitoring of mudflat habitats to assess any changes to the baseline survey conditions. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options.	Southern Water in agreement with EA and NE

In addition to the baseline monitoring and in-drought mitigation measures specified above, as part of the Habitats Regulations Assessment, specific surveys and a mitigation programme have been proposed for agreement with Natural England in relation to European sites. This is set out in Annex 11 (HRA Report).

7.1.4 Caul Bourne

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Solent Maritime SAC Newtown Harbour SSSI and NNR	Changes in habitat structure due to decreased freshwater input	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity with the saltmarsh and mudflat habitat, and risk of degradation from drought order. Carry out survey of water dependent species that are linked to these habitats (if hydrologically connected and at risk of impact from drought order) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Survey of Shalfleet Creek to confirm hydrological connectivity and carry out a baseline water quality survey for SRP, for ammoniacal nitrogen, dissolved inorganic nitrogen, dissolved oxygen, salinity, temperature and conductivity at spring low tide ideally in hot weather conditions.	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought. Repeat baseline survey of Shalfleet Creek at spring low tide to confirm impact of environmental drought on hydrological and water quality conditions.	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought order implementation compared to the antecedent environmental drought conditions. Carry out monitoring of water dependent species that are linked to these habitats Repeat baseline survey of Shalfleet Creek at spring low tide to confirm impact of drought order on hydrological and water quality conditions.	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	In year following drought order implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. Repeat baseline survey of Shalfleet Creek at spring low tide to confirm recovery from any impacts of drought order on hydrological and water quality conditions. Carry out monitoring of water dependent species that are linked to these habitats. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options.	Southern Water in agreement with EA and NE
Solent and Southampton Water SPA and Ramsar site	Habitat degradation as a result of decreased freshwater flow inputs to the estuary. Bird assemblages: Changes in food sources as a result of changes in water quality and ecology Population impacts as a result of adverse conditions during breeding season	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Obtain any bird monitoring data available Carry out a baseline water quality survey for dissolved inorganic nitrogen and for ammoniacal nitrogen	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought. Carry out monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought order implementation compared to the antecedent environmental drought conditions. Carry out further monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	In year following drought order implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options. In the year following the drought order continue monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Southern Water in agreement with EA and NE

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Fish community, including Brown/Sea Trout, Brook/River Lamprey, European eel and Bullhead **Caul Bourne** Estuarine fish community, including European eel, grey mullet and bass **Newtown transitional water body**	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Recent fish populations are not well understood as a result of lack of survey data. Electric-fishing surveys for monitoring populations to be conducted in freshwater reaches with a further trawl survey in the downstream estuary. Agreed coverage with EA includes 2 sites in the River Caul Bourne (upstream and downstream reaches) and 1 estuarine site in Newtown Harbour. Sampling locations will also complement existing EA monitoring, as discussed with the EA) 1 survey round every 1 year per site. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment at same time as the surveys. Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkover surveys, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring site to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA. Three years post drought order monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis.	Southern Water in agreement with EA
Macrophytes **Caul Bourne**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of data Collate any available local macrophyte data. Carry out walkover and river macrophyte surveys at 2 sites in the Caul Bourne (upstream and downstream). Surveys will ideally be undertaken in both normal and a dry years[5]. They will complement existing EA monitoring, as discussed with the EA). To be carried out June-September period. Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for ammoniacal nitrogen and SRP. Repeat surveys every 1 year.	Seasonal walkover and carry out macrophyte surveys at the baseline survey site (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline site including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought order implementation surveys at the baseline monitoring site for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA

[5] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Estuarine macroalgae and phytoplankton **Newtown transitional water body**	Alteration to community composition as a result of water quality deterioration Decrease in habitat availability as a result of algal blooms	Carry out summer macroalgal surveys using WFD fucoid extent tool at upstream limit and median salinity, plus WFD opportunistic macroalgae tool at 1 x baseline monitoring site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat survey every year in summer. Carry out phytoplankton surveys (chlorophyll-a 90th percentile, elevated count and seasonal succession) in spring and summer at 1 x baseline site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat surveys every year in spring and summer. Identify any key point sources of nutrient loading during surveys. Carry out water quality sampling at same time as surveys, including samples for dissolved inorganic nitrogen and SRP.	Carry out macroalgae/phytoplankton surveys at the baseline survey site Carry out water quality sampling at same time including samples for SRP. Identify any key sources of nutrient loading.	Survey to be undertaken of macroalgae/ phytoplankton at baseline monitoring site every month during the drought order implementation. Carry out water quality sampling at same time including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	Carry out post-drought order implementation surveys at the baseline monitoring site on a monthly basis for 6 months to understand the extent of recovery from any adverse impacts. Revert to the annual baseline monitoring programme thereafter. No specific post-drought order mitigation measures identified.	Southern Water in agreement with EA
Freshwater Macroinvertebrates **Caul Bourne**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Collate available local records to improve baseline datasets. Collate available local records to improve baseline datasets. Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys. For adequate coverage across the reach, 3 sites have been agreed with the EA with 1 further site, subject to walkover and confirmation of need. Per site, sampling will occur every year in spring and autumn. Survey sites will complement the existing EA monitoring, as discussed with the EA. Identify to species/mixed taxonomic level.	Seasonal monitoring of macroinvertebrates at the baseline survey site. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey site. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal baseline monitoring programme.	Southern Water in agreement with EA
Estuarine Bird community (including Black-tailed godwit, Ringed plover, curlew) **Newtown transitional water body**	Loss of habitat during incidences of decreased water levels during over-wintering period Decrease in food sources as a result of changes in water levels and water quality during over-wintering period	Carry out habitat walkover survey and wintering bird surveys in transitional water body during over-wintering period. Identify any key point sources of nutrient loading. Repeat surveys every 3 years.	Habitat walkover survey and carry out wintering bird surveys at the baseline survey sites (if during over-wintering period) Identify any key point sources of nutrient loading.	Habitat walkover survey and carry out wintering bird surveys at the baseline survey sites (if during over-wintering period) Identify any key point sources of nutrient loading.	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	Carry out post-drought order implementation surveys for 2 consecutive over-wintering periods to understand the extent of recovery from any adverse impacts. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA and NE
Estuarine Macroinvertebrates **Newtown transitional water body**	Reduction in abundance or distribution as a result of decreased freshwater input.	Estuarine macroinvertebrate populations are not well understood as a result of lack of data. Collate available local records to improve	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites.	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	No action required outside of routine seasonal baseline monitoring programmes.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
		baseline datasets. Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys. Repeat every year in spring and autumn. Identify to species level.		Samples to be collected and identified to species level.	Consider possible in-situ measures or adjustments to improve habitat conditions.		
Chalk river and priority headwater habitat	Increase in dry section of river	Targeted walkover survey (RHS and risk mapping) to identify habitats sensitive to drought and any refuge habitats which will not be impacted. Spot flow and water quality monitoring.	Repeat targeted walkover survey to assess conditions under prevailing baseline drought conditions. Spot flow and water quality monitoring.	Monthly check of habitats identified as sensitive to drought in baseline work and refuge areas, to monitor any deterioration during implementation of drought order. Spot flow and water quality monitoring at selected sites.	None applicable.	In year following after drought order implementation, carry out repeat targeted walkover survey to assess any damage to the habitat that may have arisen due to the drought order and assess extent of recovery. Due to the chemistry of the chalk streams, “concredation” of riffle habitat may occur and therefore physical works may be required to break this up.	Southern Water in agreement with EA
Groundwater Monitoring **Observation boreholes at Apes Down, Brightstone Forest and Ashengrove**	Frequency of data collection not accounting for impacts on monthly dip record	Increase monitoring from monthly to daily for: Apes Down, Brightstone Forest and Ashengrove observation boreholes, installing water loggers where appropriate or feasible	Continue baseline monitoring activities	Continue baseline monitoring activities	Not applicable	Continue baseline monitoring activities	Southern Water in agreement with EA
Water Quality **All reaches including estuarine**	Increases in nitrogen concentrations	Lack of data for impacted reaches including Shalfleet Creek. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) (for transitional water), pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Monitor for dissolved inorganic nitrogen in estuarine reaches and ammoniacal nitrogen in freshwater reaches	Monitor for dissolved inorganic nitrogen in estuarine reaches and ammoniacal nitrogen in freshwater reaches	No action required outside of routine baseline monitoring programme.	No action required outside of routine baseline monitoring programme.	Southern Water in agreement with EA and NE

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Landscape **Isle of Wight Area of National Beauty (AONB)** **Isle of Wight National Character Area (NCA)**	Potential impact on water related features	Collation of appropriate data as part of the baseline monitoring programme to inform a landscape impact assessment in dialogue with AONB officers and Natural England. Repeat assessment every 5 years (or unless material changes to the landscape)	Repeat landscape assessment from baseline activities to establish any changes arising from the environmental drought to provide a drought baseline.	Repeat landscape assessment to establish any changes arising from the drought order.	No specific measures but other mitigation measures for other features may help to ameliorate adverse effects of the drought order.	None applicable.	Southern Water in agreement with AONB officers and Natural England
Heritage **Impacted Mill**	Potential impacts on mill operation and water setting of the heritage feature	Discuss operation of the mill with site owner and understand how the mill would operate in drought conditions.	Discuss prevailing drought conditions with site owner and assess current impacts of drought on mill operations. Confirm how the mill will operate if the drought order implemented and whether it can be optimised to help protect the water environment.	Regular contact with site owner to understand how the drought order may be affecting mill operations.	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	None applicable	Southern Water in agreement with site owner and EA

In addition to the baseline monitoring and in-drought mitigation measures specified above, as part of the Habitats Regulations Assessment, specific surveys and a mitigation programme have been proposed for agreement with Natural England in relation to European sites. This is set out in Annex 11 (HRA Report).

7.1.5 Shalcombe

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Solent Maritime SAC Newtown Harbour SSSI and NNR	Changes in habitat structure due to decreased freshwater input	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity with the saltmarsh and mudflat habitat, and risk of degradation from drought order. Carry out survey of water dependent species that are linked to these habitats (if hydrologically connected and at risk of impact from drought order) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Survey of Shalfleet Creek to confirm hydrological connectivity and carry out a baseline water quality survey for SRP, for ammoniacal nitrogen, dissolved inorganic nitrogen, dissolved oxygen, salinity, temperature and conductivity at spring low tide ideally in hot weather conditions.	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought. Repeat baseline survey of Shalfleet Creek at spring low tide to confirm impact of environmental drought on hydrological and water quality conditions.	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought order implementation compared to the antecedent environmental drought conditions. Carry out monitoring of water dependent species that are linked to these habitats Repeat baseline survey of Shalfleet Creek at spring low tide to confirm impact of drought order on hydrological and water quality conditions.	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	In year following drought order implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. Repeat baseline survey of Shalfleet Creek at spring low tide to confirm recovery from any impacts of drought order on hydrological and water quality conditions. Carry out monitoring of water dependent species that are linked to these habitats. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options.	Southern Water in agreement with EA and NE
Solent and Southampton Water SPA and Ramsar Site	Habitat degradation as a result of decreased freshwater flow inputs to the estuary. Bird assemblages: Changes in food sources as a result of changes in water quality and ecology Population impacts as a result of adverse conditions during breeding season	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Obtain any bird monitoring data available Carry out a baseline water quality survey for dissolved inorganic nitrogen and for ammoniacal nitrogen	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought. Carry out monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought order implementation compared to the antecedent environmental drought conditions. Carry out further monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	In year following drought order implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options. In the year following the drought order continue monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations)	Southern Water in agreement with EA and NE

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Freshwater fish community, including river lamprey, European eel, brown/sea trout and bullhead **Caul Bourne downstream of confluence with Shalcombe Stream** **Shalcombe Manor Pond** **Shalcombe Stream** Estuarine fish community, including European eel, grey mullet and bass **Newtown transitional water body**	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Recent fish populations are not well understood as a result of lack of survey data. Electric-fishing surveys to monitor populations for at least1 agreed monitoring site downstream the Shalcombe stream tributary with the Caul Bourne (also included in Caul Bourne electro-fishing sites discussed in 'Caul Bourne' section above). Survey sites will complement the existing EA monitoring, as discussed with the EA. 1 survey round every 1 year at same sites Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment at same time as the surveys. Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkover surveys, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA. Three years post drought order monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis.	Southern Water in agreement with EA
Macrophytes **Caul Bourne downstream of confluence with Shalcombe Stream** **Shalcombe Stream**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of data Collate any available local macrophyte data. Carry out a walkover and river macrophyte survey at 1 site downstream the Shalcombe Stream tributary with the Caul Bourne. Ideally, sampling will be undertaken during both normal and a dry years[6]. Agreed survey frequency is 1 per year. (Sites will complement existing EA monitoring, as discussed with the EA). To be carried out June-September period. Identify any key point sources of	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA

[6] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
		nutrient loading. Carry out a baseline water quality survey for SRP, dissolved inorganic nitrogen and for ammoniacal nitrogen Repeat surveys every 3 years.					
Estuarine Bird community (including Black-tailed godwit, Ringed plover, curlew) **Newtown transitional water body**	Loss of habitat during incidences of decreased water levels during over-wintering period Decrease in food sources as a result of changes in water levels and water quality during over-wintering period	Carry out habitat walkover survey and wintering bird surveys in transitional water body during over-wintering period. Identify any key point sources of nutrient loading. Repeat surveys every 3 years.	Habitat walkover survey and carry out wintering bird surveys at the baseline survey sites (if during over-wintering period) Identify any key point sources of nutrient loading.	Habitat walkover survey and carry out wintering bird surveys at the baseline survey sites (if during over-wintering period) Identify any key point sources of nutrient loading.	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	Carry out post-drought order implementation surveys for 2 consecutive over-wintering periods to understand the extent of recovery from any adverse impacts. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA and NE
Freshwater Macroinvertebrates **Caul Bourne downstream of confluence with Shalcombe Stream** **Shalcombe Stream**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Collate available local records to improve baseline datasets. Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys for at least 1 confirmed site and 1 further intended site requiring walkover. Survey sites will complement existing EA monitoring, as discussed with the EA. Identify to species/mixed taxonomic level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal baseline monitoring programme.	Southern Water in agreement with EA
Estuarine Macroinvertebrates **Newtown transitional water body**	Reduction in abundance or distribution as a result of decreased freshwater input.	Estuarine macroinvertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys. Repeat every year in spring and autumn. Identify to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level. .	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne. Consider possible in-situ measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal baseline monitoring programmes.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Estuarine macroalgae and phytoplankton **Newtown transitional water body**	Alteration to community composition as a result of water quality deterioration Decrease in habitat availability as a result of algal blooms	Carry out summer macroalgal surveys using WFD fucoid extent tool at upstream limit and median salinity, plus WFD opportunistic macroalgae tool at 1 x baseline monitoring site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat survey every year in summer. Carry out phytoplankton surveys (chlorophyll-a 90th percentile, elevated count and seasonal succession) in spring and summer at 1 x baseline site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat surveys every year in spring and summer. Identify any key point sources of nutrient loading during surveys. Carry out a baseline water quality survey for SRP, dissolved inorganic nitrogen and for ammoniacal nitrogen.	Carry out macroalgae/phytoplankton surveys at the baseline survey site Carry out water quality sampling at same time including samples for SRP. Identify any key sources of nutrient loading.	Survey to be undertaken of macroalgae/ phytoplankton at baseline monitoring site every month during the drought order implementation. Carry out water quality sampling at same time including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	Carry out post-drought order implementation surveys at the baseline monitoring site on a monthly basis for 6 months to understand the extent of recovery from any adverse impacts. Revert to the annual baseline monitoring programme thereafter. No specific post-drought order mitigation measures identified.	Southern Water in agreement with EA
Chalk river and priority headwater habitat	Increase in dry section of river	Targeted walkover survey (RHS and risk mapping) to identify habitats sensitive to drought and any refuge habitats which will not be impacted. Spot flow and water quality monitoring.	Repeat targeted walkover survey to assess conditions under prevailing baseline drought conditions. Spot flow and water quality monitoring.	Monthly check of habitats identified as sensitive to drought in baseline work and refuge areas, to monitor any deterioration during implementation of drought order. Spot flow and water quality monitoring at selected sites.	None applicable.	In year following after drought order implementation, carry out repeat targeted walkover survey to assess any damage to the habitat that may have arisen due to the drought order and assess extent of recovery. Due to the chemistry of the chalk streams, “concredation” of riffle habitat may occur and therefore physical works may be required to break this up.	Southern Water in agreement with EA
Water Quality **All reaches including estuarine**	Increases in nitrogen concentrations	Lack of data for impacted reaches including Shalfleet Creek. Water quality monitoring at 1 site in each impacted reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN) (for transitional water), pH, turbidity, conductivity, salinity (for transitional water only) and water temperature. Repeat surveys annually at low flow conditions / low tide conditions.	Monitor for dissolved inorganic nitrogen in estuarine reaches and ammoniacal nitrogen in freshwater reaches	Monitor for dissolved inorganic nitrogen in estuarine reaches and ammoniacal nitrogen in freshwater reaches	No action required outside of routine baseline monitoring programme.	No action required outside of routine baseline monitoring programme.	Southern Water in agreement with EA and NE

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Recreation **Shalcombe Manor Pond**	Potential reduction in groundwater levels / river flows associated with sites Groundwater baseflow reduced to pond causing lowering of water levels	Continue to monitor groundwater levels at nearby Chessel observation borehole and abstraction from the Shalcombe boreholes. Install water level logger in Shalcombe Manor Pond in agreement with site owner. Carry out fish surveys (see fish section above) once every 1 year (encompassed in Shalcombe River fish surveying plans above) and take water quality samples at the same time for dissolved oxygen, temperature, ammonia, SRP and turbidity. Discuss potential drought order effects and mitigation measures with site owner.	Maintain contact with site owner to advise any potential reductions in water level at the onset of the drought. Discuss potential mitigation measures with site owner and EA. Continue to monitor groundwater levels, abstraction rates and water level in the pond. Surveillance walkover checks of habitat in pond. Take water quality samples for dissolved oxygen, temperature, ammonia, SRP and turbidity.	Maintain contact with site owner to advise any potential reductions in water level due to the drought order. Discuss potential mitigation measures with site owner and EA. Continue to monitor groundwater levels, abstraction rates and water level in the pond. Surveillance walkover checks of habitat in pond. Take water quality samples for dissolved oxygen, temperature, ammonia, SRP and turbidity.	Consider deployment of aeration equipment if there are critically low oxygen levels. Consider potential measures for topping up pond water levels from other raw water sources of similar chemical composition. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	Following cessation of drought order, carry out fish surveys (see fish section above) and water quality survey on a 3-monthly basis for 1 year to establish recovery from any drought order impacts. If any loss or damage to the pond, fish or habitat, consider potential for restoration measures with site owner. Continue to monitor groundwater levels, abstraction rates and water level in the pond.	Southern Water in agreement with site owner and EA
Landscape **Isle of Wight Area of National Beauty (AONB)** **Isle of Wight National Character Area (NCA)**	Potential impact on water related features	Collation of appropriate data as part of the baseline monitoring programme to inform a landscape impact assessment in dialogue with AONB officers and Natural England. Repeat assessment every 5 years (or unless material changes to the landscape)	Repeat landscape assessment from baseline activities to establish any changes arising from the environmental drought to provide a drought baseline.	Repeat landscape assessment to establish any changes arising from the drought order.	No specific measures but other mitigation measures for other features may help to ameliorate adverse effects of the drought order.	None applicable.	Southern Water in agreement with AONB officers and Natural England.
Heritage **Impacted Mill *Calbourne Mill***	Potential impacts on mill operation and water setting of the heritage feature	Discuss operation of the mill with site owner and understand how the mill would operate in drought conditions.	Discuss prevailing drought conditions with site owner and assess current impacts of drought on mill operations. Confirm how the mill will operate if the drought order implemented and whether it can be optimised to help protect the water environment.	Regular contact with site owner to understand how the drought order may be affecting mill operations.	Seek to manage the operation of impacted Mill with the site owner where feasible to optimise flows to the estuary from Caul Bourne.	None applicable	Southern Water in agreement with site owner and EA

In addition to the baseline monitoring and in-drought mitigation measures specified above, as part of the Habitats Regulations Assessment, specific surveys and a mitigation programme have been proposed for agreement with Natural England in relation to European sites. This is set out in Annex 11 (HRA Report).

7.1.6 Lower Itchen Sources

As set out earlier, a programme of mitigation and monitoring has been agreed with the Environment Agency and Natural England for the Lower Itchen sources Drought Order as part of the Section 20 Agreement. These monitoring and mitigation packages are included in Appendix B and C, respectively.

7.1.7 Candover Augmentation Scheme

As set out earlier, a programme of mitigation and monitoring has been agreed with the Environment Agency and Natural England for the Candover Augmentation Scheme Drought Order as part of the Section 20 Agreement. These monitoring and mitigation packages are included in Appendix D and E, respectively.

7.1.8 Test Surface Water

As set out earlier, a programme of mitigation and monitoring has been agreed with the Environment Agency and Natural England for the Test Surface Water Drought Permit and Drought Order as part of the Section 20 Agreement. These monitoring and mitigation packages are included in Appendix F and G, respectively.

7.2 Eastern Area Drought Permits and Orders

7.2.1 River Medway Scheme

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Medway Estuary and Marshes SPA and Ramsar Site **Reach 6 (Medway estuary)**	Habitat degradation as a result of decreased freshwater flow inputs to the estuary. <u>Bird assemblages</u>: Changes in food sources as a result of changes in water quality and ecology Population impacts as a result of adverse conditions during breeding season	To establish a baseline, monitoring should incorporate: Walkover survey to assess the level of low tide hydrological connectivity between the aquatic habitats (mudflats, sandflats, estuaries) Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence. Obtain any bird monitoring data available. Establish water quality baseline in upper estuary at times of low freshwater flow input to the estuary and at low tide: dissolved oxygen concentration; DIN; SRP and salinity. Repeat survey twice each year at low flow/low tide conditions. Continuous water quality monitoring at three estuarine sites and Ham Hill WwTW proposed to improve baseline understanding of estuarine WQ.	Surveillance walkover of habitats and investigate scale of any hydrological effects at low tide during environmental drought. Carry out monitoring of water dependent species that are linked to these habitats (Over-Wintering birds and summer Breeding Bird populations). Water quality survey in upper estuary at low tide: dissolved oxygen concentration; DIN; SRP and salinity. Installation of continuous water quality monitoring at three estuarine sites and Ham Hill WwTW during 2018 to monitor estuarine WQ. Includes spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114). Set Ammonia trigger levels for WWTW.	Surveillance walkover of habitats and investigate any changes due to reduced freshwater inflows during drought permits/order implementation compared to the antecedent environmental drought conditions. Carry out further monitoring of water dependent species that are linked to these habitats (Over-Wintering and Summer Breeding Bird populations). Water quality survey in upper estuary at low tide: dissolved oxygen concentration; DIN; SRP and salinity. Installation of continuous water quality monitoring at three estuarine sites and Ham Hill WwTW during 2018 to monitor estuarine WQ. Includes spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114).	Consider potential for alternative operation of flows from the Allington locks at low tide to reduce the potential for lower water levels at low tide. Performance enhancements to WwTW,	In year following drought permits/order implementation, carry out appropriate monitoring of habitats to assess any changes to the baseline survey conditions. In the year following the drought order continue monitoring of water dependent species that are linked to these habitats (Winter and Summer Breeding Bird populations) Water quality survey in upper estuary at low tide: dissolved oxygen concentration; DIN; SRP and salinity. Maintain continuous water quality monitoring at three estuarine sites and Ham Hill WwTW for 1 year after drought to monitor estuarine WQ. If existing habitats have been lost or damaged due to the drought order, consider scope for regeneration of habitats or otherwise consider compensatory habitat options in dialogue with Natural England.	Southern Water in agreement with EA and NE
River Beult SSSI **Reach 3b**	Reduction in habitat availability in river channel due to reduced river flow, water depth and wetted area. Risk of water quality deterioration due to low flows. Impact to macroinvertebrate community including: water beetle (*Haliplus laminatus*); hairy dragonfly (*Brachytron pratense*); white-legged damselfly (*Platycnemis pennipes*); ruddy darter dragonfly (*Sympetrum sanguineum*); aquatic snail (*Bithynia leachi*) Impact on macrophyte	Establish baseline environmental conditions, comprising: Further discussions with site owners and walkover survey to assess habitat condition of the impacted reach and relevant water-dependent habitat. Repeat walkover survey every 3 years. Establish baseline monitoring of river level at a suitable section in dialogue with site owner and Natural England. Instigate spot gauging at low flow conditions (Q_{95} flow or lower) and water level logging. Obtain at least 5 low flow spot gauging readings linked to the water level reading (and note the regulation release rate from Bewl Water and abstraction rate at Smallbridge at the time of gauging). Obtain any available site-specific evidence on sensitive designated features (macroinvertebrate and	Surveillance walkover of river habitats and establish any habitat impacts due environmental drought. Where possible (taking care not to disturb in-river habitats), repeat flow gauging at the same site as the baseline survey, noting the regulation releases from Bewl Water and abstraction rate at Smallbridge. Continue to note the river level at the baseline monitoring site. Carry out water quality monitoring for DO, SRP, ammonia and suspended sediment. Identify any key point sources of nutrient loading. Repeat macroinvertebrate sampling and macrophyte survey (if during plant growing season) subject to agreement with Natural England (depending on the vulnerability of the species in drought conditions, survey may be detrimental to the species).	Surveillance walkover of river habitats and establish any habitat impacts due to drought permits/order implementation. Where possible (taking care not to disturb in-river habitats), repeat flow gauging at the same site as the baseline survey, noting the regulation releases from Bewl Water and abstraction rate at Smallbridge. Continue to note the river level at the baseline monitoring site. Carry out water quality monitoring for DO, SRP, ammonia and suspended sediment. Identify any key point sources of nutrient loading. Repeat macroinvertebrate sampling and macrophyte survey (if during plant growing season) subject to agreement with Natural England (depending on the vulnerability of the species in drought conditions, survey may be detrimental	Consider potential local habitat protection or habitat improvement measures, as well as potential for any localised in-river measures to improve local water level/flow velocity in dialogue with NE and EA and where feasible and appropriate. If water quality is adversely affected, consider potential for addressing any point sources of nutrient loading or pollution.	In year after drought permits/order implementation, repeat habitat condition survey to assess any impact of the drought permits/order on river habitat. In the year following cessation of the drought permits/order, repeat macrophyte monitoring to establish any effects of the drought permits/order on these communities. Revert to baseline 3x per year macroinvertebrate surveys. Repeat water quality surveys at the same time as ecology surveys. If existing habitats or species have been lost or damaged, consider scope for replacement / re-creation of habitats or	Southern Water in agreement with EA and NE

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
	community	macrophyte community). Carry out macrophyte survey ideally in a normal year and a dry year[7]. To be carried out June-September (ideally complementing any existing EA or NE monitoring, in discussion with the EA/NE). Identify any key point sources of nutrient loading and carry out water quality sampling including samples for SRP. Repeat surveys every 3 years. Carry out seasonal (spring and autumn) macroinvertebrate surveys[8]. 1 site in the impacted SSSI reach (ideally complementing any existing EA/NE monitoring, in discussion with the EA/NE). Repeat each year.		to the species).		consider compensatory habitat options in dialogue with Natural England.	
Holborough to Burham Marshes SSSI **Reach 5** **River Medway**	Reduction in extent or quality of important flood plain/marsh habitats that are linked to the key designated species including standing water, ditches and dykes, reed beds and associated littoral sediment. Potential impact on designated macrophyte and macroinvertebrate communities due to impacts on habitat.	Establish baseline environmental conditions, comprising: Further discussions with site owners and walkover survey to further assess the level of hydrological connectivity between the River Medway reach 5 and relevant water-dependent habitat. This SSSI lies along the flood plain of the transitional waters of the River Medway. The site includes: standing open water and canals, reedbeds and lowland neutral grassland. A reduction in freshwater from the River Medway Scheme may cause effects for this transitional site but the extent of the connectivity with the main river channel is unclear. Clarification of this to be obtained from walkover surveys. Carry out a monitoring of standing water habitats using Common Standards Methodology[9] criteria for assessing habitat condition where appropriate in dialogue with Natural England. Establish baseline monitoring of standing water levels at the site in dialogue with Natural England (e.g. water depth gauge readings). Carry out macrophyte survey ideally in a normal year and a dry year[10]. To be carried out June-September	Surveillance walkover of water-dependent habitats and investigate if hydrological connectivity is lost or reduced during environmental drought. Carry out appropriate monitoring of standing water habitat using Common Standards Methodology criteria for assessing habitat condition in discussion with Natural England. Repeat standing water level monitoring to provide a drought baseline. Repeat macroinvertebrate sampling and macrophyte survey (if during plant growing season) subject to agreement with Natural England (depending on the vulnerability of the species in drought conditions, survey may be detrimental to the species). Identify any key point sources of nutrient loading and carry out water quality sampling including samples for SRP, noting any algal blooms. Continuous water quality monitoring at three estuarine sites and Ham Hill WwTW proposed to improve baseline understanding of estuarine WQ. Includes spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114). Spot WQ sampling in standing water within the SSSI for parameters specified in January 2018 Drought Permit EA Ref: DP201802114).	Surveillance walkover of water-dependent habitats and investigate if hydrological connectivity is lost or reduced during drought permits/order implementation. Carry out appropriate monitoring of standing water habitat using Common Standards Methodology criteria for assessing habitat condition in discussion with Natural England to identify any effects due to the drought permits/order. Repeat standing water level monitoring to assess changes from the natural drought baseline. Repeat macroinvertebrate sampling and macrophyte survey (if during plant growing season) subject to agreement with Natural England (depending on the vulnerability of the species in drought conditions, survey may be detrimental to the species). Identify any key point sources of nutrient loading and carry out water quality sampling including samples for SRP, noting any algal blooms. Continuous water quality monitoring at three estuarine sites and Ham Hill WwTW proposed to improve baseline understanding of estuarine WQ. Includes spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114).	Consider potential local habitat protection or improvement measures in dialogue with Natural England where feasible and appropriate. If water quality is adversely affected, consider potential for addressing any point sources of nutrient loading or pollution. Performance enhancements to WWTW,	In year after drought permits/order implementation, carry out a repeat of the habitat walkover surveys, water quality, macroinvertebrate and macrophyte surveys and water level readings to assess scale and extent of any impact due to the drought permit/orders and extent of recovery post-drought. If existing habitats or species have been lost or damaged, consider scope for replacement / re-creation of habitats or consider compensatory habitat options in dialogue with Natural England.	Southern Water in agreement with EA and NE

[7] Environment Agency (2011). Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)
[8] Environment Agency (2012). Freshwater macro-invertebrate sampling in rivers. Operational instruction 018_08. (Unpublished procedures manual)
[9] JNCC, Common Standards Monitoring Guidance for Freshwater Habitats and Species – rivers and lakes guidance updated January 2014 and March 2015 respectively, ISSN 1743-8160 (Online)
[10] Environment Agency (2011). Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
		(ideally complementing any existing EA or NE monitoring, in discussion with the EA/NE). Identify any key point sources of nutrient loading and carry out water quality sampling including samples for SRP, noting any algal blooms. Repeat the above surveys every 3 years. Carry out seasonal (spring and autumn) macroinvertebrate surveys[11]. Sites to be agreed in dialogue with NE. Repeat each year. Obtain any available site-specific water level/flow monitoring evidence as well as local data on sensitive features (including the macrophyte and macroinvertebrate communities). Continuous water quality monitoring at three estuarine sites and Ham Hill WwTW proposed to improve baseline understanding of estuarine WQ. Includes spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114). Spot WQ sampling in standing water within the SSSI for parameters specified in January 2018 Drought Permit EA Ref: DP201802114).	Set Ammonia trigger levels for WWTW.				
Medway Estuary MCZ **Reach 6** **Medway Estuary**	Impact on the protected tentacled lagoon worm *(Alkmaria romijni*) due to risk of increased salinity as a consequence of reduced freshwater flow inputs to the estuary.	Establish baseline environmental conditions, comprising salinity readings in those locations inhabited by the tentacled lagoon worm plus licensed monitoring of the species condition and abundance. Continuous water quality monitoring at three estuarine sites Includes spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114). Carry out 3 yearly Tentacled Lagoon Worm survey (*Alkmaria romijni*) to identify spatial distribution of the species within the Medway estuary.	Carry out licensed monitoring of species condition and habitat, alongside repeat of salinity monitoring at same sites as the baseline surveys. Continuous water quality monitoring at three estuarine sites Includes spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114). Carry out Tentacled Lagoon Worm survey (*Alkmaria romijni*) to identify status of the species within the Medway estuary.	Carry out licensed monitoring of species condition and habitat, alongside repeat of salinity monitoring at same sites as the baseline surveys. Trigger caused by significant increase in salinity.	Consider local protection measures in dialogue with Natural England where feasible and appropriate. Translocation.	Repeat tentacled lagoon worm population survey and salinity surveys in the year following cessation of the drought permits/order. If there is loss or damage to the population, consider scope for restoration or otherwise consider compensatory measures in dialogue with Natural England	Southern Water in agreement with EA and NE

[11] Environment Agency (2012). Freshwater macro-invertebrate sampling in rivers. Operational instruction 018_08. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Fish community, including Brown Trout, Lamprey species, European eel and Bullhead **Reaches 1 to 5**	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitor fish populations at 1 site in each of the impacted reaches (1-5) 1 survey round every 3 years at same sites. Collate any further information from local knowledge and EA local staff, plus local biological records. Conduct eel and elver monitoring during spring 2018 at specified abstraction intakes (3).	Walkover survey to identify potential risks to the fish community, including approximation of the number of each fish species (e.g. 10s, 100s) in any ponded reaches due to drought conditions where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment and through continuous WQ monitoring installations. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion. Conduct eel and elver monitoring during drought period at specified abstraction intakes (3).	Additional walkover surveys if situation is expected to deteriorate in river sections known to contain high fish densities. Automated alarm triggers if DO falls below 60% Weekly fish distress monitoring with increased frequency of monitoring during very low flows and periods of low DO.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure] Cease abstraction for time limited period. Consider reservoir release.	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Three consecutive years post drought order monitoring at baseline monitoring site to determine relative health of year classes which may be influenced by the drought order/permit. Including fish scale analysis. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA
Macrophytes **Reaches 1 to 4**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of recent data along entire reach. Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in each of the impacted freshwater reaches (Reaches 1 to 3 plus control) ideally in a normal year and a dry year[12]. To be carried out June-September (ideally complementing the existing EA monitoring, in discussion with the EA) Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP. Repeat surveys every 3 years.	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought order mitigation measures identified.	Southern Water in agreement with EA

[12] Environment Agency (2011). Surveying freshwater macrophytes in rivers. Operational Instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Blue-green algae **Bewl Water Reservoir** **Stage 3 drought permit (summer)**	Increased proliferation of blue green algal blooms at the reservoir due to risk of increased nutrient loading from additional abstraction at Yalding at low flow conditions in summer (Stage 3 drought permit)	Lack of historic records. Collate any historic evidence of blue-green algae from EA and other local knowledge to better assess risks.	Walkover survey of locations in reservoir previously established as at risk of algal blooms. Visual assessment of algal blooms. Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Monthly survey for visual assessment of algal blooms. Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Mitigation of blue-green algal blooms should centre around reporting all blooms to the Environment Agency to ensure that appropriate action can be taken to inform the public. If major risk identified, consider treatment of algal bloom if appropriate in dialogue with EA.	Upon cessation of the drought order and/or or permit, baseline conditions will return. No further monitoring will be required post-drought order/permit implementation. Continue vigilance during standard baseline drought permit monitoring activities.	Southern Water in agreement with EA
Macroinvertebrates **Reaches 1 to 5**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macroinvertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out seasonal (spring, and autumn) macroinvertebrate surveys[13]. 1 site in each of the impacted reaches (Reaches 1 to 4 plus control site) (ideally complementing the existing EA monitoring, in discussion with the EA) Reach 5 to be included in EA airlifting monitoring programme Surveys to be repeated every year in spring and autumn. Identify to species level. Carry out one off RHS survey at the same time.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of baseline seasonal monitoring programmes.	Southern Water in agreement with EA
Water Vole	Reduced habitat availability and/or food sources (Holborough and Burham Marshes SSSI)	Discuss with EA/Kent Wildlife Trust the planned frequency of future surveys following the 2017 survey. Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence and habitat conditions. Install gauge boards and monitor water levels	Carry out further survey to assess any risk to local population. Monitor water levels.	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Kent Wildlife Trust.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA & NE
Depressed river mussel **Reaches 1 to 6**	Reduction in abundance or distribution as a result of reduced water quality / habitat. . Freezing is the major risk to the species if exposed during draw down when air temperature is below 4 Celsius. Monitoring of air temperature should precede any planned draw down of navigation pens for the purposes of this drought permit/ order Low DO is a major threat to the species if water quality	Depressed river mussel populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out 1 survey every 5 years. 1 site above Yalding as a control and 1 site below Yalding within the impacted reaches (Reaches 4 and 5) (ideally complementing the existing EA monitoring, in discussion with the EA). Continuous WQ monitoring and spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114) during 2018.	Seasonal monitoring of depressed river mussel at the baseline survey sites. Samples to be collected and identified to species level. Continuous WQ monitoring and spot WQ sampling for parameters specified in January 2018 Drought Permit EA Ref: DP201802114).	Seasonal monitoring of depressed river mussel at the baseline survey sites. Samples to be collected and identified to species level. Continuous WQ monitoring with DO trigger levels set at 60% as specified in January 2018 Drought Permit EA Ref: DP201802114).	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions. . Cease abstraction for a time limited period if a DO “sag” arises. Consider reservoir release. For Reach 6, seek agreement with Navigation authorities to cease any planned activities that	No action required outside of baseline seasonal monitoring programmes.	Southern Water in agreement with EA and NE

[13] Environment Agency (2012). Freshwater macro-invertebrate sampling in rivers. Operational Instruction 018_08. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
	deteriorates. The proposed monitoring for DO will help assess this risk during drought permit/ order operation.				may adversely affect the species during the drought permit implementation.		
Invasive non-native species (INNS) Himalayan balsam and surveys for any other INNS **All reaches**	Risk of increasing the potential for this species to spread along watercourse	Collate available local records to improve baseline datasets. Baseline surveys required for spatial distribution of Demon Shrimp *Dikerogammarus haemobaphes*	Routine visual monitoring and shrimp trapping of INNS at key water transfer points including Bewl Water specified in January 2018 Drought Permit EA Ref: DP201802114)	Presence detected of INNS at key water transfer sites.	Depending on findings of walkover survey and risk assessment, agree with EA any appropriate risk reduction or control measures taking account of national INNS advice prevailing at the time on control and risk management measures. Eradicate INNS Contribute to Medway Valley Countryside Partnership INNS control programme at level proportionate to extent of impact.	Complete walkover survey of impacted reaches post drought to understand any changes to the coverage of species. Carry out clearance where appropriate to do so in dialogue with the EA and taking account of national INNS advice prevailing at the time on control and risk management measures. Eradicate INNS Contribute to Medway Valley Countryside Partnership INNS control programme at level proportionate to extent of impact.	Southern Water in agreement with EA
Marina and port navigation and boating activities **Chatham Maritime Marina** **Port Werburgh** **Gillingham Marina** **Allington Marina**	Potential for a reduction in connectivity at low tides and therefore impacts to navigation	Discuss potential risks with marina/port owners and boating stakeholders and carry out low tide survey at low flow conditions to determine any potential risks during drought permits/order implementation. Update drought permit risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with marina/port owners and boating stakeholders.	Proactive stakeholder engagement. Repeat baseline survey and update risk assessment as necessary in dialogue with marina/port owners and boating stakeholders to inform of them of possible need for a drought permit/order. Update and review applicable mitigation measures in discussion with marina/port owners and boating stakeholders.	Maintain contact with marina/port owners and boating stakeholders to inform of them of potential changes in connectivity during low tide.	Implement any applicable mitigation measures as agreed with marina/port owners and boating stakeholders (e.g. modifications to moorings). Put forward signage indicating slow refill. Cease abstraction or make flow releases for time limited period	Discuss any residual impacts due to the drought permits/order with marina/port owners and boating stakeholders as appropriate and any potential compensatory measures.	Southern Water in agreement with site owners
Heritage Features **Moats and/or Ponds at Allington Castle; Old Scotney Castle and Share Farm**	Potential reduction in amenity value due to lower water levels in moats and/or ponds or risk of drying up	Discuss hydrological controls on water levels in moats and ponds with site owners and understand how drought conditions may impact the water levels. Consider potential drought order/permit mitigation measures with the site owners.	Discuss prevailing drought conditions with site owners and assess current impacts of drought on water levels. Confirm how the moats/ponds will be sustained if the drought permit/ order is implemented and review mitigation measures.	Regular contact with site owners to understand how the drought permits/order may be affecting water levels in the moats/ponds and the need for instigation of any agreed mitigation measures.	Implement any agreed mitigation measures in agreement with site owners.	Dialogue with site owners as to any impacts or damage due to the drought permit/order implementation. If damage or loss has occurred, consider appropriate compensation measures with site owners.	Southern Water in agreement with site owners
Landscape **Low Weald NCA** **Greater Thames Estuary NCA**	Potential impact on water related features of the NCAs	Collation of appropriate data as part of the baseline monitoring programme to inform a landscape impact assessment in dialogue with Natural England. Repeat assessment every 5 years (or unless material changes to the landscape)	Repeat landscape assessment from baseline activities to establish any changes arising from the environmental drought to provide a drought baseline.	Repeat landscape assessment to establish any changes arising from the drought order.	No specific measures but other mitigation measures for other features may help to ameliorate adverse effects of the drought order.	None applicable.	Southern Water in agreement with NE

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Other Freshwater Abstractors **Various locations in Reaches 1 to 5**	Low river flows may derogate other protected abstraction rights	Dialogue with potentially affected abstractors to understand the precise location of the abstractions and the source of water and to assess the potential impact on their abstraction rights during a drought order/permit. Update risk assessment as appropriate and discuss any potential mitigation measures that could be put in place during drought permit/order implementation.	Proactive stakeholder engagement. Dialogue with potentially affected abstractors to understand existing abstraction conditions during environmental drought. Review potential mitigation measures that could be put in place during drought permit/order implementation.	Maintain dialogue with potentially affected abstractors to assess any impacts of the drought permit/order on abstraction capability beyond that due to the natural drought. Agree any mitigation (or compensation) measures to be implemented if high risk of derogation.	Implement mitigation and/or compensation measures as agreed with the abstractor.	Following cessation of drought permits/order discuss any claims for compensation due to confirmed derogation of abstraction due to drought permit/order implementation. Compensation payments are provided for in Section 79 and Schedule 9 of the Water Resources Act 1991 (as amended).	Southern Water in agreement with abstractors and EA
Angling activities **Reaches 1 to 5**	Potential for a reduction in connectivity and therefore impacts to angling.	Discuss potential risks with EA, angling clubs and stakeholders and assess likelihood of angling at low flow drought conditions to determine any potential risks during drought permit/order implementation. Update drought permit/order risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with EA, angling clubs and stakeholders.	Proactive stakeholder engagement. Update risk assessment as necessary in dialogue with EA, angling clubs and stakeholders to inform of them of possible need for a drought permits/order. Update and review applicable mitigation measures in discussion with EA, angling clubs and stakeholders.	Maintain contact with angling clubs and stakeholders to assess any implications of the drought permits/order on any remaining angling activities.	Implement any applicable mitigation measures as agreed with EA, angling clubs and stakeholders. (e.g. no angling periods)	Discuss any residual impacts due to the drought permits/order with EA, angling clubs and stakeholders as appropriate and any potential compensatory measures.	Southern Water in agreement with EA and owners of fishing rights/angling associations

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7.2.2 Stourmouth

The current sites used by the EA to monitor the physical environment and ecological features within the affected reaches provide a sufficient and robust baseline. Therefore, during the Drought Permit implementation, these existing monitoring locations can be used to confirm the assessment of negligible effects on environmental features.

7.2.3 Faversham sources

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Fish community, including Brown Trout, European eel and Bullhead River Len and Upper Great Stour	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Recent fish populations are not well understood as a result of lack of survey data. Electric-fishing surveys to monitoring populations at 1 x survey on Len (existing EA) and 1 x survey on Upper Great Stour (existing EA). 1 survey round every 3 years at same sites Measure water quality including dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment at same time as the surveys. Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkover surveys, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA. Three years post drought order monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis.	Southern Water in agreement with EA
White-clawed crayfish (*Austropotomobius pallipes*) River Len and Upper Great Stour	Stranding and mortality as a result of a reduction in velocity, depth and/or wetted width, possibly resulting in the exposure of the river bed. Increased mortality (density dependant) as a result of increased predation Increased risk of mortality due to reductions in water quality	Collate available local records to improve baseline datasets and complete RHS/habitat suitability assessment to confirm survey locations. Manual searching or use of bait traps in suitable substrates at identified survey locations between July and October. Water quality sampling to be completed at the same time.	Seasonal monitoring of crayfish at the baseline survey sites. Carry out water quality surveys at same time.	Seasonal monitoring of crayfish at the baseline survey sites. Carry out water quality surveys at same time	Consider possible in-stream measures or adjustments to improve habitat conditions.	In the year following drought order implementation, undertake post-drought crayfish surveys at the baseline monitoring sites to substantiate the level of impact. If white-clawed crayfish populations identified on watercourse, pre-drought mitigation measures may be required to improve resilience.	Southern Water in agreement with EA
Groundwater levels	Lack of data associated with certain boreholes and pumping stations	Seek to install additional long term groundwater monitoring (water level loggers set at a minimum of daily level readings) at key observation boreholes for Faversham sources.	Continue monitoring the groundwater levels for observation boreholes	Continue monitoring the groundwater levels for observation boreholes	Not applicable	Not applicable	Southern Water in agreement with EA
Relief Channel **Dip slope springs** **Ephemeral watercourses** **Scarp slope springs and spring fed watercourses**	Lack of characteristic data of watercourse	Watercourse surveys (winter, spring, summer and autumn) to provide field information regarding hydrological characteristics – also to include spot gauging where feasible. 1 survey per reach. Obtain original EA Spring line survey information and repeat survey	Watercourse surveys to provide field information regarding prevailing flow conditions – also to include spot gauging where feasible. 1 survey per reach.	Watercourse surveys to provide field information regarding prevailing flow conditions – also to include spot gauging where feasible. 1 survey per reach.	Not applicable	Watercourse surveys to provide field information regarding recovery of flow conditions post cessation of drought permit – also to include spot gauging where feasible. 1 survey per reach.	Southern Water in agreement with EA

7.2.4 Darwell

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Dungeness, Romney Marsh and Rye Bay SPA, Ramsar and SSSI – wetland habitat and associated species	Wetland habitat degradation as a result of decreased river flow and/or water levels within ditch network Impacts to: aquatic vegetation, marsh mallow, greater water parsnip, invertebrates, water vole, great crested newt, breeding and wintering birds	Establish baseline environment comprising: • Susceptibility of ditches to drying. • CSMG for ditches – sample survey including sampling of aquatic vegetation and recording of bankside vegetation. • Water vole – desk study, habitat suitability assessment, sampling survey to determine water vole presence • GCN – desk study, habitat suitability index assessment, sampling survey • Medicinal leech – desk study, habitat suitability assessment, sampling survey. • Invertebrate sampling[14,15] • Breeding and wintering bird surveys to supplement existing WeBS data. Obtain any available site-specific water level/flow monitoring evidence or install meters where required. Obtain any available site-specific water quality data or monitor where required Repeat survey every 3 years	Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during environmental drought. Carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition where appropriate, in dialogue with Natural England. Carry out monitoring of water dependent species that are linked to these habitats as identified from the surveillance walkover survey as potentially at risk of the drought permit.	Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during drought order implementation, if not already lost due to antecedent environmental drought conditions. Carry out appropriate monitoring of aquatic habitats using Common Standards Methodology criteria for assessing habitat condition, in discussion with Natural England. Carry out further monitoring of water dependent species as identified as being at risk from the drought order.	Consider local habitat protection measures in dialogue with Natural England where feasible and appropriate. Retaining of water via control structures for water dependent features within designated sites. Water sharing protocol to be established between Southern Water and marsh system pre-drought.	In year after drought order implementation, carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition. Carry out further monitoring of water dependent species to identify any adverse effects of the drought order. If existing habitats have been lost or damaged by the drought permit, consider scope for replacement / re-creation of habitats, or consider compensatory habitat options in dialogue with Natural England.	Southern Water in agreement with EA and NE
Dungeness, Romney Marsh and Rye Bay Ramsar and SSSI – saltmarsh and mudflats	Decrease in habitat quality and extent as a result of decreased freshwater input Changes in sediment dynamics as a result of decrease freshwater input Changes in nutrient dynamics as a result of decreased freshwater input Decrease in buffering capacity Changes in water quality, especially SRP altering community structure and food webs	Carry out baseline habitat survey (including benthic cores and transects where necessary) at low tide assess inter-tidal habitat composition and quality, and confirm drought order risk assessment. Repeat every 3 years.	Repeat baseline survey at low tide to assess prevailing drought conditions at low tide in relation to habitat composition and quality.	Repeat baseline survey at low tide every 2 months to assess any changes due to the drought order implementation at low tide in relation to habitat composition and quality.	None applicable.	In year following after drought order implementation, repeat baseline survey at low tide to establish any adverse effects that may be due to the drought permit. If existing habitats have been lost or damaged, consider scope for re-creation of habitats or consider compensatory habitat options.	Southern Water in agreement with EA and NE
Fish community, including Brown Trout, Lamprey species, European eel and Bullhead **River Rother**	Increased mortality (density dependent) as a result of increased predation and competition	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitor fish populations at 1 site in each of	Walkover survey to identify potential risks to the fish community, including approximation of the number of each fish species (e.g. 10s, 100s) in any ponded reaches due to drought conditions where safe and practical to	Additional walkover surveys if situation is expected to deteriorate in river sections known to contain high fish densities.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact.	Southern Water in agreement with EA

[14] C.M. Drake, D.A. Lott, K.N.A. Alexander & J. Webb (2007) Natural England Research Report NERR005 Surveying terrestrial and freshwater invertebrates for conservation evaluation.
[15] Palmer M, Drake M, Stewart N (2013) A manual for the survey and evaluation of the aquatic plant and invertebrate assemblages of grazing marsh ditch systems Version 6.

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Rother Transitional Water Body	Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	the impacted reaches of the River Rother and the transitional River Rother (reaches 1-5). 1 survey round every 3 years at same sites. Collate any further information from local knowledge and EA local staff, plus local biological records.	do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.		to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	Three consecutive years post drought order monitoring at baseline monitoring site to determine relative health of year classes which may be influenced by the drought order/permit. Including fish scale analysis. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	
Macrophytes **River Rother**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of recent data along entire reach. Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in each of the impacted freshwater reaches (Reaches 1 to 4 plus control site) ideally in a normal year and a dry year[16]. To be carried out June-September (ideally complementing the existing EA monitoring, in discussion with the EA) Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP plus 1 month's worth of continuous monitoring data at several sites which would support the point sample data. Need to examine current and future EA WQ sampling and ensure that either it is maintained in the Strategic monitoring review or SWS collects sufficient samples to gap fill the data. 12 samples every three years would provide a baseline for WQ. Repeat surveys every 3 years.	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought order mitigation measures identified.	Southern Water in agreement with EA

[16] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Ranunculus **River Rother**	Impacts to key growth periods due to reduced flow Change to *Ranunculus* community composition as a result of water quality deterioration	Carry out summer walkover and *Ranunculus* surveys – 1 site in each of the freshwater impacted reaches (Reaches 1 to 4). Identify any key point sources of nutrient loading. Carry out water quality sampling at same time, including SRP. Repeat surveys every 3 years.	Seasonal walkover and carry out *Ranunculus* surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time, including SRP.	Survey to be undertaken and *Ranunculus* identified (if drought order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at same time, including SRP.	Consider measures to address identified point sources of nutrient loading. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. No specific post-drought order mitigation measures identified.	Southern Water in agreement with EA
Estuarine macroalgae and phytoplankton **River Rother Transitional Water Body**	Alteration to community composition as a result of water quality deterioration Decrease in habitat availability as a result of algal blooms	Carry out summer macroalgal surveys using WFD fucoid extent tool at upstream limit and median salinity, plus WFD opportunistic macroalgae tool at 1 x baseline monitoring site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat survey every year in summer. Carry out phytoplankton surveys (chlorophyll-a 90th percentile, elevated count and seasonal succession) in spring and summer at 1 x baseline site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat surveys every year in spring and summer. Identify any key point sources of nutrient loading during surveys. Carry out water quality sampling at same time as surveys, including samples for SRP. plus 1 months' worth of continuous monitoring data at several sites which would support the point sample data	Carry out macroalgae/phytoplankton surveys at the baseline survey site Carry out water quality sampling at same time including samples for SRP. Identify any key sources of nutrient loading.	Survey to be undertaken of macroalgae/ phytoplankton at baseline monitoring site every month during the drought order implementation. Carry out water quality sampling at same time including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider potential measures to reduce any nutrient loading from Rye Wastewater Treatment Works	Carry out post-drought order implementation surveys at the baseline monitoring site on a monthly basis for 6 months to understand the extent of recovery from any adverse impacts. Revert to the annual baseline monitoring programme thereafter. No specific post-drought permit / order mitigation measures identified.	Southern Water in agreement with EA
Blue-green algae **Darwell Reservoir**	Increased proliferation of blue green algal blooms at the reservoir due to increased abstraction from the River Rother for discharge to the reservoir	Collate any historic evidence of blue-green algae from EA and other local knowledge to better assess risks.	Walkover survey of locations in reservoir previously established as at risk of algal blooms. Visual assessment of algal blooms. Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Monthly survey for visual assessment of algal blooms. Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Mitigation of blue-green algal blooms should centre around reporting all blooms to the Environment Agency to ensure that appropriate action can be taken to inform the public. If major risk identified, consider treatment of algal bloom if appropriate in dialogue with EA.	Upon cessation of the drought order and/or or permit, baseline conditions will return. No further monitoring will be required post-drought order/permit implementation. Continue vigilance during standard baseline drought permit monitoring activities.	Southern Water in agreement with EA
Macroinvertebrates **All Reaches (including transitional)**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macroinvertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream	No action required outside of baseline seasonal monitoring programmes.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
		Carry out seasonal (spring and autumn) macroinvertebrate surveys[17]. 1 site in each of the impacted reaches (Reaches 1 to 5 plus control) (ideally complementing the existing EA monitoring, in discussion with the EA). Surveys to be repeated every year in spring and autumn. Identify to species level.			measures or adjustments to improve habitat conditions.		
Water vole **All reaches**	Reduced habitat availability and/or food sources resulting in population decline	Discuss with Kent Wildlife Trust the available survey data for the impacted reaches. Carry out targeted water vole habitat surveys if local data not available to understand potential risks to the species from the drought order implementation. Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence and habitat conditions.	Carry out further survey to assess any risk to local population	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Kent Wildlife Trust.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA
Invasive non-native species (INNS) Himalayan balsam and surveys for any other INNS **River Rother**	Risk of increasing the potential for this species to spread along watercourse	Collate available local records to improve baseline datasets.	Complete walkover survey of impacted reaches 1 to 4 to understand coverage of species and other INNS and assess risk posed by implementing drought order.	Complete walkover survey of impacted reaches 1 to 4 to understand coverage of species and key locations and risk posed by implementing drought permit.	Depending on findings of walkover survey and risk assessment, agree with EA any appropriate risk reduction or control measures taking account of national INNS advice prevailing at the time on control and risk management measures.	Complete walkover survey of impacted reaches 1 to 4 post drought to understand any changes to the coverage of species. Carry out clearance where appropriate to do so in dialogue with the EA and taking account of national INNS advice prevailing at the time on control and risk management measures.	Southern Water in agreement with EA
Littoral Mudflats/ Polychaete bivalve -dominated mid estuarine mud shores **Transitional reach**	Decrease in habitat quality and extent as a result of decreased freshwater input Changes in sediment dynamics as a result of decrease freshwater input Changes in nutrient dynamics as a result of decreased freshwater input Decrease in buffering capacity Changes in water quality, especially SRP altering community structure and food webs	Carry out baseline habitat survey at low tide of the littoral mudflats and polychaete bivalve-dominated mid estuarine mud shores to assess habitat composition and quality, and confirm drought permit risk assessment. Repeat every 3 years.	Repeat baseline survey at low tide to assess prevailing drought conditions at low tide in relation to habitat composition and quality.	Repeat baseline survey at low tide every 2 months to assess any changes due to the drought permit implementation at low tide in relation to habitat composition and quality.	None applicable	In year following after drought permit implementation, repeat baseline survey at low tide to establish any adverse effects that may be due to the drought permit. If existing habitats have been lost or damaged, consider scope for re-creation of habitats or consider compensatory habitat options.	Southern Water in agreement with EA

[17] Environment Agency (2012).Freshwater macro-invertebrate sampling in rivers. Operational instruction 018_08. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Sailing activities in Rye Harbour and adjacent reaches.	Potential for a reduction in connectivity at low spring tides and therefore impacts to sailing	Discuss potential risks with sailing stakeholders and carry out low tide survey at low flow conditions to determine any potential risks during drought permit implementation. Update drought permit risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with sailing stakeholders.	Repeat baseline survey and update risk assessment as necessary in dialogue with sailing stakeholders to inform of them of possible need for a drought permit. Update and review applicable mitigation measures in discussion with sailing stakeholders.	Maintain contact with sailing stakeholders to inform of them of potential changes in connectivity during low tide.	Implement any applicable mitigation measures as agreed with sailing stakeholders. (e.g. modifications to moorings).	Discuss any residual impacts due to the drought permit with sailing stakeholders as appropriate and any potential compensatory measures.	Southern Water in agreement with boat owners/boating organisations/ Rye Harbour Master

7.2.5 Powdermill

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Dungeness, Romney Marsh and Rye Bay SPA, Ramsar and SSSI	Habitat degradation as a result of decreased river flow and/or water levels	Establish baseline environment comprising: Further discussions with site owners and a walkover survey to assess the level of hydrological connectivity between the designated water-dependent habitats (saltmarsh and mudflats) and the impacted reaches. Carry out monitoring of using Common Standards Methodology[18] criteria for assessing habitat condition, where appropriate in dialogue with Natural England. Obtain any available site-specific water level/flow monitoring evidence. Repeat survey every 3 years	Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during environmental drought. Carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition where appropriate, in dialogue with Natural England. Carry out monitoring of water dependent species that are linked to these habitats as identified from the surveillance walkover survey as potentially at risk of the drought permit.	Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during drought permit implementation, if not already lost due to antecedent environmental drought conditions. Carry out appropriate monitoring of aquatic habitats using Common Standards Methodology criteria for assessing habitat condition, in discussion with Natural England. Carry out further monitoring of water dependent species as identified as being at risk from the drought permit.	Consider local habitat protection measures in dialogue with Natural England where feasible and appropriate.	In year after drought permit implementation, carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition. Carry out further monitoring of water dependent species to identify any adverse effects of the drought permit. If existing habitats have been lost or damaged by the drought permit, consider scope for replacement / re-creation of habitats, or consider compensatory habitat options in dialogue with Natural England.	Southern Water in agreement with EA and NE
Fish community, including Brown/Sea Trout, Brook Lamprey, River Lamprey, European eel **River Brede** **River Rother Transitional Waterbody**	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitor fish populations at within reaches 1-3. 1 survey round every 3 years at same sites. Collate any further information from local knowledge and EA local staff, plus local biological records.	Walkover survey to identify potential risks to the fish community, including approximation of the number of each fish species (e.g. 10s, 100s) in any ponded reaches due to drought conditions where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkover surveys if situation is expected to deteriorate in river sections known to contain high fish densities.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought permit implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Three consecutive years post drought permit/order monitoring at baseline monitoring site to determine relative health of year classes which may be influenced by the drought order/permit. Including fish scale analysis. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA

[18] JNCC, Common Standards Monitoring Guidance for Freshwater Habitats and Species, Rivers and lakes guidance updated January 2014 and March 2015 respectively, ISSN 1743-8160 (Online)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Macrophytes **River Brede**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of recent data along entire reach. Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in each reach ideally in a normal year and a dry year[19]. To be carried out June-September (ideally complementing the existing EA monitoring, in discussion with the EA) Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SR plus month's worth of continuous monitoring data at several sites which would support the point sample data. Need to examine current and future EA WQ sampling and ensure that either it is maintained in the Strategic monitoring review or SWS collects sufficient samples to gap fill the data. 12 samples every three years would provide a baseline for WQ. Repeat surveys every 3 years.	Seasonal walkover and carry out macrophyte surveys at the baseline survey site (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought permit implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	Carry out post-drought permit implementation surveys at the baseline monitoring site for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA
Estuarine macroalgae and phytoplankton **River Rother Transitional Water Body**	Alteration to community composition as a result of water quality deterioration Decrease in habitat availability as a result of algal blooms	Carry out summer macroalgal surveys using WFD fucoid extent tool at upstream limit and median salinity, plus WFD opportunistic macroalgae tool at 1 x baseline monitoring site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat survey every year in summer. Carry out phytoplankton surveys (chlorophyll-a 90th percentile, elevated count and seasonal succession) in spring and summer at 1 x baseline site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat surveys every year in spring and summer. Identify any key point sources of nutrient loading during surveys. Carry out water quality sampling at same time as surveys, including samples for SRP.	Carry out macroalgae/phytoplankton surveys at the baseline survey site Carry out water quality sampling at same time including samples for SRP. Identify any key sources of nutrient loading.	Survey to be undertaken of macroalgae/ phytoplankton at baseline monitoring site every month during the drought permit implementation. Carry out water quality sampling at same time including samples for SRP.	Consider measures to address identified point sources of nutrient loading.	Carry out post-drought permit implementation surveys at the baseline monitoring site on a monthly basis for 6 months to understand the extent of recovery from any adverse impacts. Revert to the annual baseline monitoring programme thereafter. No specific post-drought permit / order mitigation measures identified.	Southern Water in agreement with EA
Blue-green algae **Powdermill Reservoir**	Increased proliferation of blue green algal blooms at	Lack of historic records.	Walkover survey of locations in reservoir previously established as at	Monthly survey for visual assessment of algal blooms.	Mitigation of blue-green algal blooms should centre around reporting all blooms	Upon cessation of the drought permit, baseline conditions will return. No further monitoring will	Southern Water in agreement with EA

[19] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
	the reservoir	Collate any historic evidence of blue-green algae from EA and other local knowledge to better assess risks.	risk of algal blooms. Visual assessment of algal blooms. Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	to the Environment Agency to ensure that appropriate action can be taken to inform the public. If major risk identified, consider treatment of algal bloom if appropriate in dialogue with EA.	be required post-drought permit implementation. Continue vigilance during standard baseline drought permit monitoring activities.	
Macroinvertebrates **River Brede** **Rother transitional water body**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macroinvertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys[20]. 1 site within each reach plus a control site. Surveys to be repeated every year in spring and autumn. Identify to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA
Water vole **All reaches**	Reduced habitat availability and/or food sources resulting in population decline	Discuss with Kent Wildlife Trust the available survey data for the impacted reaches. Carry out targeted water vole habitat surveys if local data not available to understand potential risks to the species from the drought order implementation. Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence and habitat conditions.	Carry out further survey to assess any risk to local population	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Kent Wildlife Trust.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA
Invasive non-native species (INNS) Himalayan balsam and surveys for any other INNS **All reaches**	Risk of increasing the potential for this species to spread along watercourse	Collate available local records to improve baseline datasets.	Complete walkover survey of impacted reaches to understand coverage of species and other INNS and assess risk posed by implementing drought permit.	Complete walkover survey of impacted reaches to understand coverage of species and key locations and risk posed by implementing drought permit.	Depending on findings of walkover survey and risk assessment, agree with EA any appropriate risk reduction or control measures taking account of national INNS advice prevailing at the time on control and risk management measures.	Complete walkover survey of impacted reaches post drought to understand any changes to the coverage of species. Carry out clearance where appropriate to do so in dialogue with the EA and taking account of national INNS advice prevailing at the time on control and risk management measures.	Southern Water in agreement with EA
Littoral Mudflats/ Polychaete bivalve -dominated mid estuarine mud shores **Transitional reach**	Decrease in habitat quality and extent as a result of decreased freshwater input Changes in sediment dynamics as a result of decrease freshwater input Changes in nutrient dynamics as a result of decreased freshwater input	Carry out baseline habitat survey at low tide of the littoral mudflats and polychaete bivalve-dominated mid estuarine mud shores to assess habitat composition and quality, and confirm drought permit risk assessment. Repeat every 3 years.	Repeat baseline survey at low tide to assess prevailing drought conditions at low tide in relation to habitat composition and quality.	Repeat baseline survey at low tide every 2 months to assess any changes due to the drought permit implementation at low tide in relation to habitat composition and quality.	None applicable	In year following after drought permit implementation, repeat baseline survey at low tide to establish any adverse effects that may be due to the drought permit. If existing habitats have been lost or damaged, consider scope for re-creation of habitats or consider compensatory habitat options.	Southern Water in agreement with EA

[20] Environment Agency (2012).Freshwater macro-invertebrate sampling in rivers. Operational instruction 018_08. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
	Decrease in buffering capacity Changes in water quality, especially SRP altering community structure and food webs						
Sailing activities in Rye Harbour and adjacent reaches.	Potential for a reduction in connectivity at low spring tides and therefore impacts to sailing	Discuss potential risks with sailing stakeholders and carry out low tide survey at low flow conditions to determine any potential risks during drought permit implementation. Update drought permit risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with sailing stakeholders.	Repeat baseline survey and update risk assessment as necessary in dialogue with sailing stakeholders to inform of them of possible need for a drought permit. Update and review applicable mitigation measures in discussion with sailing stakeholders.	Maintain contact with sailing stakeholders to inform of them of potential changes in connectivity during low tide.	Implement any applicable mitigation measures as agreed with sailing stakeholders. (e.g. modifications to moorings).	Discuss any residual impacts due to the drought permit with sailing stakeholders as appropriate and any potential compensatory measures.	Southern Water in agreement with boat owners/boating organisations/ Rye Harbour Master

7.2.6 North Deal

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Thanet Coast and Sandwich Bay SPA and Ramsar Sandwich Bay to Hacklinge Marshes SSSI **Wintering birds (Ruddy turnstone) and breeding birds**	Decrease in foraging habitat as a result of decreased water levels Decrease in food sources as a result of changes in water levels and water quality Changes in food sources as a result of changes in water quality Increased competition as a result of decreased habitat availability Reduction in surface water pools in areas of grazing marsh providing roosting and feeding habitat	Collate available local bird records collate to improve baseline dataset in dialogue with Natural England and relevant NGOs. Carry out monitoring of wintering birds where necessary to fill in any data gaps. Liaise with Natural England to consider potential mitigation measures if drought permit implemented. Repeat survey and update data every 3 years.	Monitoring of wintering bird populations and associated habitat walkover survey to assess numbers and potential risk of deterioration (if drought conditions arise during period of over-wintering of the birds) Liaise with Natural England to consider potential mitigation measures if drought permit implemented, taking account of prevailing situation.	Monitoring of wintering bird populations and associated habitat walkover survey to assess numbers and potential risk of deterioration due to drought permit (if drought permit implemented during period of over-wintering of the birds)	Consider measures to conserve important bird habitat features with site owners and Natural England if surveys show deterioration due to the drought permit.	Repeat survey in following winter after cessation of drought permit to establish level of recovery if adverse effects arise during drought permit implementation. If existing habitat has been lost or damaged due to the drought permit, consider scope for possible habitat restoration if feasible, in dialogue with Natural England, or otherwise consider compensatory measures.	Southern Water in agreement with EA
Sandwich Bay to Hacklinge Marshes SSSI **Fen, marsh and swamp habitat – including relict fen vegetation** **Fen, marsh and swamp habitat – including relict fen vegetation** **Lowland Neutral Grassland (Freshwater Grazing Marsh)** **Habitat quality**	Decrease in habitat quality as a result of decreased water levels Decrease in the extent of habitat as a result of changes in water levels Changes in the abundance and/or occurrence of the relict species Decrease in abundance and distribution as a result of water quality changes	Carry out walkover surveys during low flow and low tide conditions in permit to improve baseline understanding of hydrological functioning of the habitat, in liaison with site owner and Natural England. Risk mapping of habitat that be vulnerable to the adverse effects of the drought permit. Liaise with Natural England to consider potential mitigation measures if drought permit implemented. Repeat survey and update data every 3 years.	Walkover at low flow / low tide conditions of vulnerable areas identified as being susceptible to lower flows during baseline survey and establish condition during environmental drought. Liaise with Natural England to consider potential mitigation measures if drought permit implemented, taking account of prevailing situation. Assess risks to vulnerable areas due to implementation of the drought permit.	Walkover at low flow / low tide conditions of vulnerable areas identified as being susceptible to lower flows and establish condition during drought permit implementation and assess risks of degradation.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider measures to conserve important habitat features with site owners and Natural England if surveys show deterioration due to the drought permit. As conditions reach the trigger point look to retain water via control structures in water dependent fens.	Repeat walkover surveys every 6 months following cessation of drought permit for 1 year to establish recovery of habitat from any identified adverse effects of the drought permit.	Southern Water in agreement with EA
Sandwich Bay to Hacklinge Marshes SSSI **Nationally rare invertebrates (including moth species)**	Decrease in habitat as a result of decreased water levels Decrease in food sources as a result of changes in water levels and water quality Increased predation as a result of decrease in habitat available as refuge	Invertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) invertebrate surveys. Repeat seasonal surveys annually.	Seasonal monitoring of invertebrates at the baseline survey sites and assess condition in relation to environmental drought. Liaise with Natural England to consider potential mitigation measures taking account of prevailing situation. Samples to be collected and identified to species level.	Seasonal monitoring of invertebrates at the baseline survey sites at monthly intervals. Samples to be collected and identified to species level.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider measures to conserve important habitat features with site owners and Natural England if surveys show deterioration due to the drought permit.	Revert to routine seasonal baseline monitoring programme to establish recovery from any identified impacts due to the drought permit.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Thanet Coast and Sandwich Bay Ramsar **15 BRDB wetland invertebrates and a number of nationally scarce species**	Decrease in habitat quality as a result of decreased water levels Decrease in the extent of habitat as a result of changes in water levels Changes in soil characteristic as a result of decreased freshwater input Increased sedimentation as a result of decreased flushing Changes in vegetation community structure and zonation as a result of changes in physical characteristics Changes in water quality potentially resulting in algal blooms	Invertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) invertebrate surveys. Repeat seasonal surveys annually.	Seasonal monitoring of invertebrates at the baseline survey sites and assess condition in relation to environmental drought. Liaise with Natural England to consider potential mitigation measures taking account of prevailing situation. Samples to be collected and identified to species level.	Seasonal monitoring of invertebrates at the baseline survey sites at monthly intervals. Samples to be collected and identified to species level.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider measures to conserve important habitat features with site owners and Natural England if surveys show deterioration due to the drought permit.	Revert to routine seasonal baseline monitoring programme to establish recovery from any identified impacts due to the drought permit.	Southern Water in agreement with EA
Macrophyte community including Ranunculus (Wingham River) **Wingham River from source to confluence with Little Stour River** **North Stream reach of the North-South stream system**	Reduction in abundance or distribution of macrophyte community as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of recent data along entire reach. Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at 1 site in each impacted reach ideally in a normal year and a dry year[21]. To be carried out June-September (ideally complementing the existing EA monitoring, in discussion with the EA) Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP plus one month's worth of continuous monitoring data at several sites which would support the point sample data. Need to examine current and future EA WQ sampling and ensure that either it is maintained in the Strategic monitoring review or SWS collects sufficient samples to gap fill the data. 12 samples every three	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought permit implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought permit implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA

[21] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
		years would provide a baseline for WQ. Repeat surveys every 3 years.					
Fish community, including European Eel **Wingham River from source to confluence with Little Stour River** **North Stream reach of the North-South stream system**	Reduction in extent or quality of important habitats, including potential exposure of marginal and bed substrates (spawning, nursery and cover habitats) Fragmentation of habitats and increased significance of obstacles Increased mortality (density dependent) as a result of increased predation and competition	Carry out low flow habitat walkover survey, including mapping of likely spawning and nursery habitat and barriers/obstacles to fish migration. One walkover survey to be carried out once every 5 years. Liaise with Environment Agency fisheries and ecology teams to determine key spawning and nursery habitat locations.	Walkover of key locations recording the number of spawning/nursery sites and barriers/obstacles potentially affected by the environmental drought. Record extent of exposed marginal spawning and bed substrates. Photographs should be taken during each walkover As an alternative use historic survey data to provide an approximation, if available. Appropriate trigger values to be set for level and flow for spawning habitats based on local circumstances, timing, seasonality and expert opinion.	Additional walkover surveys if situation is expected to deteriorate in reaches known to contain spawning habitats.	Consider any measures to locally improve water depth/flow over spawning habitat, e.g. temporary in-stream flow deflectors, and/or depth of water over barriers and obstacles.	In the year following the drought permit implementation, undertake fish surveys repeat walkover of key locations recording the number of spawning/nursey sites potentially affected by the drought permit. Record extent of exposed marginal spawning and bed substrates. Photographs should be taken during each walkover. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA
Fish community, including European Eel **Wingham River from source to confluence with Little Stour River** **North Stream reach of the North-South stream system**	Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitoring populations at 1 monitoring site for each river (ideally complementing the existing EA monitoring, in discussion with the EA) 1 survey round every 3 years at same sites. Carry out water quality surveys at the same time for dissolved oxygen, conductivity, pH, turbidity, ammonia and temperature. Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach, where safe and practical to do so. Measure dissolved oxygen, turbidity, conductivity and temperature in the field using calibrated handheld equipment. Carry out water quality surveys for dissolved oxygen, conductivity, pH, turbidity, ammonia and temperature. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in stream sections known to contain high fish densities. Carry out water quality surveys or dissolved oxygen, conductivity, pH, turbidity, ammonia and temperature.	Consider deployment of aeration equipment in key reaches with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought permit/order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Three consecutive years post drought permit/order monitoring at baseline monitoring sites to determine relative health of year classes which may be influenced by the drought order/permit. Including fish scale analysis. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Macroinvertebrates **Wingham River from source to confluence with Little Stour River** **North Stream reach of the North-South stream system**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Collate available local records to improve baseline datasets. Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys. 1 site per river every year in spring and autumn. Survey sites to ideally complement the existing EA monitoring, in discussion with the EA. Identify to species level. Carry out water quality surveys at same time. Plus 1 month's worth of continuous monitoring data at several sites which would support the point sample data. Need to examine current and future EA WQ sampling and ensure that either it is maintained in the Strategic monitoring review or SWS collects sufficient samples to gap fill the data. 12 samples every three years would provide a baseline for WQ.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal baseline monitoring programme.	Southern Water in agreement with EA
Hydrology **North Stream**	Lack of flow monitoring data	Establish with EA if an appropriate mechanism for flow gauging at low flow conditions can be installed (below Q_{95} flow) and collate any available spot gauging records that may be available. Carry out spot gauging at 2 sites at low flow conditions (Q_{95} or below). Repeat surveys 4 times to gather representative set of spot gauging (if cannot install permanent gauging arrangement)	Carry out spot gauging at baseline sites to assess current flow conditions. Establish trigger level for spot gauging if drought permit/order implemented (or continuous monitoring of a gauged section if feasible).	Carry out spot gauging once trigger level reached (or use continuous monitoring of a gauged section if feasible).	Not applicable	Not applicable	Southern Water in agreement with EA
Groundwater and surface water abstractions	Abstractions may be adversely affected by the impacts of the drought permit on groundwater levels and surface water flows.	Ensure list of abstractors set out in Appendix B is maintained in dialogue with the EA on an annual basis as part of the agreed data exchange protocol (see separate Environmental Monitoring Plan)	Establish contact with abstraction licence holders at risk of derogation to inform them of the risk and collate details of their abstraction facilities and discuss possible monitoring and mitigation measures if the drought permit were to be implemented.	Implement monitoring arrangements as necessary and as agreed with the abstractors. Implement any agreed mitigation where appropriate in advance of actual impact (e.g. lower borehole pump).	Implement any other agreed mitigation measures (e.g. providing an alternative water supply, lowering a borehole pump) Provisions exist in the Water Resources Act 1991 (as amended) for compensation measures to be agreed with those adversely affected if mitigation is not feasible.	Resolve any outstanding issues with each abstractor as appropriate.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit Implementation Period		Post Drought Permit	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Water Vole & Otter	Reduced habitat availability and/or food sources	Discuss with Wildlife Trust and Kent Wildlife Trust the available survey data for the impacted reaches. Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought order implementation. Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence and habitat conditions.	Carry out further survey to assess any risk to local population.	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Sussex Wildlife Trust and Kent Wildlife Trust.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA
Wingham wastewater treatment works (WTW)	Risk to deterioration of phosphorous status	Continue operational and regulatory monitoring of the quality of the final effluent to ascertain baseline conditions and any quality variability at dry weather flows. Confirm Dry Weather Flow discharge rate and its variability over different seasons.	Review operational and regulatory water quality data for final effluent. Ascertain prevailing Dry Weather Flow from the works. Assess risks to identified environmental features due to the prevailing drought conditions and consider scope for mitigation measures if adverse effects are considered likely due to the final effluent discharge during the period of drought permit/order implementation.	Review operational and regulatory water quality data for final effluent. Ascertain prevailing Dry Weather Flow from the works. Assess risks to identified environmental features due to the prevailing drought conditions and consider scope for mitigation measures if adverse effects are considered likely due to the final effluent discharge.	Consider measures to improve quality of the final effluent to minimise adverse water quality effects during drought permit/order implementation.	No action required outside of routine baseline monitoring.	Southern Water in agreement with EA

7.3 Central Area Drought Permits and Orders

7.3.1 Pulborough Reduce MRF

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit / Order Implementation Period		Post Drought Permit/Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Arun Banks SSSI	Decrease in habitat quality as a result of decreased water levels (lowland fen) Decrease in the extent of habitat as a result of changes in water levels Changes in the abundance and/or occurrence of the rare hybrid club-rush. Decrease in abundance and distribution as a result of water quality changes	To establish a baseline, monitoring should incorporate: Walkover survey to further assess the level of hydrological connectivity between the river and the rare hybrid club-rush habitat. Carry out a monitoring of standing water habitat using Common Standards Methodology[22] criteria for assessing habitat condition where appropriate. Repeat every 3 years Obtain any available site-specific water level/flow monitoring evidence linked to the habitat of the rare hybrid club-rush. Carry out if not available including monitoring of SRP.	Surveillance walkover of the habitat and investigate if hydrological connectivity is lost during environmental drought. Carry out appropriate monitoring of standing water habitat using Common Standards Methodology criteria for assessing habitat condition where appropriate.	Surveillance walkover of the habitats and investigate if hydrological connectivity is lost during drought permit / order implementation, if not already lost due to antecedent environmental drought conditions. Carry out appropriate monitoring of aquatic habitat using Common Standards Methodology criteria for assessing habitat condition in discussion with Natural England.	None considered viable but this requires discussion with Natural England.	In year following after drought permit/order implementation, carry out appropriate monitoring of standing water habitat using Common Standards Methodology criteria for assessing habitat condition. If existing habitat has been lost or damaged due to the drought permit/order, consider scope for possible translocation from other sites if feasible, in dialogue with Natural England or otherwise consider compensatory measures.	Southern Water in agreement with EA and NE
Fish community, including Brown/Sea Trout, Brook Lamprey, River Lamprey Grayling, European eel **River Rother**	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitoring populations at 1 monitoring site for the River Rother upstream of the tidal limit (ideally complementing the existing EA monitoring, in discussion with the EA) 1 survey round every 3 years at same site. Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in stream sections known to contain high fish densities.	Consider deployment of aeration equipment in key reaches with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought permit/order implementation, undertake post-drought fish surveys at the baseline monitoring site to substantiate the level of impact. Three consecutive years post drought permit/order monitoring at baseline monitoring site to determine relative health of year classes which may be influenced by the drought order/permit. Including fish scale analysis. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA

[22] JNCC, Common Standards Monitoring Guidance for Freshwater Habitats and Species, Rivers and lakes guidance updated January 2014 and March 2015 respectively, ISSN 1743-8160 (Online)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit / Order Implementation Period		Post Drought Permit/Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Macrophytes **River Rother**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of recent data along entire reach. Collate any available local macrophyte data. Carry out walkover and river macrophyte survey at agreed site (Hardham Pumping Station; subject to access). Ideally surveys to take place across normal and dry years[23]. To be carried out June-September (ideally complementing the existing EA monitoring, in discussion with the EA) Identify any key point sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP. Repeat surveys every 1 year.	Seasonal walkover and carry out macrophyte surveys at the baseline survey site (if during plant growing season) Carry out water quality sampling at same time including samples for SRP.	Survey to be undertaken and macrophytes identified (if drought permit/order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at the baseline sites including samples for SRP.	Consider measures to address identified point sources of nutrient loading. Consider scope for addressing any identified sources of nutrient loading from walkover survey, if this would help address water quality risks. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought permit / order implementation surveys at the baseline monitoring site for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at the baseline sites including samples for SRP. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA
Estuarine macroalgae and phytoplankton **Arun transitional water body**	Alteration to community composition as a result of water quality deterioration Decrease in habitat availability as a result of algal blooms	Carry out summer macroalgal surveys using WFD fucoid extent tool at upstream limit and median salinity, plus WFD opportunistic macroalgae tool at 1 x baseline monitoring site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat survey every year in summer. Carry out phytoplankton surveys (chlorophyll-a 90th percentile, elevated count and seasonal succession) in spring and summer at 1 x baseline site (ideally complementing the existing EA monitoring, in discussion with the EA). Repeat surveys every year in spring and summer. Identify any key point sources of nutrient loading during surveys. Carry out water quality sampling at same time as surveys, including samples for SRP.	Carry out macroalgae/phytoplankton surveys at the baseline survey site Carry out water quality sampling at same time including samples for SRP. Identify any key sources of nutrient loading.	Survey to be undertaken of macroalgae/ phytoplankton at baseline monitoring site every month during the drought order/permit implementation. Carry out water quality sampling at same time including samples for SRP.	Consider measures to address identified point sources of nutrient loading.	Carry out post-drought permit / order implementation surveys at the baseline monitoring site on a monthly basis for 6 months to understand the extent of recovery from any adverse impacts. Revert to the annual baseline monitoring programme thereafter. No specific post-drought permit / order mitigation measures identified.	Southern Water in agreement with EA

[23] Environment Agency (2011).Surveying freshwater macrophytes in rivers. Operational instruction 131_07. (Unpublished procedures manual)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit / Order Implementation Period		Post Drought Permit/Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Estuarine fish assemblage Arun transitional waterbody	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Fish populations are not well understood as a result of lack of recent survey data. Baseline monitoring will follow the Inshore Fisheries and Conservation Authority Fish Survey Best Practice Guidance (2016), and relevant Environment Agency guidance. A multi-method approach will be employed, using seine netting, fyke netting and beam trawls where suitable. Three locations to be surveyed; Pulborough, Burpham and Wick (to be agreed with EA) To be surveyed annually. Collate any further information from local knowledge and EA local staff, plus local biological records.	Walkover survey to identify potential risks to the fish community, including approximation of the number of each fish species (e.g. 10s, 100s) in any ponded reaches due to drought conditions where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkover surveys if situation is expected to deteriorate in river sections known to contain high fish densities.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought permit implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Three consecutive years post drought permit/order monitoring at baseline monitoring site to determine relative health of year classes which may be influenced by the drought order/permit. Including fish scale analysis. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA
Macroinvertebrates **River Rother and River Arun Transitional Water**	Reduction in abundance or distribution as a result of reduced water quality / habitat. Reduction in abundance of the Scarce Chaser and the water snipe fly	Collate available local records to improve baseline datasets. Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys. 1 site per water body, every year in spring and autumn. Identify to species level (including the presence of any Scarce Chaser and Water Snipe Fly). Sites to ideally complement the existing EA monitoring, in discussion with the EA. Collate any local records on presence of Scarce Chaser and Water Snipe Fly in the River Rother.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit / Order Implementation Period		Post Drought Permit/Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Depressed river mussel Arun transitional waterbody	Reduction in abundance or distribution as a result of reduced water quality / habitat. Freezing is the major risk to the species if exposed during draw down when air temperature is below 4 Celsius. Monitoring of air temperature should precede any planned draw down of navigation pens for the purposes of this drought permit/ order Low DO is a major threat to the species if water quality deteriorates. The proposed monitoring for DO will help assess this risk during drought permit/ order operation.	Depressed river mussel populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out 1 survey every 5 years. 1 site at Greatham Bridge (ideally complementing any EA monitoring, in discussion with the EA). Carry out water quality surveys at the same time.	Seasonal monitoring of depressed river mussel at the baseline survey sites. Samples to be collected and identified to species level. Carry out water quality surveys at the same time.	Seasonal monitoring of depressed river mussel at the baseline survey sites. Samples to be collected and identified to species level. Carry out water quality surveys at the same time.	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions. Cease abstraction for a time limited period if a DO “sag” arises.	No action required outside of baseline seasonal monitoring programmes.	Southern Water in agreement with EA and NE
INNS: Himalayan balsam and surveys for any other INNS **River Rother**	Risk of increasing the potential for this species to spread along watercourse	Collate available local records to improve baseline datasets. Complete walkover survey of Reach 1 (River Rother) to understand coverage of species and any other INNS and assess risk posed by implementing drought permit/order	Complete walkover survey of Reach 1 (River Rother) to understand coverage of species and other INNS and assess risk posed by implementing drought permit/order	Complete walkover survey of Reach 1 (River Rother) to understand coverage of species and key locations and risk posed by implementing drought permit/order	Depending on findings of walkover survey and risk assessment, agree with EA any appropriate risk reduction or control measures taking account of national INNS advice prevailing at the time on control and risk management measures.	Complete walkover survey of Reach 1 (River Rother) post drought to understand any changes to the coverage of species. Carry out clearance where appropriate to do so in dialogue with the EA and taking account of national INNS advice prevailing at the time on control and risk management measures.	Southern Water in agreement with EA
Water quality (specifically DIN and change in salinity gradient) Arun transitional waterbody	Lack of baseline data for Dissolved Inorganic Nitrogen in transitional waterbody Uncertainty over how drought order/permits will impact salinity gradient	Monitoring at 3 sites (upper, mid and lower estuary) in reach during low flows/low tide conditions. Parameters to be sampled for are soluble reactive phosphorous (SRP), dissolved oxygen, ammoniacal nitrogen (freshwater), Dissolved Inorganic Nitrogen (DIN), pH, turbidity, conductivity, and salinity	Repeat baseline survey if over 3 years old.	Monitoring of DIN and salinity gradient at 3 baseline survey points every 2 weeks during implementation of drought order/permit.	No specific measures identified.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA
Wealden Greensand NCA	Uncertain impacts on character of area due to impacts to flora and fauna of River Rother and River Arun	Walkover survey and photographic record during summer low flow conditions and complete scoping exercise for LVIA within initial indication of significance of impacts	Update walkover survey and photographic records if required and complete full LVIA to support drought order application.	Photographic record/evidence to be taken at fixed points used during on-set of drought surveys to document changes.	Mitigation likely to be associated with that for flora and fauna species.	N/A	Southern Water in agreement with Natural England

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Permit / Order Implementation Period		Post Drought Permit/Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Angling	Potential for a reduction in connectivity and therefore impacts to angling.	Discuss potential risks with EA, angling clubs and stakeholders and assess likelihood of angling at low flow drought conditions to determine any potential risks during drought permit/order implementation. Update drought permit/order risk assessment as appropriate. Consider applicable mitigation measures that may be required in discussion with EA, angling clubs and stakeholders.	Proactive stakeholder engagement. Update risk assessment as necessary in dialogue with EA, angling clubs and stakeholders to inform of them of possible need for a drought permits/order. Update and review applicable mitigation measures in discussion with EA, angling clubs and stakeholders.	Maintain contact with angling clubs and stakeholders to assess any implications of the drought permits/order on any remaining angling activities.	Implement any applicable mitigation measures as agreed with EA, angling clubs and stakeholders. (e.g. no angling periods)	Discuss any residual impacts due to the drought permits/order with EA, angling clubs and stakeholders as appropriate and any potential compensatory measures.	Southern Water in agreement with EA and owners of fishing rights/angling associations

7.3.2 Weir Wood

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Macrophytes River Medway between Weir Wood Reservoir and Withyham (Reach 1) River Medway between Withyham and Chafford (Reach 2)	Reduction in abundance or distribution of macrophyte community as a result of reduced water quality / habitat.	Water quality (in particular SRP) is not well understood due to a lack of water quality monitoring data: • Identify and collate any additional local water quality data that may be available (e.g. Local Biological Record Centre). • Carry out water quality sampling at 1 x monitoring site in each reach at times of low flow/low water levels for: dissolved oxygen, pH, turbidity, suspended sediment, conductivity, temperature, ammonia and SRP o 2 x surveys per year at times of low flow/water levels at the same survey sites • One month's worth of continuous monitoring data at several sites which would support the point sample data	Carry out water quality sampling at baseline monitoring sites	Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at baseline monitoring site.	Consider measures to address identified point sources of nutrient loading. Consider scope for improving quality of effluent from Southern Water WTW discharges in Reach 1 if this would help address adverse water quality issues.	Carry out water quality sampling at baseline monitoring sites No specific post-drought order mitigation measures identified.	Southern Water in agreement with EA
		Macrophyte populations and species composition are not well understood due to lack of data: • Collate any available local macrophyte data • Carry out summer walkover and macrophyte surveys o 2 sites within reach 1 and 1 site within reach 2 plus a control site. Identify any key point sources of nutrient loading at Repeat surveys every 3 years.	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if drought onset is during plant growing season)	Macrophyte survey and walkover survey to identify any key point sources of nutrient loading (if drought order implemented in plant growing season)	Consider possible in-stream measures or channel adjustments to improve habitat conditions.	Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of the drought (one survey each year) to understand the extent of recovery from any adverse impacts.	Southern Water in agreement with EA
Fish community, including brown trout and bullhead	Reduction in extent or quality of important habitats, including potential exposure of marginal and bed substrates (spawning, nursery and cover habitats)	Each reach to be surveyed for fish habitat as part of a wider low flow/low water level habitat walkover survey, including mapping of likely spawning and nursery habitat. One walkover survey to be carried out for each reach once every 5 years. Liaise with Environment Agency fisheries and ecology teams to determine key spawning and nursery habitat locations.	• Walkover of key locations recording the number of spawning/nursery sites potentially affected if survey is undertaken at right time of year. • Record extent of exposed marginal spawning and bed substrates. Photographs should be taken during each walkover • As an alternative use historic survey data to provide an approximation, if available. • Appropriate trigger values to be set for level and flow for spawning habitats based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in reaches known to contain spawning habitats.	Consider any measures to locally improve water depth/flow over spawning habitat, e.g. temporary in-stream flow deflectors.	• In the year following the drought order implementation, undertake fish surveys at the baseline monitoring sites to substantiate the level of impact. • Repeat walkover of key locations recording the number of spawning/nursey sites potentially affected if survey is undertaken at right time of year. • Record extent of exposed marginal spawning and bed substrates. • Photographs should be taken during each walkover. • Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA
	Fragmentation of habitats and increased significance of obstacles	Fish populations are not well understood as a result of lack of historic survey data. Electric-fishing surveys to monitor populations at 1 monitoring site for each impacted reach. 1 survey round every 3 years at same	• Walkover of key sections known to be susceptible to lower flows. • Known areas of dry habitats are typically avoided during the walkover, but recorded where observed to confirm and/or confirm existing knowledge	Additional walkovers, if situation is expected to deteriorate in stream sections / waterbodies known to contain high fish densities.	Consider possible in-stream measures or adjustments to barriers to support fish movement and/or improve habitat conditions. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
		sites Collate any further information from local knowledge and EA local staff, plus local biological records.	• Electric-fishing surveys to monitoring populations at each of the four sites.				
	Increased mortality (density dependent) as a result of increased predation and competition	Fish populations are not well understood as a result of survey data. Fish walkover surveys and data collation as above.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values to be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA
Fish community including brown trout and bullhead	Impacts on growth and/or alteration to feeding and migration	Fish populations are not well understood as a result of lack of historic surveys. Walkover and electric fishing surveys and data as above.	Monitoring this potential impact is not feasible during a drought (involves post drought monitoring of the fish population – see other column). No monitoring is advised during drought as this may cause further stress.	Monitoring this potential impact is not feasible during a drought (involves post drought monitoring of the fish population – see other column). No monitoring is advised during drought as this may cause further stress.	None - mitigating the impact of changes to feeding regimes and movement patterns is not considered feasible during drought order implementation.	Three years post drought order monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis. Monitoring will help to determine overall health of fish population and inform measures to facilitate the recovery of the fish population. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA
Fish community including brown trout and bullhead	Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities.	Fish populations are not well understood as a result of lack of historic survey data. Data and monitoring as above.	Surveillance walkover of key sections/water bodies with fish populations which are known to be susceptible to hydrological impacts (as informed by baseline surveys and data)	Surveillance walkover of key sections/water bodies with fish populations which are known to be susceptible to hydrological impacts (as informed by baseline surveys and data)	Consider possible in-stream measures or adjustments to barriers to support fish movement and/or improve habitat conditions.	In the 2 years following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. This will assist with determining if fish have successfully migrated back to previously impacted reaches from non-impacted tributaries/reaches. In extreme cases, following consultation with the Environment Agency, restocking of flow sensitive fish species can be considered if recovery needs to be facilitated.	Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Fish community, including brown trout and bullhead	Reduction in abundance or distribution as a result of reduced water quality.	Water quality is not well understood due to limited water quality data for the impacted reaches. Collate any local water quality data that may be available (e.g. Local Biological Record Centre). Carry out water quality sampling at 1 site in each impacted reach at times of low flow/low water levels for: dissolved oxygen, pH, turbidity, suspended sediment, conductivity, temperature, ammonia and SRP 2 surveys per year at times of low flow/water levels at the same survey sites.	Surveillance walkover of key sections with known water quality pressures and sections known to be susceptible to lower flows. At baseline water quality monitoring sites, measure dissolved oxygen, pH, turbidity, conductivity and temperature in the field using calibrated handheld equipment. Collect water quality samples to analyse for ammonia, suspended sediment and SRP and to confirm hand-held probe readings. Appropriate trigger values would be set for key water quality determinands (e.g. dissolved oxygen), level and flow based on local circumstances, timing, seasonality and expert opinion. Known areas of dry habitats are typically avoided during the walkover, but recorded where observed to confirm and/or confirm existing knowledge.	Surveillance walkover of key sections with known water quality pressures and sections known to be susceptible to lower flows. Measure dissolved oxygen, pH, turbidity, conductivity and temperature in the field using calibrated handheld equipment. Collect water quality samples to analyse for ammonia, suspended sediment and SRP and to confirm hand-held probe readings. Frequency = fortnightly, or more frequently if water quality is shown to be critical for fish. If DO saturation becomes critical for fish, deployment of automated water quality equipment that continuously monitors for dissolved oxygen in dialogue with EA.	Consider deployment of aeration equipment if critically low oxygen levels that could place fish in distress. Consider scope for improving quality of effluent of the Southern Water WTW discharges in Reach 1 if this would help address adverse water quality issues.	Carry out water quality surveys following baseline monitoring requirements. It is considered that water quality will return back to normal following cessation of the drought conditions that necessitated the drought order implementation. No specific mitigation applicable post-drought order implementation.	Southern Water in agreement with EA
Macroinvertebrates	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Water quality is not well understood due to lack of data for these waterbodies. Carry out water quality surveys (see above). Spot sampling plus one month's worth of continuous monitoring data at several sites which would support the point sample data Macroinvertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out seasonal (spring and autumn) macroinvertebrate surveys. 3 sites within reach 1, every year in spring and autumn. Identify to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider scope for improving quality of effluent discharges from Southern Water WwTW in Reach 1 if this would help address adverse water quality issues. Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA
Water Vole	Reduced habitat availability and/or food sources	Discuss with Sussex Wildlife Trust and Kent Wildlife Trust the available survey data for the impacted reaches. Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought order implementation. Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence and habitat conditions.	Carry out further survey to assess any risk to local population.	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Sussex Wildlife Trust and Kent Wildlife Trust.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA
Hydrology	Uncertainty regarding impact magnitude,	Complete low flow monitoring and flow accretion profiling.	N/A				Southern Water in agreement with EA

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Reach 1	especially in Reach 1 where no contributing flow	Consider scope for improving quality of effluent discharges from Southern Water WwTW in Reach 1 if this would help address adverse water quality issues.					
Hydrology All reaches	Concerns regarding catchment rescaling used in assessment	Establish whether additional gauging data is available for the wider network and discuss need for monitoring points in lower reaches. Establish whether Southern Water's CATCHMOD model could be used to refine assessment conclusions	N/A				Southern Water in agreement with EA

7.3.3 North Arundel

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Arundel Park SSSI	Habitat degradation as a result of decreased water levels or flows.	To establish a baseline, monitoring should incorporate: Walkover surveys to further assess the level of groundwater and/or hydrological connectivity between the aquatic habitats (standing open water; canals; fens; marsh, swamp) Carry out a monitoring of standing water habitats using Common Standards Methodology[24] criteria for assessing habitat condition where appropriate. Repeat survey every 3 years Obtain any available site-specific water level/flow monitoring evidence.	Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during environmental drought. Carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition where appropriate.	Surveillance walkover of aquatic habitats and investigate if hydrological connectivity is lost during drought order implementation, if not already lost due to antecedent environmental drought conditions. Carry out appropriate monitoring of aquatic habitats using Common Standards Methodology criteria for assessing habitat condition in discussion with Natural England.	None applicable.	In year following drought order implementation, carry out appropriate monitoring of standing water habitats using Common Standards Methodology criteria for assessing habitat condition. If existing habitats have been lost or damaged due to the drought order, consider scope for replanting / re-creation of habitats or consider compensatory habitat options, in dialogue with Natural England.	Southern Water in agreement with EA and NE
Fish community, including European eel, Bullhead and trout in Chalk Springs fishery Park Bottom tributary and Chalk Springs Fishery; Swanbourne Lake; Mill Stream; WWT Reserve	Reduction in extent or quality of important habitats, including potential exposure of marginal and bed substrates (spawning, nursery and cover habitats) in distributaries that are not level controlled	Each waterbody to be surveyed for fish habitat as part of a wider low flow/low water level habitat walkover survey, including mapping of likely spawning and nursery habitat. One walkover survey to be carried out for each waterbody once every 5 years. Liaise with Environment Agency fisheries and ecology teams to determine key spawning and nursery habitat locations.	Walkover of key locations recording the number of spawning/nursery sites potentially affected if survey is undertaken at right time of year. Record extent of exposed marginal spawning and bed substrates. Photographs should be taken during each walkover As an alternative use historic survey data to provide an approximation, if available. Appropriate trigger values would be set for level and flow for spawning habitats based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers if situation is expected to deteriorate in reaches/water bodies known to contain spawning habitats.	Consider any measures to locally improve water depth/flow over spawning habitat, e.g. temporary in-stream flow deflectors. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	In the year following the drought order implementation, undertake fish surveys at the baseline monitoring sites to substantiate the level of impact. Repeat walkover of key locations recording the number of spawning/nursey sites potentially affected if survey is undertaken at right time of year. Record extent of exposed marginal spawning and bed substrates. Photographs should be taken during each walkover. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA and WWT

[24] JNCC, Common Standards Monitoring Guidance for Freshwater Habitats and Species, Rivers and lakes guidance updated January 2014 and March 2015, respectively. ISSN 1743-8160 (Online)

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Fish community, including European eel and Bullhead Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT Reserve	Fragmentation of habitats and increased significance of obstacles	Fish populations are not well understood as a result of lack of historic survey data. Electric-fishing surveys to monitoring populations at 1 monitoring site confirmed at Swanbourne Millstream. Dependent on results of walkover and subsequent consultation, more surveys may be agreed for water bodies at Park Bottom, Swanbourne Lake, Mill Stream; WWT Reserve. 1 survey round every 1 year at same sites (unless no fish at WWT Reserve) Collate any further information from local knowledge and EA local staff, plus local biological records.	Walkover of key sections known to be susceptible to lower flows. Known areas of dry habitats are typically avoided during the walkover, but recorded where observed to confirm and/or confirm existing knowledge Electric-fishing surveys to monitoring populations at each of the four sites.	Additional walkovers, if situation is expected to deteriorate in stream sections / waterbodies known to contain high fish densities.	Consider possible in-stream measures or adjustments to barriers to support fish movement and/or improve habitat conditions. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA and WWT
Fish community including European eel and Bullhead Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT Reserve	Increased mortality (density dependent) as a result of increased predation and competition	Fish populations are not well understood as a result of survey data. Survey and data as set out in above row.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach/water body, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities.	Consider deployment of aeration equipment in key reaches/water bodies with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA and WWT

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Fish community including European eel and Bullhead Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Impacts on growth and/or alteration to feeding and migration	Fish populations are not well understood as a result of lack of historic surveys. Surveys and data as above rows for fish.	Monitoring this potential impact is not feasible during a drought (involves post drought monitoring of the fish population – see other column). No monitoring is advised during drought as this may cause further stress.	Monitoring this potential impact is not feasible during a drought (involves post drought monitoring of the fish population – see other column). No monitoring is advised during drought as this may cause further stress.	None - mitigating the impact of changes to feeding regimes and movement patterns is not considered feasible during drought permit implementation.	Three years post drought order monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis. Monitoring will help to determine overall health of fish population and inform measures to facilitate the recovery of the fish population. Consider re-stocking options where appropriate and applicable in dialogue with the EA.	Southern Water in agreement with EA and WWT
Fish community including European eel and Bullhead Park Bottom tributary; Mill Stream	Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities.	Fish populations are not well understood as a result of lack of historic survey data. Data and monitoring as above rows for fish.	Surveillance walkover of key sections/water bodies with fish populations which are known to be susceptible to hydrological impacts (as informed by baseline surveys and data)	Surveillance walkover of key sections/water bodies with fish populations which are known to be susceptible to hydrological impacts (as informed by baseline surveys and data)	Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to barriers to support fish movement and/or improve habitat conditions.	In the 2 years following drought order implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. This will assist with determining if fish have successfully migrated back to previously impacted reaches from non-impacted tributaries/reaches. In extreme cases, following consultation with the Environment Agency, restocking of flow sensitive fish species can be considered if recovery needs to be facilitated.	Southern Water in agreement with EA
Fish community, including European eel and Bullhead Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Reduction in abundance or distribution as a result of reduced water quality.	Water quality is not well understood due to limited water quality data for the impacted sites. Collate any local water quality data that may be available (e.g. from WWT). Carry out water quality sampling at 1 site in each impacted water body at times of low flow/low water levels for: dissolved oxygen, pH, turbidity, suspended sediment, conductivity, temperature, ammonia and SRP 2 surveys per year at times of low flow/water levels at the same survey sites.	Surveillance walkover of key sections with known water quality pressures and sections known to be susceptible to lower flows. At baseline water quality monitoring sites, measure dissolved oxygen, pH, turbidity, conductivity and temperature in the field using calibrated handheld equipment. Collect water quality samples to analyse for ammonia, suspended sediment and SRP and to confirm hand-held probe readings. Appropriate trigger values would be set for key water quality determinands (e.g. dissolved oxygen), level and flow based on local circumstances, timing, seasonality and expert opinion. Known areas of dry habitats are typically avoided during the walkover, but recorded where observed to confirm and/or confirm existing knowledge.	Surveillance walkover of key sections with known water quality pressures and sections known to be susceptible to lower flows. Measure dissolved oxygen, pH, turbidity, conductivity and temperature in the field using calibrated handheld equipment. Collect water quality samples to analyse for ammonia, suspended sediment and SRP and to confirm hand-held probe readings. Frequency = fortnightly, or more frequently if water quality is shown to be critical for fish. If DO saturation becomes critical for fish, deployment of automated water quality equipment that continuously monitors for dissolved oxygen in dialogue with EA.	Consider deployment of aeration equipment if critically low oxygen levels that could place fish in distress. Consider scope for improving quality of effluent or reducing inputs from the trout fishery and/or the Southern Water WSW discharge, if this would help address adverse water quality issues.	Carry out water quality surveys following baseline monitoring requirements. It is considered that water quality will return back to normal following cessation of the drought conditions that necessitated the drought permit implementation. No specific mitigation applicable post-drought permit implementation.	Southern Water in agreement with EA and WWT

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Macrophytes Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve - Arundel	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Water quality is not well understood due to lack of water quality monitoring at these water bodies. Obtain local water quality data that may be available (e.g. from WWT) Carry out water quality surveys as noted above for fish. Macrophyte populations are not well understood as a result of lack of data. Collate any available local macrophyte data (e.g. from WWT). Carry out summer walkover and macrophyte surveys at sites to be agreed following site walkovers. One advanced possibility is a site at the River Arun Tributary into Arundel Park (dependent on walkover but believed appropriate for invertebrates). Identify any key point sources of nutrient loading. Survey frequency to be discussed following walkover and survey site decisions with EA and other stakeholders.	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time (see fish section above for parameters).	Survey to be undertaken and macrophytes identified (if drought order implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at same time (see fish section above for parameters).	Consider measures to address identified point sources of nutrient loading. Consider scope for improving quality of effluent or reducing inputs from the trout fishery and/or the Southern Water WSW discharge, if this would help address adverse water quality issues. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought order implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. Carry out water quality sampling at same time. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA and WWT
Blue-green algae Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Increased proliferation of blue green algal blooms at each of the four sites.	Lack of historic records. Where identified, water samples to be taken to analyse the algae and water quality conditions, following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom, EA are to be notified. Collate any historic evidence of blue-green algae from EA and other local knowledge to better assess risks.	Monthly walkover of key locations previously established. Visual assessment of algal blooms. Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Monthly walkover of key locations previously established for visual assessment of algal blooms. Samples to be collected from algal blooms which are suspected to contain blue green algae. Samples to be analysed following EA guidance on assessing blue green algae blooms. On confirmation of a blue green algae bloom EA are to be notified.	Mitigation of blue-green algal blooms should centre around reporting all blooms to the Environment Agency to ensure that appropriate action can be taken to inform the public. If major risk identified, consider treatment of algal bloom if appropriate in dialogue with EA and water body owner/riparian owners.	Upon cessation of the drought order, baseline conditions will return. No further monitoring will be required post-drought order implementation. Continue vigilance during standard baseline drought permit monitoring activities.	Southern Water in agreement with EA and WWT

Feature	Potential Impact identified in EAR	Baseline Monitoring	On-set of environmental drought	During Drought Order Implementation Period		Post Drought Order	Responsibility for monitoring and mitigation
		Key locations	Monitoring and trigger setting	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring	Monitoring and post-drought mitigation (where applicable)	
Macroinvertebrates Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Water quality is not well understood due to lack of data for these waterbodies. Macroinvertebrate populations are not well understood as a result of lack of data. Collate available local records to improve baseline datasets. Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys at sites to be agreed following site walkovers. One advanced possibility discussed is a site at the River Arun Tributary into Arundel Park (dependent on walkover but believed appropriate for invertebrates). Identify to species/mixed taxonomic level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider scope for improving quality of effluent or reducing inputs from the trout fishery and/or the Southern Water WSW discharge, if this would help address adverse water quality issues. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable. Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal monitoring programmes.	Southern Water in agreement with EA and WWT
Water Vole Park Bottom tributary; Swanbourne Lake; Mill Stream; WWT reserve	Reduced habitat availability and/or food sources	Discuss with Sussex Wildlife Trust the available survey data for the impacted sites. Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought permit implementation. Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence, population size and habitat conditions. **Note:** in review, data may provide guidance as to how drought permit implementation impacts water vole population structure and health.	Carry out further survey to assess any risk to local population.	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Sussex Wildlife Trust. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA and WWT
South Downs National Park and NCA	Uncertain impacts on character of area	Walkover survey and photographic record during summer low flow conditions and complete scoping exercise for LVIA with initial indication of significance of impacts	Update walkover survey and photographic records if required and complete full LVIA to support drought order application.	Photographic record/evidence to be taken at fixed points used during on-set of drought surveys to document changes.	Mitigation likely to be associated with that for flora and fauna species.	N/A	Southern Water in agreement with Natural England
Swanbourne Lake recreational facility	Uncertain impacts on recreational use of lake as a result of drought option and visual amenity	Walkover survey and photographic record during summer low flow conditions and complete scoping exercise for recreational and visual amenity assessment within initial indication of significance of impacts	Update walkover survey and photographic records if required and complete full assessment to support drought order application.	Photographic record/evidence to be taken at fixed points used during on-set of drought surveys to document changes.	Mitigation likely to be associated with that for flora and fauna species.	N/A	Southern Water in agreement with local council and EA and NE as appropriate

Southern Water has discussed the above suite of environmental monitoring and in-drought mitigation measures with Portsmouth Water in relation to its nearby “Source S” Drought Permit. Southern Water will continue to work closely with Portsmouth Water and the Environment Agency as part of the programme of refining the monitoring and monitoring plans for these two Drought Permits.

7.3.4 East Worthing

Feature	Potential Impact identified in EAR	Baseline Monitoring Key locations	On-set of environmental drought Monitoring and trigger setting	During Drought Permit Implementation Period Trigger and monitoring to inform mitigation action	 Mitigation actions triggered by monitoring	Post Drought Permit Monitoring and post-drought mitigation (where applicable)	Responsibility for monitoring and mitigation
Fish community, including European eel **Teville Stream/Broadwater Stream**	Increased mortality (density dependent) as a result of increased predation and competition Impacts on growth and/or alteration to feeding and migration (particularly eels formerly recorded in waterbody) Reduction in abundance and distribution of flow sensitive species due to low flows, reduced wetted width and flow velocities. Reduction in abundance or distribution as a result of reduced water quality.	Fish populations are not well understood as a result of lack of recent survey data. Electric-fishing surveys to monitor populations in perennially flowing reaches of the Teville Stream (1 site) and Brooklands Lake (1 site). Sites, discussed with EA, will complement existing EA fish monitoring sites. 1 survey round every 1 year at same sites Collate any further information from local knowledge and EA local staff, plus local biological records.	Approximation of the number of each fish species (e.g. 10s, 100s) in each ponded reach, where safe and practical to do so. Measure dissolved oxygen, conductivity and temperature in the field using calibrated handheld equipment. Appropriate trigger values would be set for level and/or flow based on local circumstances, timing, seasonality and expert opinion.	Additional walkovers, if situation is expected to deteriorate in stream sections/water bodies known to contain high fish densities.	Consider deployment of aeration equipment in key reaches with critically low oxygen levels. Consider provision of bird scarers to deter piscivorous birds at significant locations, if appropriate taking account of the balance between bird food supply and fish requirements. Consider possible in-stream measures or adjustments to improve habitat conditions. In extreme cases, consider capture/rescue surveys for fish. It is noted these will need sufficiently sized aerated holding tanks as it is unlikely that they can be moved to elsewhere in the catchment. [to be agreed with EA if this should be a mitigation measure]	In the year following drought permit implementation, undertake post-drought fish surveys at the baseline monitoring sites to substantiate the level of impact. Consider re-stocking options where appropriate and applicable in dialogue with the EA. Three years post drought permit monitoring at baseline monitoring sites to determine relative health of year classes which are influenced by this impact. Including fish scale analysis.	Southern Water in agreement with EA
Macrophytes **Teville Stream/Broadwater Stream**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Macrophyte populations are not well understood as a result of lack of recent data along entire reach. Collate any available local macrophyte data In consultation, no suitable locations for macrophyte surveys were located in across the Teville and Broadwater Streams/Broadwater Lake. As such no macrophyte survey sites were recommended, but subject to reassessment following walkover. Identify any key point sources of nutrient loading and carry out water quality samples at survey sites, including for SRP.	Seasonal walkover and carry out macrophyte surveys at the baseline survey sites (if during plant growing season) Carry out water quality sampling at same time, including for SRP.	Survey to be undertaken and macrophytes identified (if drought permit implemented in plant growing season) Walkover survey to identify any key sources of nutrient loading. Carry out water quality sampling at same time, including for SRP.	Consider measures to address identified point sources of nutrient loading. Consider possible in-stream measures or adjustments to improve habitat conditions.	Carry out post-drought permit implementation surveys at the baseline monitoring sites for 2 consecutive summers after the last summer of a drought (one survey each year) to understand the extent of recovery from any adverse impacts. No specific post-drought permit mitigation measures identified.	Southern Water in agreement with EA
Macroinvertebrates **Teville Stream/Broadwater Stream**	Reduction in abundance or distribution as a result of reduced water quality / habitat.	Collate available local records to improve baseline datasets. Carry out seasonal (spring, summer and autumn) macroinvertebrate surveys in perennially flowing reaches: 1 site in the Teville Stream and 1 site in Broadwater Stream every year in spring and autumn. Identify to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Seasonal monitoring of macroinvertebrates at the baseline survey sites. Samples to be collected and identified to species level.	Consider possible in-stream measures or adjustments to improve habitat conditions.	No action required outside of routine seasonal baseline monitoring programmes.	Southern Water in agreement with EA

Water Quality **Teville Stream/Broadwater Stream**	Potential reductions in water quality due to reductions in flow.	Very limited data set. Carry out monitoring in perennially flowing reaches: 1 site in the Teville Stream and 1 site in Broadwater Stream every year during low flow conditions for SRP, dissolved oxygen, ammoniacal nitrogen, pH and temperature.	Water quality monitoring at the baseline sites for the same parameters: SRP, dissolved oxygen, ammoniacal nitrogen, pH and temperature.	Water quality monitoring at the baseline sites for the same parameters: SRP, dissolved oxygen, ammoniacal nitrogen, pH and temperature.	Consider deployment of aeration equipment in key reaches with critically low oxygen levels.	No action required outside of routine baseline monitoring programme.	Southern Water in agreement with EA
River Flow **Broadwater Brook (Teville Stream)**	Lack of surface water flow gauging data	It is recommended that spot flow and level gauging is carried out on this reach at times of low flow to create a baseline data set of 4 low flow surveys.	Repeat low flow monitoring at baseline survey site.	Repeat low flow monitoring at baseline survey site once every month.	None applicable.	Monitor rate of flow recovery over the following 6 months or until flows recover above the estimated Q95 flow values.	Southern Water in agreement with EA
Water Vole	Reduced habitat availability and/or food sources	Discuss with Sussex Wildlife Trust the available survey data for the impacted sites. Carry out targeted water vole/water vole habitat surveys if local data not available to understand potential risks to the species from the drought permit implementation. Repeat survey every 3 years.	Review baseline data and carry out further survey of water vole presence, population size and habitat conditions. **Note:** in review, data may provide guidance as to how drought permit implementation impacts water vole population structure and health.	Carry out further survey to assess any risk to local population.	Consider opportunities to create alternative habitat if significant risk identified in dialogue with EA and Sussex Wildlife Trust. Operation of key flow control structures to maintain water levels in key reaches/water bodies where applicable.	Carry out further survey of water vole presence and habitat conditions for 2 years after the drought order implementation.	Southern Water in agreement with EA and WWT

8 Monitoring and Mitigation for Temporary Emergency Desalination Options

Table 8.1 sets out the monitoring and mitigation measures for the temporary emergency desalination options included in the Drought Plan 2018. We are discussing these measures with the Environment Agency and Natural England with the aim of agreeing the specific locations, frequencies and survey methods during summer 2019.

Table 8.1 Mitigation and compensation measures: temporary emergency desalination options

Sheerness

Feature	Potential impact	Baseline monitoring	Mitigation during construction	On-set of environmental drought	During implementation of emergency measure		Post Drought	Responsibility for monitoring and mitigation
				Monitoring and trigger settings	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring		
Medway Estuary and Marshes Special Protection Area	Loss and/or degradation of offsite functional land (within estuary) used qualifying species	Data collection (e.g. biological record centre data, WeBS) on use of functional land around pipeline route and intake/outfall structures Baseline breeding and wintering bird surveys to support data collection and understanding of use where necessary Baseline estuarine macroalgae and macroinvertebrate surveys	Best practice construction methods to be used when installing pipeline and intake/outfall Timings of construction to minimise bird disturbance Construction environmental management plan to be produced	N/A– positioning of outfall and pipeline to be completed before drought	N/A	TBC	Bird and estuarine macroalgae/ macroinvertebrate surveys to establish any change from baseline (if necessary) following construction	Southern Water in agreement with NE and EA
	Degradation of habitat from dispersion of hypersaline discharge	Dispersion modelling (if technically feasible) or a quantitative assessment to ensure outfall is located at a sufficient distance from designated sites to ensure sufficient mixing is achieved	N/A	N/A	N/A	Release discharge from desalination plant on ebbing tide		
	Noise disturbance during	Baseline noise monitoring to understand existing levels and revised	Best practice construction methods e.g. silencers,	Update baseline				

Feature	Potential impact	Baseline monitoring	Mitigation during construction	On-set of environmental drought	During implementation of emergency measure		Post Drought	Responsibility for monitoring and mitigation
				Monitoring and trigger settings	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring		
	construction S	assessment of likely construction noise levels and potential impacts (once details of construction methods known)	hoarding To be finalised after updated assessment Flight responses to be monitoring during construction if necessary					
Medway Marine Conservation Zone	Loss and/or degradation of habitat along pipeline route and intake/outfall structure Degradation of habitat from dispersion of hypersaline discharge	Baseline estuarine macroalgae/ macroinvertebrate/protected species surveys and data collection (e.g. biological record centre) Dispersion modelling (if technically feasible) or a quantitative assessment to ensure outfall is located at a sufficient distance from designated sites to ensure sufficient mixing is achieved	Positioning of outfall and pipeline to be optimised to avoid impacts Relevant licences obtained for protected species N/A	N/A – positioning of outfall and pipeline to be completed before drought N/A	N/A N/A	N/A Release discharge from desalination plant on ebbing tide	Estuarine macroalgae and macroinvertebrate surveys to establish any change from baseline (if necessary) following construction N/A	Southern Water in agreement with EA and NE
Invasive non native species	Spread of INNS during construction	Baseline survey to identify presence of INNS in construction zone and relevant buffer up and downstream	INNS on site to be removed or treated as required prior to construction work	N/A	N/A	N/A	N/A	Southern Water in agreement with NE and EA
Fish	Entrainment in intake screens	Baseline fish surveys to inform optimal design of intake to avoid entrainment	Screens on intake to minimise entrainment	N/A – mitigation during design of intake	N/A – mitigation during design of intake	N/A – mitigation during design of intake	N/A	Southern Water in agreement with NE and EA

Feature	Potential impact	Baseline monitoring	Mitigation during construction	On-set of environmental drought	During implementation of emergency measure		Post Drought	Responsibility for monitoring and mitigation
				Monitoring and trigger settings	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring		
Population and health	General construction impacts – noise, air quality and vibration issues, traffic disruption	Data collection and baseline surveys where necessary to inform construction methods and mitigation	Best practice construction methods e.g. hoarding, dust suppression Construction environmental management plan to be produced	N/A	N/A	N/A	N/A	Southern Water in agreement with NE and EA
Water quality	Sediment loaded runoff during construction	N/A – best practice construction methods	Best practice construction methods e.g. runoff attenuation, sediment traps	N/A	N/A	N/A	Estuarine macroalgae and macroinvertebrate surveys to establish any change from baseline (if necessary) following construction	Southern Water in agreement with NE and EA
	Increased sedimentation and turbidity of water column during pipeline/intake and outfall construction	Baseline estuarine macroalgae/ macroinvertebrate/protected species surveys	Positioning of outfall and pipeline to be optimised to avoid impacts Best practice construction methods	N/A	N/A	N/A		
	Degradation of habitat from dispersion of hypersaline discharge	Dispersion modelling (if technically feasible) or a quantitative assessment to ensure outfall is located at a sufficient distance from designated sites to ensure sufficient mixing is achieved	N/A	N/A	N/A	N/A	N/A	
Recreation	Disruption to public rights of way during construction	Baseline data collection on public rights of way and assessment of those that need to be closed/diverted during construction works	Closure/diversion of footpaths to be completed prior to construction	N/A	N/A	N/A	N/A	Southern Water in agreement with relevant local authorities

Sandown

Feature	Potential impact	Baseline monitoring	Mitigation during construction	On-set of environmental drought	During implementation of emergency measure		Post Drought	Responsibility for monitoring and mitigation
				Monitoring and trigger settings	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring		
Bembridge Marine Conservation Zone	Loss and/or degradation of habitat around intake structure and any associated pipeline	Data collection (e.g. biological record centre) and baseline habitat and species surveys along pipeline route and intake structure	Positioning of intake to be optimised to avoid impacts to key sensitive habitats of the MCZ where possible Best practice construction methods to be used	N/A – mitigation to be incorporated during construction	N/A	N/A	Habitat and species surveys to establish any change from baseline (if necessary) following construction	Southern Water in agreement with NE and EA
Invasive non native species	Spread of INNS during construction	Baseline survey to identify presence of INNS in construction zone and relevant buffer up and downstream	INNS on site to be removed or treated as required prior to construction work	N/A	N/A	N/A	N/A	Southern Water in agreement with NE and EA
Fish	Entrainment in intake screens	Baseline fish surveys to inform optimal design of intake to avoid entrainment	Screens on intake to minimise entrainment	N/A – mitigation during design of intake	N/A – mitigation during design of intake	N/A – mitigation during design of intake	N/A	Southern Water in agreement with NE and EA
Population and health	General construction impacts – noise, air quality and vibration issues, traffic disruption	Data collection and baseline surveys where necessary to inform construction methods and mitigation	Best practice construction methods e.g. hoarding, dust suppression Construction environmental management plan to be produced	N/A	N/A	N/A	N/A	Southern Water in agreement with NE and EA
Water quality	Sediment loaded runoff during construction	N/A – best practice construction methods	Best practice construction methods e.g. runoff attenuation, sediment traps	N/A	N/A	N/A	Habitat and species surveys to establish any change from	Southern Water in agreement with NE and EA

Feature	Potential impact	Baseline monitoring	Mitigation during construction	On-set of environmental drought	During implementation of emergency measure		Post Drought	Responsibility for monitoring and mitigation
				Monitoring and trigger settings	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring		
	Increased sedimentation and turbidity of water column during intake construction	Baseline habitat and species surveys along pipeline route and intake structure	Positioning of intake to be optimised to avoid impacts to key sensitive habitats of the MCZ where possible Best practice construction methods	N/A – mitigation to be incorporated during construction	N/A	N/A	baseline (if necessary) following construction	
Recreation	Disruption to public rights of way during construction	Baseline data collection on public rights of way and assessment of those that need to be closed/diverted during construction works	Closure/diversion of footpaths to be completed prior to construction	N/A	N/A	N/A	N/A	Southern Water in agreement with relevant local authorities

Littlehampton

Feature	Potential impact	Baseline monitoring	Mitigation during construction	On-set of environmental drought	During implementation of emergency measure		Post Drought	Responsibility for monitoring and mitigation
				Monitoring and trigger settings	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring		
Coastal/ intertidal habitats and species	Loss and/or degradation of habitat around intake structure and pipeline	Data collection (e.g. biological record centre) and baseline habitat and species surveys along pipeline route and intake structure	Positioning of intake to be optimised to avoid impacts to key sensitive habitats and species where possible Best practice construction methods to be used	N/A – mitigation to be incorporated during construction	N/A	N/A	Habitat and species surveys to establish any change from baseline (if necessary) following construction	Southern Water in agreement with NE and EA
Invasive non native species	Spread of INNS during construction	Baseline survey to identify presence of INNS in construction zone and relevant buffer up and downstream	INNS on site to be removed or treated as required prior to construction work	N/A	N/A	N/A	N/A	Southern Water in agreement with NE and EA
Fish	Entrainment in intake screens	Baseline fish surveys to inform optimal design of intake to avoid entrainment	Screens on intake to minimise entrainment	N/A – mitigation during design of intake	N/A – mitigation during design of intake	N/A – mitigation during design of intake	N/A	Southern Water in agreement with NE and EA
Population and health	General construction impacts – noise, air quality and vibration issues, traffic disruption	Data collection and baseline surveys where necessary to inform construction methods and mitigation	Best practice construction methods e.g. hoarding, dust suppression Construction environmental management plan to be produced	N/A	N/A	N/A	N/A	Southern Water in agreement with NE and EA
Water quality	Sediment loaded runoff during construction	N/A – best practice construction methods	Best practice construction methods e.g. runoff attenuation, sediment traps Positioning of intake to be optimised to avoid	N/A	N/A N/A	N/A N/A	Habitat and species surveys to establish any change from baseline (if necessary)	Southern Water in agreement with NE and EA

Feature	Potential impact	Baseline monitoring	Mitigation during construction	On-set of environmental drought	During implementation of emergency measure		Post Drought	Responsibility for monitoring and mitigation
				Monitoring and trigger settings	Trigger and monitoring to inform mitigation action	Mitigation actions triggered by monitoring		
	Increased sedimentation and turbidity of water column during intake construction	Baseline habitat and species surveys along pipeline route and intake structure	impacts to key sensitive habitats of the MCZ where possible Best practice construction methods	N/A – mitigation to be incorporated during construction			following construction	
Recreation	Disruption to public rights of way during construction	Baseline data collection on public rights of way and assessment of those that need to be closed/diverted during construction works	Closure/diversion of footpaths to be completed prior to construction	N/A	N/A	N/A	N/A	Southern Water in agreement with relevant local authorities

Appendix A: Standard Survey and Analysis Methodologies

Hydrogeology: Groundwater level monitoring

Boreholes/Wells:

The approach adopted should consider the ability to install an automatic water level logging device (preference) or otherwise manual dip readings. The datum level should be carefully determined and noted and referenced to ground level datum or other appropriate local datum.

The process for the manual dip is as follows:

- Ensure dip tape is clean (wipe tape with sterilising solution as it is lowered into borehole).
- Dip water level to the top of the welded flange ring (steel OBH), top of uPVC casing or other datum.
- Record levels to correct datum point and note time in notebook/record sheet.

Where automatic logging is installed, a manual calibration dip should be taken once every 6 months as a minimum and compared to the logger data. Any discrepancies and any re-calibration should be clearly identified in the data record. The manual calibration dip reading should be carefully recorded and retained for future reference.

If the groundwater level is being obtained from a borehole used for potable supply purposes, great care must be taken not to cause any contamination of the groundwater during installation of automatic logging equipment or manual dip readings.

Hydrology: Water level and river flow gauging

The approach adopted to water level monitoring of rivers or standing water bodies (e.g. lakes, ponds) includes continuous monitoring and ad hoc surveys which require single or repeated visits to manually collect data. A non-exhaustive list is provided below:

Continuous (auto data logging) surveys include:

- River level and flow gauging – Data is collected by the EA as part of routine monitoring of the physical environment. This data can be requested from the EA's regional data centres for analysis and many are located in the vicinity of puttable water infrastructure.
- Standing water level logging - Data is collected by Southern Water (in-reservoir), the EA or other responsible body (Wetland trusts, etc.) as part of routine monitoring of the physical environment. This data can be requested from the EA's regional data centres for analysis.
- Manual gauge board reading – Manual gauge board readings are undertaken where a weir exists, but no electronic data monitoring is currently installed. This requires the visual identification of the water level on the gauge board, which is recorded on a regular basis. This visual identification can be done via eye (visit) or via webcam.
- Wetland table monitoring – Wetland monitoring of surface water may be gauged at any outflow of wetland water body and by borehole (explained in Section 6.35 above). A surface water outflow will flow over a weir at which it is possible to ascertain a water level from the gauge board. Should the weir not have continuous data monitoring capabilities, readings from the gauge board can be taken and recorded on a regular basis.

Ad hoc surveys include:

- Spot flow gauging – Safe and effective spot flow gauging is dependent on the size and current flow of the water body. Common methods include:
    - In channel measurement using Acoustic Doppler Current Profiler (ADCP). This can be undertaken with a hand held ADCP when the water is at a suitable flow and the user can safely wade across the water body. This involves the submersion of the unit and taking measurements at particular locations/intervals to create a flow profile.
    - In channel measurement using an Electromagnetic (EM) gauge. Such a technique is employed when stream flow is extremely low and involves the submersion of the EM unit into the flow, to take a measurement, where possible.
    - Measurement using a deployable unit, such as a Teledyne RDI Stream Pro, that automatically takes in-river measurements across a bridge or a tagline to collect data.

Water quality

Where specified, water quality surveys will be undertaken during low flow conditions to establish baseline conditions.

The surveys will comprise:

a) Spot measurements using a hand-held multi-sonde device to measure instantaneous pH, temperature, electrical conductivity and dissolved oxygen (% saturation and mg/l).

b) Water samples will be taken for subsequent analysis by an accredited laboratory for the following parameters:

- Alkalinity expressed as CaCO3.
- Unionised Ammonia expressed as N.
- Ammonia expressed as NH3.
- Hardness expressed as CaCO3.
- Nitrate.
- Phosphate.
- Suspended Solids (Total).
- Total Oxidised Nitrogen.
- Orthophosphate.
- Temperature.
- pH.

The number and location of samples will be determined by the EMP reach length, specific water quality pressures identified within the reach and will take into account the spatial distribution and results of, all relevant Environment Agency historic water quality monitoring data. In addition, samples will be taken in areas that are targeted for ecological monitoring (particularly macro-invertebrates).

For sites downstream of reservoirs, there will be one sample taken close to the compensation flow release to assess the quality of the released water and a least one other sample towards the downstream end of the reach.

As stated above, where specific water quality pressures are identified (e.g. STW discharge), additional sample sites will be required.

Following site selection, a list of selected sites, including grid references, will be passed to the Environment Agency for information.

Sampling will be on two occasions during the sampling year. The two occasions will be required to be:

i. approximately equally distributed throughout the year,

ii. at low environmental flows (i.e. flows equal to or less than Q80 and after a prolonged period of little precipitation) and,

iii. at times without spill of excess water from upstream Southern Water reservoirs.

Geomorphology

Each relevant river reach that has a lack of geomorphological data identified in the EMP will be characterised into separate physical geomorphological sub-reaches based on key indicators of geomorphological change and their sensitivity to very low flows during drought conditions.

Geomorphological features that will be captured within these sub-reaches will include:

- Significant changes in substrate characteristics/distribution
- Significant changes in bank material
- Approximate measurements of channel widths and bank heights to provide an indication of typical low flow channel cross-sections
- An assessment of the sensitivity of the reach to drought conditions

The data collected will highlight areas considered to be at high risk of impact from very low flow conditions.

Sediment has an important role to play as coarse sediments provide habitat for a range of species: fine sediment can deposit out of suspension under low flow velocities during a period of drought leading to negative impacts upon in-stream ecology. Features that will be monitored include:

- Bars – areas of both coarse and fine sediment accumulation
- Bank erosion – areas of significant bank erosion delivering fine sediment to the system
- Tributaries delivering fine sediment
- Wider catchment sediment pathways

Ecological habitats and impacts upon these habitats through modifications will be captured by the following information

- Flow types including pools, riffles, steps, runs, glides and backwaters
- Areas of significant shelter/shading including overhanging banks or vegetation
- Presence of significant in-channel vegetation
- Barriers to fish passage or channel modifications

Presence of any Wildlife and Countryside Act, Schedule 9 (as amended) species, evident to a walkover survey[25].

The geomorphological and habitat survey will be a one-off survey carried out under low flow conditions so that the survey is focused on drought-sensitive features. Providing flow, weather and access conditions allow, all surveys will be completed within the same year.

[25] Surveyors will not be expected to survey submerged or inaccessible vegetation, however stands of emergent or floating macrophytes like Floating Penny Wort or Curly Waterweed will be noted. Species present within the riparian zone (e.g. Giant Hogweed, Japanese Knotweed) will also be recorded in a presence absence record per species per reach.

The data will be collected continuously for any EMP river reach less than 6 kilometres in length. A subset of the total length will be captured in longer reaches, using a desk study to focus the field surveys on key areas. Typically, any reach between 6 kilometres and 23 kilometres long will have a total of 6 kilometres of survey undertaken; 12 kilometres will be surveyed in those reaches between 24 kilometres and 47 kilometres. Any reach over 48 kilometres in length will have a total of 18 kilometres surveyed.

Fish

All fish survey work will be carried out by electric fishing methods. The electric fishing sampling protocol will follow standard electric fishing practice for operators and equipment, as developed by BS EN 14011: 2003 Water Quality Sampling of Fish with Electricity and detailed in the Environment Agency (2001) R&D Technical Report W2-054/TR. This will allow comparisons to be made with historical data sets held by the EA.

In all cases, the equipment used will be a bank-side control box with 50 or 100Hz pulsed-DC output at 220 volts and variable current. For all electric fishing equipment and modes of operation to comply with the EA Health and Safety Regulations, a minimum of a 3-person survey team will be required for the surveys, and in wider rivers this would preferably be a 4-person team.

The general survey approach will be to undertake one quantitative and two semi-quantitative surveys within each reach <15 metres in width identified as requiring survey by Southern Water, with results from the former being used to calibrate results from the latter.

Quantitative sampling

Quantitative sampling will be carried out at all study sites to obtain absolute estimates of population density. This method provides more robust biomass and density estimates of fish.

Each quantitative survey site will be fished by at least a three-person team, in an upstream direction three consecutive times taken from 100 metres stretches of river. A depletion in abundance should occur between each run (consecutive runs should be undertaken if there is not a significant depletion). A period of 20 minutes will be left between each run to allow water clarity to return and fish to become naturally distributed after each disturbance. Fish to be returned to the water after all the three runs are completed.

Semi-quantitative sampling

Semi-quantitative sampling will differ from quantitative sampling only in that one run will be carried out rather than three. The total number of fish caught is given as a minimum population estimate.

At new sites, a minimum of 30 metres of river length should be sampled, but preferably 50 metres or at least 100 m^2. At sites sampled previously, the same length of river must be sampled year on year. At each site, the number of fish of each species in each catch will be recorded and the length (fork length, nearest millimetre) will be measured.

The age of smaller fish from length-frequency distributions will be determined. Samples of scales will be taken from a small number of individual salmonid fish for determination of age and growth of the fish populations. Where large numbers of individuals are caught, scales will be taken from a representative sample of fish covering all size ranges (maximum of five fish from each 10 millimetre length band), and the age structure determined from comparison with length frequency data.

Following processing, fish will be placed in oxygenated recovery bins to recover, before being released at the site where they were captured following completion of data collection.

Prioritisation exercise

A prioritisation exercise to refine the drought monitoring exercise will also be carried out. The overall aim of which will be to deliver a cost-efficient, robust, ecologically relevant and legislatively appropriate monitoring program for fish. Communities, habitats and compensation flow schemes that would be sensitive to drought orders and would require monitoring will be identified. Elements will include:

- Literature review pertaining to the impact of droughts on fish communities to identify sensitive communities and habitats and define appropriate ecological responses and metrics of assessment; characterise the reservoir schemes, rivers and habitats and drought orders that are involved in Southern Water drought management to identify sensitive catchments, reaches and priority schemes (high risk of drought order) that might need monitoring, and where appropriate suitable control/reference sites.
- Support the delivery and analysis of the monitoring programme.
- Analyse existing databases for fish populations in the Southern Water catchment to identify fish population status and populations that may be sensitive to drought.
- Collate the knowledge reviewed above, pertaining to the sensitivity of fish populations/communities to drought (and flow management) and the sensitivity of habitats and schemes to drought orders, to create a weighted prioritisation matrix to determine the high priority sites and schemes requiring monitoring.
- Propose options for cost-efficient, robust, ecologically relevant and legislatively appropriate monitoring program for fish, detailing in each case the strengths, limitations and potential costs.

In summary, the exercise will involve analysing existing baseline data to identify the most appropriate metrics for assessment and the time-scales over which data would need to be collected (either as a baseline or as a continuous annual monitoring programme) depending on the legislative (assessments for single schemes/drought orders or higher level catchment based assessment) and statistical (power/resource analysis) requirements to deliver a robust assessment.

The output of the prioritisation exercise will be shared with the Environment Agency.

Electric fishing for lamprey

In habitat suitable for lamprey ammocoetes in or adjacent to a sampling area these will be surveyed. This will involve targeted electric fishing using a single anode, but if large numbers of ammocoetes are caught sites will be surveyed following a standardised fixed framework protocol (Harvey and Cowx 2003[26]), by selecting three small (<3m^2) patches of suitable habitat (e.g. tree roots, silt substrate). Lamprey will be speciated out in the field where possible and their abundance and life-stage recorded.

Physico-chemical data

During the fish surveys the following information will also be collected: site length; average width; flow characteristics; substrate type; bankside vegetation; temperature; and conductivity.

In addition, a habitat survey will be carried out after each fish survey (on an annual basis) to meet

[26] Harvey J.P & Cow I.G. (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.

the requirements of the HABSCORE assessment (Wyatt and Lacey 1994[27]; Wyatt et al. 1995[28]). These data will be analysed through the HABSCORE programme to evaluate the suitability of the site in terms of juvenile salmon and trout abundance, and provide a measure for future assessment of the impact of any drought permit changes in compensation flow on the habitat suitability and availability for salmonids.

Three sites will be sampled in each drought permit impact reach <15 metres wide as identified as requiring monitoring by Southern Water (i.e. where the EA are not surveying or where a sufficient baseline does not already exist).

One site in each reach will be sampled using a three-catch quantitative survey and the other two sites will be sampled using single-catch semi-quantitative surveys. The efficiency of sampling effort or probability of capture (P) at quantitative sites will be used to derive relative density ($N/100m^2$) at semi-quantitative sites: N = ((C / P) / A) *100, where C is the total number of fish caught in the single run and A is the sampling area (Cowx 1996[29]).

This approach will establish sufficient baseline fish data to inform statistically robust impact assessments of drought option implementation, over and above the effects of environmental drought.

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

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 routine biological assessment tools for rivers based on invertebrates, i.e. River Invertebrate Prediction and Classification System (RIVPACS) and Lotic-invertebrate Index for Flow Evaluation (LIFE) scores.

A three-minute kick/sweep sample will be taken, covering all in-stream habitats, followed by a one-minute hand search. This is consistent with the method set out in the Environment Agency (EA) procedure for RIVPACS/LIFE analysis (EA, 1999).

Samples collected will be preserved using a 90% industrial methylated spirits on site, allowing long term storage of samples if required. Every six months' samples need to be checked and it may be necessary to top up the preservatives to replace losses from evaporation.

As a number of factors determine the composition and dynamics of macro-invertebrate populations, other environmental parameters will be collected at each sampling location including: pH, conductivity, dissolved oxygen concentration at the surface and near the bed, wetted width of the river, river depth, substratum composition, macrophyte cover, riparian vegetation, shading, riparian land use, altitude, slope of bank and underlying geology.

Macrophytes

The survey method used should conform to CEN 14184: 2003 Water quality – Guidance standard for the surveying of aquatic macrophytes in running waters. In order to obtain the data with which to

[27] Wyatt R.J. & Lacey R.F. (1994) Guidance notes on the design and analysis of river fishery surveys. NRA R&D Note 292, 118 pp.
[28] Wyatt R.J., Barnard S. & Lacey R.F. (1995) Use of HABSCORE V software and application to impact assessment. Report to NRA, No. 400 WRc.
[29] Cowx I.G. (1996) The integration of fish stock assessment into fisheries management. In: Cowx, I.G. (ed.) Stock Assessment in Inland Fisheries. Fishing News Books, Blackwell Science, Oxford. pp 495-506.

calculate the observed values for each of the parameters, 100 metre stretches of the river should normally be sampled between 1st June and 30th September. Sampling should not be undertaken during or immediately after periods of high flow. Macrophytes should also be sampled during periods of low flows to assess the extent to which it affects the community.

Where cold weather or spring floods may have delayed the growth of macrophyte taxa, sampling should commence after 30th June. Location of the survey stretches should be selected to be representative of the water body as a whole. The number of 100 metre stretches required to adequately characterise a water body will vary depending on the water body size (length) and heterogeneity of habitat. Previous work to assess variability in river macrophytes[30] indicated that in most water bodies three 100 metre stretches would be adequate to produce a classification with 95% confidence, and in some very small or very uniform water bodies it may be possible to reduce this number. Surveying should establish the presence, and percentage of the river channel (up to the height of bank that would typically be submerged for >50% of the year) covered by, any of the macrophyte taxa listed in the UKTAG guidance[31].

Estuarine macroalgae and phytoplankton

Sampling is usually carried out during summer when blooms are at their peak, and between mean high water and mean low water of spring tides. The overall size of algal mats is estimated either from aerial imagery or by walking around the algal patches with a GPS. Randomly placed quadrats are used to assess the density of mats (% cover within the quadrats), and also biomass (g.m $-^{2}$). Weed growing within the sediment is also noted (entrainment). The more weed there is, the more likely it is to affect organisms in the sediment and birds trying to feed on them. We assess the entire intertidal area of a waterbody, but only where algae have the potential to grow; this is called the available intertidal habitat (AIH).

Estuarine macroinvertebrates

The number of samples required for an assessment is dependent on the survey aims and the variability of the EQRs in the habitat sampled. WFD water body assessments generally use single samples taken from stations spread across suitable habitats within a water body. The EQR is calculated at the sample level. (Multiple samples may be collected at a station, but the implications to the calculation of the standard error and representation of the area being assessed must be considered.) The water body status is then derived by calculating the mean EQR and relating it to the class status boundaries. Careful consideration must be given as to the aims of the survey before commencing sample selection. As for any investigation, enough samples must be taken to ensure the required degree of confidence in the final assessment is reached. In habitats with high inherent variability, the IQI may not be a suitable assessment method as the number of samples required would be disproportionately high[32].

Samples are collected in areas of soft sediments. Grab size should be 0.1 m 2 for sub-tidal samples is used, while intertidal samples are taken by using a hand corer. After collection, samples are sorted in the laboratory and identified to the lowest practical taxonomic level where possible (usually species).

Blue-green algae

Water samples will be collected and analysed for chlorophyll measurements and in the summer for

[30] Willby, N.J., Pitt, J-A., & Phillips, G.L. (2012). The ecological classification of UK rivers using aquatic macrophytes. Science Report SC01008O/R1. Environment Agency, Bristol.
[31] Directive, W.F., 2014. UKTAG River Assessment Method Macrophytes and Phytobenthos.
[32] UKTAG (2014). UKTAG Transitional and Coastal Water Assessment Method Benthic Invertebrate Fauna.

cyanobacteria biovolume assessment.

Breeding and wintering birds

During the breeding bird season (April-June), surveys will be carried out across determined transects and from relevant vantage points. Frequency and methodology to follow accepted guidelines used in bird monitoring surveys[33][34].

Habitat extent is mandatory for assessing condition of bird features, and relates to the broad habitat type used by the species. In some cases, the habitat extent to be assessed will represent only a small part of a larger site, especially if the species habitat needs are quite specific, but in others it will effectively be the whole site as some species are more generalist in habitat use and require a mosaic of different habitats[35].

Once all of the data for each of the feature attributes has been collected and analysed/interpreted, the comparison with the baseline values for each attribute can be made to establish whether targets have been met and whether it will reduce or influence bird populations.

White-clawed Crayfish

The survey method will follow the Common Standards Method (CSM) for population monitoring of white-clawed crayfish prepared by Bradley *et al* in the guidance issued by JNCC (2015)[36]. The protocol involves manual searching at all sites with suitable substrate or the use of baited traps where manual searching is not possible. In some cases refuge traps may be used (for example where water voles are present at trapping sites and if few searchable refuges are available). Survey forms provided with the CSM guidance will be completed for each site.

In flowing water, individual monitoring sites may cover up to 200m of watercourse depending on the abundance and accessibility of refuges within the reach. Sites can be surveyed within randomly selected 500m river lengths or target lengths where the species has previously been recorded (e.g. utilising information from the Environment Agency or Local Records Centre). As a general guide between eight and 15 sites per watercourse assessment unit should be appropriate. Where the manual search technique is employed, 100 refuges should be searched and additional effort employed dependant on the initial results. The number of refuges searched should be recorded to facilitate catch per unit effort calculation. Should trapping be required, the exact number of traps will depend on the presence of suitable habitat and could expect to involve at least 10 per 500m river length.

Strict biosecurity procedures will be employed to minimise the risk of accidental spread of disease (e.g. crayfish plague) and all specimens captured should be carefully processed, recording species, sex and missing limbs or injuries on the CSM forms provided. Any evidence of invasive non-native crayfish species will be recorded and communicated to Southern Water.

A class licence to survey and handle white-clawed crayfish is required from Natural England and, should traps be needed, their use will require approval from the Environment Agency. Access

[33] Gregory, R D; Wilkinson, N I; Noble, D G; Robinson, J A; Brown, A F; Hughes, J; Procter, D A; Gibbons, D W and Galbraith C A (2002) The Population Status of Birds in the United Kingdom, Channel Islands and Isle of Man: an Analysis of Conservation Concern 2002-2007. British Birds 95: 410-450
[34] Gilbert, G., Gibbons, D.W. & Evans, J (1998) Bird Monitoring Methods: a manual of techniques for key UK species. RSPB, Sandy,
Bedfordshire.
[35] JNCC (2004) Common Standards Monitoring Guidance for Birds. Updated August 2004. ISSN 1743-8160 (Online)
[36] JNCC (2015) Common Standards Monitoring Guidance for Freshwater Fauna. Updated March 2015. ISSN 1743-8160 (Online)

permissions and risk assessments must be completed prior to undertaking any on-site activities.

Surveys should be undertaken between July and October (inclusive) with the optimum period from the second half of July through to late September.

Water Vole

The survey will follow the strategic survey methodology described by the Water Vole Conservation Handbook 3rd edition[37] and The Water Vole Mitigation Handbook[38] and will be completed for each site (and mitigation should follow this).

The monitoring sites will be located so that they sit over known locations for water vole (e.g. from Local Records Centre, Environment Agency and Wildlife Trust). The remainder of the survey area will then be sampled every 5 kilometres within habitat which could potentially be suitable for this species with the objective of identifying previously unknown populations.

The surveys will be undertaken between April and September.

Any evidence of mink, or other Wildlife and Countryside Act Schedule 9 species, recorded during surveys will be recorded and highlighted to Southern Water.

Designated Sites and Habitats

The features to be monitored are known as interest features for which the site has been notified or designated. They include individual habitat types, species and physical environment features, and also complex features such as habitat mosaics and species assemblages. Each interest feature must be monitored separately and will be covered by one of the methods above in this section.

Monitoring for each specific water dependent habitat should be designed with the following aims in mind[39]:

- to cover all the attributes highlighted in the assessments indicating habitat quality
- to monitor at 'wetland' and community levels, as appropriate for each attribute.

Baseline maps of the designated site should be produced, showing the boundaries of the interest features, the extent of the structural elements and the distribution of key vegetation communities and nationally rare/scarce or locally distinctive plant species. Aerial photography can help in the production of the maps. The use of GPS to determine the position of interfaces and notable species is recommended. These maps can subsequently be used during droughts to assess change.

During monitoring, aerial photography may be adequate for making a rapid determination of the extent of features and of component wetlands, although some ground-truthing may be necessary. Aerial photographs may also be useful for assessing the overall cover of trees and shrubs.

Visual assessment along a structured walk or transects is recommended for monitoring habitat and vegetation structure, and the presence of indicators of local distinctiveness. This method can also be used for assessing cover of woody species. The line of transects and the route of structured walks should be set using information from the baseline map, to make sure that all the necessary habitats, vegetation types, populations of notable species and other indicators of local distinctiveness can be

[37] Gelling, M., Moorhouse, T., & Strachan, R. (2011). Water Vole Conservation Handbook.
[38] Dean M, Strachan R, Gow D, Andrews R (2016) *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series)* Ed.s Fiona Mathews and Paul Chanin. The Mammal Society, London.
[39] JNCC, Common Standards Monitoring Guidance for Lowland Wetland updated January 2014 and March 2015 respectively, ISSN 1743-8160 (Online)

examined.

The final assessment of the wetland interest feature should be produced by combining the information from all of the component water influenced habitats that have been monitored.

Invasive and Non-Native Species

Collate available local records to improve baseline datasets.

Complete walkover survey of each impacted reach to understand coverage of species and any other non-native invasive species (INNS) and assess risk posed by implementing the Drought Permit or Order. Surveyors will adopt appropriate biosecurity measures in line with an agreed biosecurity method statement.

Appendix B: Specific Monitoring Package for Lower Itchen

INFORMATION IN SEPARATE PDF, AVAILABLE UPON REQUEST

Appendix C: Specific Mitigation Package for Lower Itchen

INFORMATION IN SEPARATE PDF, AVAILABLE UPON REQUEST

Appendix D: Specific Monitoring Package for Candover

INFORMATION IN SEPARATE PDF, AVAILABLE UPON REQUEST

Appendix E: Specific Mitigation Package for Candover

INFORMATION IN SEPARATE PDF, AVAILABLE UPON REQUEST

Appendix F: Specific Monitoring Package for Test Surface Water

INFORMATION IN SEPARATE PDF, AVAILABLE UPON REQUEST

Appendix G: Specific Mitigation Package for Test Surface Water

INFORMATION IN SEPARATE PDF, AVAILABLE UPON REQUEST